

Technical Note

Network Requirements for Optris Imager in Industrial Applications

Purpose:

This technical note describes the network requirements for the use of multiple imagers in an industrial environment, e.g. for process control in thermal imaging, condition monitoring or fire prediction and protection systems. The aim is to ensure optimal performance and reliability of the network intended for these imagers.

1. Introduction

Industrial thermal imager systems, such as those used for thermal imaging, condition monitoring, and fire prevention, generate significant amounts of data due to high-resolution imaging and continuous streaming. To maintain system performance, the network infrastructure must be carefully designed to handle the data load. This note provides guidelines for determining the maximum number of cameras supported by different network types and emphasizes the need for an exclusive network for these systems.

2. Network Requirements

a. Exclusive Network Environment

The imagers must operate on a dedicated network separate from other company traffic. The cameras and the computer must be assigned with static IP addresses. DHCP is not supported. This ensures:

- Consistent bandwidth availability.
- Reduced latency and packet loss.
- Enhanced security and reliability.

b. Static IP Addresses

Assigning static IP addresses ensures that each device on the network has a unique, unchanging IP address, preventing conflicts and simplifying management. This is particularly useful for devices like servers, printers, or IoT devices that need consistent network access.

c. Firewall & Access Control

Firewall and access control involve configuring rules to monitor and restrict incoming and outgoing network traffic. By setting up these rules, unauthorized access is blocked, enhancing network security and protecting sensitive data from potential threats.

d. Network Bandwidth

The bandwidth requirement depends on:

- The number of cameras.
- The data transfer rate of each camera.
- The type of network (100 Mbits/s or 1000 Mbits/s).

e. Network components

Regardless of the network type and number of cameras in your network, a managed switch is required. We recommend using industrial-grade switches that are capable of operating at ambient temperatures of up to 85°C. For high ambient temperatures we also recommend the use of suitable Ethernet cables (for example: Siemens IE TP Cord RJ45/RJ45, 4x2, up to 80°C ambient operating temperature).

- GS510TPP (up to 50°C ambient operating temperature)
- ALLNET ALL-SGI8112PMJ (up to 75°C ambient operating temperature)
- FS IES3110-8TFP-R (up to 85°C ambient operating temperature)

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For High-Bandwidth and Long-Distance applications we recommend Cat6 cables. For distances bigger than 100m Cat7 cables are required. Use shielded cables in environments with EMI.

f. Camera Data Transfer Rates

Different cameras have varying data transfer rates based on their resolution and their frame rate. You will find in the table below the transfer data of our cameras and the theoretical maximum number of cameras for different networks. Please note that the USB cameras can be integrated into a network via the USB server and the limiting factor for the data transfer is the data transfer of the USB server.

g. Ambient Temperature

For ambient temperatures exceeding 45°C, it is recommended to use a high-temperature PoE adapter with the (part number: **ACXIETPOECBxHx**).

h. Power over Ethernet (PoE)

The cameras can be powered via Ethernet using PoE technology. If the cameras require power through Ethernet, the following components are necessary: Xi ETH series imager: PoE adapter (part number: **ACXIETPOECBx** in scope of supply with the imager), PoE-capable switch or PoE-Injector (part number: **ACPIPOE**) see Figure 1. Without using PoE use an extra power supply for the imager, see Figure 2. For imager PI series use the USB-Server, which can be also powered via PoE see Figure 3 or via an extra power supply see Figure 4.



Figure 1: Xi ETH series using PoE technology



Figure 2: Xi ETH series using external power supply

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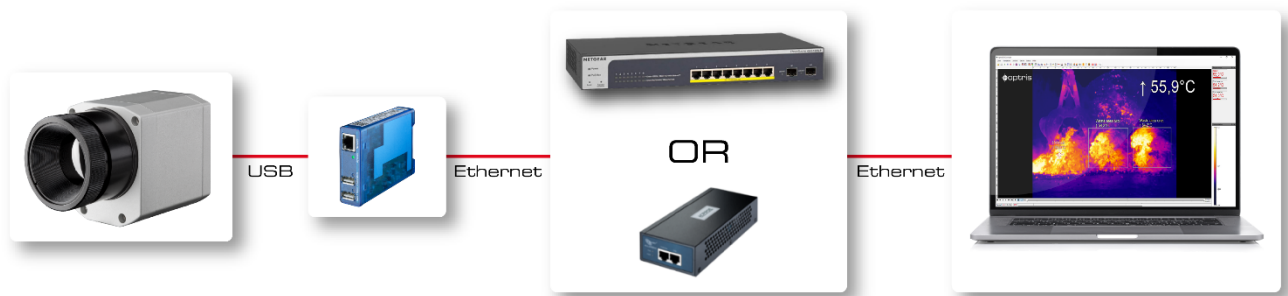


Figure 3: PI series using USB server and PoE technology



Figure 4: PI series using USB server without PoE technology

3. Maximum Number of Imagers

The maximum number of imagers supported by a network can be calculated using the formula:

$$\text{Max Cameras} = \frac{\text{Total Network Bandwidth}}{\text{Data Transfer Rate per Camera}}$$

- Example:**

For a 100 Mbit/s network and a camera with a data transfer rate of 5,1 Mbit/s (Xi 80):

$$\text{Max Cameras} = \frac{100 \text{ Mbit/s}}{5,1 \text{ Mbit/s}} = 19,7 = 19 \text{ Cameras}$$

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The following picture shows you the network bandwidth for multiple different imagers depending on the number of imagers.

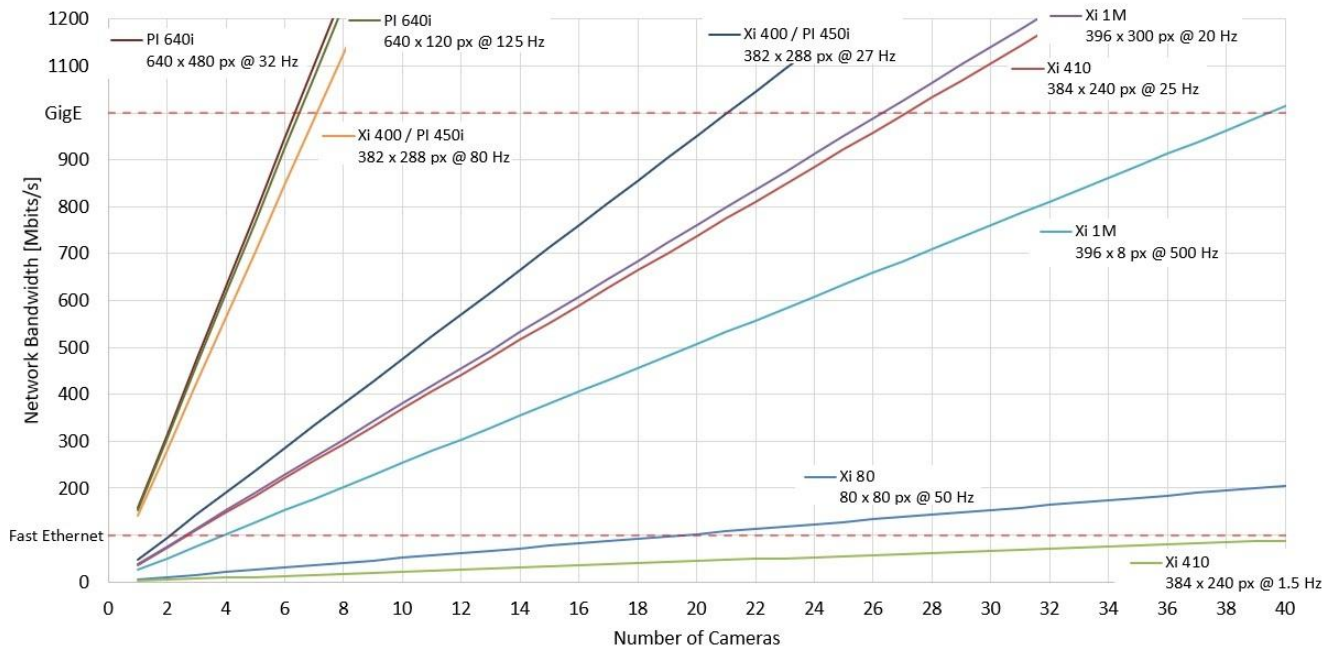


Figure 5: required Network bandwidth for multiple imager

This table shows the data transfer rate for each imager and the theoretical maximum number of cameras can be integrated into this network.

imager: Data rate/ Max. Number of imager in a Network	Xi 80 80 x 80 px @ 50 Hz	Xi 410 384 x 240 px @ 25 Hz	Xi 1M 396 x 300 px @ 20 Hz	Xi 1M 396 x 8 px @ 500 Hz	Xi 410 384 x 240 px @ 1.5 Hz	Xi 400 / PI 450i 382 x 288 px @ 80 Hz	Xi 400 / PI 450i 382 x 288 px @ 27 Hz	PI 640i 640 x 480 px @ 32 Hz	PI 640i 640 x 120 px @ 125 Hz
data rate for 1 imager	5.1 Mbit/s	36.8 Mbit/s	38 Mbit/s	25.3 Mbit/s	2.2 Mbit/s	140.8 Mbit/s	47.5 Mbit/s	157.2 Mbit/s	153.6 Mbit/s
100 Mbit/s Network	19	2	2	3	45	-	2	-	-
1000 Mbit/s Network	195	27	26	39	452	7	21	6	6

4. Recommended Network Configuration

100 Mbits/s Network:

- Suitable for smaller installations with lower-resolution cameras.
- Limited to a lower number of cameras due to bandwidth constraints.

1000 Mbits/s (Gigabit) Network:

- Recommended for larger installations or high-resolution cameras.
- Supports a significantly higher number of cameras.

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5. Conclusion

To ensure reliable operation of industrial thermal imager systems, it is critical to design a dedicated network with sufficient bandwidth. The table above provides a guideline for determining the maximum number of cameras supported by different network types based on their data transfer rates. Adhering to these recommendations will help maintain optimal performance and reliability for thermal imaging, condition monitoring, and fire prevention systems.