System Architecture

Thinknx has launched Thinknx UP, a completely redesigned version of the Classic Thinknx software. To learn more about the migration, click here.

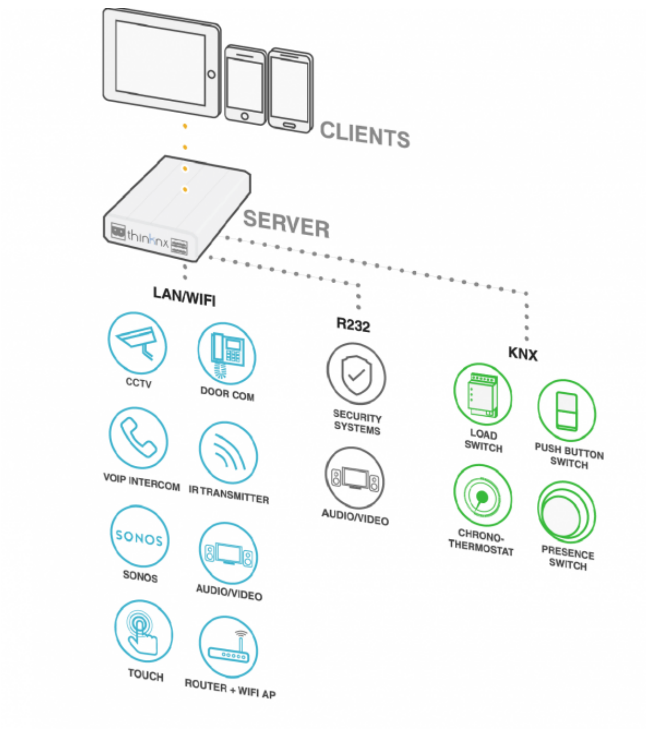
Introduction

ThinKnx is a supervision system for home and building automation based on client-server architecture.

- The **server** consists of one ThinKnx device (Compact, Micro, Rack or Touch) that represents the logical unit of the system and controls all the equipment connected to it.
- The **client** consists of any PC, touch screen, tablet or smartphone connected to the LAN via Ethernet or WiFi: all these devices, through the ThinKnx software, communicate with the server to control the plant.
- The **Thinknx cloud** is also an important part of the system architecture and is used for multiple purposes that serve both the integrator and the end user.
- The **Configurator** is provided as the indispensable tool to build complete Thinknx solutions. It is a software used by the integrator to create attractive and customizable graphical interfaces and deploy them on the servers and clients to control the different systems installed in the plant.

Figure 1: Scheme of a typical integrated installation

The picture to the left shows a standard installation of ThinKnx system in a KNX or Modbus plant.
The ThinKnx server interfaces with KNX plant through its dedicated **bus connector**. It is also possible to interface with Modbus or other buses through **RS232** or **TCP**. Additional systems can be integrated with server through RS232 or TCP. For example, anti-theft systems, audio or video matrix, home theater systems, etc.
The ThinKnx server controls all the devices



connected to it and, working as a gateway, allows interactions between the connected devices even if they are using different technologies. The clients, on the other hand, send their commands to the server which forwards them to the remaining devices allowing the communication between both parties.

The Gateway feature inside the server allows to control and integrate different devices and systems:

- *For example, Sonos Player or IR transmitter can be controlled from KNX keypads by simply configuring server logic.*
- *Anti-theft system can also send telegrams on KNX or launch scenes on particular events.*
- *When an intercom door station makes a call to a Thinknx client, the server can perform actions on other devices or KNX.*

With a powerful tool such as the Thinknx server, the possibilities are endless.

ThinKnx Solution Components

ThinKnx Servers

During normal runtime, ThinKnx server is the logical unit of the supervision system and communicates directly with the ThinKnx clients.
The ThinKnx servers range was born to cover all the possible installation cases of a supervision system. All the devices are able to interface directly with the KNX plant and have several communication ports to connect to the Ethernet and to other buses (like Modbus etc.) or to other devices like anti-theft systems (through RS232 or TCP/IP). They are also accurately designed for 24/7 operation and optimized for high reliability. In respect to the basic functions - that are included on every server model - additional functionalities can be activated by means of licenses.

ThinKnx Compact_20 / Compact_DIN

A completely re-engineered version of the Compact, the Compact_20 and Compact_DIN offer an extended set of I/O's and two serial ports, in addition to a small monitor allowing the integrator to easily control the inputs and outputs. This server is the perfect fit for all types of projects, and can be upgraded with all available licenses such as Z-Wave, Lutron, Modbus, Intercom, Security and more.

- Fanless processing device optimized for continuous operation
- Power: 9-24 VDC - 1A Max
- Memory on chip eMMC
- 1x EIB/KNX port with direct connection through clips

- 1x network port
- 1x RS-232 and 1x RS-485 serial ports
- 2x USB ports
- 4x Output relays (6A)
- 3x digital outputs open collector
- 4x Analog/Digital inputs
- 2x Digital inputs
- 1x Monitor

For more information about Compact_20 ports, visit this link.

ThinKnx Micro_20 / Micro_DIN

It is a very small device with the ability to completely control KNX systems. Can be enhanced with VoIP function for intercom communication or with Z-wave dongle for wireless integration.

- Fanless processing device optimized for continuous operation
- Mass memory on MicroSD
- Power: 9-24 VDC - 1A Max
- 1x EIB/KNX port with direct connection through clips
- 1x network port
- 1x USB port (for Z-wave dongle)
- KNX telegrams led
- Consumption 1 Watt

ThinKnx Envision7_20

All-in-one Touch Server which allows control of the home or building using a high resolution touch screen.

- Octa-core Cortex A53 CPU
- Capacitive touch screen
- 7” screen 155×87 mm visible area, 1024×600 resolution
- Linux embedded operating system
- Power: 12-24 VDC - 1.5A Max
- 1x EIB/KNX port with direct connection through clips
- Consumption: 10 W Max
- 1x network port
- 1x RS-232 and 1 RS-485 serial ports
- Sensors: 1x temperature sensor, 1x humidity sensor, 1x ambient luminosity sensor

ThinKnx Envision7R_20 (Retrofit)

All-in-one Touch Server which allows control of the home or building using a high resolution touch screen.

- Octa-core Cortex A53 CPU
- Capacitive touch screen
- 7” screen 155×87 mm visible area, 1024×600 resolution
- Linux embedded operating system
- Power: 12-24 VDC - 1.5A Max
- 1x EIB/KNX port with direct connection through clips
- Consumption: 10 W Max
- 1x network port
- 1x RS-232 and 1 RS-485 serial ports

- Sensors: 1x temperature sensor, 1x humidity sensor, 1x ambient luminosity sensor

ThinKnx Envision10_20

All-in-one Touch Server which allows control of the home or building using a high resolution touch screen.

- Octa-core Cortex A53 CPU
- Capacitive touch screen
- 10” screen 217×136 mm visible area, 1280×800 resolution
- Linux embedded operating system
- Power: 12-24 VDC - 1.5A Max
- 1x EIB/KNX port with direct connection through clips
- Consumption: 12 W Max
- 1x network port
- 1x RS-232 and 1 RS-485 serial ports
- Sensors: 1x temperature sensor, 1x humidity sensor, 1x ambient luminosity sensor

ThinKnx Rack

It is the most powerful and expandable device, designed for large buildings or demanding applications.

- Fanless processing device optimized for continuous operation
- Mass memory on industrial Compact-Flash
- External power supply 220V AC
- 1x EIB/KNX port with direct connection through clips
- 2x serial ports configurable for RS232 or RS485
- 1x serial port RS232 9 pins
- 4x USB ports
- 2x Ethernet ports

Using the same hardware, but with completely different functionalities, the **Brickbox** is a Thinknx gateway without UI functionalities. In addition to the ports available on the Micro, Brickbox has two serial ports: one RS232 and one RS485.

ThinKnx Clients

Thinknx clients are all the devices connected to the network and using the Thinknx application to connect to a Thinknx server. ThinKnx offers a wide range of native applications to allow tablets, smartphones, touch screens and PCs to interface with the supervision system. The choice to create native applications comes from the necessity to obtain the best possible performances during the Wi-Fi or 3G connection to ThinKnx servers, providing the user with an unprecedented experience.

- **Thinknx UP Player for Windows** This application allows to control the building from any Windows device. It is an upgraded version of the Classic Thinknx Player with a totally redesigned interface and many additional features. The UP Player only works with servers using firmware 1.1.10 or above, and can only view projects created with the UP Configurator (with extension .tup).
- **ThinKnx Player for Windows (Classic)** This application allows to control the building from any Windows device. Suitable even for the Windows 10 operating system, it includes settings that allows to disable the full-screen mode, resize the application window and visualize the mouse cursor, adapting the application to the device which the application is installed on and

improving the user's experience. The Classic Player only works with servers using firmware 1.1.9 or below, and can only view projects created with the Classic Configurator (with extension .erg).

- **Thinknx UP Player for Mac** *coming soon*
- **ThinKnx Player for Mac (Classic)** This application allows to control the building from any computer running Mac operating system. It offers the same functions of the Player for Windows application. This player only works with servers using firmware 1.1.9 or below, and can only view projects created with the Classic Configurator (with extension .erg).

> ThinKnx Player for Mac is an Air application, thus to be installed on Mac computers it requires Adobe Air software installed. Adobe Air sotfware can be found at https://get.adobe.com/air/.

- **Thinknx UP for iOS** This application allows to control the building from any iOS device (iPad / iPhone). It is an upgraded version of the Thinknx Pocket with a totally redesigned interface and many additional features. Thinknx UP for iOS only works with servers using firmware 1.1.10 or above, and can only view projects created with the UP Configurator (with extension .tup).
- **ThinKnx for iPad (Classic)** This is the app for iPad that connects to ThinKnx servers and allows to manage the automation directly from iOS tablets. It allows to control several buildings using a quick and intuitive project selector. It only works with servers using firmware 1.1.9 or below, and can only view projects created with the Classic Configurator (with extension .erg).
- **ThinKnx Pocket for iPhone (Classic)** This is the app for iPhone that connects to ThinKnx servers and allows to manage the automation directly from iOS phones. It allows to control several buildings using a quick and intuitive project selector. It only works with servers using firmware 1.1.9 or below, and can only view projects created with the Classic Configurator (with extension .erg).
- **Thinknx UP for Android** This application is used on Android tablets and smartphones to control the building automation. It is an upgraded version of the classic Thinknx for Android app with a totally redesigned interface and many additional features. It only works with servers using firmware 1.1.10 or above, and can only view projects created with the UP Configurator (with extension .tup).
- **ThinKnx for Android (Classic)** This is the app for Android tablet and smartphone that coordinates the intelligent building through a Wi-Fi or 3G connection to ThinKnx servers. The interface is designed with attention to the smallest detail to adapt the graphics to the display size of the employed device.

ThinKnx Cloud

Thinknx Cloud is used for several services in the Thinknx system:

1. **Modifying and updating the project remotely on server and clients**. Using the Thinknx Configurator, the integrator or installer can deploy the modified project to the Cloud. The server will automatically be alerted and will reboot once the new version is downloaded, and all the clients will get a notification that a newer version of the project is available to download on their devices. For more information regarding Thinknx Cloud, check out this section.
2. **Automatic client connection**. In the absence of a fixed external IP address at the automated location, it is possible to use Thinknx Cloud to allow remote access to the project for all clients.

They will be able to monitor their entire house from anywhere using only the Internet at no additional cost. However, some services might not be available for this option, such as answering a SIP call remotely or viewing a local IP camera from outside the house. For more information regarding Thinknx Cloud, check out this section.

3. **Database for live data storage**. Every project will require to save some data for continuous monitoring, chart visualization, or monthly reporting. This data will be saved for each single server in a dedicated space on the cloud. Every time a Thinknx application is launched, the server will contact the cloud to retrieve this data, and update them as they change. Only a small amount of values is saved locally on the server. For more information regarding Thinknx Cloud, check out this section.
4. **Dynamic DNS**. This option is used in the absence of a *fixed* external IP address at the automated location. Instead, the public IP address is accessible but changes after each connection renewal or on router reboot. Thinknx offers a free dynamic DNS service configurable from the server's web page. With this service, a host name (such as *myhome.my.thinknx.net*) is associated to the public IP address of the router and the server will always be reachable through this host name no matter what the public IP address is. For more information regarding Thinknx Cloud, check out this section.

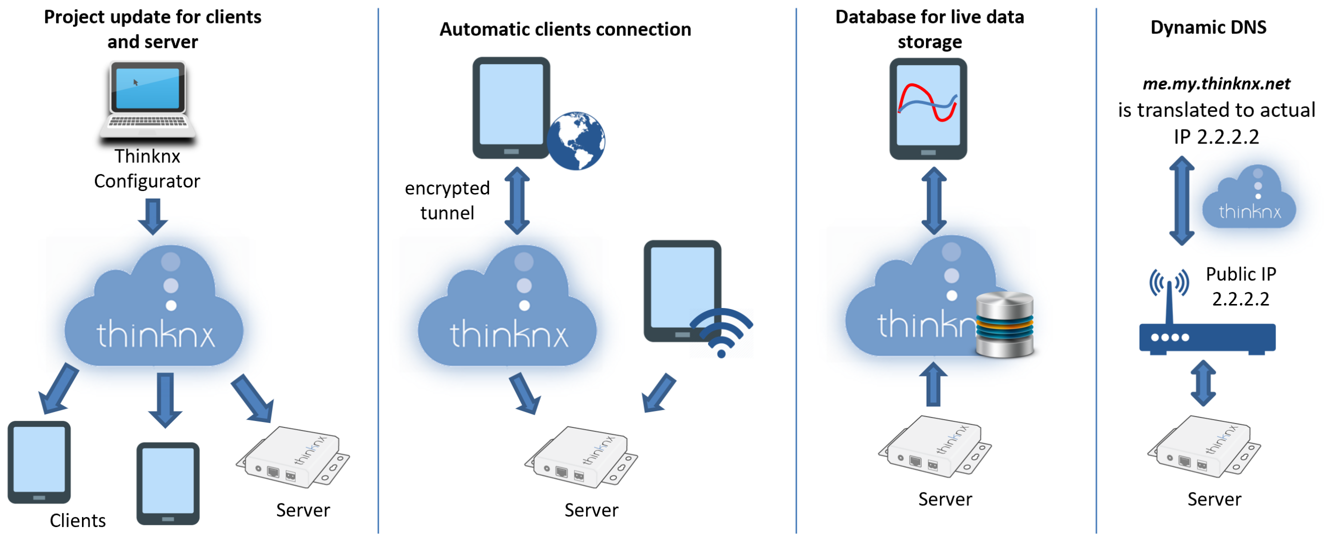


Figure 2: Thinknx Cloud Services

ThinKnx Configurator

The ThinKnx Configurator software is the indispensable tool for the creation and development of a supervision project. It makes possible to create all the connections between the graphical user interface and all the devices integrated into the plant.

Following some simple steps and intuitive parameters, graphic interfaces can be deeply customized and are accessible from every client and device. Just as efficiently, it is possible to create logics and to set up all the system elements to obtain deep integrations between all the existing devices.

Finally, the same tool allows to upload the project on client devices and ThinKnx servers with differentiated exports based on the specific user.

For a detailed explanation of the Configurator, please refer to Thinknx Configurator chapter, or visit our quick guide to learn how to create the first project.

Communication Between Components

All the clients can connect to the server using two IP addresses, one local address to use inside the LAN and one host name or external address to use outside the LAN for remote access.
It is highly recommended to configure the local IP address of the server to be fixed and not use DHCP service. Otherwise, it is possible to run into client-server connection problems when the DHCP lease expires.
The fixed local address can be configured by accessing the server's web interface using port 5051 TCP. This can be done by inputting http://server_ip_address:5051 into the web browser.
In addition to **port 5051** TCP used for the web interface, the client-server connection is possible through **port 7550** TCP.
Port 5050 is used to deploy a Thinknx project from Configurator to a client's device when using the local network instead of Thinknx Cloud.

To allow clients a remote access to the server, multiple scenarios can be considered depending on the actual situation:

- The existence of a **static external IP address** which is directly accessible from the Internet. This option is usually sold at an additional cost by the Internet provider. In that case, the external IP address can be set inside the Configurator, and clients will try to connect directly to this IP. Since the server is usually behind a router, the router has to be configured to forward connections to the server.

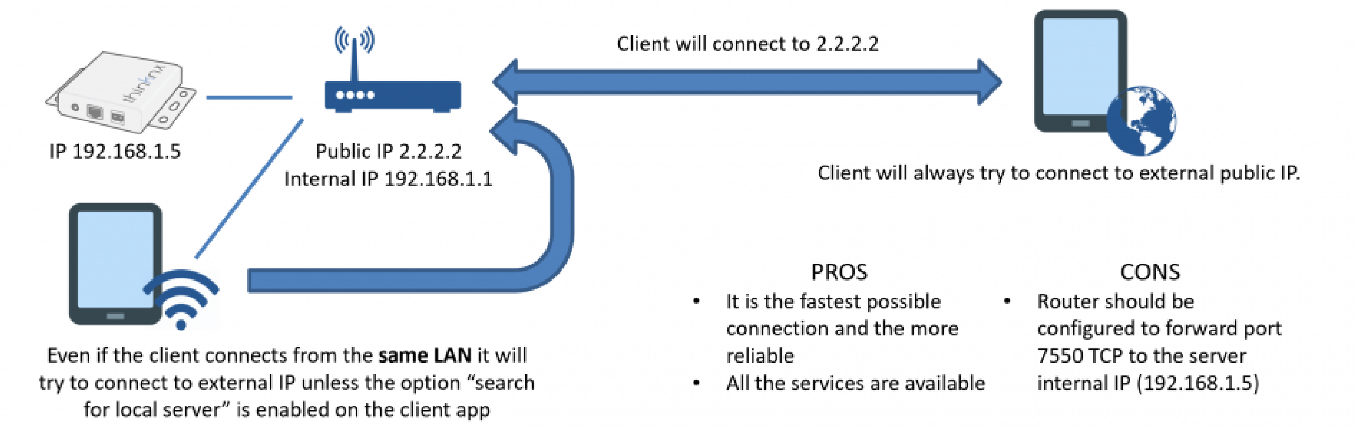
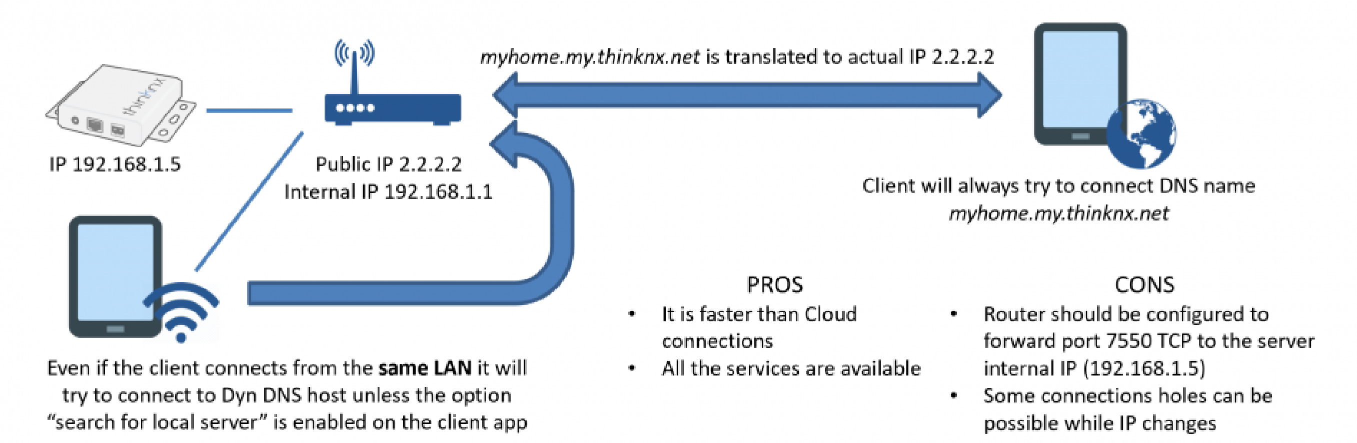

Client will connect to 2.2.2.2
IP 192.168.1.5
Public IP 2.2.2.2
Internal IP 192.168.1.1
Client will always try to connect to external public IP.
Even if the client connects from the same LAN it will try to connect to external IP unless the option "search for local server" is enabled on the client app
PROS
• It is the fastest possible connection and the more reliable
• All the services are available
CONS
• Router should be configured to forward port 7550 TCP to the server internal IP (192.168.1.5)

Figure 3: Static External IP Address

- The existence of a **dynamic external IP address** which is directly accessible from the Internet but changes at router reboot or after a connection renewal. In that case, and to overcome the problems tied to not having a static IP, Thinknx offers a free Dynamic DNS service configurable from the server's web interface. With this service, a hostname will be associated to the public IP address of the router and will always be translated to the actual IP address.



myhome.my.thinknx.net is translated to actual IP 2.2.2.2

Client will always try to connect DNS name *myhome.my.thinknx.net*

Even if the client connects from the **same LAN** it will try to connect to Dyn DNS host unless the option "search for local server" is enabled on the client app

PROS

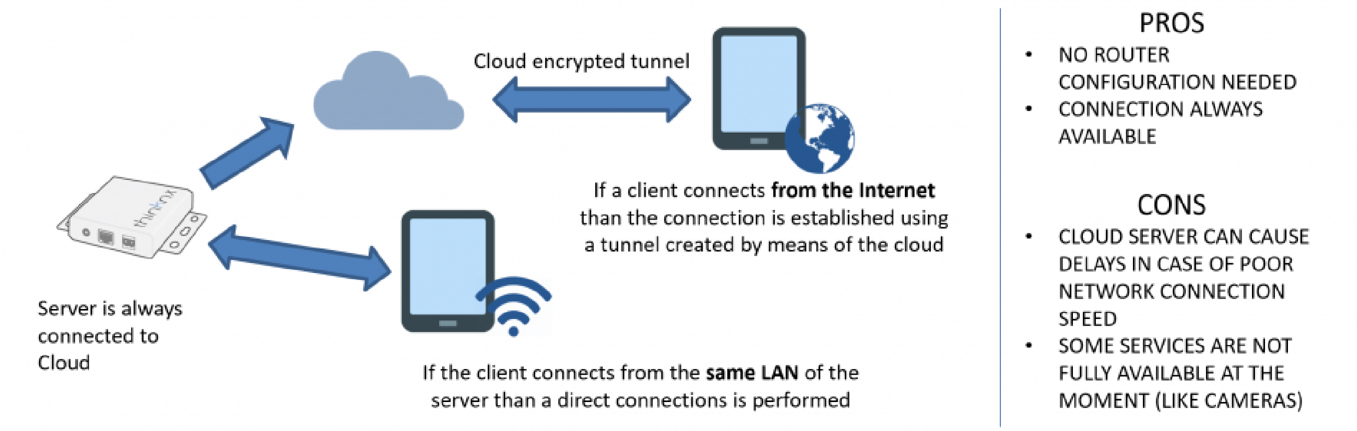
- It is faster than Cloud connections
- All the services are available

CONS

- Router should be configured to forward port 7550 TCP to the server internal IP (192.168.1.5)
- Some connections holes can be possible while IP changes

Figure 4: Dynamic External IP Address

- The **absence of a public IP address**. In that case, the IP given from the Internet provider is not directly reachable from the Internet because it is part of a sub-network or behind a NAT. By enabling and using Thinknx Cloud, remote clients can establish a connection to the server using a tunnel created by means of the Cloud.



If a client connects **from the Internet** than the connection is established using a tunnel created by means of the cloud

Server is always connected to Cloud

If the client connects from the **same LAN** of the server than a direct connections is performed

PROS

- NO ROUTER CONFIGURATION NEEDED
- CONNECTION ALWAYS AVAILABLE

CONS

- CLOUD SERVER CAN CAUSE DELAYS IN CASE OF POOR NETWORK CONNECTION SPEED
- SOME SERVICES ARE NOT FULLY AVAILABLE AT THE MOMENT (LIKE CAMERAS)

Figure 5: No Public IP address

Network requirements for Thinknx services

To run properly, our services need to access some internet services and optionally needs some port forwarding. Hereafter all the involved ports and hosts with specifications of connection direction and purpose.

Service	Host port and protocol	Comments	Note
NTP	123 (TCP and UDP) outbound/inbound	Used to sync clock with NTP servers.	1

Service	Host port and protocol	Comments	Note
Thinknx cloud	*.thinknx.eu 80, 443, 24532 (TCP) outbound	Used to connect to Thinknx cloud service	2
Thinknx projects sync	data.thinknx.eu 80, 443 (TCP) outbound	Used to download project updates from cloud	2
Thinknx clients	7550 (TCP) inbound	Used by client to connect to server for control	3
Thinknx clients (cloud)	cloud.thinknx.eu 24531 (TCP) outbound	Used by client to connect to server using cloud for control	2
Internal webpage	5051 (TCP) inbound	Used to connect to server webpage for maintenance	4
Remote assistance	www.pulsareng.it 80, 443 (TCP) outbound	Used to sync with remote assistance service	5

Notes:

1. This service is mandatory to sync clock with internet services. Server can act as NTP server as well (inbound connection) and it is advised to use just for local network (not exposed to the internet)
2. These services are required when cloud connection is used.
3. Port 7550 inbound is only required when direct client connection is adopted. It usually requires to create port forwarding rules on router/firewall depending on network infrastructure
4. Access to webpages is not required and it is advised not to expose to the internet.
5. Remote assistance service used on request to obtain factory support