PlantStruxure PES 3.1
Selection Guide

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Description

PlantStruxure™ PES (Process Expert System) is the innovative process automation system from Schneider Electric. It brings together the best of the PLC/SCADA and DCS worlds to meet the demands of today's production facilities while delivering on growing energy management requirements.

- ✔ PlantStruxure PES offers integrated energy management features to deliver superior value throughout the lifecycle of the plant.

- ✔ The tight integration of the system ensures efficiency from design engineering through to operation – engineers can develop the configuration faster and more accurately, operators will have all data at their fingertips for better insights and process optimization, and maintenance teams can diagnose and solve problems faster to reduce downtime.

- ✔ PlantStruxure PES helps our customers make the right decision at the right time, leading to increased uptime for the whole plant, and a more productive enterprise.

1.2
PlantStruxure PES as a key pillar of the PlantStruxure architecture

PlantStruxure is Schneider Electric's collaborative and integrated automation architecture for industrial and infrastructure applications. It brings together our Telemetry, PLC/SCADA and DCS offerings with complete lifecycle services to help make your operations more efficient. From initial design to modernization, PlantStruxure transparently connects control, operation and enterprise levels of your business. Also contributing to your energy efficiency goals, PlantStruxure helps you measure, analyze and improve the energy consumption of your process so you can produce efficiently with minimum waste, effort and cost.

PlantStruxure is built on an Ethernet network – it's open and flexible architecture and network topologies offer transparent access to the information you need, from the plant floor up to the enterprise level. In addition, it is a key building block of Schneider Electric's comprehensive energy management portfolio, EcoStruxure, and complementary to our StruxureWare software suites.

As one of the three pillars of the PlantStruxure architecture, PlantStruxure PES shares these key values.
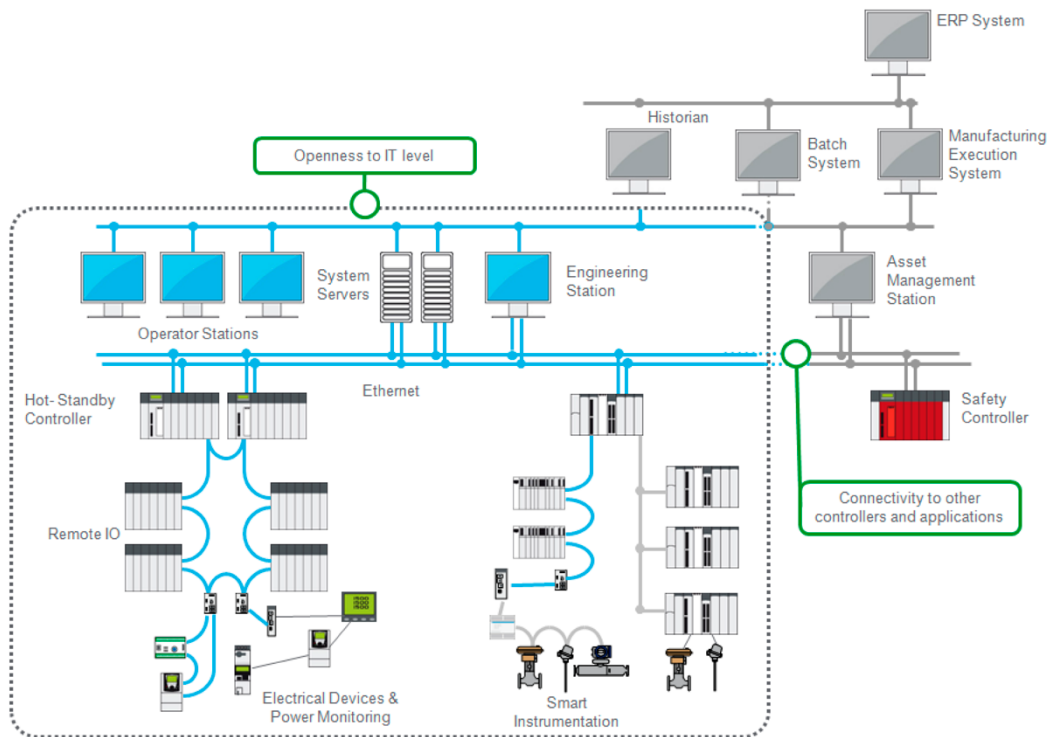
Figure 1: Positioning of PlantStruxure PES within the PlantStruxure architecture

The image above shows an overview of an automation system. All elements that are located inside the dotted line are part of PlantStruxure PES. PES covers the needs of an automation system from the field devices all the way up to the control room. In addition, PES is open so other components can be added to ti – either as devices, other controllers or IT level applications like batch, MES, historian or asset management.

1.3
PlantStruxure PES overview

PlantStruxure PES is based on three key elements, all of which are delivered within a single environment that integrates all its key engineering and operation functionalities:

1 **A system-wide, Ethernet based energy-aware architecture** - transparent and standardized Ethernet technology ensures connectivity, flexibility, scalability and performance.

2 **A powerful and scalable controller platform** - PlantStruxure PES supports a range of controllers to meet different process needs: the controller platforms are modular, scalable and redundant, with the ability to add or remove hardware online. In addition, they support a full range of input and output modules, along with dedicated communication and fieldbus modules, regulatory control, sequencing, motor control, power devices and instrumentation.

3 **Integrated functionalities in a single environment** - PlantStruxure PES integrates functionalities to efficiently manage a process and its energy use in a single environment for engineering, operation and maintenance. This includes a single, object-oriented database to engineer and maintain systems more quickly and easily, a powerful operations and navigation environment for real-time monitoring and control of the plant, including alarms, events and trend data, and standard interfaces with historian, MES and other business systems for fast and easy information exchange.

StruxureWare PE (Process Expert) is the software component of PlantStruxure PES. It's user interface and compatibility is common to the Schneider Electric StruxureWare software suites.

2.1
Engineering

PlantStruxure PES improves efficiency throughout the engineering phase of a plant, accelerating start-up and minimizing project risk with five key features:

1 **Intuitive and modern user interface** - PlantStruxure PES embeds all the software tools needed to design a process application:
   - ✓ The Library Manager contains extensive object templates organized into libraries
   - ✓ The Application Manager describes the equivalent plant hierarchy
   - ✓ The Topology Manager describes the overall topology of the system
   - ✓ The Project Manager defines the project that runs in the topology

2 **All-in-one configuration** - PlantStruxure PES offers an all-in-one configuration functionality, allowing faster system design from a single point of data entry. Via the Application Manager, a replication of the application can be seen as it is in real life, using any model, the ISA88 or ISA95 standards, or any other model of choice. In addition, the design can be based on a hierarchical organization according to the P&ID definition, allowing easier evolution of the installation.

3 **Object model approach** - an object is composed of different facets that contain internal information about the software participant. These facets offer different points of view of the same object. Interfaces allow connections between object instances, enabling collaboration between participants, even while they remain de-coupled.

Figure 2: The Object Model based on facets that give several point of view

The image above shows (with the example of a pump) the concept of object modelling. Several points of view are represented through the facets: control and the command of the pump at the bottom, monitoring of the pump through a graphic display and faceplate on top, and other information such as alarms, data history, user guides and so on. When an instance of an object is created, all facets are created as well, along with all the links between those facets.

4 **Sustainable engineering** - PlantStruxure PES remains adaptable to different business needs at every stage of the application lifecycle. The original design of the process application can be adjusted at any time, and the system will execute the modifications by propagating the required changes across the plant. Modifications of an object facet can be applied to all objects or to the selected instances only. System libraries support versioning, and the system always verifies any discrepancy between the object model and its instances.

5 **Standard and reusable application data** - PlantStruxure PES includes a set of object libraries that help kick-start the design process. The ready-to-use libraries can be modified to address specific preferences. Optional libraries focus specifically on applications for different segments, with embedded expertise like energy management functionalities to help with the reduction of energy waste at the source of overconsumption.

2.2
Operation and Maintenance

PlantStruxure PES provides a consistent control and operational interface with a real-time view of the process. The system delivers operators all the data they need to make timely and accurate decisions and all the standard DCS functionalities are available in the PlantStruxure PES operator interface, including:

1 **Trending** - trends are a seamless combination of real-time and historical data. When users view a trend page they can monitor the current activity as it happens and simply scroll back through time to view the trend history. The distributed trending system handles a large number of variables without compromising system performance or data integrity. Operators can choose from a selection of pre-configured trend pages that provide clear data representation with customizable views for quick and simple trend analysis.

2 **Advanced alarms and events** - the PlantStruxure PES alarm system is fast and reliable, providing detailed information about the status of the plant. Alarms are displayed on dedicated alarm pages, with the most recent alarms visible at all times in the alarm banner on every page. Working in conjunction with the controller, alarms are time stamped with precision.

3 **From any operator station, monitor the process and identify the root cause of any disturbance** - from any animated symbol on the display the object faceplates can be directly opened. Each faceplate provides the basic object information (also indicated by the status icon on the object) along with a wealth of other data, such as monitoring parameters, interlocks, alarms and others.
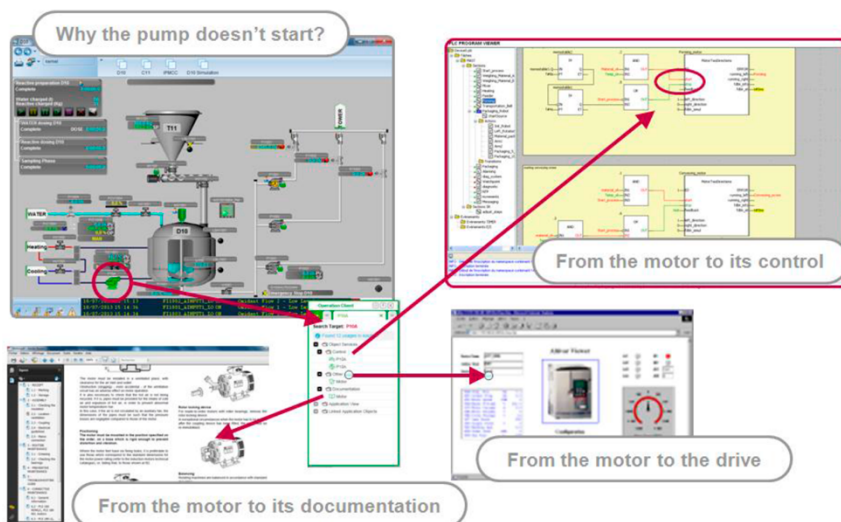
Figure 3: Navigation using the Application Manager to speed up diagnostics

3.1
System Presentation

3.1.1 System deployed on site

The PlantStruxure PES architecture is fully flexible and its infrastructure can be deployed on one single machine that hosts all the needed functions, or on a set of multiple machines. This choice will be based mainly on the size of the project, its topology and the expected performance of the application. The functions needed to execute a PlantStruxure PES project are:

1   **PlantStruxure PES System Server** – this server hosts the global database and centralizes and synchronizes all the information throughout the system infrastructure. The engineering software to configure, monitor, diagnose and maintain the deployed application is also embedded on the System Server. The engineering software suites are embedded on a virtual machine, which is installed with the PES System Server. There is only one System Server for any PlantStruxure PES configuration.

2   **PlantStruxure PES Engineering Client** – this workstation houses all the editors that are needed to configure and build the project. It is located on the PlantStruxure PES System Server workstation. In next version of PlantStruxure PES there will be the possibility for multiple engineering clients to be connected to an Engineering Server.

3   **PlantStruxure PES Operation Servers** – these servers offer a set of services such as I/O servers, alarms servers, trend servers and report servers. A minimum of one Operation Server is required when deploying a PES configuration. In order to improve the scalability and the performance of PlantStruxure PES the Operation Servers can be split into several machines that can be stand alone or redundant. Each operation server embeds a local PlantStruxure PES Operation Client. In addition, it is possible to set up a redundant configuration of the PlantStruxure PES Operation Servers to en sure the monitoring of the automation system at any time.

4   **PlantStruxure PES Operation Clients** – the number of Operation Clients needed depends on from where the Control System Application is monitored, and how many client stations are required. There are two types of operation clients – the Control Client enables modifications to be made like set points; the View Only client doesn't allow any kind of modification to be made to the running system.
Both the Control and View Only Clients can be used remotely as Web Clients. In addition, each Operator Server embeds a local Operation Client, which can run exclusively on the server.

All these machines are interconnected through the Ethernet Network architecture (refer to the figure below).

Figure 4: PlantStruxure PES infrastructure deployed on site

3.1.2 Licensing for PlantStruxure PES infrastructure deployed on site

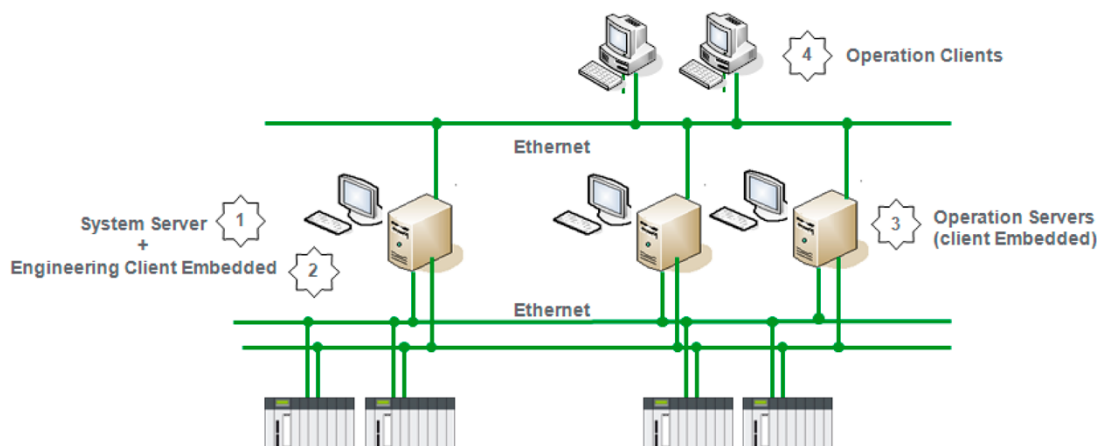All the software components that are described above require licenses to run permanently on site. These licenses are not system size dependent. The scalability of the infrastructure is managed through the Application License where one Application License is required for the overall PlantStruxure PES infrastructure deployed on site.

Management of licenses is done by one or more a floating license servers, which can be located on any machine. In most cases, the license server is located on the same workstation as the PlantStruxure PES System Server for a non redundant configuration, but an alternative is to install it on a dedicated machine. In the case of redundant Operation Servers, the licenses and the Operation Client licenses must be installed on the servers to ensure the availability of one Operation Server and Operation Client at any time, and to avoid a single point of failure.

PlantStruxure PES uses virtualization technologies to provide some of its functions and features. However, from a user perspective, this is completed transparently. The virtual machine requires a Windows 7 license, which must be installed and registered after the installation of PlantStruxure PES on the system server.

3.1.2.1 Non-redundant Configuration: how to define the licenses to be ordered

1 One PlantStruxure PES Server license is mandatory. Only one is required in a PES configuration. It includes the engineering client license.
   License to be ordered: **EUSBEUCZZSPEZZ** SW PE ENG SINGLE LIC.

2 One PlantStruxure PES Operation Server license is mandatory. Each Operation Server includes a local Operation Client license. Depending on the system size and topology the system may have more than one Operation Server.
   License to be ordered: **EUSOPECZZSPEZZ** SW PE OPER SERVER LIC.

3 At least one PlantStruxure PES Operation Client license is mandatory. The client embedded with the Operation Server license can be used. Otherwise, add at least one license, plus the number of other licenses required for the clients installed throughout the system infrastructure. Two kinds of licenses are available: Control Client or View Only Client. Both can be used as Web Clients.
   Licenses to be ordered: **EUSLCCCZZSPEZZ** SW PE CTRL CLIENT LIC
   EUSVCCCZZSPEZZ SW PE VIEW CLIENT LIC

4 **Application License**
   Lic: 500 instances EUSAPPCZTSPEZZ
   or   1250 instances EUSAPPCZSSPEZZ
   or   3000 instances EUSAPPCZMSPEZZ
   or   7500 instances EUS APPCZL SPEZZ
   or >7500 instances EUSAPPCZXSPEZZ

3 **Operation Clients**
   Lic: EUSLCCCZZSPEZZ
   or EUSVCCCZZSPEZZ

1 **System Server**
   Lic: EUSBEUCZZSPEZZ
   (engineering)

2 **Operation Server**
   Lic: EUSOPECZZSPEZZ

5 **Embedded Virtual Machine**
   Lic: EUSLICWINPRO7

Figure 5: Non-redundant configuration: PlantStruxure PES licenses deployed on site

4 One Application License must be ordered for the whole configuration. Five sizes are available, depending on the automation system size. The size is defined according to the maximum number of object instances that can be included within the system.
Possible licenses to be ordered (one of these possibilities):

500 instances	**EUSAPPCZTSPEZZ**	SW PE APPL LIC EXTRA SMALL
1250 instances	**EUSAPPCZSSPEZZ**	SW PE APPL LIC SMALL
3000 instances	**EUSAPPCZMSPEZZ**	SW PE APPL LIC MEDIUM
7500 instances	**EUS APPCZLSPEZZ**	SW PE APPL LIC LARGE
>7500 instances	**EUSAPPCZXSPEZZ**	SW PE APPL LIC EXTRA LARG

It is possible to upgrade the application license in order to increase the number of object instances.
Possible licenses to be ordered:

500 to 1250 instances	**EUSAPPGZASPEZZ**	SW PE UPG XS TO S APP LIC
1250 to 3000 instances	**EUSAPPGZESPEZZ**	SW PE UPG S TO M APP LIC
3000 to 7500 instances	**EUSAPPGZHSPEZZ**	SW PE UPG M TO L APP LIC
7500 to >7500 instances	**EUSAPPGZKSPEZZ**	SW PE UPG L TO XL APP LIC

More than one license may be necessary to upgrade to a larger system. For example: to upgrade from 500 instances to 3000 instances, two licenses must be ordered:

EUSAPPGZASPEZZ	SW PE UPG XS TO S APP LIC
EUSAPPGZESPEZZ	SW PE UPG S TO M APP LIC

5 The embedded virtual machine within the PlantStruxure PES System Server requires a license for Windows. Only one license is required per PlantStruxure PES architecture. The license can be ordered from Schneider Electric or obtained from Microsoft if an agreement exists between the company and Microsoft. Or it can be obtained from a retailer.
License to be ordered: **EUSLICWINPRO7**   WIN PRO 7 LICENSE

3.1.2.2 Redundant Configuration: how to define the licenses to be ordered

1 One PlantStruxure PES Server license is mandatory. Only one is required in a PES configuration. It includes the engineering client license. Redundancy of the PlantStruxure PES System Server is not possible and in the case of System Server failure, engineering and advanced diagnostic services in operation (like navigation within the control system) are not possible, however, operation from the supervision system will remain available.

License to be ordered: **EUSBEUCZZSPEZZ**   SW PE ENG SINGLE LIC

2 One PlantStruxure PES Operation Server license is mandatory. Each Operation Server includes a local Operation Client license. Depending on the size and topology of the system it may have more than one Operation Server. For redundancy, the number of PlantStruxure PES Operation Servers must be doubled.

License to be ordered: **EUSOPECZZSPEZZ**   SW PE OPER SERVER LIC

3 At least one PlantStruxure PES Operation Client license is mandatory. The client embedded with the Operation Server license can be used. Otherwise, add at least one license, plus the number of other licenses required for the clients installed on the system infrastructure. To maintain control of the automation system when an Operation Server fails, it is required to double the Operation Client licenses to ensure each Operation Client recovers a license from the Operation Server that is available when the other fails. For each Operation Client license, it is recommended to order a corresponding Redundant Operation Client license and install them on a secondary server.

Two kinds of licenses are available: Control Client or View Only client. Both can be used as Web Clients.

Licenses to be ordered: **EUSLCCCZZSPEZZ**   SW PE CTRL CLIENT LIC
                                          EUSVCCCZZSPEZZ   SW PE VIEW CLIENT LIC
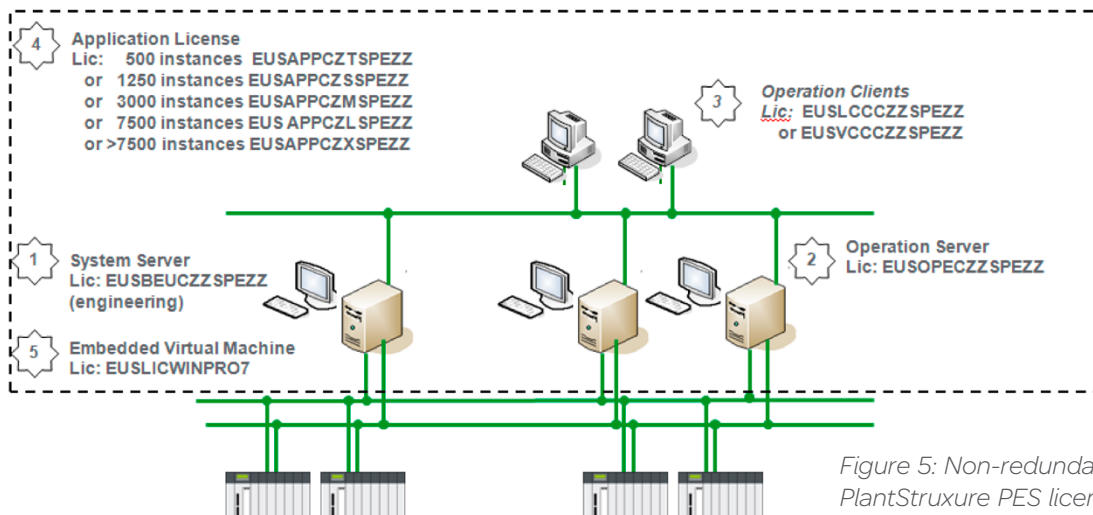   **EUSLRCCZZSPEZZ**   SW PE REDUNDANT CTRL CLIENT LIC
                                          EUSVRCCZZSPEZZ   SW PE REDUNDANT VIEW CLIENT LIC

Figure 6: Redundant configuration: PlantStruxure PES licenses deployed on site

4 One Application license must be ordered for the whole configuration. Five sizes are available, depending on the automation system size. The size is defined according to the maximum number of object instances that can be included within the system.

Possible licenses to be ordered (one of these possibilities):

500 instances	**EUSAPPCZTSPEZZ**	SW PE APPL LIC EXTRA SMALL
1250 instances	**EUSAPPCZSSPEZZ**	SW PE APPL LIC SMALL
3000 instances	**EUSAPPCZMSPEZZ**	SW PE APPL LIC MEDIUM
7500 instances	**EUS APPCZLSPEZZ**	SW PE APPL LIC LARGE
>7500 instances	**EUSAPPCZXSPEZZ**	SW PE APPL LIC EXTRA LARGE

It is possible to upgrade the application license in order to increase the number of object instances.

Possible licenses to be ordered:

500 to 1250 instances	**EUSAPPGZASPEZZ**	SW PE UPG XS TO S APP LIC
1250 to 3000 instances	**EUSAPPGZESPEZZ**	SW PE UPG S TO M APP LIC
3000 to 7500 instances	**EUSAPPGZHSPEZZ**	SW PE UPG M TO L APP LIC
7500 to >7500 instances	**EUSAPPGZKSPEZZ**	SW PE UPG L TO XL APP LIC

More than one license may be necessary to upgrade to a larger system. For example, to upgrade from 500 instances to 3000 instances, two parts must be ordered:

EUSAPPGZASPEZZ	SW PE UPG XS TO S APP LIC
EUSAPPGZESPEZZ	SW PE UPG S TO M APP LIC

5 The embedded virtual machine within the PlantStruxure PES System Server requires a license for Windows. Only one license is required per PlantStruxure PES architecture. The license can be ordered from Schneider Electric or obtained from Microsoft if an agreement is exists between the company and Microsoft. Or it can be obtained from a retailer.

License to be ordered: **EUSLICWINPRO7** WIN PRO 7 LICENSE

3.1.3 System deployed on site: very small "all-in-one" configuration

For very small automation systems which don't require redundancy, an "all-in-one" license called PlantStruxure PES Mini enables all the software components to be installed on a single machine at a cost effective price. This alternative has some parameters which include:

1 The control system doesn't require more than 200 object instances; however the system can be upgraded to 500 object instances at a maximum

2 The System Server, the Operation Server and the Operation Client are installed on the same workstation

3 The configuration cannot be extended to a second Operation Server so a redundant operation configuration is not supported by PES Mini

4 The number of Operation Clients can be extended with additional licenses
License to be ordered: **EUSMINZTSPEZZ**   SW PE MINI CONF WITH 200 OBJ INST LIC

To add Operation Clients, use the following licenses:
Licenses to be ordered: **EUSLCCCZZSPEZZ**   SW PE CTRL CLIENT LIC
                                          EUSVCCCZZSPEZZ   SW PE VIEW CLIENT LIC

The same as for flexible configurations, the virtual machine embedded in PlantStruxure Mini requires a Windows 7 license. Only one license is required.
License to be ordered: **EUSLICWINPRO7**   WIN PRO 7 LICENSE

It is possible to upgrade PlantStruxure PES Mini to a maximum of 500 object instances. The limitations mentioned above remain the same when upgrading PlantStruxure PES Mini.
License to be ordered: **EUSMINGZASPEZZ**   SW PE UPG MINI TO 500 OBJ INST LIC
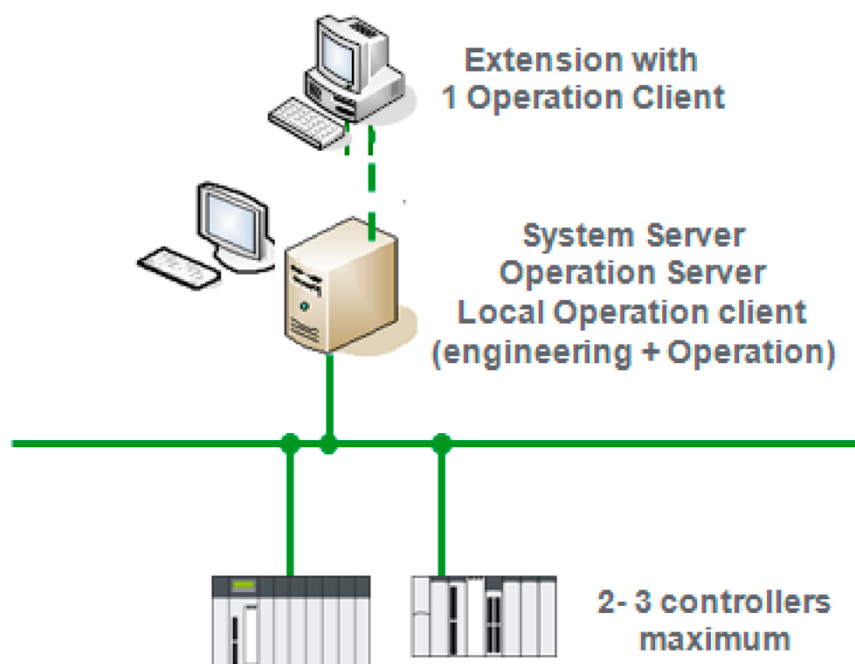

Figure 7: Very small configuration: PlantStruxure PES Mini

3.1.4 Engineering

Depending on the status of the design of the PlantStruxure project, there are three possibilities for the license of the engineering configuration:

1 When the PlantStruxure PES project is executed by Schneider Electric staff, Schneider Electric own the license and it is not transferable to the end user. In this case there are three part numbers, depending on the number of users. A Multiple Users license (e.g: "Group" license for three users) includes the rights to run PlantStruxure PES on many standalone computers that are defined for this license (e.g: running PES on three computers). The features and benefits of this license are:

- ✓ All engineering services to design the control system (editors from Unity Pro) and the supervision (graphic builder of Vijeo Citect) and the controller simulator are embedded
- ✓ Application license with unlimited number of object instances to design any size project
- ✓ 1 x Operation Server (one local control client embedded)
- ✓ Possibility to run seven Control Clients/View Only clients connected to the Operation Server
- ✓ Runtime services (supervision) are limited to eight continuous hours; and are re-launchable
- ✓ Permanent licensing
- ✓ Windows 7 license embedded through a Schneider Electric corporate contract with Microsoft

Each part includes all the required services to engineer and test the design and it includes an Application license with an unlimited number of process objects to enable the design of any size of control system.

Licenses to be ordered:		
EUSBACZZSPEZZ	SW PE ENG ASC SINGLE LIC (single user)
EUSBASCZZGPEZZ	SW PE ENG ASC GROUP LIC (3 users)
EUSBASCZZTPEZZ	SW PE ENG ASC TEAM LIC (10 users)

2 For project execution by a Schneider Electric SI Alliance Partner a one year temporary license is available. This license is not transferable to the end user and the System Integrator must be part of the Schneider Electric SI Alliance Partner Program. There are three part numbers, depending on the number of users. A Multiple User license (e.g: "Group" license for three users) includes the rights to run PlantStruxure PES on many standalone computers that are defined for this license (e.g: running PES on three computers). The features and benefits of this license are:

- ✓ All engineering services to design the control system (editors from Unity Pro) and the supervision (graphic builder of Vijeo Citect) and the controller simulator are embedded
- ✓ Application license with unlimited number of object instances to design any size project
- ✓ 1 x Operation Server (one local control client embedded)
- ✓ Possibility to run two Control Clients/View Only clients connected to the Operation Server
- ✓ Runtime services (supervision) are limited to eight continuous hours; and are re-launchable
- ✓ One year license reserved for a System Integrator who is part of the SI Alliance Partner Program

Each part includes all the required services to engineer and test the design. It includes an Application license with an unlimited number of process objects to enable the design of any size control system.

Licenses to be ordered:		
EUSBALCZZSXEZZ	SW PE ENG ALL SINGLE LIC (single user)
EUSBALCZZGXEZZ	SW PE ENG ALL GROUP LIC (3 users)
EUSBALCZZTXEZZ	SW PE ENG ALL TEAM LIC (10 users)

Each PlantStruxure PES configuration requires a license for Windows for the embedded virtual machine. Each standalone PlantStruxure configuration requires a license.

License to be ordered:	**EUSLICWINPRO7**	WIN PRO 7 LICENSE

3 For other cases, the core configuration is based on a section of the PlantStruxure PES configuration described above – the PES System Server, PES Application License and PES Operation Server will be used to design the project. This configuration is transferable to the end user and can be part of the deployed configuration on site. The features and benefits of this license are:

- ✅ All engineering services to design the control system (editors from Unity Pro) and the supervision (graphic builder of Vijeo Citect) and the controller simulator are embedded
- ✅ Maximum number of object instances is defined by the Application license that is ordered; there are five sizes.

  Licenses to be ordered: **EUSBEUCZZSPEZZ**   SW PE ENG SINGLE LIC

  Possible licenses to be ordered (one of these possibilities):

500 instances	**EUSAPPCZTSPEZZ**	SW PE APPL LIC EXTRA SMALL
1250 instances	**EUSAPPCZSSPEZZ**	SW PE APPL LIC SMALL
3000 instances	**EUSAPPCZMSPEZZ**	SW PE APPL LIC MEDIUM
7500 instances	**EUS APPCZLSPEZZ**	SW PE APPL LIC LARGE
>7500 instances	**EUSAPPCZXSPEZZ**	SW PE APPL LIC EXTRA LARGE

The embedded virtual machine within the PlantStruxure PES System server requires a license for Windows. Only one license is required.
License to be ordered: **EUSLICWINPRO7**   WIN PRO 7 LICENSE

To be able to test the system design using the supervision system the configuration above needs to be enhanced. It is possible to run the supervision system without the PES Operation Server license for only 15 minutes so to obtain permanent runtime services provided by the supervision system an peration Server license minimum must be added. This license enables a local Control Client on the server.
License to be ordered: **EUSOPECZZSPEZZ**   SW PE OPER SERVER LIC

This configuration can be reused for the deployed configuration on site. It may be enhanced with other software components, depending on the automation system requirements – refer to chapter 3.1.1.

PlantStruxure PES Mini can be used for project engineering within its limitation of 200 objects.

License to be ordered: **EUSMINZTSPEZZ** SW PE MINI CONF WITH 200 OBJ INST LIC

3.1.5 Promotion

For promotion of PlantStruxure PES by Schneider Electric staff, a demo software license is available. This license is not transferable to anyone outside of Schneider Electric. This license is dedicated to demon-strations and must not be used for customer project design. In addition it features:

- ✅ All engineering services to design the control system (editors from Unity Pro) and the supervision (graphic builder of Vijeo Citect) and the controller simulator are embedded
- ✅ Application license with the number of object instances limited to 500
- ✅ 1 x Operation Server (one local control client embedded)
- ✅ Possibility to run seven Control Clients/View-Only Clients connected to the Operation Server
- ✅ Runtime services (supervision) are limited to eight continuous hours; and are re-launchable
- ✅ Permanent license
- ✅ Windows 7 license embedded through a Schneider Electric corporate contract with Microsoft

  Licenses to be ordered: **EUSSSVZZSPEZZ**   SW PE SALES LICENSE (single user)

PlantStruxure PES Configuration: Examples

4.1

Example 1

4.1.1 Configuration without redundancy of Operation Servers

This example is an automation system with

- ✓ 400 object instances
- ✓ Two workstations set up as Operation Clients to monitor the process
- ✓ One server to collect process data; with the same machine used as an Operation Client
- ✓ No supervision redundancy

Four workstations are used in this configuration

- ✓ Workstation 1 – dedicated for the PES System Server and Engineering Client and which will be used for the maintenance of the automation system
- ✓ Workstation 2 – dedicated for operations and embeds the server and one client
- ✓ Workstation 3 – dedicated as an operator workstation as it embeds one Operation Client
- ✓ Workstation 4 – dedicated as an operator workstation as it embeds one Operation Client

Figure 8: Example 1 – PlantStruxure PES configuration without redundancy of Operation Servers

Licenses installed on the workstations

Workstation 1	1 x EUSBEUCZZSPEZZ	SW PE ENG SINGLE LIC
	1 x EUSAPPCZTSPEZZ	SW PE APPL LIC EXTRA SMALL (500 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE
Workstation 2	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (embeds one client)
	2 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC

Workstation 3   No license installed; the Operation Client gets its license from the Operation Server

Workstation 4   No license installed; the Operation Client gets its license from the Operation Server

Note: if the Operation Server must be located elsewhere (e.g.: outside of the control room) another Operation Client license must be ordered and in this case this additional license should be installed on Workstation 2.

4.1.2 Configuration with redundancy of Operation Servers

This example is an automation system with

- ✓ 400 object instances
- ✓ Two workstations set up as Operation Clients to monitor the process
- ✓ One server with redundancy to collect process data; with the same machine used as an Operation Client

Five workstations are used in this configuration

- ✓ Workstation 1 – dedicated for the PES System Server and Engineering Client, and used for main tenance of the automation system
- ✓ Workstation 2 – dedicated for operations as it embeds the primary server and one client
- ✓ Workstation 3 – dedicated for operations as it embeds the secondary server and one client
- ✓ Workstation 4 – dedicated as an operator workstation as it embeds one Operation Client
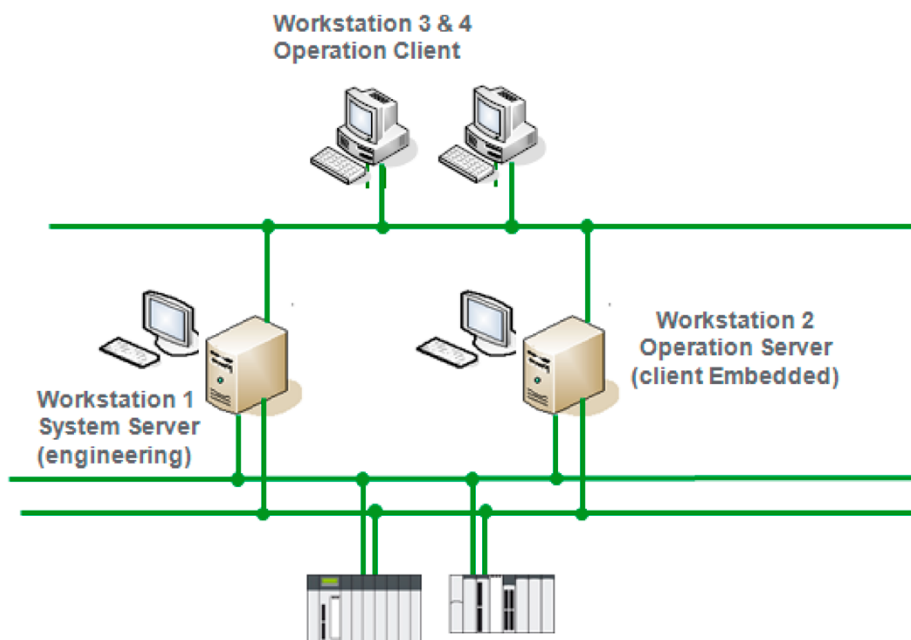- ✓ Workstation 5 – dedicated as an operator workstation as it embeds one Operation Client

Figure 9: Example 1 – PlantStruxure PES configuration with redundancy of Operation Servers

Licenses installed on the workstations

Workstation 1	**1 x EUSBEUCZZSPEZZ**	SW PE ENG SINGLE LIC
	1 x EUSAPPCZTSPEZZ	SW PE APPL LIC EXTRA SMALL (500 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE
Workstation 2	**1 x EUSOPECZZSPEZZ**	SW PE OPER SERVER LIC (primary server with client)
	2 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 3	**1 x EUSOPECZZSPEZZ**	SW PE OPER SERVER LIC (secondary server with client)
	2 x EUSLRCCZZSPEZZ	SW PE REDUNDANT CTRL CLIENT LIC
Workstation 4	No license installed; the Operation Client gets its license from the Operation Servers on workstations 2 or 3 (Primary or Secondary)	
Workstation 5	No license installed; the Operation Client gets its license from the Operation Servers on workstations 2 or 3 (Primary or Secondary)	

Note: if the Operation Server must be located elsewhere (e.g.: outside of the control room) then two additional Operation Client licenses must be ordered:

| | **1 x EUSLCCCZZSPEZZ** | SW PE CTRL CLIENT LIC |
| | **1 x EUSLRCCZZSPEZZ** | SW PE REDUNDANT CTRL CLIENT LIC |

EUSLCCCZZSPEZZ must be installed on Workstation 2 and EUSLRCCZZSPEZZ must be installed on Workstation 3.

PlantStruxure PES Configuration: Examples

4.2
Example 2

4.2.1 Configuration without redundancy of Operation Servers

This example is an automation system with

- 1000 object instances
- Two istributed areas with access for two operators only
- Monitoring from four locations
- Two workstations set up as Operation Clients to monitor the process
- Two servers to collect process data; with each machine used as an Operation Client
- No supervision redundancy

Five workstations are used in this configuration

- Workstation 1 – dedicated as a PES System Server and Engineering Client and will be used for maintenance of the automation system
- Workstation 2 – dedicated for operations as it embeds Server_1 and one client
- Workstation 3 – dedicated for operations as it embeds Server_2 and one client
- Workstation 4 – dedicated as an operator workstation as it embeds one Operation Client
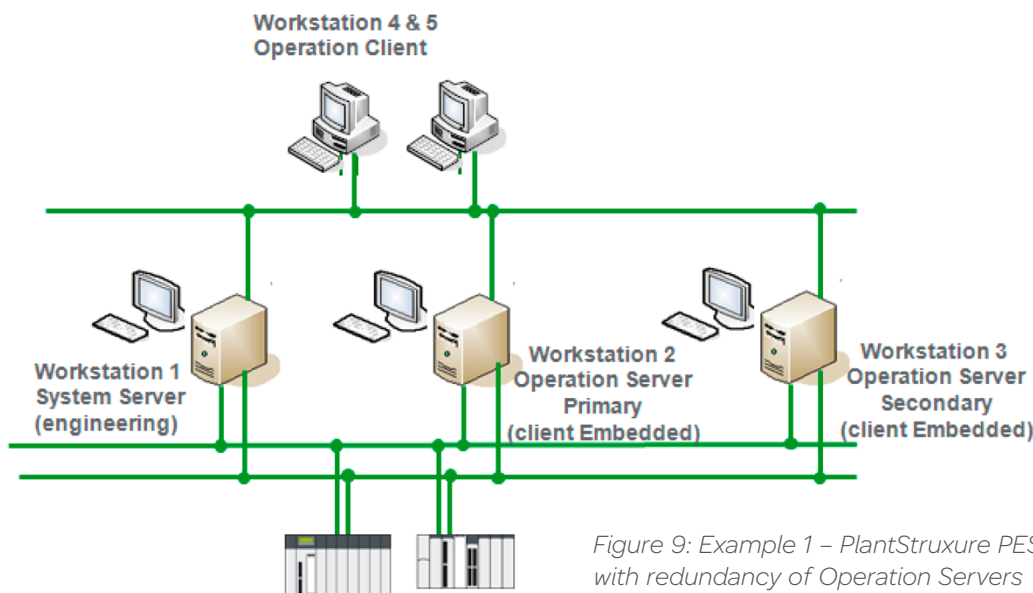- Workstation 5 – dedicated as operator workstation as it embeds one Operation Client
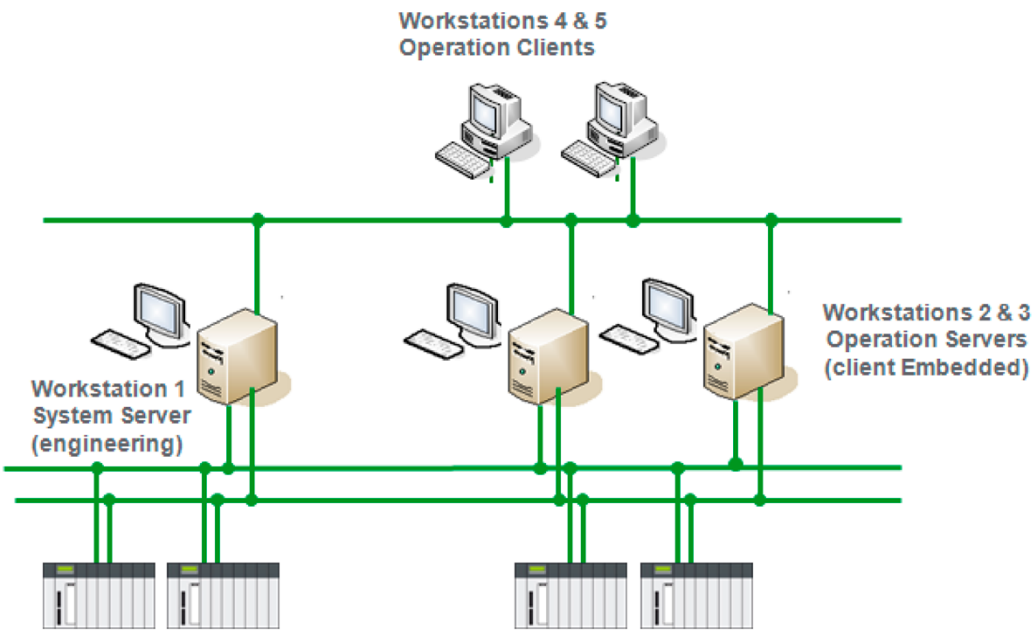
Figure 10: Example 1 – PlantStruxure PES configuration without redundancy of Operation Servers

Licenses installed on the workstations

Workstation 1	1 x **EUSBEUCZZSPEZZ**	SW PE ENG SINGLE LIC
	1 x **EUSAPPCZSSPEZZ**	SW PE APPL LIC SMALL (1250 object instances)
	1 x **EUSLICWINPRO7**	WIN PRO 7 LICENSE
Workstation 2	1 x **EUSOPECZZSPEZZ**	SW PE OPER SERVER LIC (each embeds one client)
	2 x **EUSLCCCZZSPEZZ**	SW PE CTRL CLIENT LIC

Workstation 3	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (each embeds one client)
	2 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC

Workstation 4   No license installed as the Operation Client gets its license from the Operation Server on workstation 2

Workstation 5   No license installed as the Operation Client gets its license from the Operation Server on workstation 3

Note: if the Operation Server must be located elsewhere (e.g.: outside of the control room) another Operation Client license must be ordered and in this case this additional license should be installed on Workstation 2.

Note: there are other options available when housing the licenses on the workstations. In this example we have chosen to locate all the engineering licenses on Workstation 1 and distribute the runtime licenses on servers in order to maintain availability of at least one part of the system should a workstation fail. However, if you choose you can group all the licenses on one workstation, or locate the licenses with the machine that supports the corresponding features.

4.2.2 Configuration without redundancy of Operation Servers

This example is an automation system with:

- ✔ 1000 object instances
- ✔ Two distributed areas with access for two operators only
- ✔ Monitoring from four locations
- ✔ Two workstations set up as Operation Clients to monitor the process
- ✔ Redundancy of the supervision
- ✔ Two redundant servers to collect process data; each used as an Operation Client

Seven workstations are used in this configuration

- ✔ Workstation 1 – dedicated for the PES System Server and Engineering Client and will be used for maintenance of the automation system
- ✔ Workstation 2 – dedicated for operations as it embeds Primary Server_1 and one client
- ✔ Workstation 3 – dedicated for operations as it embeds Primary Server_2 and one client
- ✔ Workstation 4 – dedicated for operations as it embeds Secondary Server_1 and one client
- ✔ Workstation 5 – dedicated for operations as it embeds Secondary Server_2 and one client
- ✔ Workstation 6 – dedicated as an operator workstation as it embeds one Operation Client
- ✔ Workstation 7 – dedicated as an operator workstation as it embeds one Operation Client

Figure 11: Example 2 – PlantStruxure PES configuration with redundancy of Operation Servers

Licenses installed on the workstations

Workstation 1	**1 x EUSBEUCZZSPEZZ**	SW PE ENG SINGLE LIC
	1 x EUSAPPCZSSPEZZ	SW PE APPL LIC SMALL (1250 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE

| Workstation 2 | **1 x EUSOPECZZSPEZZ** | SW PE OPER SERVER LIC (primary server_1 with client) |
| | **1 x EUSLCCCZZSPEZZ** | SW PE CTRL CLIENT LIC |

| Workstation 3 | **1 x EUSOPECZZSPEZZ** | SW PE OPER SERVER LIC (primary server_2 with client) |
| | **1 x EUSLCCCZZSPEZZ** | SW PE CTRL CLIENT LIC |

| Workstation 4 | **1 x EUSOPECZZSPEZZ** | SW PE OPER SERVER LIC (secondary server_1 with client) |
| | **1 x EUSLRCCZZSPEZZ** | SW PE REDUNDANT CTRL CLIENT LIC |

| Workstation 5 | **1 x EUSOPECZZSPEZZ** | SW PE OPER SERVER LIC (secondary server_2 with client) |
| | **1 x EUSLRCCZZSPEZZ** | SW PE REDUNDANT CTRL CLIENT LIC |

Workstation 6 — No license installed as the Operation Client gets its license from the Operation Servers on workstations 2 or 4

Workstation 7 — No license installed as the Operation Client gets its license from the Operation Servers on workstations 3 or 5

Note: if the Operation Server must be located elsewhere (e.g.: outside of the control room) then four additional Operation Client licenses must be ordered:

| | **2 x EUSLCCCZZSPEZZ** | SW PE CTRL CLIENT LIC |
| | **2 x EUSLRCCZZSPEZZ** | SW PE REDUNDANT CTRL CLIENT LIC |

4.3
Example 3

4.3.1 Large configuration with many servers and clients

This example is an automation system with

- 4000 object instances
- Monitoring of the process from 11 locations
- Five workstations set up as Operation Clients to monitor the process in the control room
- Two additional workstations which are remote and used as Web Clients, with View Only features
- Four servers to collect process data; with each machine used as an Operation Client
- No redundancy of the Operation Server

Twelve workstations are used in this configuration

- Workstation 1 – dedicated as the PES System Server and Engineering client and will be used for maintenance of the automation system
- Workstation 2 – dedicated for operations as it embeds Server_1 and one client
- Workstation 3 – dedicated for operations as it embeds Server_2 and one client
- Workstation 4 – dedicated for operations as it embeds Server_3 and one client
- Workstation 5 – dedicated for operations as it embeds Server_3 and one client
- Workstation 6 – dedicated as an operator workstation as it embeds one Operation Client
- Workstation 7 – dedicated as an operator workstation as it embeds one Operation Client
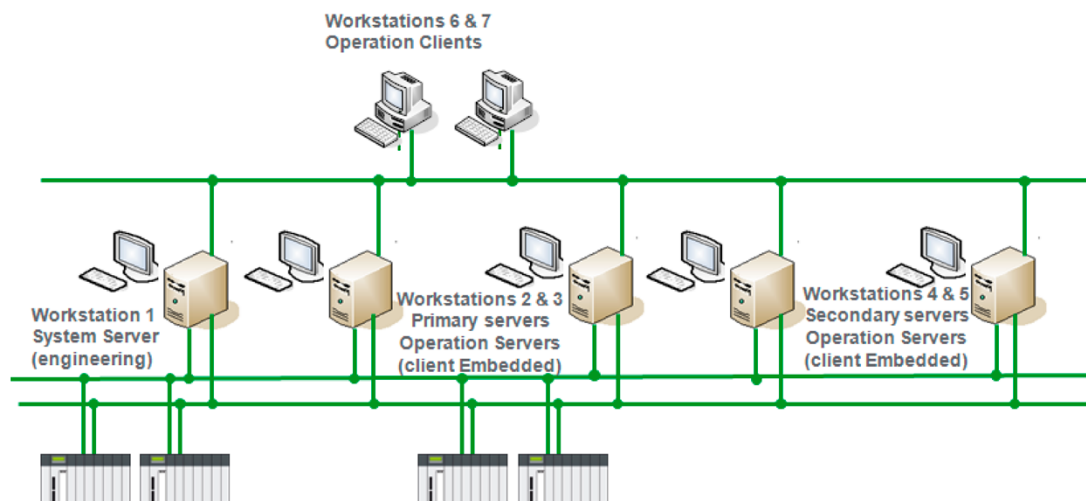- Workstation 8 – dedicated as an operator workstation as it embeds one Operation Client
- Workstation 9 – dedicated as an operator workstation as it embeds one Operation Client
- Workstation 10 – dedicated as an operator workstation as it embeds one Operation Client
- Workstation 11 – dedicated as a remote operator workstation as it embeds one Operation Client (View Only)
- Workstation 12 – dedicated as a remote operator workstation as it embeds one Operation Client (View Only)
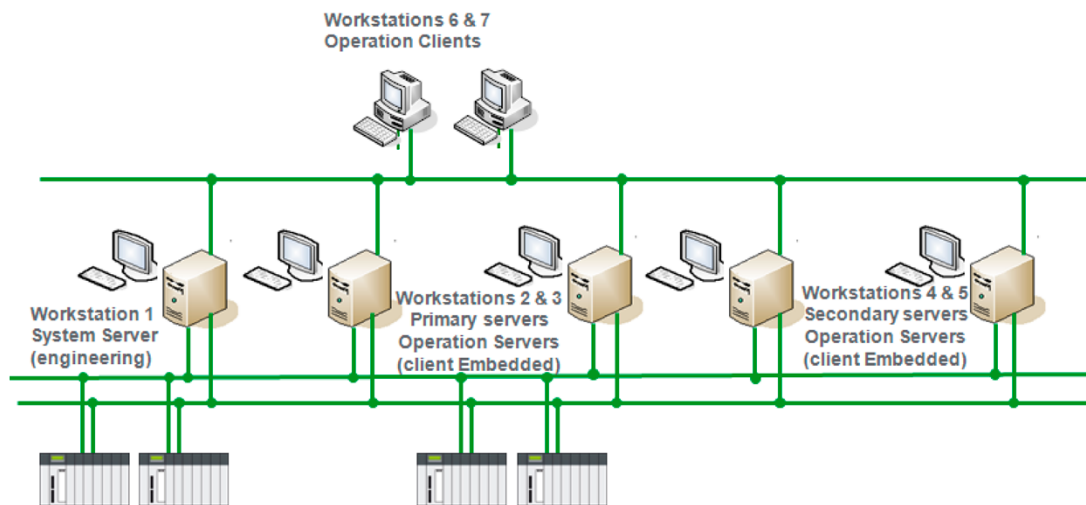
PlantStruxure PES Configuration: Examples

Figure 12: Example 3 – PlantStruxure PES large configuration with many servers and clients

Licenses installed on the workstations

Workstation 1	1 x EUSBEUCZZSPEZZ	SW PE ENG SINGLE LIC
	1 x EUSAPPCZLSPEZZ	SW PE APPL LIC LARGE (7500 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE
Workstation 2	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (embeds one client)
	2 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 3	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (embeds one client)
	1 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 4	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (embeds one client)
	1 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 5	1 x EUSOPECZZSPEZZ	SW PE OPER SERVER LIC (embeds one client)
	1 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 6	No license installed; the Operation Client gets its license from the Operation Server on workstation 2	
Workstation 7	No license installed; the Operation Client gets its license from the Operation Server on workstation 2	
Workstation 8	No license installed; the Operation Client gets its license from the Operation Server on workstation 3	
Workstation 9	No license installed; the Operation Client gets its license from the Operation Server on workstation 4	
Workstation 10	No license installed; the Operation Client gets its license from the Operation Server on workstation 5	
Workstation 11	1 x EUSVCCCZZSPEZZ	SW PE VIEW CLIENT LIC
Workstation 12	1 x EUSVCCCZZSPEZZ	SW PE VIEW CLIENT LIC

Note: if the Operation Server must be located elsewhere (e.g.: outside of the control room) four additional Operation Client licenses must be ordered and they should be installed and distributed in the Operation Servers on Workstation 2.

Note: there are other options available when housing the licenses on the workstations. In this example we have chose to locate all the engineering licenses on Workstation 1 and distribute the runtime licenses on the servers in order to maintain availability of at least one part of the system should a workstation fail. However, if you choose you can group all the licenses on one workstation, or locate the licenses on the machine that supports the corresponding features.

4.4
Example 4

4.4.1 Extension of an existing application

In this example a PlantStruxure PES configuration has already been deployed on site. The parameters of this example automation system are:

- ✓ 1000 object instances
- ✓ One workstation installed as an Operation Server to collect process data; and also used as an Operation Client (see next point)
- ✓ Two Operation Clients to monitor the process

The following list of licenses has been deployed on site

Workstation 1	**1 x EUSBEUCZZSPEZZ**	SW PE ENG SINGLE LIC
	1 x EUSAPPCZSSPEZZ	SW PE APPL LIC SMALL (1250 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE
Workstation 2	**1 x EUSOPECZZSPEZZ**	SW PE OPER SERVER LIC (embeds one client)
	1 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 3	No license installed; the Operation Client gets its license from the Operation Server on workstation 2

The Plant Manager now needs to extend the automation system, which leads to the addition of many object instances and also an Operation Client in the control room. The number of object instances is now 1500.

To achieve this upgrade there are two addition licenses needed:

| | **1 x EUSAPPGZESPEZZ** | SW PE UPG S TO M APP LIC (to upgrade from 1250 to 3000 object instances) |
| | **1 x EUSLCCCZZSPEZZ** | SW PE CTRL CLIENT LIC |

Note: Upgrading the application license will mean this example now has the equivalent of the Medium Application license. To enable this upgrade the user has to return the Small Application license and upgrade it to the Medium Application license using the Software Licensing Web Portal.

These licenses are deployed on site as follows

Workstation 1	**1 x EUSBEUCZZSPEZZ**	SW PE ENG SINGLE LIC
	1 x EUSAPPCZSMPEZZ	SW PE APPL LIC MEDIUM (3000 object instances)
	1 x EUSLICWINPRO7	WIN PRO 7 LICENSE
Workstation 2	**1 x EUSOPECZZSPEZZ**	SW PE OPER SERVER LIC (embeds one client)
	2 x EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
Workstation 3	No license installed; the Operation Client gets its license from the Operation Server on workstation 2
Workstation 4	No license installed; the Operation Client gets its license from the Operation Server on workstation 2

List of References and Hardware Requirements

5.1
References

Process Expert System MINI

EUSMINZTSPEZZ	SW PE MINI CONF WITH 200 OBJ INST LIC
EUSMINGZASPEZZ	SW PE UPG MINI TO 500 OBJ INST LIC

Process Expert System for End Users

EUSBEUCZZSPEZZ	SW PE ENG SINGLE LIC
EUSAPPCZTSPEZZ	SW PE APPL LIC EXTRA SMALL
EUSAPPCZSSPEZZ	SW PE APPL LIC SMALL
EUSAPPCZMSPEZZ	SW PE APPL LIC MEDIUM
EUS APPCZLSPEZZ	SW PE APPL LIC LARGE
EUSAPPCZXSPEZZ	SW PE APPL LIC EXTRA LARGE
EUSOPECZZSPEZZ	SW PE OPER SERVER LIC
EUSLCCCZZSPEZZ	SW PE CTRL CLIENT LIC
EUSVCCCZZSPEZZ	SW PE VIEW CLIENT LIC
EUSLRCCZZSPEZZ	SW PE REDUNDANT CTRL CLIENT LIC
EUSVRCCZZSPEZZ	SW PE REDUNDANT VIEW CLIENT LIC
EUSAPPGZASPEZZ	SW PE UPG XS TO S APP LIC
EUSAPPGZESPEZZ	SW PE UPG S TO M APP LIC
EUSAPPGZHSPEZZ	SW PE UPG M TO L APP LIC
EUSAPPGZKSPEZZ	SW PE UPG L TO XL APP LIC

Process Expert System Engineering for ASC

EUSBACZZSPEZZ	SW PE ENG ASC SINGLE LIC
EUSBASCZZGPEZZ	SW PE ENG ASC GROUP LIC
EUSBASCZZTPEZZ	SW PE ENG ASC TEAM LIC

Process Expert System Engineering for Alliance Partners

EUSBALCZZSXEZZ	SW PE ENG ALL SINGLE LIC
EUSBALCZZGXEZZ	SW PE ENG ALL GROUP LIC
EUSBALCZZTXEZZ	SW PE ENG ALL TEAM LIC

Process Expert System for demonstration (Sales)

EUSSSVZZSPEZZ	SW PE SALES LICENSE

License Windows 7 Pro for Virtual Machine embedded in PES

EUSLICWINPRO7	WIN PRO 7 LICENSE

The software is downloadable from the Schneider Electric portal (no hardware media supplied). Registration is required to access to the website (www.pes.schneider-electric.com).

List of References and Hardware Requirements

5.2
Hardware requirements

Workstation embedding the System Server

System: Minimum: Core i5; recommended: Core i7 (Quad Core) Processor

RAM memory: 8GB minimum, 16 GB recommended

Hard disk: 250 GB / Fast disk 7200 rpm; format: NTFS file system and not FAT32

40 GB of free memory space on the hard disk is required to install and run the software

DVD-ROM drive to install the software

Recommended display: SVGA (1024-768 or more) with high color 24 bits

Pointing device: mouse or compatible device

Workstation embedding the Operation Server

System: Minimum: Core i3; recommended: Core i5

RAM memory: 4GB minimum, 8 GB recommended

Hard disk: 80 GB (SSD) / Fast disk 7200 rpm;

DVD-ROM drive to install the software

6.1
Introduction

PlantStruxure Process Expert System provides resources:

- ✓ That have been pre-configured and tested by Schneider Electric.
- ✓ That were specifically designed for automating a large variety of processes.

The control resources for the Control and monitoring resources for Operator Interface provide the commonly required functions to facilitate the development of the DCS application.

StruxureWare PE includes global templates organized through the Foundation and General Purpose libraries. Optional libraries to address specific needs in markets and applications can be installed as options on top of StruxureWare PE.

The picture below shows an overview of the General Purpose and optional libraries available with PlantStruxure PES V3.1:
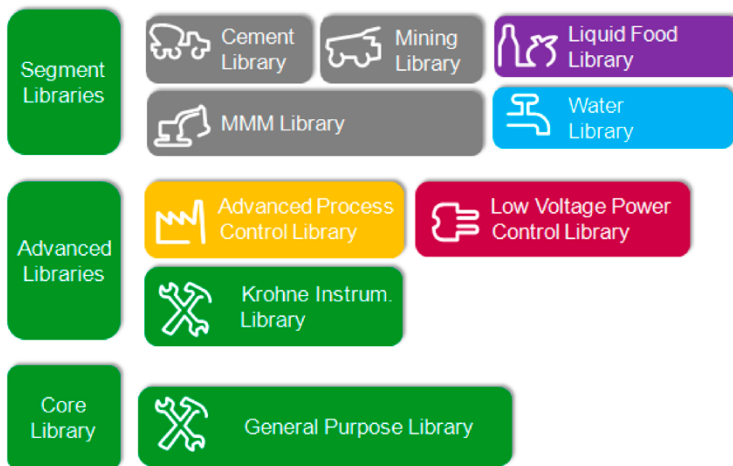
Figure 13: PlantStruxure PES General Purpose and Market/Application Libraries

The system provides Control function blocks (DFB) at the control level, and dynamic representations (Genies) at the supervision level. In addition, ready to-use faceplates (implemented through windows with Super Genies syntax) enable the users to get the status and interact with the process at the monitoring level. To automate and simplify the implementation of automation systems, project designers can use these resources together for massive code generation and for the synchronization of control and supervision.

6.2
Global templates libraries

Global templates include two libraries:

- ✓ Foundation library, which includes elementary object templates. Generally, these templates are not used as single templates, but combined with others as composites with more value-added features. This library is required to design home-made templates.
- ✓ General Purpose library (GPL), which embeds composite templates corresponding to a process feature, as a control module. Automation systems are designed with object templates from the GPL, and objects may also be used from the optional libraries and home-made templates

The General Purpose Library is organized in categories according to their purpose.

6.2.1 Four main categories of templates

1 Process templates
> Signal conditioning and processing
> On/off device control
> Analog device control
> Process control
> Sequential control
> Auxiliary functions

2 Devices
> Circuit breakers
> Digital protective relays
> Motor control and starters
> Power monitoring devices
> Progressive starters
> Variable speed drives

3 Communication
> Ethernet Modbus TCP
> Modbus serial

4 Diagnostics
> Modicon M340 CPU
> Modicon Quantum CPU

The picture below gives an overview of these object templates. Most of them embed graphical representations as there could be many representations of the same object that can be used in the Operator Interface. Some examples are given below.

Signal processing / calculation

Function family	Sub-Function	Template	Graphical representation
Signal processing	Digital input acquisition	$DigitalInput	
	Digital output signal	$DigitalOutput	
	Digital calculation	$DigitalCalc	
	Analog input calculation	$AnalogInput	
	Analog input calculation with conversion	$AnalogInput1	
	Multiple Analog Input Acquisition	$MAnalogInput1	
	Analog output signal	$AnalogOutput	
Analog calculation	Derivative rate of change, totalizing, average, minimum, maximum	$AnalogCalc	
	Analog Signal Linearization	$AnalogLinear	

Figure 14: GPL library; signal processing / calculation

Process control

Function family	Sub-Function	Template	Graphical representation
Controllers	Internal Model Controller (IMC)	$IMC	
	PID Controller (to condition the signals associated with the control of a PID with optional Feed forward)	$PID	Process Value, Setpoint
	PID closed loop circuit (to condition the signals associated with the control of a PID with optional Feed forward. It also include analog input and output management)	$PIDLoop	Vertical 3 ways valve
	Ratio Controller (to condition the signals associated with the control of a Ratio Controller)	$RatioCtl	
	Split Range Controller (to condition a PID signal into split range signal)	$SplitRange	
	Pulse with Modulation Controller (to condition an analog signal into modulated pulses)	$PMWController	Ratio Controller
	Step3 Controller (to condition the signals associated with the control of a step 3 controller)	$Step3Ctl	
	Lead Lag calculation	$LeadLag	
Sequential control	Advanced Sequence control (Monitor and manage a control sequence)	$SequenceDFB	

Figure 15: GPL library; process control

Device control management / PLC Diag

	Function family	Sub-Function	Template	Graphical representation
	On/Off device control; Valve	Hand Valve management	$HandValve	
		Mvalve: Motorized valve	$MValve	
		On/Off Valve	$Valve	
		On/Off Valve with 2 outputs	$Valve2	
	On/Off device control; Motor	On-Off motor 1 speed, 1 rotation direction	$Motor	
		On-Off motor 2 speed, 2 rotation direction	$Motor2	
	Analog devices Control; Valve	Control valve with optional position feedback (analog position and/or limit switches)	$ControlValve	
		Motorized valve, or a gate with analog position feedback and 2 rotational direction	$MValveWithPos	
	Analog devices Control; Motor	Motor management with Variable Speed Drive	$MotorVS	
	Diagnostic	M340 PLC Diagnostic	$M340Diag	
		Quantum PLC Diagnostic	$QuantumDiag	

Figure 16: GPL library; device control management /controller diagnostics

Automation and Power Devices

	Family of devices	Device name	Ethernet	Modbus Serial	Advantys local bus (CANopen)
	Progressive starters	ATS22, ATS48		☑	
	Variable speed drives	ATV12, ATV312,		☑	
		ATV31		☑	☑
		ATV61, ATV71	☑	☑	☑
	Motor controllers and starters	TesysU (5 functions)		☑	☑
		TesysT (2 functions)	☑	☑	☑
	Digital protective relays	Sepam20C, Sepam40C, Sepam80C		☑	
	Circuit breakers	CompactNSX, MasterPact, MasterPactC		☑	
	Power monitoring devices	PM9, PM710, PM800, PM1200		☑	
	Harmonic filter and power compensation	Accusine	☑		
	Uniterruptible power supply	SmartUPS		☑	
	Safety module	XPSMC		☑	
	Generic device		☑		

Figure 17: GPL library; automation and power devices

6.2.2 Configuration to edit and create instances of templates

Even if it is recommended to minimize the development time to use pre-defined template, any configuration of PES for engineering enables the design of templates. This design can be done from scratch, or following a copy of an existing template of the GPL library and its customization to fulfill the project requirements. Refer to the paragraph "Engineering" to discover the software licenses enabling the engineering..

6.3
Advanced Process Control Library

6.3.1 Presentation

Advanced Process Control Library v2.0 consists of 18 functions blocks for monitoring and controlling complex processes in the plant.
An additional software called OptiReg v3.1 provides features for modeling the process, tuning PIDs as well as the model based controllers.

The APC Library V2.0 for the PES offer includes:
- ✓ Standard Library
- ✓ PCR Library
- ✓ IMC Library

The Standard Library includes the following functions:

PID Block - Standard PID function with the ability manage the complete loop from a single place. Data from transmitter and positioner (value, status and mode) are seamless in the loop and used for calculations. Upstream object information transfers to the downstream objects.

Enhanced PID Block - This is an enhanced and completed PID block with feed forward gain for disturbance compensation and override function by copying the actuator current status (RCPY). Auto tuning functionality is embedded in this block.

Analog Acquisition Block - Analog input with signal filtering, square root extraction and process analyst.

Analog Positioner Block - Analog output with ability to loop back the output data (value, status and mode) with upstream object to downstream objects information transfer feature.

De-multiplexer Block - Auxiliary block; transfers single control output to 4 positioners. Upstream object to downstream objects information transfer feature.

Choice Block - Auxiliary block; select 1 of 4 input signals by PLC logic and manual. Selection is bump-less. Priority management is also possible.

Set Point Block - Auxiliary block, used to create a filtered set point with upstream object to downstream objects information transfer feature.

Ratio Block - Auxiliary block; ratio control function with filtering, tracking mode and alarm detection. Generally used in cascade mode, it supports a loop back from the connected actuators. Error mode or manual mode operation of actuators is used in ratio control & PID calculations to prevent saturation.

Split Block - Auxiliary block; split range function with transforms an analog input value into 2 analog outputs using the coordinate values, and checks for threshold overruns. The values and status of the downstream actuators are used to initialize the loop and to prevent integral saturation.

Selection Block - Auxiliary block; this block is used to select one of 3 transmitter signals based on logical decisions, where status of the analog output is looped back and manages different modes. It checks for threshold overruns.

Vote Block - Auxiliary block; this object is used to calculate a mean value of 3 process variables. A deviation alarm occurs if the deviation between 1 input and the 2 others is greater than the set limit.

Wrapper Block – Auxiliary block; this block is used for using/linking the analog actuators of other libraries (e.g. General Purpose Library, Water Library etc.) with APC library blocks without losing the APC library's key feature of upstream object status transfer to the downstream object (i.e. back-in / back-out feature).

The model based predictive control library includes the following functions:

AP_PSF1 Block - Predictive controller for 1st order simple process. (Model: Km,Tm & Dm) : simple, and convenient for long time delays.

AP_PIF1 Block - Predictive controller for 1st order integrative process.

AP_PZTR Block - Zone control with non-linear time response. This block is used for automatically changing the closed-loop time-response when the process variable (PV) is inside or outside a zone.

The internal model based control library includes the following functions:

AP_MSF1 Block - Internal model based controller for 1st order simple processes. It identifies a first order system with pure delay (the transfer function of the process and the transfer function of closed loop (controller + process)). The controller AP_MSF1 allows a static gain unit and acceleration of the time constant by a factor 'n', where n is the gain speed.

AP_MIF1 Block - Internal model based controller for 1st order integrative process.

AP_MRAMP Block - An intelligent ramp management block. It is used with IMC controllers and allows both the AP_MSF1 block and APMIF1 block to follow a parallel path to ramp the setpoint and to join and follow it precisely. Tracking a reference trajectory, and in particular a setpoint ramp is necessary in many applications.
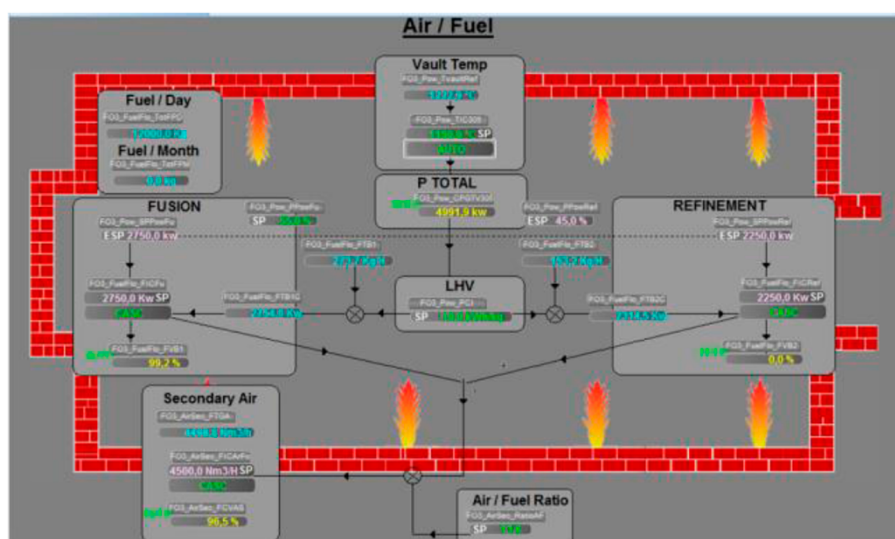

Figure 18: APC library: example of use in a glass furnace

6.3.2 List of References

The standard library comes with the standard license for APC library v2.0.
PCR & IMC libraries have model based control functions and come with the APC library v2.0 model license.

Each license enables the creation of 100.000 object instances.

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.
Only one Advanced Process Control Library license is required for the PES project deployed on site.

Standard library
License to be ordered: **EUSAPCCZSSPEZZ**   SWPE APC Library – Standard

Standard library + PCR & IMC libraries
License to be ordered: **EUSAPCCZMSPEZZ** SWPE APC Library - Std + Model

Possibility to upgrade the Standard library license with PCR & IMC libraries
License to be ordered: **EUSAPCGZESPEZZ**   SWPE APC Library - Std–>Model Upgrade

Optireg software is delivered when an APC library license is ordered.

6.4
Low Voltage Power Control Library

6.4.1 Presentation

Low Voltage Power Control (LVPC) Library V1.0 for PES provides the ability to monitor the energy situation in low voltage power circuits in a plant and retain the available energy for the most critical loads by shedding the least critical ones.

The LVPC Library contains following functions:

LOADMNG - Load manager manages the system's available power in order to ensure the availability of the installation's top-priority loads.

GENERATOR – It manages a generator's most characteristic signals and alarms. It is combined with the SOURCE block.

SOURCE – It represents an element that supplies power to the system.

TRAFO - It manages a transformer's most characteristic signals and alarms. It is combined with the SOURCE block.

COMPACT / MASTERPACT - Model and control COMPACT NSX or MASTERPACT devices. In the LVPC Library, it is used together with the INFEED or LOAD.

INFEED - Circuit breaker. It can be combined with COMPACT and MASTERPACT, as well as with any ON-OFF device. It allows the simulation, interlocks, owner management, failure summary, and confirmation of alarms.

LOAD - It is combined with COMPACT & MASTERPACT. It allows the simulation, interlocks, failure summary, owner management, and confirmation of alarms.

BUSBAR – It closes the circuit breakers with voltage in order to supply power to the system

The LVPC library includes the following services:

Design of a power circuit
- ✅ Components to build a one-line diagram of the electrical system
- ✅ Seamless connections between components of the electrical system
- ✅ Each item of equipment can be uniquely identified with nominal ratings

Management of load and priorities
- ✅ Maximum (nominal) power that a source is capable of providing
- ✅ Generation that can be picked up within reasonable time after the loss of connected generation
- ✅ The maximum (nominal) power that every load can draw
- ✅ Criticality of every load connected
- ✅ Priority of loads for re-connection within a criticality group

Load shedding
- ✅ Continuous power balance calculations that enable decisions
- ✅ Perform automatic load shedding
- ✅ Re-connecting the disconnected loads when power source is restored
- ✅ Interlocking between loads to control load shedding

Simulation
- ✅ Supports simulation for efficient design of power management systems
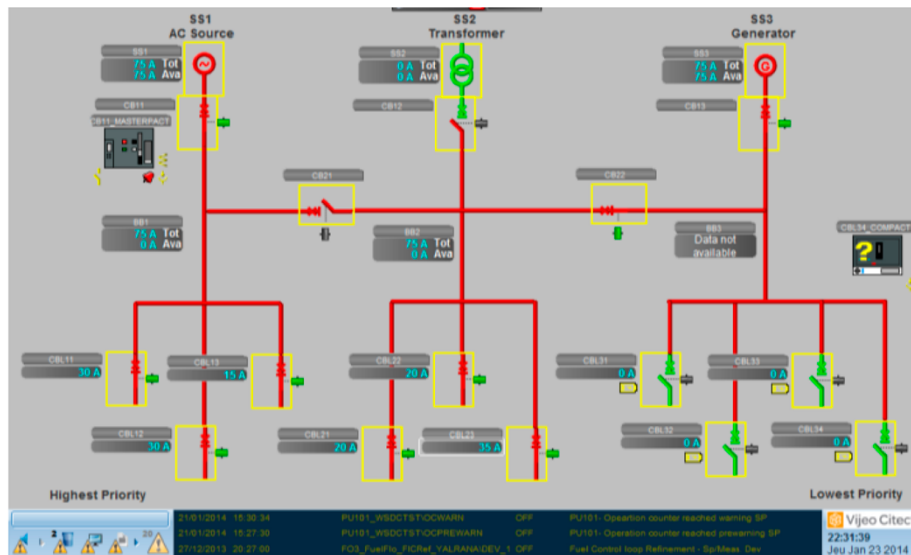- ✅ Evaluate impact of power loss or overload scenarios during operation by simulation

Figure 19: LVPC library: example of use

6.4.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of object instances to be enlarged.

Complete packages:

License to be ordered:		
	EUSLPCCZSSPEZZ	LVPC Library for PES – Small (500 instances)
	EUSLPCCZMSPEZZ	LVPC Library for PES – Medium (2000 instances)
	EUSLPCCZLSPEZZ	LVPC Library for PES – Large (>2000 instances)

Upgrades:

License to be ordered:		
	EUSLPCGZESPEZZ	LVPC Library for PES – S to M
	EUSLPCGZHSPEZZ	LVPC Library for PES – M to L

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.
Only one LVPC Library license is required for the PES project deployed on site.

6.5
Energy Manangement Library

6.5.1 Presentation

The Energy Management Library V2.0 offers monitoring and measurement of electrical and non – electrical process objects. It takes into account WAGES (Water, Air, Gas, Electricity and Steam) inputs. These blocks are capable of providing aggregated energy at each level, by giving information to users about the energy consumption data.

The Energy Measurement Library offers library blocks which convert process measurement values (flows, temperature, pressure, current, voltage) into energy measurement values (kW/kWh). These values are formatted to comply with the ODVA energy object standards. The energy measurement library also allows these blocks to be added and subtracted, providing an approximate energy measurement for higher levels within the process hierarchy. This enables the energy consumption and the process to be compared to alarm conditions and for energy to be monitored constantly but only alarmed when issues occur. The energy measurement libraries act as enablers for both the energy performance architectures used by Schneider Electric to perform overall energy management and also the energy performance services which provide Schneider Electric's expertise to customers as a service.

The Energy Management library contains following functions:

Aggregator - it aggregates the energy values from the energy objects connected to this object. It provides the instantaneous energy and the total energy in local units.

Gas – it calculates the energy produced/consumed by gas fuel.

Electric – it calculates the energy produced/consumed by an electrical circuit. It is able to calculate energy for single phase and three-phase circuits.

Boiler – it calculates the amount of energy that is consumed to produce superheated steam from water.

Aircomp - it calculates the ratios of pressure and volume flow rate to energy consumption. These values are key performance indicators (KPIs) of the air compressor and give an indication of its efficiency.

Liquid - it calculates the energy produced/consumed by liquid fuel.

CO2 - it calculates the CO2 equivalent in kg for an amount of energy.

ProcessEnergy - it compares the actual energy with the modelled process energy template for a particular production period. This function can determine if the plant/area/section is consuming more or less energy than planned.

ProcessEnergyAdv – it compares the actual energy with the modelled process energy advanced template for a particular production period. This function can determine if the plant/area/section is consuming more or less energy than planned during this period.

Solid – it calculates the energy produced/consumed by solid fuel.

The Energy Management library includes the following services:

A standard way of communicating energy data
- ✓ Energy library is capable of providing energy data in standardized form (kwh) which can be accessed across the platform from device level. It is capable of providing energy equivalent information even in local units to users.

The energy consumption information at each level
- ✓ The calculated energy values can be aggregated at upper levels, by giving user information about total energy consumption at various levels in a plant. With this value information, users would able to take appropriate action based on the total consumed energy.

The energy data for electrical and non electrical energy objects
- ✓ The library supports measurement of energy consumption for electrical energy, gas consumption and virtual measurement of energy. This can help the user in implementing a measurement solution for both electrical and non electrical plant components.

Energy monitoring
- ✓ Data obtained from the energy library helps users to know the total energy consumption of the plant and therefore analyse and monitor the key areas.

A data representation aligned to ODVA standards
- ✓ Energy information displayed by the library is in line with ODVA data format.

A set of energy blocks for parameter measurement
- ✓ Energy library has also non-energy related blocks for measurement of CO_2 emissions, pressure, and volume flow consumption.

6.5.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of the object instances to be enlarged.

Complete packages:

License to be ordered:	**EUSEGMCZSSPEZZ**	SWPE Energy library – Small (100 instances)	
	EUSEGMCZMSPEZZ	SWPE Energy library – Medium (500 instances)	
	EUSEGMCZLSPEZZ	SWPE Energy library – Large (> 500 instances)	
Upgrades:			
License to be ordered:	**EUSEGMGZESPEZZ**	SWPE Energy library – S -> M	Upgrade
	EUSEGMGZHSPEZZ	SWPE Energy library – M -> L	Upgrade

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.

Only one Energy Management Library license is required for the PES project deployed on site.

6.6
Krohne Instrumentation Library

6.6.1 Presentation

Krohne instrumentation Library V2.0 for PES enables smart instrumentation integration into the PES architecture from one of the leading instrument manufacturers, "Krohne". This library offers a set of functional blocks to enable the efficient management of field instruments connected through a Hart interface module embedded in a Modicon STB island.

List of instruments on HART that are supported:

- Variable Area Flow meter – ESK4
- Electro Magnetic Flow Meter – IFC300
- Electro Magnetic Flow Meter – IFC100
- Ultrasonic Flow meter – UFC400
- Temperature Transmitter – TT51
- Samson Positioner – POS3730
- Level Transmitter – 5200
- Level Transmitter – 2200
- pH Transmitter – pH8320
- Vortex Flow meter - VFC070
- Mass Flow meter – MFC400

These instruments are exchanging information with the controller through the Hart interface module (STB AHI 8321), which is embedded inside a Modicon STB island, connected to the controller through Ethernet Modbus TCP.
The Krohne library has following features that apply to the whole life cycle of a project:

The Krohne library has following features that apply to the whole life cycle of a project:

- Simple and consistent integration of smart instruments into PlantStruxure PES
- Predefined data structure for Krohne instruments
- Management of the communication through HART
- No manual configuration required for Control and Supervision

6.6.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of the object instances to be enlarged.
Complete packages:

License to be ordered:	**EUSKRNCZSSPEZZ**	SWPE Krohne library – Small (1250 instances)
	EUSKRNCZMSPEZZ	SWPE Krohne library – Medium (3000 instances)
	EUSKRNCZLSPEZZ	SWPE Krohne library – Large (7500 instances)

Upgrades:

| License to be ordered: | **EUSKRNGZESPEZZ** | SWPE Krohne library – S -> M | Upgrade |
| | **EUSKRNGZHSPEZZ** | SWPE Krohne library – M -> L | Upgrade |

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with the library.
Only one Krohne Instrumentation Library license is required for the PES project deployed on site.

6.7
Mining, Metals and Minerals Library

6.7.1 Presentation

The Mining Metals & Minerals library V2.0 offers all the common functions required by most of the MMM segment industries.

This library can be enhanced with the Cement Library, which offers additional objects specific to this segment's applications. Another library is under development to address specifics generally found in Mining process control.

The MMM library includes the following services:

Group Management

- ✅ A set of functions used in a process circuit are combined to form a group. The various functions or Control modules (motors, actuators, etc…) in a group are administered and controlled globally as a single entity (the group). For example, the transportation of material from pile to hopper is done by using many conveyors and it involves many actuators, motors, sensors.
- ✅ Ability to group equipment
- ✅ Manage start, stop of a group, with a single management of interlocks
- ✅ Alarm management of a group: first device failure alarming, alarm inhibition and alarm and warning masking

Route Management

- ✅ Different sets of devices that belong to same operational group, performing similar functionality and that are mutually exclusive are called "routes". For example, the transportation of different grade of cement to silos involving different sets of equipment (motors/actuators)
- ✅ Management of the routing: selection between routes and to control the start and stop of devices on a selected route
- ✅ Possibility to manage 5 routes with an instance of the object in the library
- ✅ During initialization, the pre-defined default route is selected. Later, the route can be selected by the operator from HMI popup or by process logic in the controllers.
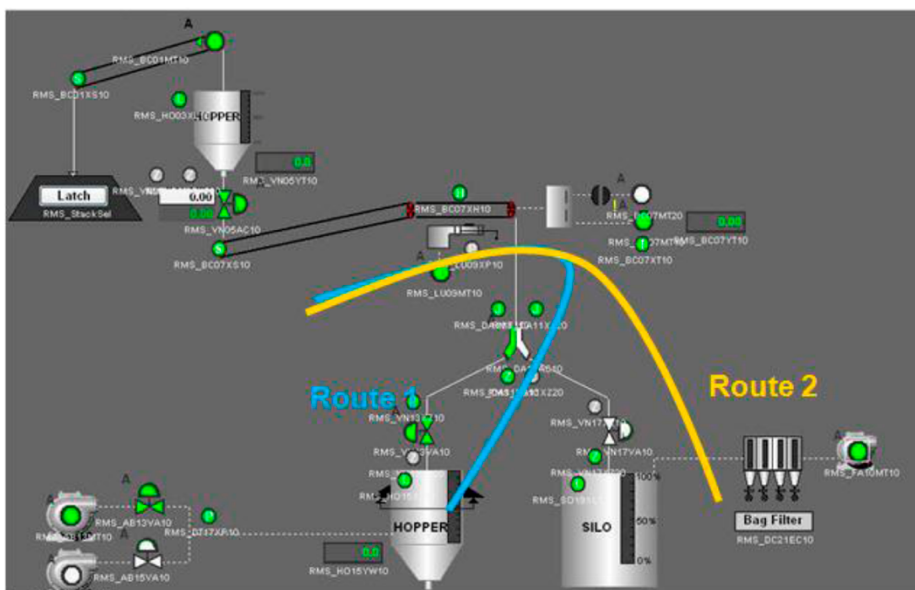
Figure 20: MM library: route management

Bag filter
- ⊘ Bag filter is a custom built sequencer block for supervision and control of the bag filter purging operation. This block supports 18 bags (18 outputs to solenoid valves). This block supports the auto mode of operation.

Belt conveyor
- ⊘ The belt conveyor object is the customized management of a motor with 1 direction 1 speed, specifically used for conveyor belts that include inoperable conditions like belt sway and pull chord. In addition, it also checks the process feedback, such as zero speed switches, belt running empty. This block supports 3 modes of operation: Auto, Manual, and Local.

In addition to these process objects, the library includes:
- ⊘ A set of objects for equipment control: digital / analog sensors and actuators, and several kinds of motors.
- ⊘ Generic objects which are useful in process applications: Totaliser, RatioControl, PID, and Scheduler for energy

6.7.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of the object instances to be enlarged.

Complete packages:

License to be ordered:	**EUSMMMCZSSPEZZ**	MMM Library for PES – Small (500 instances)
	EUSMMMCZMSPEZZ	MMM Library for PES – Medium (2000 instances)
	EUSMMMCZLSPEZZ	MMM Library for PES – Large (> 2000 instances)

Upgrades:

| License to be ordered: | **EUSMMMGZESPEZZ** | MMM Library for PES – S -> M | Upgrade |
| | **EUSKRNGZHSPEZZ** | MMM Library for PES – M -> L | Upgrade |

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.

Only one MMM Library license is required for the PES project deployed on site.

6.8
Cement Library

6.8.1 Presentation

The Cement library V2.0 offers specific functions that are commonly required in cement plants. Cement works are process applications that require a huge amount of energy and produce combustion gas from burners. In addition, equipment is running in a dusty environment and so it needs to be monitored carefully to ensure its availability.

The Cement library contributes to better efficiency of these processes thanks to:
- ⊘ The energy efficiency by managing multi fuel control
- ⊘ Supervision and control of the gas with a gas analyzer operation
- ⊘ Girth gear lubrication control with monitoring and warning of the lubrication oil tank levels

The Cement library includes the following services:

Multi Fuel Controller

- ✓ Control the ratio of ingredients of a continuous process
- ✓ Designed to increase the energy efficiency by increasing the secondary fuel throughput
- ✓ Possibility to control up to 6 fuels: 6 set points are managed for individual actuators and to maintain a ratio between 6 different fuels.
- ✓ Single set point entry by operator in GJ/h to increase the ease of operation
- ✓ Monitoring of the process feedback value continuously
- ✓ Bump-less transfer and unaffected by Online start/stop of actuators

The main application is to manage a Kiln Burner Fuel Ratio.

Gas Analyzer

- ✓ Supervision and control of the gas analyser
- ✓ Supports 8 analyser types
- ✓ Supports 4 gas parameters (O2,CO,NOx,SOx)
- ✓ Processes the input parameters and holds the value during Purging

Main applications: Kiln inlet Gas, Pre Heater Outlet Gas…

Girth Gear Lubrication control

- ✓ Lubrication Valve status monitoring
- ✓ Lubrication nozzle position status
- ✓ Monitoring and warnings for lubricator oil level in tank, Air Pressure, Grease Flow, Line differential Pressure

6.8.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of the object instances to be enlarged.

Complete packages:

License to be ordered: **EUSCEMCZSSPEZZ** Cement Library for PES – Small (500 instances)

EUSCEMCZMSPEZZ Cement Library for PES – Medium (2000 instances)

EUSCEMCZLSPEZZ Cement Library for PES – Large (> 2000 instances)

Upgrades:

License to be ordered: **EUSCEMGZESPEZZ** CEM Library for PES – S -> M   Upgrade

EUSCEMGZHSPEZZ CEM Library for PES – M -> L   Upgrade

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.

Only one Cement Library license is required for the PES project deployed on site

6.9
Liquid Food Library

6.9.1 Presentation

The Liquid Food Library (LFL) V2.0 provides a set of objects, which are designed to perform device functions on specialized devices used in the Food and Beverage industry and process functions to operate the process operations in the plant. These objects help to design automation systems to comply with the ISA S88 batch process engineering model. Liquid Food Library objects can be combined with the General Purpose Library to design a liquid food application solution. This association provides a cost effective and high value-add process automation solution for liquid food producers.
The library includes two sets of objects: the device objects and the process monitoring /control objects

The liquid food library contains following device objects:

VLVCTL - 2-way, 3-way, 4-way On-Off Valve Pneumatic Load Manager.

PLGCTL - Leakage Chamber Seat Lifting Actuator

VLV1PLGCTL - 3-way mix proof valve with one leakage chamber

VLV2PLGCTL - 4-way Mix proof valve with one / two leakage chambers

MOTORCYC - Cyclic Motor operation

ENODE4T, ENODE4T_LIGHT - Weighing Module - Scaime weight modules

The liquid food library contains following process monitoring and control objects:

EQUIP - Provides the supervision and the status information of the equipment.

SELPRESEL - is used for selection or pre-selection of the process equipment to carry out operations on it

SEQCTL2 - The block implements the sequence status management and processes the commands received from the monitoring subsystem or by other control sequences in program mode.

SEQFCT - The function block executes a sequence function for a process operation as per the guidelines followed in SEQCTL2. The SEQFCT supports the process functions such as transfer of the material from one item of equipment to another, agitation, and others.

SEQFCTRECIPELINE - is based on SEQCTL2 function block, with enhanced features, to execute a sequence of functions based on a predefined recipe.

SEQCTL3_PLI - the control object implements the sequence status management and processes the commands received from the batch control subsystem (the subsystem sends the commands and checks the status of the sequence to determine what action has to be taken). This block implements the phase logic interface (PLI) to interface with the batch control system software.

SEQCTL3FCTBATCH - combined with the SEQCTL3_PLI control object, it can manage 30 initial conditions, 30 failure conditions, 16 process input parameters and 16 process output parameters

CIP Recipe Management - CIP Recipe Management is an assembly function used for configuring CIP recipes and corresponding recipe parameters to clean equipment or a process line.

Parameter Management - The Parameter Management function is normally used to transfer a single or set of parameters from SCADA to PLC or vice versa.
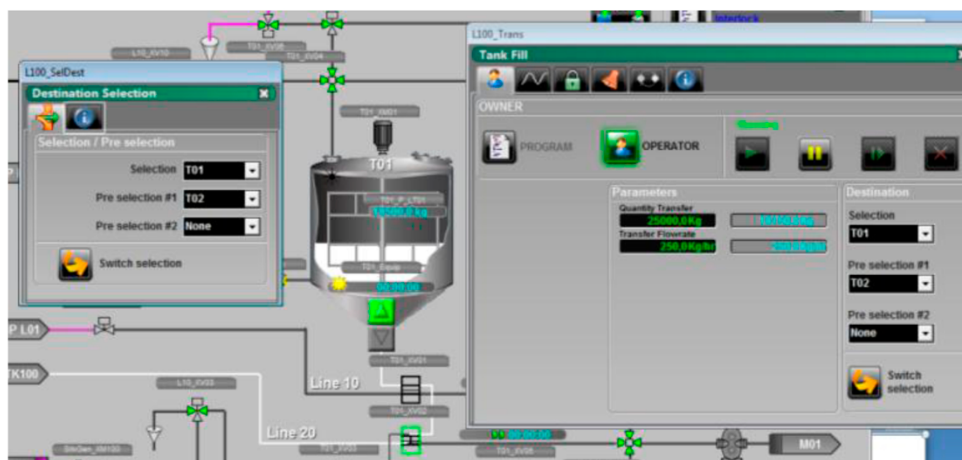
Figure 21: LFL library: example of use (transfer in tanks)

6.9.2 List of References

Three references are available, depending on the number of object instances that are allowed to be created. In addition, upgrades enable the number of the object instances to be enlarged.

Complete packages:

License to be ordered:	**EUSLFLCZSSPEZZ**	LFL Library for PES – Small (1250 instances)
	EUSLFLCZMSPEZZ	LFL Library for PES – Medium (2000 instances)
	EUSLFLCZLSPEZZ	LFL Library for PES – Large (>2000 instances)

Upgrades:

License to be ordered:	**EUSLFLGZESPEZZ**	LFL Library for PES – S -> M	Upgrade
	EUSLFLGZHSPEZZ	LFL Library for PES – M -> L	Upgrade

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.

Only one Liquid Food Library license is required for the PES project deployed on site.

6.10
Water Library

6.10.1 Presentation

The Water library provides a set of generic functions that are commonly used in water and waste water applications. The library helps in the management of multiple pumps and time-based scheduling of operations on equipment and devices to simplify remote operations. Local mode operation of equipment on remote pumping stations is possible. Objects in the water library provide the capability to manage energy by load shedding.

The water library contains following device objects:

WPUMPSEL (Pump Selection) - It checks the status and plontrols the operations of a maximum of 5 pumps. It calculates the number of operational hours for each pump. After completion of a maximum of operational hours, the object switches operation to another pump in standby. It checks the health of each pump and to ignore it when it is not ready for operation. It is possible to switch between pumps by using the buttons in the faceplate when in manual mode.

WSCHEDULER (Scheduler) – It allows the mode of operation of equipment to be scheduled. The output can be used to set a PID value, a control valve output or the speed of a motor. The scheduler is capable of holding information for up to 10 events.

WMOTOR - To control a motor with 1 direction and 1 speed.

WMOT1D2S - To control a motor with 1 direction and 2 speeds.

WMOT2D1S – To control a motor with 2 directions and 1 speed.

WMOTORVS - To control a motor with a variable speed drive, whether the speed driver is switched through communications, I/O wiring, or a mixture of both.

WVALVE – To control an on-off a device as an on-off valve with 2 limit switches (e.g. electro-pneumatic valve).

WMVALVE - To control a motorized valve with a positioner.

WMVALVED - To control an on-off motorized valve as a gate with 2 limit switches.

The water library includes the following functions:

- ✅ Management of multiple pumps (up to 5 pumps)
- ✅ Time-based scheduling of operations on equipment and devices to simplify remote operations
- ✅ Alarms and interlock messages can be sent via SMS through a 3rd party system
- ✅ Local Mode operation of equipment in remote pumping stations
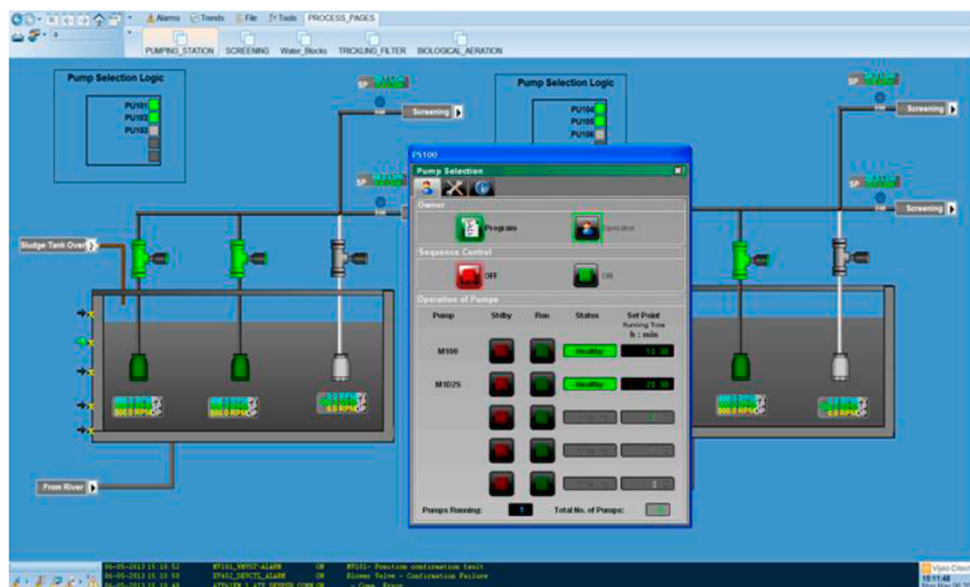- ✅ Energy Management by load shedding functionalities embedded in objects

Figure 22: Water library: example of use (pumping station)

6.10.2 List of References

One reference enables the creation of an unlimited number of object instances from this library.

License to be ordered: **EUSWWWCZSSPEZZ**   WWW Library for PES – Unlimited

Note: the maximum number of object instances allowed with the application license of a PES system configuration includes the number of instances created with library.

Only one Water Library license is required for the PES project deployed on site.