Plant-wide Automation in the Water Industry

SIMATIC PCS 7, SIMIT, STEP 7, WinCC, TIA Portal

Legal information

Use of application examples

Application examples illustrate the solution of automation tasks through an interaction of several components in the form of text, graphics and/or software modules. The application examples are a free service by Siemens AG and/or a subsidiary of Siemens AG (“Siemens”). They are non-binding and make no claim to completeness or functionality regarding configuration and equipment. The application examples merely offer help with typical tasks; they do not constitute customer-specific solutions. You yourself are responsible for the proper and safe operation of the products in accordance with applicable regulations and must also check the function of the respective application example and customize it for your system.

Siemens grants you the non-exclusive, non-sublicensable and non-transferable right to have the application examples used by technically trained personnel. Any change to the application examples is your responsibility. Sharing the application examples with third parties or copying the application examples or excerpts thereof is permitted only in combination with your own products. The application examples are not required to undergo the customary tests and quality inspections of a chargeable product; they may have functional and performance defects as well as errors. It is your responsibility to use them in such a manner that any malfunctions that may occur do not result in property damage or injury to persons.

Disclaimer of liability

Siemens shall not assume any liability, for any legal reason whatsoever, including, without limitation, liability for the usability, availability, completeness and freedom from defects of the application examples as well as for related information, configuration and performance data and any damage caused thereby. This shall not apply in cases of mandatory liability, for example under the German Product Liability Act, or in cases of intent, gross negligence, or culpable loss of life, bodily injury or damage to health, non-compliance with a guarantee, fraudulent non-disclosure of a defect, or culpable breach of material contractual obligations. Claims for damages arising from a breach of material contractual obligations shall however be limited to the foreseeable damage typical of the type of agreement, unless liability arises from intent or gross negligence or is based on loss of life, bodily injury or damage to health. The foregoing provisions do not imply any change in the burden of proof to your detriment. You shall indemnify Siemens against existing or future claims of third parties in this connection except where Siemens is mandatorily liable.

By using the application examples you acknowledge that Siemens cannot be held liable for any damage beyond the liability provisions described.

Other information

Siemens reserves the right to make changes to the application examples at any time without notice. In case of discrepancies between the suggestions in the application examples and other Siemens publications such as catalogs, the content of the other documentation shall have precedence.

The Siemens terms of use (https://support.industry.siemens.com) shall also apply.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens’ products and solutions constitute one element of such a concept. Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit https://www.siemens.com/industrialsecurity.

Siemens’ products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer’s exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at: https://www.siemens.com/industrialsecurity.
Table of contents

Legal information ................................................................................................................................. 5

1 Automation tasks in the water industry .......................................................................................... 5
   1.1 Introduction .................................................................................................................................... 5
   1.2 Typical plant types in the water industry ....................................................................................... 7
   1.3 Implementation of plant-wide automation ..................................................................................... 10
   1.4 Benefits ........................................................................................................................................ 12

2 Product overview ............................................................................................................................. 13
   2.1 SIMATIC engineering tools ............................................................................................................. 13
   2.2 Process visualization ....................................................................................................................... 16
   2.3 SIMATIC controllers ....................................................................................................................... 17
   2.4 Telecontrol ..................................................................................................................................... 20
   2.5 Solutions for energy technology .................................................................................................... 22
   2.6 Panel integration .............................................................................................................................. 26
   2.7 Water management system ............................................................................................................ 27
   2.8 Process instrumentation ................................................................................................................... 28
   2.8.1 SITRANS F - flow measurement ................................................................................................. 29
   2.8.2 SITRANS L - level meter ............................................................................................................ 29
   2.8.3 SITRANS P - pressure measurement ......................................................................................... 31
   2.8.4 SITRANS T – temperature measurement .................................................................................... 32

3 Specific solutions/ approaches ........................................................................................................ 33
   3.1 PCS 7 libraries ............................................................................................................................... 33
   3.2 Application examples ...................................................................................................................... 36
   3.3 Water-specific master data library and templates ........................................................................... 37
   3.3.1 Standards and guidelines ............................................................................................................ 38
   3.3.2 Water Control Module Types (WCMT)/ Water Process Tag Types (WPTT)............................... 38
   3.3.3 Water Equipment Module Templates (WEMT)........................................................................... 39
   3.3.4 Water Unit Templates (WUT) ..................................................................................................... 39
   3.3.5 Control strategy of the water unit templates ............................................................................... 40

4 Guidelines for planning and configuring ......................................................................................... 42
   4.1 Engineering ..................................................................................................................................... 42
   4.2 Naming convention .......................................................................................................................... 45
   4.3 P&ID diagram ................................................................................................................................ 47
   4.4 Process control and operation ........................................................................................................ 52
   4.5 Communication ............................................................................................................................... 55

5 Industrial Security – ”Defense in Depth” ....................................................................................... 56
   5.1.1 Concept of deep defense - ”Defense in Depth” ............................................................................ 57
   5.1.2 Network security - Automation and security cells ...................................................................... 59

6 Digitalization ................................................................................................................................. 61
   6.1 From integrated engineering to integrated plant operation ............................................................. 61
   6.2 SIMATIC PCS 7 Plant Automation Accelerator .............................................................................. 62
   6.2.1 Data exchange with PCS 7 .......................................................................................................... 63
   6.2.2 Differentiation of PAA from COMOS workflow with the "Integration Layer".............................. 64
   6.2.3 Advantages of PAA ..................................................................................................................... 65
   6.3 Simulation of automation data and processes with SIMIT ............................................................. 66
   6.3.1 Simulation of automation ............................................................................................................ 67
   6.3.2 SIMIT VC – The virtual controller for simulation of automation systems .................................... 69
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.4</td>
<td>Asset and Process Performance Suite for industrial applications and plant monitoring services</td>
<td>71</td>
</tr>
<tr>
<td>6.4.1</td>
<td>MindSphere</td>
<td>71</td>
</tr>
<tr>
<td>6.4.2</td>
<td>SIWA applications</td>
<td>73</td>
</tr>
<tr>
<td>7</td>
<td>Appendix</td>
<td>77</td>
</tr>
<tr>
<td>7.1</td>
<td>Glossary</td>
<td>77</td>
</tr>
<tr>
<td>7.2</td>
<td>Service and support</td>
<td>79</td>
</tr>
<tr>
<td>7.3</td>
<td>Links and Literature</td>
<td>80</td>
</tr>
<tr>
<td>7.4</td>
<td>Change documentation</td>
<td>81</td>
</tr>
</tbody>
</table>
1 Automation tasks in the water industry

1.1 Introduction

In the widely distributed systems of the water industry, the predominantly automated operation of plants is considered state of the art. Technical difficulties are encountered when implementing automated operation due to the complexity of the water management system itself. Compared to process engineering plants in other industries, such as the chemical industry, the number of actuators, sensors, measuring instruments and control loops is similarly high.

This document gives you an overview of the standardized and plant-wide automation solutions from Siemens.

Challenge

The standardization of automation engineering is a major challenge due to the various process actions, procedures, devices and elevated plant configuration requirements. This also includes the customized selection and dimensioning of suitable products for the respective application. Siemens supports you in selecting the right hardware and software for your plant-wide automation solution and is a reliable service partner in the water industry sector.

Approach with plant-wide automation in the water industry

Plant-wide automation in the water industry leads to a sustainable success throughout the entire life cycle of the process plant including planning and services. Particular sectors include:

- Drinking water, desalination, water transportation
- Wastewater, water purification, industrial water
- Irrigation, pumping stations, dams
- Defensive structures, waterways, locks
- Dikes, flood protection

Figure 1-1 Water industry sectors
1 Automation tasks in the water industry

Automation mainly includes the following elements:
- Controllers of actuators, motors, valves, flaps, motor valves and servo-drives
- Detection of process values such as flow, pressure, temperature, level and substance analysis
- Control and monitoring of dynamic processes and circuits
- Display of processes and plant state
- Centralized, distributed and local plant control from the field to the web

You can find further information on the automation engineering in the water industry at:

Requirements of the automation solution
In the water industry, plants require a high level of automation. Further requirements for continuous and safe plant operation also include:
- Simple planning
- Fast implementation in engineering
- Preapproved and safe commissioning
- Flexibility and expandability
- Scalability of the components to the plant size
- High level of software and hardware standardization
- Integration of third party and old systems
- High plant reliability and integrity
- Robust design of automation hardware mechanics/electronics
- Reliable communication over long distances
- Uniform control and representation of plant data
- Long-term archiving of measurement and operating data
- Easy upgrading to new automation software versions
- Future-proof thanks to long life cycles and suitable replacement components
- Digitalization

Additional information
You can find further information on the topic of automation in the water industry by accessing the sector-specific pages on the PCS 7 website:
1.2 Typical plant types in the water industry

The different water management systems can be fully automated with Siemens products. The following schematic representations of typical plants cover large parts of the water industry and provide guidance for your own plant.

Figure 1-2 Schematic representation of a desalination plant
1 Automation tasks in the water industry

Figure 1-3 Schematic representation of a potable water plant

Figure 1-4 Schematic representation of water transportation
1 Automation tasks in the water industry

Figure 1-5 Schematic representation of a wastewater treatment plant
1.3 Implementation of plant-wide automation

Plant-wide automation is the basis for a smooth, uniform and standardized solution for water management systems. Siemens supports you in the area of project planning with customized products such as:

- SIMATIC SIMATIC PCS 7 / PCS neo process control system
- SCADA system: SIMATIC WinCC
- Engineering tools: COMOS / PAA, SIMATIC PCS 7 / PCS neo, SIMIT, TIA Portal

This document focuses on the following points:

- Product overview
- Overview of the water-specific automation solutions – Specific solutions/approaches
- Description of the PCS 7 and SIMIT Water Templates as a template for automation solutions – Water-specific master data library and templates
- Introduction to the requirements and guidelines for standardized automation solutions in the water industry – Guidelines for planning and configuring

Selecting suitable hardware and software

In the German Guidelines on Water and Sewage Treatment (ATV), the processing plants are described, treated and operated from the smallest to the most complex
plants. Plants in the water industry are process plants with many package units (machine-oriented automation), which are fully integrated in PCS 7 from the field to the web. For small and medium-sized plants, depending on the operator concept, only a predominantly control-related solution can be used without the typical control requirements of a SCADA system such as WinCC or WinCC Professional (TIA Portal).

In the following table, you can find the different performance features of the Siemens SIMATIC PCS 7 and TIA Portal automation products and their general use.

Table 1-1 Differences in performance features between SIMATIC PCS 7 and TIA Portal

<table>
<thead>
<tr>
<th>Property</th>
<th>SIMATIC PCS 7</th>
<th>TIA Portal / WinCC + STEP 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of application</td>
<td>Process automation, DCS</td>
<td>Machine-oriented automation, PLC</td>
</tr>
<tr>
<td>Use for</td>
<td>Continuous processes, remote control technology incl. medium/low voltage switchgear with local and widely distributed plants for the monitoring of drives with local panel control, local control systems as well as local, central and/or regional control rooms via multi-user control in a multi-server architecture SIMATIC PCS 7 is also available as a virtualized solution.</td>
<td>Discrete processes and machines with spatially limited distributed measuring points, drives and low voltage switchgear systems, including local control systems and panel control, which are controlled and monitored via a local and/or central control room using a single-user station or a client-server architecture. WinCC is also available as a visualized solution.</td>
</tr>
<tr>
<td>Controller</td>
<td>S7-300, IM151-8, S7-400, PA CPU 410 and 410E, S7-1200 3), S7-1500, RTU3010C 3), RTU3030C 3)</td>
<td>S7-300, IM151-8, S7-400, S7-1200, S7-1500 RTU3010C 3), RTU3030C 3)</td>
</tr>
<tr>
<td>Changes during operation (CIR functionality)</td>
<td>Yes (S7-400, S7-410)</td>
<td>No</td>
</tr>
<tr>
<td>Programming with CFC</td>
<td>Yes</td>
<td>Yes 1)</td>
</tr>
<tr>
<td>Advanced Process Library (APL)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Industry Library (IL)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Panel connection, e.g. SIMATIC Basic/ Comfort Panel</td>
<td>Yes 2)</td>
<td>Yes</td>
</tr>
<tr>
<td>Highly available (so called hot standby)</td>
<td>Yes (S7-400, S7-410)</td>
<td>Yes (S7-1500R/H)</td>
</tr>
<tr>
<td>Highly available (so-called software standby)</td>
<td>No</td>
<td>Yes (S7-300)</td>
</tr>
<tr>
<td>Industry Library</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Power Control APL Library</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SITRANS Library</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SITOP Library</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Basic Process Library</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1) Only in STEP 7 Classic with additional option package S7-CFC for S7-300 and S7-400
The selection of the automation products for a water management system is based on the requirements of the respective system. For further information on the technical features of the Siemens automation solutions, please refer to the Chapter Product overview.

1.4 Benefits

By using a Siemens standardized solution you achieve the following advantages in the automation of functions, sections and complete plants:

- Standardization through unified program structures provide time and cost savings during the planning and conception phase, implementation phase, and entire operation time and migration phase to new SW and HW versions
- Safe monitoring with uniform operator control and monitoring from the field to the web
- Secure data transfer
- Uniform and simple understanding of the entire automation system
  - Shorter operator familiarization periods
  - Shorter and cost-optimized training periods
  - Simple and cost-optimized expansion of the existing system
- Lifecycle guarantee with short maintenance and service times
  - Lower maintenance costs and system downtime
  - Fast, flexible and reliable support by Siemens
2 Product overview

Siemens offers tools and software solutions for use as a scalable SCADA system with WinCC Professional (TIA Portal) or WinCC and the SIMATIC PCS 7 process control system. In this chapter, you will be introduced to some of the Siemens product families and their use in the water and wastewater sectors.

2.1 SIMATIC engineering tools

Depending on the application and requirements, you can use differently powerful SIMATIC controllers and engineering tools for your water management system. Thereby a distinction is made between a distributed operation that is at machine level, local or plant-wide.

SIMATIC PCS 7

With the SIMATIC PCS 7 process control system, you can automate customized solutions from the smallest to the most complex water management system as well as small operating units (plant sections). SIMATIC PCS 7 is flexibly scalable from a small single-user system with more than 50 measuring points and drives, right up to 280,000 in a multi-user system including redundancy. The max. number of configurable messages is 200,000 per server/single-user station.

Consistency in data management, secure communication as well as simple configuration and high performance put the PCS 7 together with the SIMATIC PA CPU-410-5S/H/E at the heart of your water management system. Existing control systems by third party manufacturers can also be upgraded step by step or even migrated to SIMATIC PCS 7 during operation. PM@ANALYZE and/or Energy Manager Pro are used to store the measured values and messages in the water industry in PCS 7. Alternatively, ACRON can also be used for long-term archiving. Siemens also supports the integration of Energy Manager Pro as an option.

Outdoor stations are integrated into the process control system of widely distributed systems such as pipelines or water industry plants via system-compliant telecontrol systems (simultaneous protocol type: SINAUT ST7, IEC 60870-5-101/103/104, DNP3, Modbus) using TeleControl for PCS 7. You can find further relevant information in the chapter Telecontrol.

It is also possible to operate and monitor local and widely distributed plants energetically. Power Control APL Library for PCS 7 offers the right solution for medium and low voltage switchgear systems for integration via Industrial Ethernet, PROFINET and PROFIBUS DP.

You can find further information on energy management with Power Control APL Library in the chapter: PCS 7 libraries.

For a quick introduction, you can access the PCS 7 automation templates that were specifically created for the water industry. You can find a compact overview in the chapter Water-specific master data library and templates.

**SIMATIC PCS neo**

SIMATIC PCS neo is a completely web-based process control system with object-oriented data management.

With SIMATIC PCS neo, you are already opting today for a safe and future-oriented process control system which, as the next generation of this era, is based on the successful and reliable SIMATIC PCS 7.

You can find more detailed information under:


**COMOS – Uninterrupted flow of information**

Thanks to the COMOS Plant Engineering Software, you can implement your water management system in a holistic manner throughout the entire life cycle. The uniform data platform of COMOS enables a seamless information flow of project-relevant data and efficient mass data engineering across all project phases.

COMOS manages all the plant data and the corresponding documentation on a single integrated data platform, right from the initial planning phase. This means that every operator can access up-to-date information at any time and at any place.

You can find more detailed information under:


**Integrated engineering with PAA and SIMATIC PCS 7**

The SIMATIC PCS 7 Plant Automation Accelerator (PAA) is a fully integrated solution for the planning and documentation of plant projects.

You can easily transfer data from PAA to SIMATIC PCS 7 without errors and thus automatically generate the entire plant structure in the control system. With just one data platform, project participants from different trades can plan the areas of your plant in parallel. This saves crucial time during engineering and when implementing your automation solution.

Changes and adaptations made in SIMATIC PCS 7 during the operating phase can be played back in PAA at the push of a button. As a result, any changes made are automatically copied to the entire system documentation. The data exchange between the two systems connects the worlds between engineering and automation and allows you to digitalize your water management system.

The SIMATIC PCS 7 Plant Automation Accelerator also provides advantages for COMOS users: COMOS customers with an existing or planned COMOS installation can purchase the PAA as a COMOS module with the so-called "Integration Layer", which allows them to use all available functionalities for fully integrated engineering with COMOS and SIMATIC PCS 7 by using the SIMATIC standard objects supplied.

You can find more information on the PAA in Chapter 6.2 “SIMATIC PCS 7 Plant Automation Accelerator” or at:

2 Product overview

SIMIT

The SIMIT simulation software enables real-time simulation and emulation for comprehensive testing of automation solutions. The SIMIT V9.1 software generation is based on a uniform simulation platform that can be used to implement both the virtual commissioning of automation technology for systems, machines and processes and realistic training environments for plant operators.

You can find more information in chapter 6.3 “Simulation of automation data and processes with SIMIT” or at:

SIMATIC STEP 7

The Siemens SIMATIC STEP 7 engineering system is a unique integrated automation solution for your plant, allowing you to assign parameters, program and test the controllers. With STEP 7, you can configure the controller families SIMATIC S7-300, IM151-8 and S7-400 and implement plant-wide distributed process automation.

You can find more detailed information under:

TIA Portal

The Totally Integrated Automation Portal (TIA Portal) helps you in the engineering and commissioning phases of your machine-level automation solution. The SIMATIC S7-300, IM151-8, S7-1200 and S7-1500 controllers are ideally priced for these local tasks in small plants in the water industry. In addition to central engineering with the TIA portal, they also enable simple connection of SIMATIC HMI Comfort Panels, SIMATIC NET and telecontrol components. As an option, additional extensions in drive and power engineering can be integrated with SIMOCODE ES, Starter, SENTRON, SITOP DC24V and STEP 7 Safety (TIA Portal).

You can find more detailed information under:
2.2 Process visualization

For process visualization, Siemens offers customized solutions ranging from the smallest of applications to large systems with redundantly designed servers.

SIMATIC PCS 7 Operator System

In PCS 7, the operator system is the central station for monitoring and controlling a PCS 7 plant. The PCS 7 system is monitored and operated in the process management system by means of process pictures. Faceplates provide you information on the status of individual components and technological functions. The information you need for monitoring and operation is rounded up by trends for the temporal signal sequence, message lists, alarm lists and archive information. The OS is configured on the Engineering Station (ES). The configuration data of the OS is stored and managed centrally on the engineering station.

The operator system is scalable with regard to quantity structure and functionality. From the single-user station to the distributed multi-user system and web solutions. You can find more detailed information under:


SIMATIC PCS 7 Advanced Process Graphics

Increasingly complex process plants pose an enormous challenge to operating personnel. For this reason, it is important for relevant process information to be available and for plant conditions and operational parameters to be displayed in the control room in a clear, simple and well-arranged manner. Only in this way can the correct decisions be made and the appropriate measures taken quickly. For effective process control, APG offer hybrid views, trend curves, and Kiviat charts that provide information instead of data to operators.

For further information, please refer to:


SIMATIC WinCC (SCADA System)

Siemens offers the right SIMATIC software for the SCADA area. From a comprehensive solution as a PC-based multi-user system with SCADA functionality for the machine level right to the open and scalable SCADA system SIMATIC WinCC, which has been tried and tested in the market for many years.

SIMATIC WinCC is scalable with regard to quantity structure and functionality. From the single-user station to the distributed multi-user system and web solutions. For an overview of the process visualization functions in the SCADA environment with WinCC, please refer to:

2 Product overview

**SIMATIC WinCC Professional (TIA Portal)**

Almost the entire range of SIMATIC operator panels can be configured with SIMATIC WinCC Professional (TIA Portal), the successor to SIMATIC WinCC flexible. The functionality covers both visualization tasks on the machine level and SCADA applications on PC-based multi-user systems.


### 2.3 SIMATIC controllers

The versatile SIMATIC controllers with their enhanced performance spectra allow you to automate your system in a customized and optimal manner. In doing so, you can use the controllers for local and/or distributed applications and combine them to achieve a uniform SIMATIC automation solution for your entire system.

**SIMATIC S7-300: An all-rounder for all processes**

The SIMATIC S7-300 controllers are versatile and compact controllers, which are characterized by flexible parameter assignment and powerful performance. A local and distributed automation solution can be implemented with up to 256 integrated inputs/outputs and up to 65336 distributed inputs/outputs. The PROFINET interface allows you to easily connect the controller and the data exchange with the control system and the I/Os. Comprehensive engineering with SIMATIC STEP 7 minimizes the costs of operation, maintenance and documentation.


**SIMATIC S7-400: High performance and security for system solutions**

The controllers of the SIMATIC S7-400 family are characterized by their large memory, up to 65336 inputs and outputs and extremely high speed. Thanks to their high performance, the S7-400 controllers are used primarily for data-intensive tasks – for example, you can use the S7-400 to centrally control and process the data of many smaller units and distributed areas with local controllers. With their state-of-the-art technology and maximum cost-effectiveness, they are ideal for system solutions in water treatment plants – even in extreme environments – and can also be used for high-availability and safety-oriented applications, if necessary.

The highly available SIMATIC S7-400H provides hardware redundancy (hot standby) for uninterruptible processes, such as the ones that are often required in desalination plants and important pump stations.

SIMATIC PA CPU 410: Flexible and uninterruptible

The S7-SIMATIC PA CPU 410 controller is best suited for new systems and is ideal if the performance requirements of your automation solution have to be scaled to the increasing requirements. Apart from the familiar SIMATIC features, such as great ruggedness and minimal downtimes, the controller is characterized by its top-level flexibility. The integrated PROFINET interfaces allow fieldbuses to be designed in a simple and redundant manner.

The controller is generally delivered with the maximum computing and storage capacity level, and can be scaled to the required performance (number of process objects) by means of a system expansion card (SEC). As from the PCS 7 V8.1 version, it is possible to update individual block types and install new expansion modules without causing an interruption. This means that at a later date you can expand your plant flexibly during operation with regard to its performance and scale.

You can find more detailed information under:

SIMAPTIC PA CPU 410E

With the SIMATIC CPU 410E, version 9.0 of SIMATIC PCS 7 offers an optimal automation solution for compact applications with few process values. The CPU 410E is based on the hardware of the CPU 410-5H and is in no way inferior to its fanless and robust design as well as its high quality standards. This controller can also be configured for high-availability or safety-related applications and can process up to 200 process objects (PO).

Areas of application are dedicated applications in the water and wastewater industry, in oil and gas or in the food industry. In combination with the CPU 410-5H, the CPU 410E can also be used as a decentralized automation solution, e.g. for highly modular technological units that can be integrated into the overall system via Plug & Produce.

You can find more detailed information under:

SIMATIC S7-1200: Modular and compact

In the class of compact controllers, the SIMATIC S7-1200 offers the necessary performance for smaller yet highly precise automation tasks. The SIMATIC S7-1200 controller offers up to 30 signal, communication and technology modules as an expansion, integrated I/O interfaces, integrated communication with HMI panels, and a simple PROFINET connection to the control system. In combination with the easy-to-use and integrated TIA Portal engineering system, you can automate your plant simply, compactly and modularly.

You can find more detailed information under:
SIMATIC S7-1500: Performant and flexible

The SIMATIC S7-1500 is suitable for medium to large automation tasks. Thanks to fast signal processing, it meets the high demands on response times and fast high-precision control. The integrated PROFINET interfaces allow you to easily integrate the controller into your existing control system and also to implement distributed automation solutions. The engineering is carried out uniformly via the TIA Portal and allows simple implementation of logics, data management and user interface. In addition to the integrated HMI panel connection for local operation, the S7-1500 also offers an integrated web server for simpler collection of information over the Internet.

You can find more detailed information under:

SIMATIC S7-1500R/H

With the S7-1500R or S7-1500H CPU, new redundant or highly available solutions are also available. Both CPUs are connected with the I/O stations via a PROFINET-IO ring. Synchronization for the S7-1500R is via this ring, or via separate FOC synchronization cables for the S7-1500H. In the event of a CPU failure, the one of two CPUs automatically assumes control of the process as backup CPU. No data is lost and the process can be continued extremely quickly. The PROFINET IO ring ensures that all nodes remain accessible in the event of a fieldbus interruption.

You can find more detailed information under:
SIMATIC S7-1500R:

SIMATIC S7-1500H

SIMATIC IM151-8 PN/DP CPU

The IM 1518 PN/DP CPU interface module is a component of the ET 200S distributed I/O system with degree of protection IP20. The IM 1518 PN/DP CPU interface module is an "intelligent preprocessor". It enables you to decentralize control tasks.

Therefore, an ET 200S with IM151-8 PN/DP CPU can exercise full and, if necessary, independent control over a process-related functional unit.
SIMATIC RTU3000C

The compact RTUs of the SIMATIC RTU3000C series, such as the RTU3010C (connection of an external router possible) or RTU3030C (external router or integrated UMTS modem), are autonomous low-power telecontrol units (Remote Terminal Units - RTUs) with their own power supply. This enables the most remote measuring points to be monitored independently – even in locations where no power supply or hard-wired communication infrastructure exists. Thanks to their optimized energy consumption, the compact SIMATIC RTUs require no external power source. They supply themselves either from battery or accumulator with solar panel.

The engineering software required for this is implemented in this device upon delivery and works in a web-based manner.

You can find more detailed information under:

2.4 Telecontrol

The distributed structures and external sites often found in the water industry (e.g. elevated storage tanks, pump stations and attenuation tanks) can be connected to a central control system using Siemens telecontrol. The inclusion of all information from the outdoor stations creates transparency and is a prerequisite for optimizing your overall system. Siemens offers you a complete RTU portfolio (Remote Terminal Unit) and supports all essential protocols for data transmission (IEC, DNP3, ST7).

SINAUT

SINAUT is based on SIMATIC and supplements the basic system with all the necessary hardware and software components for reliable and efficient networking of individual controllers and control systems over WAN (Wide Area Network). Data transmission takes place via classic as well as Internet-based networks. To cover the different requirements, SINAUT includes the following independent systems:

- **SINAUT ST7** is a multifunctional telecontrol system that provides fully automatic monitoring and control of distributed process stations. Data is exchanged with one another and with one or more control centers via various WAN/LAN media.
- **SINAUT DNP3** is a multifunctional telecontrol system that provides fully automatic monitoring and control of distributed process stations. Data is exchanged with one another and with one or more control centers via various WAN/LAN media.
SIMATIC PCS 7 TeleControl

The integrated SIMATIC PCS 7 TeleControl remote control technology provides a solution for integrating the outdoor stations into the SIMATIC PCS 7 control system. The system automation and monitoring of distributed process areas are combined into one control room. This results in a common operator prompting, comfortable and simple data management as well as comprehensive engineering.

You can find further information and examples for libraries and application examples under the following links:

- Connection of Remote Terminal Units via SINAUT ST7 protocol in PCS 7 TeleControl
- All application examples for TeleControl under:
  https://support.industry.siemens.com/cs/ww/en/ps/15915/ae

SIPLUS RIC IEC Library

SIPLUS RIC (Remote Interface Control) is designed in accordance with IEC 60870-5-101/103/104 for remote operation under demanding environmental conditions. The modular and comprehensive telecontrol system uses internationally standardized IEC protocols and is executable on all controllers of the SIMATIC family thanks to software libraries. This also makes it possible to design redundant telecontrol sections with the high-availability SIMATIC S7-400H system. The SIPLUS extreme variant is available for use in harsh environmental conditions.

Modbus TCP/IP

With Modbus TCP/IP, controllers and systems from different manufacturers can be integrated into SIMATIC PCS 7. Modbus TCP/IP is an open communication protocol which is widely used internationally and supported by many manufacturers.

The request to couple third-party systems to SIMATIC PCS 7 via Modbus is particularly relevant for the:

- expansion or upgrading of existing systems
- coupling of controllers and systems of different manufacturers (also in the course of constructing new systems)

Modbus TCP/IP is based on a server/client architecture (also master/slave architecture), which can be implemented within PCS 7 in various ways.

You can find further information and examples for libraries and application examples under the following links:

- Modbus/TCP - standardized and redundant communication of SIMATIC PCS 7 with third-party systems
- Add-on modules for Modbus/TCP communication
2.5 Solutions for energy technology

With Totally Integrated Power, Siemens offers innovative and interface-optimized products and systems for electrical energy distribution. These are optimally matched to each other and enable easy integration into plants within the water industry. The connection to the automation system is established via communication and software modules.

The Siemens portfolio includes planning tools and matching hardware: from medium voltage switchgear and distribution systems to transformers, switching and protection devices, low voltage busbar systems as well as small distribution boards and sockets. Both maintenance-free medium voltage and low-voltage switchgear as well as their specific busbar interfaces are type-tested.

Powerful and safe at the extra-low-voltage level

SITOP is the power supply series for the lower performance range that has an extremely space-saving, slim design, making it particularly suitable for integration in distributed applications such as inside switch boxes or in the control cabinet. There is a suitable power supply with optional expansion modules for every application, such as:

- SITOP PSU8200: 1 and 3-phase 24 V power supplies
- SITOP PSE202U: Redundancy module for decoupling SITOP PSU8200
- SITOP PSE200U: Selectivity module for monitoring 4x24 V feeders
- SITOP PSU8600: 3-phase modular power supply system with Ethernet/PROFINET interface
  The power supply system can be individually adapted to the system requirements with the following components:
  - Up to 4 selectivity modules CNX8600 (extension of PSU8600 up to 36x24 V feeders)
  - Up to 2 buffer modules BUF8600
  - Up to 2 UPS modules UPS8600
  - Up to 5 BAT8600 battery modules of the same type per UPS module
- SITOP UPS1600: Uninterruptible DC power supply (DC-UPS) with USB and signaling contact
- SITOP UPS1600: Uninterruptible DC power supply (DC-UPS) with PROFINET and signaling contact
- SITOP UPS1100: Maintenance-free SITOP UPS1100 battery modules with 1.2 Ah up to 12 Ah and various types of energy storage (lead, pure lead, lithium iron phosphate = LiFePo) for SITOP UPS1600 DC UPS modules.
- SIMATIC HMI TP1200, TP1400: In the event of a power failure, the Comfort Panels buffer enough power to correctly close all active archives and back up the data already archived in RDB format.
You can find further information and examples for libraries and application examples under the following links:

- SITOP UPS1600: Faceplates and Communication Blocks (TIA Portal, STEP 7 and WinCC) at: https://support.industry.siemens.com/cs/ww/en/view/78817848
- SITOP PSU8600: Faceplates and Communication Blocks (TIA Portal, STEP 7 and WinCC) at: https://support.industry.siemens.com/cs/ww/en/view/102379345
- All application examples for SITOP at https://support.industry.siemens.com/cs/ww/en/ps/18018/ae

**Powerful at low voltage level (SIVACON)**

The SIVACON S8 switchboard and the 8PS busbar trunking system are used at the low voltage level. The SIVACON systems ensure safe operation with high plant and operator protection. Furthermore, the SIVACON LR busbar trunking system is proven to provide optimal and safe power conveyance in aggressive wastewater atmospheres and has high short-circuit strength and modular outlet boxes. Whenever economical, safe and reliable low-voltage power distribution is required, the SENTRON family offers intelligent circuit breakers, proven load breaker switches or innovative power monitoring devices. SENTRON products come with an extensive range of accessories and are modularly designed for high versatility and flexibility.

**Flexibly expandable (SIMARIS)**

The modular products and overarching protection systems are expandable with regard to adjustable parameters and communication, and they are easy and quick to replace in the event of a fault. This allows you to quickly and easily adapt the power distribution products to your evolving requirements. The SIMARIS design software helps you plan your plant's power distribution.

**Powerful in the medium voltage level (SIPROTEC)**

SIPROTEC is the standard for the protection, automation and monitoring of your supply system at the medium voltage level. With the SIPROTEC G5 version, you get access to a new, highly modular and therefore flexible generation of intelligent, digital field devices. SIPROTEC G5 offers a comprehensive product range with modular elements for every application and requirement. The connection can be established via PROFINET.

For further information, please refer to: http://w3.siemens.com/smartgrid/global/en/products-solutions/Protection/Pages/overview.aspx
2 Product overview

Powerful energy management (SIMATIC Energy Manager PRO)

Energy is a valuable resource. If you want to cut energy costs, increase your competitiveness and meet statutory requirements, you already know how important it is to have integrated energy management for the process. To be able to make the right decisions at the right time, you must always keep an eye on the energy consumption of your entire company. For this purpose, Siemens has created SIMATIC Energy Management – a comprehensive and scalable product and solution portfolio certified by ISO-50001, which can collect energy data at the field level and even provide company-wide energy analyses at the management level.

Your advantages with SIMATIC Energy Manager PRO (SQL) / B.Data (Oracle):

- As an operator
  - Make energy consumption visible –
    Energy data linked to process data
  - Cut down on energy costs –
    identify high energy consumers and optimize energy acquisition
  - Fulfill legal requirements efficiently –
    through ISO-50001 conformity and TÜV certification
  - Scalability –
    from the sub-process plants to the energy management across all plants

- As a planner
  - Integrated solution –
    through project planning via SIMATIC Energy Suite (TIA Portal)
  - Efficient configuration –
    through customized metrics and flexible web dashboards
  - Open and secure system –
    thanks to numerous interfaces and safe communication
  - Scalability –
    from the sub-process plants to the energy management across all plants

Additional information is available at:

Switchgear automation with SIMATIC PowerControl

SIMATIC PCS 7 PowerControl is the solution for integrating the switchgear automation in the process industry. It enables the merging of the process automation and the automation of electrical switchgear for medium voltages in PCS 7. The advantage for plant operators: significant cost savings over the entire life cycle of the plant.

Intelligent electrical devices (IEDs) such as SIPROTEC protective devices are used for automating switchgears, that is, for protection, control, measuring and monitoring functions in electrical energy transmission and distribution. IEDs are integrated into the SIMATIC PCS 7 process control system via Ethernet TCP/IP communication with the IEC 61850 transmission protocol for protection and control technology in electrical plants.

The SIMATIC PCS 7 PowerControl library provides you with a PCS 7 standard solution for this purpose.
PM-ANALYZE – Analysis of messages and process data

Localization of fault sources and weak points in technical plants, reduction of plant downtimes and maintenance times, early detection of signs of wear and tear – just a few of the reasons for using PM-ANALYZE.

Messages and process values from one or more HMI systems such as SIMATIC WinCC, WinCC RT Professional / RT Advanced / Comfort or PCS7 are inserted into the alarm and process value archives of the PM-SERVER in chronological order. These archives form the database for evaluations and analysis functions of PM-ANALYZE.

In addition to an overview of the latest entries, PM-ANALYZE offers a variety of options for filtering messages according to message content and time range. PM-ANALYZE not only allows the chronological display of messages from different sources. It also provides an optimal overview with its user-friendly filters and analysis options, even if there are large numbers of messages. Analysis results can be imported directly into Microsoft Excel and be further processed there.

PM-ANALYZE offers a wide range of charts for displaying process values, from dot, stair or curve lines to bar and pie diagrams.

Workspaces are configured to display multiple views of messages and process values in parallel. The synchronization of the time ranges for all views in a workspace provides a transparent overview of the process data in critical situations.

Additional information is available at: https://www.siemens.de/industrysolutions/de/de/wincc/produkte/pm-analyze/seiten/default.aspx
2.6 Panel integration

The SIMATIC SCADA system for process visualization offers a flexible system for monitoring and controlling processes in the water sector. It offers all functions for operator control and monitoring and can be extended at any time with branch-specific options, e.g. for telecontrol or archiving and reporting tasks related to the water industry. Integrated diagnostics units facilitate plant maintenance and ensure fast, successful troubleshooting in the event of a fault.

The panels are configured with TIA Portal. If the panels are designed as an independent solution (e.g. configured as a package-solution close to the machine), you can integrate them with building blocks from the Industry Library (IL).

The following versions are available:

- STEP 7 optionally with S7-CFC and S7-IL
- SIMATIC PCS 7 with IL.

For more detailed information on the integration of Comfort and Operator Panels in SIMATIC PCS 7, refer to: https://support.industry.siemens.com/cs/ww/en/view/50708061.


SIMATIC HMI Key Panels

Key panels are compact pushbutton panels and complement the classic touch screen panel operation. PROFINET allows you to integrate the key panels into existing automation networks – without complex cabling and with no additional hardware.

SIMATIC HMI Basic Panel

The HMI Basic Panels are the entry-level series for simple visualization tasks. The HMI devices contain numerous basic functionalities (e.g. alarm logging and trends), are easy to configure and provide intuitive operation.

SIMATIC HMI Comfort Panel

SIMATIC HMI Comfort Panels are designed for implementing high-performance visualization tasks at machine level. High performance, functionality and numerous integrated interfaces offer maximum convenience in high-end applications.

SIMATIC Advanced HMI PC based

The powerful HMI PC based panels are used for data intensive and complex visualization tasks. These consist of a small PC and a panel, and provide maximum performance and flexibility for your application. You can choose between the following variants:

- All-in-one PC
- Separate in panel and PC
2.7 Water management system

With the SIWA modular water management system, applications are available for the entire water cycle to ensure reliable and optimized operation. Additional applications are currently being developed and are continuously supplementing the digitalization portfolio for the water industry.

For more information, go to www.siemens.com/wasser.

SIWA OPTIM

SIWA Optim optimizes pump and valve schedules based on the latest plant data and demand forecasts as well as daily updated energy prices. This enables you to reduce energy costs by up to 15% while safeguarding the supply at the same time. In addition, SIWA Optim can simulate different scenarios based on actual operating data.

Additional information is available at:

SIWA Leak / SIWA LeakPlus

SIWA Leak and SIWA LeakPlus support you in detecting and locating leaks in water transport pipes and water distribution systems. The continuous recording of the condition of the water pipes provides decision-relevant information so that leaks can be detected at an early stage and the right countermeasures can be initiated.

SIWA Burst

With SIWA Burst you can quickly and reliably detect sudden line breaks or the bursting of valves or flange connections. The application also locates the damage with an accuracy of up to 20m, enabling you to act quickly and minimize consequential damage. Furthermore, SIWA Burst offers the possibility to adjust the operation of the water network by detecting pressure anomalies and to avoid bursts by stress-reduced operation.

SIWA SEWER

SIWA SEWER has been specifically developed for operators of sewer networks and sewage treatment plants. The system controls the ductwork and helps regulate sewage flows and storage volumes in the network. As a result, sewage treatment plants are utilized more consistently, energy costs are reduced, the risk of damage to the pipe system is minimized, and the overflows of untreated sewage into natural waters is prevented.

SIWA OTS

SIWA OTS has been specially designed as an educational and training tool for personnel. Thanks to the simulation, operators can be taught the basic system functions, and trained on how to handle the control system and how to deal with extraordinary events in a realistic manner.

1 powered by BuntPlanet
2.8 Process instrumentation

Field devices are an essential component for measurement of pressure, temperature, flow rate or level in every automation. Electrical transmission of the real values is the central function of a field device and enables system regulation and control. The comprehensive Siemens portfolio enables you to implement the entire process instrumentation of your PCS 7 system. The field devices are integrated in your system either centrally or de-centralized via PROFIBUS DP/PA or PROFINET and can be controlled and monitored from all your system’s operating stations. Parameter assignment is carried out with the Process Device Manager (PDM) and then loaded in the field devices via the network after completion. Below you will find an overview of the possible location of process instruments in a "water filtration" unit of the water industry.

Figure 2-2 – "Water filtration" plant area

You can find further information on the process instrumentation used in the water industry at:

With the products of the SITRANS family, Siemens offers an extensive product portfolio for process instrumentation. A selection of field devices tailored to the needs of the water and wastewater industry is briefly explained below.
2 Product overview

2.8.1 SITRANS F - flow measurement

SITRANS F M MAG 6000
The SITRANS F M MAG 6000 is a microprocessor-based transmitter. It is powerful and offers easy installation, commissioning and maintenance. The transmitter is robust and suitable for universal applications. Its measuring accuracy is ±0.2 % of the flow rate and it can be equipped with optional plug-in communication modules.

Figure 2-3 SITRANS F M MAG 6000

To obtain a complete flowmeter, the SITRANS F M MAG 6000 transmitter must be combined with a MAG series sensor. The SITRANS F M MAG 5100 W is particularly suitable for water and waste water environments.

Additional information is available at:
https://w3.siemens.com/mcms/sensor-systems/de/messumformer/durchflussmessung/magnetisch-induktiv/messumformer/Seiten/sitrans-f-m-mag-6000.aspx

2.8.2 SITRANS L - level meter

SITRANS Probe LU
Compact SITRANS Probe LU is a 2-wire ultrasonic meter for level and volume measurements of liquids in storage tanks and simple process containers as well as for flow measurements in open canals.

Figure 2-4 SITRANS Probe LU

The SITRANS Probe LU is suitable for level measurements in the water and wastewater industry and in the storage of chemicals.

The measuring range of the SITRANS Probe LU is 6 or 12 m (20 or 40 ft). The function autom. suppression of interfering echoes resulting from fixtures, the improved signal-to-noise ratio, and an increased accuracy of 0.15% of the measuring range or 6 mm (0.25") provide the device with maximum reliability.
2 Product overview

Additional information is available at:

Hydro Ranger 200

HydroRanger 200 is an ultrasonic level monitor for up to six pumps. It is suitable for level control, differential measurement and flow measurement in open channels.

Figure 2-5 SITRANS HydroRanger 200 / 200 HMI

HydroRanger 200 is a low-cost, low-maintenance solution for water authorities as well as public water and sewage plants. It delivers the performance and productivity required to meet today’s stringent standards. While all versions offer single-channel monitoring, the 6-relay version offers the option of dual-channel monitoring. Digital communication with integrated Modbus RTU via RS-485 is also available.

Additional information is available at:
SITRANS LR250

SITRANS LR250 is the first choice for level measurement of liquids in storage and process vessels, in ranges up to 20 meters (66 ft). A large selection of antennas makes it the ideal solution for all your measurement tasks.

Figure 2-6 SITRANS LR250

Thanks to the new, encapsulated antennas with flange and hygiene connection, the transmitter can also handle corrosive or aggressive media as well as hygienic and sanitary requirements.

Additional information is available at:

2.8.3 SITRANS P - pressure measurement.

SITRANS P300

The SITRANS P 300 offers the usual measuring precision and robustness as already known from the SITRANS P DSIII.

Figure 2-7 SITRANS P300

With a measurement error of max. 0.075% and the proven operating philosophy, it fits seamlessly into the SITRANS P family.

Additional information is available at:
2.8.4 SITRANS T – temperature measurement

TH400 PROFIBUS PA

The SITRANS TH400 is available for either PROFIBUS PA or FOUNDATION Fieldbus interface. Via PROFIBUS PA, a simple connection to the automation system via the Compact Field Unit (CFU) is possible, thus opening up new decentralization options. In addition, Plug & Produce is possible with the connection via PROFIBUS PA of the TH400 in combination with the CFU. This allows easy and fail-safe integration and should this be necessary, a simple and safe device replacement, without interfering with the engineering system.

Figure 2-8 SITRANS TH400

The TH400 is suitable for all commonly available resistance thermometers and thermocouples. Even resistance sensors and millivolt signals can be evaluated with it. The device is quickly and easily configured via SIMATIC PDM (PA) or a AMS handheld communicator (FF). Thanks to its small size, it opens up a wide range of mounting options, even directly onto the measuring insert in the Form B connection head with small cover.

Additional information is available at:

- SITRANS TH400

- SIMATIC CFU:
3 Specific solutions/ approaches

The standardization of automation engineering for process plants, such as in the water industry, is a major challenge. Different process steps and sequences, different equipment and flexibility in the process make this task more difficult.

One standardization approach includes the use of standard libraries and the configuring of the plant according to the physical model of the DIN EN 61512 standard. This specifies the lower four levels, i.e. plant, unit, equipment module and control module. A plant always consists of units. The units contain standardized equipment modules.

3.1 PCS 7 libraries

The SIMATIC PCS 7 Advanced Process Library (APL) and Industry Library (IL) are among those available for implementation. Through the libraries, you can design your automation in a standardized way by means of predefined blocks.

Advanced Process Library

The library building blocks of APL cover a wide range of functions for process automation, such as channel blocks, controller blocks, technology blocks and maintenance blocks. When you create the automation program, the associated data blocks are installed automatically. Uniform operating elements (faceplates) are also created automatically for the visualization process.

User-friendly engineering with the APL library reduces the effort involved in creating your standardized system.

You can find further information about the Advanced Process Library at:

SIMATIC PCS 7 TeleControl

Optimum plant overview for decentralized process areas: With SIMATIC PCS 7 TeleControl, the outstations can be integrated into SIMATIC PCS 7 so that the operator notices no difference between central or remote automation with regard to the operating philosophy and alarm response. SIMATIC PCS 7 TeleControl can not only integrate newly configured remote terminal units into the control system environment, but can also migrate existing subsystems in the outdoor areas.

SIMATIC PCS 7 TeleControl also simplifies the structure of hierarchical system configurations.

Additional information is available at:
3 Specific solutions/ approaches

SITOP Library
The SITOP library provides you with the driver blocks, function blocks, block icons, and faceplates for monitoring the PROFINET-capable devices (UPS1600 and PSU8600), in addition to preconfigured process tag types for monitoring the signal contacts of mains units, redundancy as well as selectivity modules via the digital input assemblies.

Further information:

SIMATIC PCS 7 Advanced Process Graphics
Increasingly complex process plants pose an enormous challenge to operating personnel. For this reason, it is important for relevant process information to be available and for plant conditions and operational parameters to be displayed in the control room in a clear, simple and well-arranged manner. Only in this way can the correct decisions be made and the appropriate measures taken quickly. For effective process control, APG offer hybrid views, trend curves, and Kiviat charts that provide information instead of data to operators.

Condition Monitoring Library
The SIMATIC PCS 7 Condition Monitoring Library (CML) provides blocks for economic monitoring and analysis of mechanical assets (plant components such as pumps, valves, etc.) that increase efficiency and availability and detect possible damages as early as possible.

The CML blocks in APL style fit perfectly into the process pictures based on APL.

The following blocks are available:
- PumpMon for monitoring electrically driven rotary pumps with constant and variable speed (e.g. cavitation monitoring)
- VlvMon for monitoring continuously variable valves with position feedback (e.g. mechanical damage and soot build-up)

Industry Library
The Industry Library extends the functional scope of the standard APL functionality with the same look and feel. Thus the libraries complement each other perfectly and offer a uniform overall solution. The Industry Library supplies blocks for the following applications:
- Extended multiple control room concept
- HVAC
- Small load management
- Extended unit control
- Special process data monitoring (8 limits)
- Connection of S7-300 / IM151-8 to PCS 7

You can find further information on the Industry Library at:
3 Specific solutions/ approaches

SITRANS Library

By means of the SITRANS Library, you can integrate process instruments of the product families SITRANS and SIPART into the SIMATIC PCS 7 process control system with high quality, efficiency and safety. You can also integrate them in the S7-300, IM151-8 and S7-400 controllers and in a WinCC system for operation and monitoring as well as in SIMATIC comfort panels with TIA Portal. The look and feel is based on the APL standard of SIMATIC PCS 7 and is thus uniform for all target systems.

Additional information concerning the SITRANS library is provided under: https://w3.siemens.com/mcms/sensor-systems/en/process-instrumentation/communication-and-software/Pages/SITRANS-Library.aspx

SIMATIC PowerControl

SIMATIC PCS 7 PowerControl allows the integration of switchboards in the SIMATIC PCS 7 process control system. This enables the merging of process automation and the automation of electrical switchboards for medium voltages in one control system. The advantage for plant operators: significant cost savings over the entire life cycle of the plant.

For further information on PowerControl, please refer to: https://w3.siemens.com/mcms/process-control-systems/en/distributed-control-system-simatic-pcs-7/simatic-pcs-7-technologies/PowerControl/Pages/SIMATIC-Power-Control.aspx

SIMATIC PCS 7 Advanced Process Graphics

Increasingly complex process plants pose an enormous challenge to operating personnel. For this reason, it is important for relevant process information to be available and for plant conditions and operational parameters to be displayed in the control room in a clear, simple and well-arranged manner. Only in this way can the correct decisions be made and the appropriate measures taken quickly. For effective process control, APG offer hybrid views, trend curves, and Kiviat charts that provide information instead of data to operators.

3.2 Application examples

Application examples support you with functional solutions. Instead of emphasizing on just the single product, they rather deal with the interaction of the entire system. You can use the following application examples to develop know-how and as a template for your plant section in the water industry:

- Introduction to the Water Industry and Siemens Solutions

- Remote control in the Water Industry

- Example project: Remote control of S7-1200 RTU with PCS 7 TeleControl (IEC protocol)

- Siemens Water Templates and their Applications

- Siemens Water SIMIT Templates and their Applications
3 Specific solutions/ approaches

3.3 Water-specific master data library and templates

For standardized automation, Siemens offers a special library and configuration templates tailored to the requirements of the water industry. This is based on the Industry Library, which is available as an add-on product for SIMATIC PCS 7 V8.0 and WinCC V7.2 or higher. The PCS 7 and S7 templates that are based on this enable a standardized implementation of complete package solutions as well as smaller operation and functional units. The templates are already preconfigured and contain all the typical components for controllers and closed loop controls. The implementation is carried out with SIMATIC PCS 7 or SIMATIC WinCC.

Water Templates

The Water Templates consist of three hierarchically successive groups and are based on the physical model of the NAMUR NE33 and ISA S88.01 (ANSI/ISA-88.01-1995) standards.

Figure 3-1: Siemens Water Templates in relation to NAMUR/ISA

Performance of the Water Templates

PCS 7 Water Templates offer you a solution approach in the following areas:

- Simple multi-user control 1 out of 8 control locations
- Integrated Panel operation (optional mosaic Panel connection)
- Integrated local controls (HW) without automation (AS)
- Integrated local controls (SW) with automation
- Unit switchover for 8/16 drives
- 96 turning points with 15 minutes setpoint curve specifications
- Configurable and controllable polygon with 8 turning points
- Monitoring of measured values with up to 8 limit values
- Time-driven controller for simple process operations
- Simple integration of package unit solutions with S7-300, IM151-8 in the automation solution
- Provision of additional monitoring functions of centrifugal pumps and control valves
- Finished drive solutions (pumps, agitators etc.) via fieldbus connection with SIMOCODE pro V PB / PN (incl. HW engineering)
- Complete drive solutions (dosing pumps, blowers, etc.) via field bus connection with SINAMICS G120P / X
- Integrated solution with process instrumentation via field bus connection, e.g. SITRANS MAG 6000
3 Specific solutions/ approaches

- Power engineering from 24V DC via low-voltage switchgear (NSHV) to medium-voltage switchgear (MSHV)

**Licensing concept**

To use the PCS 7 / S7 Water Templates you must have the following licensed components installed:

- SIMATIC PCS 7 Add-on Industry Library (IL)
- SITRANS Library (SL)
- SIMOCODE ES (TIA Portal) or PDM in combination with SIMOCODE per EDD and/or STARTER license

### 3.3.1 Standards and guidelines

The water templates comply with the requirements of the IEC 62424 and ATV M260 standards and are based on DIN/VDI/VDE/IEC/ISO standards.

<table>
<thead>
<tr>
<th>Standard / guideline</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV-DVWK-M260</td>
<td>Capture, display, evaluate and archive the automated operation of sewage plants</td>
</tr>
<tr>
<td>DWA-M 253</td>
<td>Process control and automation of sewage plants</td>
</tr>
<tr>
<td>DWA-M 207</td>
<td>Information and communication networks for sewage plants</td>
</tr>
<tr>
<td>DWA- M181</td>
<td>Fill level and flow measurement in drainage systems</td>
</tr>
<tr>
<td>ISO 7000, IEC 60417</td>
<td>Graphical symbols for the operating resources used</td>
</tr>
<tr>
<td>IEC 62424</td>
<td>Technical representation of the process control using P&amp;I diagrams and data exchange between P&amp;ID tools and PCE-CAE tools</td>
</tr>
<tr>
<td>DIN 2403</td>
<td>Labeling of the pipe flow medium</td>
</tr>
</tbody>
</table>

### 3.3.2 Water Control Module Types (WCMT)/ Water Process Tag Types (WPTT)

The smallest functional unit of the templates consists of the Water Process Tag Types (WPTT) and Water Control Module Types (WCMT). These are used for closed loop controls, measuring value detection, actuator control, etc.

WCMTs are enhanced WPTTs and offer the following advantages for engineering in SIMATIC PCS 7 and for mass data engineering with COMOS or with the PCS 7 Process Automation Accelerator:

- Instance-specific changes to the instance of the control module are not lost during synchronization between type and instance.
- It is possible to generate different variants for an instance based on a single control unit type. In addition to this, optional blocks are also configured in WCMT. The activated optional blocks are predefined for each instance. As of PCS 7 V8.0, this is done in the additional “Technological Connections” view of the CFC.
You can find the "Standard PCS 7 and S7 Water Templates for the water industry" at:

3.3.3 Water Equipment Module Templates (WEMT)

Water Equipment Modules Templates (WEMT) are available for technical units which can be composed of controls, valves, sensors, devices/actuators and/or mechanical components. The individual WEMTs are grouped from various PCS 7 Water Templates (WCMT) or consist of separate control system operation units.

The WEMTs for control system operations (e.g. multi-user selection, aggregate switching, package unit connection) are stored as CFCs. Regulations, such as the split-range regulation, are created in the form of a sample solution. WEMTs are stored in a PCS 7 master data library, consisting of:

- a CFC plan
- a PCS 7 OS block icon
- PCS 7 APL faceplates.

Processing via mass data engineering using COMOS/

An overview of the available WEMTs can be found in the article:

You can find the "Standard PCS 7 and S7 Water Templates for the water industry" at:

3.3.4 Water Unit Templates (WUT)

The water unit templates (WUT) are templates for complete units, which consist of control modules (WCMT / WPTT) and devices (WEMT). All functions are combined into a logical unit within the WUT, to provide you with an easy-to-use template for the automation solution of a unit.

The following WUTs are available to help you build know-how and as a template for your own projects:

- PCS 7 Water Unit Template - Control of Biological Stage of a Wastewater Treatment Plant with Upstream Denitrification

- PCS 7 Water Unit Template – Control of Biological Stage of a Wastewater Treatment Plant with Intermittent Operation

- PCS 7 Water Unit Template – Efficient Management of Storm Water Tank

- PCS 7 Water Unit Template – External Pump Station of a Wastewater Treatment Plant (WWTP)
3 Specific solutions/ approaches

3.3.5 Control strategy of the water unit templates

The control strategy in the water industry is usually based on multi-user control, which allows access to a maximum of eight different locations (e.g. OS servers or panels). The control strategy has four different levels of control rights, which are also defined by prioritization. This definition of the control strategy is implemented uniformly by the templates.

<table>
<thead>
<tr>
<th>Operation mode description</th>
<th>Operation priority</th>
<th>Possible actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central remote control room(s):</td>
<td>1 (lowest)</td>
<td>• Manual operation</td>
</tr>
<tr>
<td>The operator controls one or several water stations from a central control room by means of the SIMATIC OS user interface.</td>
<td></td>
<td>• Automatic operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Remote operation of every actuator</td>
</tr>
<tr>
<td>Local control room:</td>
<td>2</td>
<td>• Manual operation</td>
</tr>
<tr>
<td>The operator controls one or several water stations from a local control room by means of the SIMATIC OS user interface.</td>
<td></td>
<td>• Automatic operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Remote operation of every actuator</td>
</tr>
<tr>
<td>Local panel:</td>
<td>3</td>
<td>• Manual operation</td>
</tr>
<tr>
<td>Local operation of functions via panels directly on the control cabinet. The operator controls a local sub-section of the plant via the panels.</td>
<td></td>
<td>• Automatic operation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Local panel operation</td>
</tr>
<tr>
<td>Local devices:</td>
<td>4 (highest)</td>
<td>• Operation with panels connected to the automation system</td>
</tr>
<tr>
<td>Local operation gets the highest priority and is divided into three different operating concepts.</td>
<td></td>
<td>• Operation with local software switches connected to the automation system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Operation with local hardware switches, connected directly to the local electro-technical devices and/or in the control cabinet. During normal operation with communication to the Process Control System, only signal tracking is performed. In the event of a complete failure of the control and/or automation system, local operation and monitoring are ensured at all times in emergency mode.</td>
</tr>
</tbody>
</table>
The local hardware interconnection of functions has priority over local software interconnection if local operation takes place via both paths at the same time. The following figure illustrates the operation via local software and hardware switches. Both variants can be operated via direct interconnection and an automation system.

**Figure 3-2 Operation with local SW switch or HW switch**

**Note**

Further information about the multi-user concept can be found in the manual of the PCS 7 Industry Library at: [https://support.industry.siemens.com/cs/ww/en/view/109750809](https://support.industry.siemens.com/cs/ww/en/view/109750809)
4 Guidelines for planning and configuring

There are binding requirements for the implementation of automation projects in the water industry. These are listed in the IEC 62424 and ATV M260 directives (only for wastewater management). To a certain extent, the requirements mentioned here apply as a general rule to a standardization and especially to the application of the Siemens Water Templates.

You can find further information on the IEC directives that apply to the water industry at:
https://www.iec.ch/about/brochures/pdf/about_iec/IEC_role_in_water_management_LR.pdf

4.1 Engineering

The standardization of the automation solution is based on the general requirements for engineering to ensure a uniform procedure when creating a solution and/or applying the PCS 7 templates.

PCS 7 compendia

Create your own PCS 7-compliant and upgradable solutions according to the following PCS 7 recommendations:

- PCS 7 Compendium Part A - Configuration Guidelines
- PCS 7 Compendium Part B - Process Safety
- PCS 7 Compendium Part C - Technical Functions with SFC Types
- PCS 7 Compendium Part D - Operation and Maintenance
- PCS 7 Compendium Part E - Hardware Configuration
- PCS 7 Compendium Part F - Industrial Security

You can find an overview of the PCS 7 compendia at the following link:
http://www.siemens.com/industry/onlinesupport/pcs7

PCS 7 libraries

To implement and create your own solutions, use the following PCS 7 libraries:

- PCS 7 Advanced Process Library (APL)
- SIMATIC PCS 7 Industry Library (IL)
- SITRANS Library for PCS 7 (SL)
- PCS 7 Advanced Process Graphics (APG)
- PCS 7 Condition Monitoring Library
- PCS 7 SiTOP Library
- PCS 7 PowerControl
- PCS 7 TeleControl
4 Guidelines for planning and configuring

Note If you intend on using the Industry Library and the SITRANS Library in your configuration environment or in process mode, you are obliged to buy the engineering and runtime licenses.

Standardized engineering
By using the water templates (WEMT/ WCMT) resolutely, you achieve consistent standardization of your unit or entire plant. This forms the basis for future migrations.

Alarm limits and messages
For all analog measurements in your own solution, use the templates WCMT_MonAnalog08 and WCMT_S/MonAnalog08. The following table gives you the definitions of the alarm messages:

<table>
<thead>
<tr>
<th>Limit</th>
<th>P&amp;ID diagram</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>AHH</td>
<td>Alarm High-High</td>
</tr>
<tr>
<td>L2</td>
<td>AH</td>
<td>Alarm High</td>
</tr>
<tr>
<td>L3</td>
<td>WH (SHH)</td>
<td>Warning High; can also be used as SHH, Switch High-High</td>
</tr>
<tr>
<td>L4</td>
<td>SH</td>
<td>Switch High</td>
</tr>
<tr>
<td>L5</td>
<td>SL</td>
<td>Switch Low</td>
</tr>
<tr>
<td>L6</td>
<td>WL (SLL)</td>
<td>Warning Low; can also be used as SLL, Switch Low-Low</td>
</tr>
<tr>
<td>L7</td>
<td>AL</td>
<td>Alarm Low</td>
</tr>
<tr>
<td>L8</td>
<td>ALL</td>
<td>Alarm Low-Low</td>
</tr>
</tbody>
</table>

Archiving and reporting
For long-term archiving and reporting according to ATV-DVWK-M260, it is recommended to use the following solutions that create conformant archiving:

- PM-ANALYZE
- Power Control
- Energy Manager Pro

Creating CFCs
For a uniform program structure and standardization of the software when creating your own CFCs use the standard functions and function blocks of the PCS 7 Advanced Process Library, Industry Library and SITRANS Library.

SI unit
Assign the corresponding physical units (SI units) for your measured values. The APL supports you with a large variety of SI units, which are configured in the display module and channel blocks during the engineering phase.

Note From PCS 7 V9.0, you can apply up to 199 customized units.
4 Guidelines for planning and configuring

Multiproject / Multiuser engineering

SIMATIC PCS 7 helps you configure automation projects effectively. In multiproject engineering, full automation tasks are generally divided into several PCS 7 projects. Each of these is then processed separately on distributed engineering stations by one project engineer and subsequently synchronized with the central engineering server.

On the other hand, in the case of multiuser engineering, several users work on the same project via network.

In the following application example, the engineering procedures are described in a practical way and in some cases with step by step instructions:

Creating new functions/function blocks

When creating your own functions (FC) and function blocks (FB), observe the following prerequisites:

- Implementation with SIMATIC SCL
- It is not permitted to use S7 timers, S7 counters and S7 flags
- Tags are handled within the instance-specific data block (DB)
- Function blocks run in each runtime OB
- The block must fulfill the following functions
  - Restart (set/reset parameters to the default values depending on their function)
  - New instance of the block (to facilitate the on-line instantiation of the block)
  - Changing the sampling rate
4.2 Naming convention

The naming conventions with your own classification make your project easier to read. The naming convention applies to the ATV-DVWK-M260 guideline and was applied in the Water Templates.

Note: Standardization also means that all measuring points in your projects must have resolute and consistent labeling according to the industry-specific naming convention.

Naming convention of the Water Templates

The WCMT and WEMT Water Templates have uniform names and term definitions for quick assignment of tasks and functions. They are made up of the following three criteria:

1. Template type (WCMT, WEMT)
2. Template function (Name = technology block name from the APL, IL or SITRANS Library)
3. Signal connection (without text /_Fb /_FbMMS /_FbDrv)

Example: WCMT_MonAnalog_Fb

For further information about the naming convention of the templates, see: Standard PCS 7 and S7 Water Templates for the water industry

Note: The naming convention of the Water Templates concerns the naming of the template. The labeling of the measuring point follows the general naming convention.

General naming convention of the measuring points

For the names of the individual measuring points, use the following convention:

XXN_XXXX_XX

Process action
Measuring principle
Element

- The label of the process action must be abbreviated by two characters in accordance with the ATV260 guideline. You can find further relevant information in the list below. The "N" character is optional, in case several actions of the same name are present. The abbreviations for the process actions are shown in the table below.
- Measuring principle, such as FQIR, LIS
- Element: two characters with leading zero
### Guidelines for planning and configuring Plant-wide automation in the water industry

<table>
<thead>
<tr>
<th>Process action abbreviation</th>
<th>Process action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATV 260</td>
<td>DVD</td>
</tr>
<tr>
<td>RB</td>
<td>RB</td>
</tr>
<tr>
<td>P</td>
<td>PW</td>
</tr>
<tr>
<td>PW</td>
<td>ZL</td>
</tr>
<tr>
<td>FA</td>
<td>AM</td>
</tr>
<tr>
<td>AS</td>
<td>AS</td>
</tr>
<tr>
<td>RE</td>
<td>RE</td>
</tr>
<tr>
<td>SF</td>
<td>SF</td>
</tr>
<tr>
<td>VK</td>
<td>VK</td>
</tr>
<tr>
<td>FL</td>
<td>KN</td>
</tr>
<tr>
<td>MB / DN / NI</td>
<td>AN / DN / NI</td>
</tr>
<tr>
<td>GS</td>
<td>TV</td>
</tr>
<tr>
<td>NK</td>
<td>NK</td>
</tr>
<tr>
<td>RS / US</td>
<td>RL / NI</td>
</tr>
<tr>
<td>AU</td>
<td>??</td>
</tr>
<tr>
<td>FK</td>
<td>PF</td>
</tr>
<tr>
<td>SE</td>
<td>UE</td>
</tr>
<tr>
<td>FA / AY</td>
<td>FB</td>
</tr>
<tr>
<td>GB / GF</td>
<td>GB</td>
</tr>
<tr>
<td>NA / BK</td>
<td>NE</td>
</tr>
<tr>
<td>VE / NE</td>
<td>VE</td>
</tr>
<tr>
<td>KP</td>
<td>FS / FP</td>
</tr>
<tr>
<td>NS / MS</td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td></td>
</tr>
<tr>
<td>BW</td>
<td>---</td>
</tr>
<tr>
<td>HW</td>
<td>HW</td>
</tr>
</tbody>
</table>
### 4.3 P&ID diagram

A P&ID diagram maps the modes of action of the individual process variables and components in a plant or unit. This representation helps when configuring the automation system and when creating OS user interfaces.

In the following section, you will find examples for P&ID diagrams of various motor and valve versions as a simplified representation.

**Template N1 - Symbol for motor with simple speed**

**Templates N2 – Symbol for motor with simple speed and control via SIMOCODE pro V**
Templates N3 - Symbol for motor with variable speed

Template N4 - Symbol for motor with variable speed and control via SINAMICS G120)
Template Y1 - On/Off valve

Template Y2 - Symbol for On/Off valve and control via SIMOCODE pro V

Detail view:
4 Guidelines for planning and configuring

Template Y3 - Symbol for analog valve

Template Y4 - Symbol for analog valve and control via SIMOCODE pro V
4 Guidelines for planning and configuring

Template Y5 - Symbol for analog valve and control via digital output

Overview of WCMT based on the P&ID diagram

<table>
<thead>
<tr>
<th>Item</th>
<th>Template</th>
<th>WCMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N1</td>
<td>WCMT_Mot2Spd, WCMT_MotLean</td>
</tr>
<tr>
<td>2</td>
<td>N2</td>
<td>WCMT_Mot2Spd_FbMMS, WCMT_MotLean_FBMMS</td>
</tr>
<tr>
<td>3</td>
<td>N3</td>
<td>WCMT_MotRev, WCMT_SpdCon</td>
</tr>
<tr>
<td>4</td>
<td>N4</td>
<td>WCMT_MotRev_FbMMS, WCMT_SpdCon_Fbdrv</td>
</tr>
<tr>
<td>5</td>
<td>Y1</td>
<td>WCMT_VlvLean</td>
</tr>
<tr>
<td>6</td>
<td>Y2</td>
<td>WCMT_VlvLean_FbMMS</td>
</tr>
<tr>
<td>7</td>
<td>Y3</td>
<td>WCMT_VlvMotor</td>
</tr>
<tr>
<td>8</td>
<td>Y4</td>
<td>WCMT_VlvMotor_FbMMS</td>
</tr>
<tr>
<td>9</td>
<td>Y5</td>
<td>WCMT_VlvAnalog</td>
</tr>
</tbody>
</table>

Definition of motor and unit names in the P&ID diagrams

<table>
<thead>
<tr>
<th>Unit type</th>
<th>Unit</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump</td>
<td>Pnn</td>
<td>Mnn</td>
</tr>
<tr>
<td>Fan</td>
<td>Vnn</td>
<td>Mnn</td>
</tr>
<tr>
<td>Scraper/screen</td>
<td>Rnn</td>
<td>Mnn</td>
</tr>
<tr>
<td>Sieve, press, etc.</td>
<td>Snn</td>
<td>Mnn</td>
</tr>
</tbody>
</table>
4.4 Process control and operation

A clearly structured and unified interface is required for effective and safe process management. The P&ID diagram forms the basis for the division and arrangement of the user interface of the respective unit. The ATV-DVWK M260 guideline must be applied for the design of PCS 7 and WinCC process pictures.

You can run the process management for the entire plant either with

- the SIMATIC PCS 7 process control system operator station or with
- the visualization solution such as WinCC or WinCC Professional (TIA Portal) in the SCADA environment.

You can also

- split the process pictures of the units between various OS clients and
- also create local visualization by means of panels with restricted user rights for each unit.

Note

You can find water-specific example projects of units (Water Unit Templates), which include both the automation program and the process pictures for SIMATIC PCS 7 and TIA Portal (Panel Project).

The following link provides you an overview of industry-specific examples and solutions:
https://support.industry.siemens.com/cs/products?mfn=ps&pnid=21154&lc=en-WW

Process level of process pictures in the OS runtime

In the engineering phase, a level can be predefined for each object of a process picture. In this way, you can position the individual graphical objects in such way as to avoid interfering objects, such as faceplates and cables during processing.

<table>
<thead>
<tr>
<th>Layer</th>
<th>Object type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Layout</td>
</tr>
<tr>
<td>2</td>
<td>Static objects</td>
</tr>
<tr>
<td>3</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>---</td>
</tr>
<tr>
<td>5</td>
<td>Piping</td>
</tr>
<tr>
<td>6</td>
<td>---</td>
</tr>
<tr>
<td>7</td>
<td>---</td>
</tr>
<tr>
<td>8</td>
<td>---</td>
</tr>
<tr>
<td>9</td>
<td>---</td>
</tr>
<tr>
<td>10</td>
<td>Control modules</td>
</tr>
<tr>
<td>11</td>
<td>---</td>
</tr>
<tr>
<td>12</td>
<td>---</td>
</tr>
<tr>
<td>13</td>
<td>---</td>
</tr>
<tr>
<td>14</td>
<td>---</td>
</tr>
</tbody>
</table>
## Color of cables and lines in the process pictures

To standardize the process control interface and achieve a consistent material representation, use the following line colors.

<table>
<thead>
<tr>
<th>Material</th>
<th>Color</th>
<th>R</th>
<th>G</th>
<th>B</th>
<th>Palette</th>
<th>No.</th>
<th>HTML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Water</td>
<td>RAL 6018</td>
<td>079</td>
<td>168</td>
<td>051</td>
<td>1</td>
<td>0</td>
<td>#FA833</td>
</tr>
<tr>
<td>Sea Water (SM)</td>
<td>RAL 6027</td>
<td>125</td>
<td>204</td>
<td>189</td>
<td>1</td>
<td>01</td>
<td>#7DCCED</td>
</tr>
<tr>
<td>Oily Water (OVIS)</td>
<td>RAL 6030</td>
<td>038</td>
<td>066</td>
<td>041</td>
<td>1</td>
<td>02</td>
<td>#E8382D</td>
</tr>
<tr>
<td>Process Water (PW)</td>
<td>RAL 6025</td>
<td>074</td>
<td>110</td>
<td>051</td>
<td>1</td>
<td>03</td>
<td>#A8E33</td>
</tr>
<tr>
<td>Air (WTP)</td>
<td>RAL 7001</td>
<td>135</td>
<td>148</td>
<td>165</td>
<td>1</td>
<td>04</td>
<td>#7994A6</td>
</tr>
<tr>
<td>Flammable gases (digester gas, Azlen, hydrogen, flammable exhaust gases etc.)</td>
<td>RAL 1012</td>
<td>227</td>
<td>194</td>
<td>066</td>
<td>1</td>
<td>05</td>
<td>#E3E338</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>RAL 1018</td>
<td>255</td>
<td>214</td>
<td>077</td>
<td>1</td>
<td>06</td>
<td>#F08040</td>
</tr>
<tr>
<td>Nitrogen(N)</td>
<td>RAL 1026</td>
<td>255</td>
<td>255</td>
<td>010</td>
<td>1</td>
<td>07</td>
<td>#F0FF0D</td>
</tr>
<tr>
<td>Methanol(ME)</td>
<td>RAL 5017</td>
<td>000</td>
<td>069</td>
<td>128</td>
<td>1</td>
<td>08</td>
<td>#038550</td>
</tr>
<tr>
<td>Oxygen (WTP)</td>
<td>RAL 5015</td>
<td>023</td>
<td>097</td>
<td>171</td>
<td>1</td>
<td>09</td>
<td>#7C0ADD</td>
</tr>
<tr>
<td>Acids (sulfuric acid, hydrochloric acid, nitric acid, etc.)</td>
<td>RAL 2000</td>
<td>224</td>
<td>094</td>
<td>081</td>
<td>1</td>
<td>10</td>
<td>#E0E1F</td>
</tr>
<tr>
<td>Lye (Sodium Hydroxide, Ammonia Water, Milk of Lime etc.)</td>
<td>RAL 4001</td>
<td>130</td>
<td>004</td>
<td>128</td>
<td>1</td>
<td>11</td>
<td>#943A80</td>
</tr>
<tr>
<td>Rammlide liquids (Diesel etc.)</td>
<td>RAL 2004</td>
<td>242</td>
<td>069</td>
<td>028</td>
<td>1</td>
<td>12</td>
<td>#F2B1C</td>
</tr>
<tr>
<td>Fuel Oil (FO)</td>
<td>RAL 8016</td>
<td>031</td>
<td>031</td>
<td>028</td>
<td>1</td>
<td>13</td>
<td>#C1F1C</td>
</tr>
<tr>
<td>Pilot Gas (PG)</td>
<td>RAL 1028</td>
<td>255</td>
<td>140</td>
<td>023</td>
<td>1</td>
<td>14</td>
<td>#FCB1A</td>
</tr>
<tr>
<td>Blowdown (BD)</td>
<td>RAL 1020</td>
<td>156</td>
<td>143</td>
<td>039</td>
<td>1</td>
<td>15</td>
<td>#C6F61</td>
</tr>
<tr>
<td>Chemical O Color 2</td>
<td>RAL 2012</td>
<td>222</td>
<td>082</td>
<td>071</td>
<td>1</td>
<td>16</td>
<td>#E5E7E7</td>
</tr>
<tr>
<td>Purge Gas (PG)</td>
<td>RAL 4010</td>
<td>191</td>
<td>023</td>
<td>151</td>
<td>1</td>
<td>17</td>
<td>#B177B3</td>
</tr>
<tr>
<td>Relief (RF)</td>
<td>RAL 5018</td>
<td>219</td>
<td>227</td>
<td>222</td>
<td>1</td>
<td>18</td>
<td>#C3E3C3</td>
</tr>
<tr>
<td>Drinking Water (WWTP)</td>
<td>RAL 6021</td>
<td>133</td>
<td>166</td>
<td>122</td>
<td>2</td>
<td>19</td>
<td>#5A66A7</td>
</tr>
<tr>
<td>Chemical O Color 1</td>
<td>RAL 2011</td>
<td>237</td>
<td>062</td>
<td>041</td>
<td>2</td>
<td>20</td>
<td>#E5C5E9</td>
</tr>
<tr>
<td>Heating Flow</td>
<td>RAL 3000</td>
<td>171</td>
<td>031</td>
<td>028</td>
<td>2</td>
<td>21</td>
<td>#A1F1C</td>
</tr>
<tr>
<td>Heating Return</td>
<td>RAL 5010</td>
<td>000</td>
<td>043</td>
<td>112</td>
<td>2</td>
<td>22</td>
<td>#00D700</td>
</tr>
<tr>
<td>Chlorine Gas</td>
<td>RAL 1021</td>
<td>252</td>
<td>189</td>
<td>031</td>
<td>2</td>
<td>23</td>
<td>#2C67E1</td>
</tr>
<tr>
<td>Natural Gas (WTP)</td>
<td>RAL 2000</td>
<td>224</td>
<td>094</td>
<td>081</td>
<td>2</td>
<td>24</td>
<td>#E0E1F</td>
</tr>
<tr>
<td>Solution (Chlorine, Neutral Salt-)</td>
<td>RAL 2008</td>
<td>256</td>
<td>069</td>
<td>064</td>
<td>2</td>
<td>25</td>
<td>#F7D7F7</td>
</tr>
<tr>
<td>Digestion Water, Turbid Water, Central</td>
<td>RAL 4003</td>
<td>201</td>
<td>066</td>
<td>140</td>
<td>2</td>
<td>26</td>
<td>#C388C8</td>
</tr>
<tr>
<td>Waste Water</td>
<td>RAL 5021</td>
<td>036</td>
<td>122</td>
<td>099</td>
<td>2</td>
<td>27</td>
<td>#A76683</td>
</tr>
<tr>
<td>Industrial Water</td>
<td>RAL 6005</td>
<td>010</td>
<td>066</td>
<td>031</td>
<td>2</td>
<td>28</td>
<td>#A388F</td>
</tr>
<tr>
<td>Drinking or Pure Water (WTP)</td>
<td>RAL 6019</td>
<td>191</td>
<td>227</td>
<td>185</td>
<td>2</td>
<td>29</td>
<td>#8EE8BA</td>
</tr>
<tr>
<td>Air (fresh air, compressed air, Oxygen etc.) (WVTP)</td>
<td>RAL 5014</td>
<td>077</td>
<td>105</td>
<td>153</td>
<td>2</td>
<td>30</td>
<td>#D89998</td>
</tr>
<tr>
<td>Exhaust Air -&gt; dashed line</td>
<td>RAL 5014</td>
<td>077</td>
<td>105</td>
<td>153</td>
<td>2</td>
<td>30</td>
<td>#D89998</td>
</tr>
<tr>
<td>Sludge/ Wastewater</td>
<td>RAL 8001</td>
<td>145</td>
<td>062</td>
<td>046</td>
<td>2</td>
<td>31</td>
<td>#F1522E</td>
</tr>
<tr>
<td>Fresh- Activated- Secondary- Surplus- Raising- Fecal Sludge</td>
<td>RAL 8003</td>
<td>115</td>
<td>059</td>
<td>038</td>
<td>2</td>
<td>32</td>
<td>#733E34</td>
</tr>
<tr>
<td>Sludge after centrifuge</td>
<td>RAL 8015</td>
<td>077</td>
<td>031</td>
<td>028</td>
<td>2</td>
<td>33</td>
<td>#C1F1C</td>
</tr>
<tr>
<td>Non-flammable Gases (nitrogen containing gases, CO2 etc.)</td>
<td>RAL 6010</td>
<td>054</td>
<td>105</td>
<td>038</td>
<td>2</td>
<td>34</td>
<td>#86E9E9</td>
</tr>
<tr>
<td>Ozonator</td>
<td>RAL 5018</td>
<td>056</td>
<td>148</td>
<td>130</td>
<td>2</td>
<td>35</td>
<td>#669482</td>
</tr>
<tr>
<td>Steam</td>
<td>RAL 5034</td>
<td>057</td>
<td>140</td>
<td>181</td>
<td>2</td>
<td>36</td>
<td>#763C3E</td>
</tr>
<tr>
<td>Flocculant</td>
<td>RAL 3015</td>
<td>232</td>
<td>156</td>
<td>181</td>
<td>2</td>
<td>37</td>
<td>#86C3B6</td>
</tr>
</tbody>
</table>
Representation of cables and lines

Use the following line types in the process pictures:

<table>
<thead>
<tr>
<th>Line type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Arrows point to the target object, e.g. container</td>
</tr>
<tr>
<td>Measuring point line</td>
<td>• Line width: 1 pixel</td>
</tr>
<tr>
<td></td>
<td>• Line color: black</td>
</tr>
<tr>
<td>Work lines</td>
<td>• Standard representation and removal is possible by means of a button</td>
</tr>
<tr>
<td></td>
<td>• Direction is indicated via an arrow</td>
</tr>
<tr>
<td></td>
<td>• Line width: 2 pixels</td>
</tr>
<tr>
<td></td>
<td>• Line color: black</td>
</tr>
<tr>
<td>Side line</td>
<td>• Line end is represented by the WinCC standard arrow</td>
</tr>
<tr>
<td></td>
<td>• Line width: 2 pixels</td>
</tr>
<tr>
<td></td>
<td>• Line color: black</td>
</tr>
<tr>
<td>Main process line</td>
<td>• Line width: 5 pixels</td>
</tr>
<tr>
<td></td>
<td>• Line end is represented by a separate arrow (see Figure 4-1 Examples of main process lines)</td>
</tr>
<tr>
<td></td>
<td>• Line color: Based on the color of the main medium (see requirement “Color of cables and lines in process pictures”)</td>
</tr>
</tbody>
</table>

Figure 4-1 Examples of main process lines
Static objects and symbols

For process pictures to have a uniform appearance, you have to create your static objects, images and symbols according to the specifications of the PCS 7 APL Style Guide.

For further information, please refer to:

Text formatting

Use the following formatting in your process pictures:

- Static texts of objects, such as containers and lines:
  - Font: Arial
  - Font size: 11 pixels
  - Not bold

- Text representation of jump labels:
  - Font: Arial
  - Font size: 11 pixels
  - Bold

Opening process pictures

You can create dynamic jumps in lower-level process pictures by clicking on the static text or arrow.

Figure 4-2 - Creating picture jumps

4.5 Communication

In order to ensure control and consistent plant operation, a communication connection must be set up with the central remote control room for each WUT subproject.

The communication connection can be set up using SIMATIC TeleControl. For further information on how to configure the telecontrol, see the following articles:

- Remote Configurations in Water and Wastewater Technology

- Creating technological functions with SIMATIC TeleControl and OPEN OS for a consistent Process Visualization in PCS 7
5 Industrial Security – "Defense in Depth"

In the production and automation environment, it is primarily the availability of the plant that is important. The protection of information or data comes second. "Industrial security" must not be reduced to information security in the automation environment. The information transmitted controls and monitors physical and/or chemical processes directly and deterministically. For this reason, when considering possible IT-related damage in the production environment, the actual information is comparatively unimportant (exception): trade secrets such as formulas). What matters is the possible (and intended) direct effect of information on process control and monitoring through the use of automation technology. If this flow of information is disrupted, a whole series of consequences can be expected:

- Limited process availability, up to the loss of process control
- Immediately faulty controls
- Plant standstills, production downtimes, loss of quality and product contamination
- Danger for man, the environment and the plant.
- Breaches of statutory or official regulations
- Criminal or civil proceedings
- Damage to the company's public image

A modern security concept is therefore needed to prevent these consequences. The "Defense-in-Depth" concept described in the IEC 62443 standard is a good choice here. The following figure shows how this approach can be successfully implemented:

Figure 5-1 Industrial Security W&WW
5.1.1 Concept of deep defense - "Defense in Depth".

The concept of deep defense (Defense-in-Depth) is a security strategy in which several layers of defense are placed around the system to be defended, in this case the automation system ("Peel the onion"). The implementation of deep defense requires a combination of different security measures. These include:

**Figure 5-2 "Defense-in-Depth" strategy**

More information on the topic of industrial security can be found in the SIMATIC PCS 7 Compendium Part F - Industrial Security manual: [https://support.industry.siemens.com/cs/ww/en/view/109756871](https://support.industry.siemens.com/cs/ww/en/view/109756871)

**Plant security**
- Physical security measures:
  Control of physical access to given areas, buildings, rooms, cabinets, devices, operating equipment, cables and wiring. The physical security measures must be aligned with the security cells and the responsible persons. It is important to implement physical protection on remote single-user systems as well.
- Organizational security measures:
  Security guidelines, security concepts, security regulations, security checks, risk analyses, assessments and audits, awareness measures and training.

**Network security**
- Division into security cells
  A highly secure network architecture subdivides the control network into various task levels. Perimeter zone techniques should be used for this purpose. This means that the systems installed in the perimeter network (DMZ) are shielded from other networks (e.g. Internet, office network) by one or more firewalls (front and back or threehomed firewall). This separation allows access to data in the perimeter network without having to simultaneously allow access
5 Industrial Security – “Defense in Depth”

to the internal network to be protected (e.g. automation network). This significantly minimizes the risk of access violations.

• Securing access points to security cells
  A single access point to each security cell (to be implemented by means of a firewall) for authenticating users and the applications and devices used, for direction-based access control, for assigning access authorizations, and for detecting attempted break-ins. The single access point is the main access point to the network of a security cell and serves as the first point of control of access rights at the network level.

• Securing the communication between two security cells via an “insecure” network
  Certificate-based, authenticated and encrypted communication is to be used whenever perimeter zone technology involves communication via access points. This can be done using tunnel protocols such as PPTP (Point to Point Tunneling Protocol), L2TP (Layer Two Tunneling Protocol) or IPSec (IPSecurity). Communication is also possible via protocols that are secured by server-based certificates, such as RDP (Remote Desktop Protocol) or a website published via HTTPS. Communication via the firewall takes place using TLS (Transport Layer Security) or SSL (Secure Sockets Layer) technology.

System integrity

• System hardening
  System settings on a system to make that system more resistant to attacks by malicious software.

• User management and role-based user authorizations
  Role-based access control

• Patch management
  Patch management is the standard procedure for installing updates on plant computers.

• Malware detection & prevention
  Use of suitable and correctly configured virus scanners
5.1.2 **Network security - Automation and security cells**

The strategy of dividing plants and associated plants into safety cells increases the availability of an overall system. Individual failures or safety threats that cause failures can thus be limited to their immediate sphere of influence. When planning the security cells, the plant is first divided into automation cells (process cells) and then into security cells by security measures.

**Note**
Criteria for dividing a plant into automation and safety cells can be found in the document "Safety concept PCS 7 & WinCC (Basis)":

More information on industrial security can be found in the SIMATIC process control system PCS 7 Compendium Part F - Industrial Security (V9.0):

The following sample configuration is used for the division into security cells:

**Figure 5-3 Sample configuration**

The sample configuration consists of two independent subsystems with a common operating and monitoring level. Thus, a safety cell can be formed for subsystem A with the S7 controllers and OS servers assigned to subsystem A in each case. A separate safety cell is formed for subsystem B and the controls and OS servers assigned to this subsystem.

The division of the entire system into a safety cell for subsystem A and for subsystem B also requires the separation of the system bus and terminal bus. The OS clients, on which operation and monitoring of the entire process (subsystems A and B) should be possible, are assigned to the safety cell of subsystem A.
Communication between the safety cells of subsystems A and B must therefore be ensured.

The web server, which is used for operation and monitoring from the corporate network or the Internet, is placed in a separate security cell (perimeter). Virus scan servers and WSUS update servers are also placed in this security cell. For a data exchange (project data / project backup) between the security cells, a quarantine PC is implemented in the perimeter security cell.

The components of the production planning connection (SIMATIC IT) are in turn combined in a separate safety cell (MON/MES). This results in a total of four different safety cells (DCS1, DCS2, MON and perimeter) for the sample configuration, which are shown in the following figure:

Figure 5-4
6 Digitalization

The Siemens "Digital Enterprise" strategy addresses the main features of Industry 4.0 such as integrated engineering and operation, the connection of your systems to the cloud via the open Internet of Things (IoT) MindSphere operating system and the use of a wide variety of applications such as SIWA Optim to analyze and utilize data in the cloud.

In parallel with Industry 4.0, which was first launched in Germany, other initiatives with a similar focus are underway around the world, including the "Industrial Internet Consortium" in the U.S. and "Made in China 2025". Digitalization is the key to all of these initiatives.

6.1 From integrated engineering to integrated plant operation

The focus on integrated engineering and operations helps our customers respond to the challenges of digitization in plant design and operations with significant speed, flexibility and efficiency.

Both the production and process industries need tailored solutions, products and services for their different value chains.
However, Siemens is also able to offer cross-industry technologies, e.g. for industrial communication, identification, as well as comprehensive digital services.

From integrated engineering to integrated plant operation, Siemens provides a holistic landscape of tools with seamless data transfer for all phases of the life cycle of a plant.
6 Digitalization

From Integrated Engineering to Integrated Operations

- Lifecycle plant management with a holistic tool landscape
- Common data model for a shorter time-to-market
- Increased efficiency through simulation
- Optimized operations based on high plant and process transparency with a digital twin

A shared data model for all disciplines and simulation tools accelerates engineering and commissioning. The simulation forms the basis for increased efficiency. Improved transparency allows optimization of plant operation with the use of a digital twin for the process and plant.

6.2 SIMATIC PCS 7 Plant Automation Accelerator

The SIMATIC PCS 7 Plant Automation Accelerator (PAA) is a fully integrated solution for the planning and documentation of plant projects.

In particular, you benefit from consistent engineering without system breaks between automation planning and control system. Thanks to its object-oriented approach, SIMATIC PCS 7 Plant Automation Accelerator enables work on a central data platform and thus guarantees fully integrated planning - from plant engineering to automation - based on an electronic workflow. This ranges from the
planning to the preparation of quotations, including material parts lists, to the automatic generation of control data from the SIMATIC PCS 7 process control system from electrical planning, to controlled mass data engineering and direct assistance documentation of the plant.

6.2.1 Data exchange with PCS 7

PAA features an interface for bi-directional exchange of engineering data with SIMATIC PCS 7. PAA supports this process with Delta View, which synchronizes the data during the transfer. The user can thus decide on changes and perform controlled bulk data engineering.

The following options are available for data transfer and matching:

- Direct data exchange: When PAA and PCS 7 are installed on the same computer, data is exchanged via an integrated interface in PAA.
- Indirect data exchange: When PAA and PCS 7 are installed on different computers, data is exchanged via XML files.
6.2.2 Differentiation of PAA from COMOS workflow with the "Integration Layer"

The SIMATIC PCS 7 Plant Automation Accelerator also provides advantages for existing COMOS users: COMOS customers with an existing or planned COMOS installation can purchase the PAA as a COMOS module with the so-called "Integration Layer", which allows them to use all available functionalities for fully integrated engineering with COMOS and SIMATIC PCS 7 by using the SIMATIC standard objects supplied. With the corresponding COMOS licenses, data can be transferred from process design as well as from basic and detail engineering to the control system and vice versa. A combination with other COMOS modules is possible. The Integration Layer can also be used in multi-user mode in an existing COMOS installation.

Figure 6-5 Integration of PAA into COMOS
6.2.3 Advantages of PAA

- Shorter project durations thanks to easy and consistent data synchronization between engineering and automation
- Increased plant availability thanks to error-free data transfer and system documentation that is always up-to-date
- Planning and documenting projects as early as in the bid and engineering phases together with return documentation during the commissioning phase and in normal operation minimize the time and cost involved through elimination of customization and provision of standard documents.
- Project planning already in the quotation and documentation phase in the engineering phase as well as back-documentation during commissioning and ongoing operation minimize costs and time through standard documents supplied and the elimination of customizing effort.
- Out-of-the box SIMATIC PCS 7 engineering
- Reduced work effort thanks to reusability of hardware configurations
- Easy configuration of the SIMATIC PCS 7 topology
- Consistent as-is documentation of software and hardware throughout the entire lifecycle
- Reusability of the as-is documentation for migrations, plant extensions and new-builds

Note

More information about the SIMATIC PCS 7 Plant Automation Accelerator can be found on the corresponding overview page:

6.3 **Simulation of automation data and processes with SIMIT**

The SIMIT simulation software enables real-time simulation and emulation for comprehensive testing of automation solutions. For the first time, the new SIMIT 9.1 software generation relies on a uniform simulation platform with which both the virtual commissioning of automation technology for systems, machines and processes and realistic training environments for plant operators can be implemented.

Figure 6-6 Possible applications of SIMIT
6.3.1 Simulation of automation

Hardware or software in the loop?

To test the project engineering and the automation program and to perform the validation, the two configuration options “Hardware in the Loop” (HiL) and “Software in the Loop” (SiL) are used.

The two configuration options differ as follows:

- **Use of a real automation system (HiL: “Hardware in the loop”)**
  - In this application, the automation program to be tested runs in a real automation system, but without any real process I/O. Instead, it is coupled to SIMIT or a software tool using a SIMIT Unit (SU).
  - The SIMIT UNIT simulates device communication with the field devices for PROFIBUS or PROFINET.

- **Use of a virtual automation system (SiL: “Software in the loop”)**
  - When SIMIT Simulation Framework is coupled to the SIMIT Virtual Controller or the S7-PLCSIM emulation software, the automation function can be tested in advance in the engineering office without the physical hardware – from the sensor through the automation system and back down to the actuator.
  - The user program is loaded in the automation system emulated by the SIMIT Virtual Controller or S7-PLCSIM in SIMATIC Manager without modifications and started. It receives the simulated I/O signals from the SIMIT Simulation Framework via the coupling of the emulated automation system.
Advantages of the SIMIT Simulation Platform

The Simit Simulation platform offers the following:

- Testing of the entire automation application, with HW controllers and/or emulated controllers for SIMATIC S7 and PCS 7
- Broad application range with minimum simulation design thanks to libraries with generic and application-specific simulation components, e.g. the SIMIT water templates.
Faster commissioning with fewer risks
Plant operators can be trained at an early stage before the commissioning of the real plant
Intuitive, user-friendly and easy simulation setup from the I/O and signal level and the sensor and actuator level to the process level
Flexible, scalable and open simulation setup and configuration
Graphical user interface, intuitive navigation via drag&drop, visualization including 3D representation.

6.3.2 SIMIT VC – The virtual controller for simulation of automation systems

The virtual controller simulates the behavior of a SIMATIC controller of type S7-300 or S7-400. The virtual controller is loaded with the original PLC user program. The field device level and its connection over distributed bus systems are ignored. Instead, process simulation is connected directly over the process image input and output.

You can use up to 32 virtual controllers in the simulation project, and can distribute them across multiple PCs.
Virtual controllers can communicate with each other; connections to external partners and the operator control and monitoring system are also possible. Only IP-based connections in address space IPv4 are supported, however.
The above figure shows which automation level components are simulated as virtual controllers:

1. **PC with SIMIT SF (Simulation Framework) installed**
   - Manages the SIMIT project
   - Starts/stops simulation
   - Simulates the field and process level
   - Can also include a virtual controller.

2. **PC with SIMIT VC (virtual controller) installed**
   - Hosts 1 to 8 virtual controllers
   - Must be accessible in the network from the SIMIT PC
   - Must be accessible from the OS server

3. **PCs with PCS 7 installed (ES, OS server and client)**

**Note**

Further information on SIMIT is available on the SIMIT overview page:
6.4  **Asset and Process Performance Suite for industrial applications and plant monitoring services**

In the age of digitalization, plant data are becoming increasingly important. They can be used for data analysis, condition monitoring and predictive maintenance. Siemens offers a wide range of industrial applications and services that provide you with all the information you need to operate your plant more safely and efficiently. With the connection to MindSphere, this data is available to you worldwide at any time in the cloud.

Figure 6-11 Asset and Process Performance Suite

---

6.4.1  **MindSphere**

MindSphere is the cloud-based, open IoT operating system from Siemens that connects your products, plants, systems and machines, enabling you to harness the wealth of data generated by the Internet of Things (IoT) with extensive analysis.

MindSphere offers a wide range of protocol options for device and enterprise applications, industry applications, extensive analytics, and an innovative development environment that leverages Siemens’ open platform-as-a-service (PaaS) capabilities as well as access to cloud services from Amazon Web Services (AWS) and Microsoft Azure and Alibaba.

Through these features, MindSphere connects real things to the digital world and delivers powerful industry applications and digital services that drive business success.

MindSphere enables the development and deployment of new industry applications in a diverse partner ecosystem through open PaaS capabilities. Benefit from the
experience and knowledge of our partners. No development on your part is required to advance your IoT strategy.

Siemens offers business-oriented solutions that promote closed-loop innovation through digital twins for products, production and performance.

Benefits

- Faster development of robust industrial IoT solutions
- Open Platform-as-a-Service with native access to the cloud
- Comprehensive device systems, enterprise systems and edge-to-cloud connectivity
- Powerful industry solutions with comprehensive analytics
- Closed-loop innovations with digital twins
- First-class partner ecosystem for industry solutions and services

Note: You can find more information on the MindSphere applications under: https://new.siemens.com/global/en/products/software/mindsphere.html
6.4.2 SIWA applications

SIWA applications are a modular set of cloud based applications which cover the entire water cycle. The following descriptions shall give an overview about the different applications and your value add.

Note

You can find more information on the SIWA applications under:

SIWA Optim

SIWA Optim is the key for an energy-efficient and reliable water supply. This cloud-based application enables you to optimally configure and automate all relevant assets.

Figure 6-12

Pump and valve schedules can be optimized based on the latest plant data and demand forecasts as well as the variable daily energy prices. This enables a reduction of energy consumption and costs by up to 15% whilst safe-guarding the supply at the same time.

When performing maintenance work, the tanks, pumps and capacity needed to ensure a reliable supply can be identified. This application offers efficient decision-making support in terms of timing, type and scope of maintenance works.

The application can be used to quickly search for alternative operation scenarios in order to maintain a reliable supply. For example, supply zones can be connected easily with each other.

SIWA Optim allows simulation of different scenarios based on actual operating data. The application is therefore also pre-destined for the creation of case studies and can be utilized as an engineering tool by consultants and pump manufacturers.
SIWA Leak and SIWA LeakPlus 1)

SIWA Leak is an application for detecting water losses on transmission pipe lines, whereas SIWA Leak Plus is a system for detecting water losses in water distribution networks. Both applications follow the target to reduce operational cost by reducing Non Revenue Water Losses. In special situations a water leak can also cause environmental and collateral (buildings, roads, etc.) damages and even floods if the leak is not repaired.

Figure 6-13

SIWA Leak provides real time monitoring of transmission pipelines giving the operator an overview over the current health status of the pipes. All events are conveniently placed on a list as well as on a map. The operator becomes all needed information which supports in the next steps of decision making and prioritization of tasks (surrounding area, pipe characteristics, leak rate, etc...).

SIWA Leak Plus powered by BuntPlanet is an application for water distribution networks which is based on artificial intelligence. The application is suitable for networks using any type of pipe diameter and material and can be applied to DMAs of all sizes. SIWA LeakPlus analyses data from different types of sensors to identify and locate leaks. Artificial Intelligence and Hydraulic Simulation enable greater accuracy in the assessment of leak size and position to avoid false positive alarms, saving time and money.

SIWA Leak and SIWA Leak Plus are able to detect small, early stage leaks before they can escalate, preventing collateral damage.
SIWA Burst detects and localizes burst in pipes in water networks. By monitoring the pressure transients and the application of intelligent algorithms SIWA Burst identifies most probable event type, e.g.: burst, consumption and valve operation and is able to provide a real-time localization of the pipeline breakage up to 20 meters accuracy.

Continuous high frequency recording of pressure anomalies allows to detect harmful operation. This can enable measures for a smoother operation which can reduce pressure peaks, water hammering and stress in the pipeline and in the consequence prevent pipeline elements to fail.
SIWA Sewer

SIWA Sewer provides dynamic online Sewer operational optimization to reduce spill over of untreated water into the environment. SIWA Sewer is an application which enables operators of sewer networks and sewage treatment plants to make optimum use of the storage/retention volumes, as well as to support and relieve the operating personnel in normal and emergency operation of their plants.

The application takes actual sewer volumes in sewage water basins, storm water tanks, pipes and channels as well as the weather forecasts into account. The optimization algorithm runs continuously (3 min intervals) and results in pump and valve schedules and optimized settings for all relevant equipment. The schedules and optimized settings are passed to customer SCADA via OPC UA protocol. SIWA Sewer can be taken to optimize maintenance scenarios as well as for decision support for worst case scenarios (storm water surges, etc.).
## 7 Appendix

### 7.1 Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdvES</td>
<td>Advanced Engineering System</td>
</tr>
</tbody>
</table>
| APL                           | Advanced Process Library  
The PCS 7 AP Library V8.1 SP1 contains all blocks and functionalities of the PCS 7 Library V8.1 SP1 and also offers additional functionalities and entirely new blocks. All parameters of the APL blocks are subject to a new naming convention. |
| CFC                           | Continuous Function Chart  
An advanced graphic language with function blocks for configuring continuous control systems.                                                                                                                                 |
| Process tag (control module)  | Actuators and sensors are used on the individual control level as individual control units. In PCS 7, the control module is implemented with software typicals (control module types) such as a valve, motor, or controller, for example. The implementation in the CFC plan contains all relevant components, circuits and basic parameters. A control module type is produced from the CFC, which is then stored in the PCS 7 master data library. You can create as many instances as you like from this control module type, for instance using the automation interface. There can be major differences between the instances, e.g. you can select options for functions as well as for the process link. Each name of an individual control unit follows a uniform naming convention. This means that the label provides information about the function and the job of the control module. |
| Equipment module (technical function) | An equipment module forms part of a unit and contains sensors, actuators and the automation system (hardware and software). Equipment modules are designed and configured for use in concrete applications, such as process technology (dosing device, level or temperature control). |
| Unit (plant section)          | A unit template is composed of various equipment modules that form a partial automation solution. In a unit template, it is also possible to display further information, such as economic or process engineering parameters (KPIs) or the operating times of assemblies. A unit template is grouped in a hierarchy folder and you can easily integrate it into existing projects and adapt it. |
| Faceplate (picture block/operating screen) | A graphic element on the screen of the operator station which represents, for instance, an analogue control instrument, a hardwired pushbutton or a switch and enables the operator to monitor and operate the device. |
| Function block                | A control module as defined in IEC 1131-3. See also “Block”.                                                                                                                                               |
| Instance                      | A copy of a function block, which is reused for the control configuration of a similar application.                                                                                                           |
| Communication connection      | The hardware and software for the transmission and reception of analogue and digital information via a communication system such as, for instance, a bus.                                                                 |
| TIA                           | With Totally Integrated Automation™, Siemens offers a universal range of products and systems for the efficient automation of plants in the water industry – whether in water, wastewater, irrigation or desalination. |
| TIP                           | Totally Integrated Power™ stands for integrated electrical energy distribution plants for infrastructure, buildings and industry.                                                                            |
| HiL                           | Hardware in the Loop                                                                                                                                                                                           |
| SiL                           | Software in the Loop                                                                                                                                                                                           |
| IEC                           | International Electrotechnical Commission                                                                                                                                                                   |
| RTU                           | Remote Terminal Unit                                                                                                                                                                                           |
| IoT                           | Internet of Things                                                                                                                                                                                             |
### Appendix

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug-and-produce</td>
<td>Plug and Produce is a principle for simple and secure integration of components in industry 4.0, with minimal engineering times.</td>
</tr>
</tbody>
</table>
7.2 Service and support

Industry Online Support
Do you have any questions or need assistance? Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.
The Industry Online Support is the central address for information about our products, solutions and services. Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:
support.industry.siemens.com

Technical Support
The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:
www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry
We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that’s tailored to the customer’s specific needs.
For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer
Our range of services includes the following:
• Plant data services
• Spare parts services
• Repair services
• On-site and maintenance services
• Retrofitting and modernization services
• Service programs and contracts
You can find detailed information on our range of services in the service catalog web page:
support.industry.siemens.com/cs/sc

Industry Online Support app
You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
support.industry.siemens.com/cs/ww/en/sc/2067
### 7.3 Links and Literature

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1   | Siemens Industry Online Support  
https://support.industry.siemens.com |
| 2   | Link to this entry page of this application example  
| 3   | PCS 7 water industry solution overview  
| 4   | Process instrumentation and analytics: Water industry  
| 5   | Information on Siemens automation and control systems  
| 6   | Siemens product catalog:  
| 7   | IEC information brochure about the directives that apply to the water industry  
https://www.iec.ch/about/brochures/pdf/about_iec/IEC_role_in_water_management_LR.pdf |
| 8   | Standard PCS 7 and S7 Water Templates for the water industry  
| 9   | Typical configurations in water and wastewater technology  
| 10  | Remote Configurations in Water and Wastewater Technology  
| 11  | SIMATIC PCS 7 overview page with specific access for the water industry  
| 12  | WUT: PCS 7 Water Unit Template - Control of Biological Stage of a Wastewater Treatment Plant with Upstream Denitrification  
| 13  | WUT: PCS 7 Water Unit Template – Control of Biological Stage of a Wastewater Treatment Plant with Intermittent Operation  
| 14  | WUT: PCS 7 Water Unit Template – Efficient Management of Storm Water Tank  
| 15  | WUT: PCS 7 Water Unit Template – External Pump Station of a Wastewater Treatment Plant (WWTP)  
| 16  | Integration of Comfort Panels, Operator Panels and S7-300 Package Units in SIMATIC PCS 7 with PCS 7 Industry Library  
| 17  | SIMATIC panel overview  
| 18  | System requirements for the integration of the S7-300 into PCS 7  
| 19  | SIMATIC PCS 7 Industry Library for PCS 7  
| 20  | PCS 7 Libraries APL Style Guide  
7 Appendix

Creating technological functions with TeleControl and OPEN OS for a consistent Process Visualization in PCS 7

7.4 Change documentation

Table 7-1

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Modifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1.0</td>
<td>08/2017</td>
<td>First version</td>
</tr>
<tr>
<td>V2.0</td>
<td>08/2019</td>
<td>Document updated:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- General revision / update</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Expansion Chapter 2: Product overview</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Expansion Chapter 3: Specific solutions / Solution approaches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- New chapter 5 &quot;Industrial Security – “Defense in Depth” on IT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- New chapter 6 on digitalization, SIMIT, PAA and the IoT.</td>
</tr>
</tbody>
</table>