

Sewer network (wastewater)

Pumping station

Supply network (freshwater)

# Plant-wide Automation in the Water Industry

SIMATIC PCS 7, STEP 7, WinCC, TIA Portal

https://support.industry.siemens.com/cs/ww/en/view/109748869

Siemens Industry Online Support

ater treatment plant



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## **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



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:

https://w3.siemens.com/mcms/water-industry/en/process-productssystems/Pages/automation-engineering.aspx

#### 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

#### **Further 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:

https://w3.siemens.com/mcms/water-industry/en/Pages/water-industry.aspx

### **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



Figure 1-3 Schematic representation of a drinking water plant

Figure 1-4 Schematic representation of water transportation





#### Figure 1-5 Schematic representation of a wastewater treatment plant



Figure 1-6 Schematic representation of an irrigation system

### 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 PCS 7 process control system
- SCADA system: SIMATIC WinCC , WinCC Professional
- Engineering tools: COMOS, SIMATIC PCS 7, TIA Portal

This document focuses on the following points:

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

### Selecting suitable hardware and software

In the German Guidelines on Water and Sewage Treatment (ATV), the plants are described, treated and operated as process 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 process monitoring in small to medium-sized plants, it is possible to use PCS 7 or even a SCADA system with WinCC or 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

Property	SIMATIC PCS 7	TIA Portal / WinCC+STEP 7		
Application area	Process automation, DCS	Machine-oriented automation, PLC		
Use for	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.	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.		
Controller	S7-300, S7-400, PA CPU 410, S7-1200, S7-1500	S7-300, S7-400, S7-1200, S7-1500		
Changes during operation (CiR functionality)	Yes (S7-400, S7-410)	No		
Programming with CFC	Yes	Yes*		
Advanced Process Library (APL)	Yes	No		
Industry Library (IL)	Yes	No		
Panel connection, e.g. SIMATIC Basic / Comfort Panel	Yes**	Yes		
Highly available (so called hot standby)	Yes (S7-400, S7-410)	No		

\* Only in STEP 7 with additional optional package S7-CFC for S7-300 and S7-400

\*\* TIA Portal Advanced Engineering: The engineering of the measured values takes place in CFC based on the IL. TIA Portal is required for graphical display on the panels.

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 <u>Product overview.</u>

### 1.4 Advantages

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
  - 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, also 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 / 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 systems 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 1280,000 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. To help you store your measured values and messages, PCS 7 offers the SIMATIC Process Historian – a central long-term archiving system.

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 supply and distribution 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 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 Library in the chapter: <u>PCS 7 libraries.</u>

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 <u>Water-specific master data library and templates.</u>

### **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 projectrelevant 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.

### Integrated engineering with COMOS and SIMATIC PCS 7

You can easily transfer data from COMOS 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 COMOS 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.

#### **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 and S7-400 and implement plant-wide distributed process automation.

#### **TIA Portal**

The Totally Integrated Automation Portal (TIA Portal) is a central data management solution with a uniform operating concept and integrated services, which helps you in the engineering and commissioning phases of your machine-level automation solution. For these local, small to medium-sized tasks in the water industry you can rely on the SIMATIC S7-300 and S7-1200 controllers. Besides central engineering with the TIA Portal, they also enable you to easily connect SIMATIC HMI panels.

### 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 station 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.

For further information, please refer to:

http://w3.siemens.com/mcms/process-control-systems/en/distributed-control-system-simatic-pcs-7/simatic-pcs-7-system-components/operator-system/Pages/operator-system.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.

For further information, please refer to:

http://w3.siemens.com/mcms/process-control-systems/en/distributed-control-systemsimatic-pcs-7/simatic-pcs-7-technologies/Efficient-Process-Control/Pages/Advanced-Process-Graphics.aspx

### 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:

http://w3.siemens.com/mcms/human-machine-interface/en/visualizationsoftware/scada/simatic-wincc/Pages/default.aspx

### 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.

Further information

http://w3.siemens.com/mcms/automation-software/en/tia-portal-software/wincc-tiaportal/Pages/default.aspx

### 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 CPU410: Flexible and uninterruptible

The SIMATIC PA CPU410 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.

#### 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.

### 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.

### 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 MICRO for monitoring and controlling distributed systems via mobile radio communication (GPRS)
- 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 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.

### SIPLUS RIC

SIPLUS RIC (Remote Interface Control) is designed 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.

### 2.5 Solutions for energy management

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 is 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 24 V feeders
- SITOP PSU8600: 3-phase power supply system with Ethernet / PROFINET interface
- SITOP UPS1600: Uninterruptible DC power supply (DC-UPS) with signaling contact
- SITOP UPS1600: Uninterruptible DC power supply (DC-UPS) with Ethernet / PROFINET

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

- Integration of a SITOP 24 V Power Supply in SIMATIC PCS 7 at https://support.industry.siemens.com/cs/ww/en/view/109481908
- SITOP UPS1600: Faceplates and Communication Blocks (TIA Portal, STEP 7 and WinCC) at <u>https://support.industry.siemens.com/cs/ww/en/view/78817848</u>
- 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.

In the SIPROTEC 4 device families, all the protection, control, measurement and automation functions have been integrated into one device. Thanks to the exceptional advantage of a homogeneous system platform, a unique engineering program – DIGSI 4 and the high field experience of more than one million devices, the SIPROTEC 4 device family enjoys the highest appreciation among users all over the world. Today, SIPROTEC 4 is the standard for digital protection technology in all areas of application. The connection can be established via PROFIBUS DP.

With the SIPROTEC 5 version, you get access to a new, highly modular and therefore flexible generation of intelligent, digital field devices. SIPROTEC 5 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-systemssolutions/Protection/Pages/overview.aspx

### Powerful energy management (SIMATIC Energy Manger 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 in 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
  - Fulfil legal requirements efficiently
    - through ISO-50001 conformity and TÜV certification
  - Scalability –
     from the sub process 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 to the energy management across all plants

### 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 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.

For an overview of the SIMATIC HMI portfolio, please visit:

http://w3.siemens.com/mcms/automation/en/human-machineinterface/Pages/Default.aspx

### **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 Panels

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 modular water management system SIWA, you can control and manage your plant and infrastructure intelligently. This smart water solution is based on the SIMATIC PCS 7 process control system and contains flexible software modules that can be combined with one another. The software assists you in the following subjects:

- Optimization of processes
- Detection and localization of leaks
- Dynamic simulation of pipeline systems

### SIWA Leak / SIWA LeakControl leak detection

SIWA Leak and SIWA LeakControl are both systems that help detect large as well as slow leaks in water transport pipelines and distribution systems. By continuously recording the state of the water pipes, you get vital information that helps you implement the right countermeasures when a leak occurs.

### SIWA SEWER network control

SIWA SEWER has been specially 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 discharge of untreated sewage into natural waters is prevented.

### SIWA CONCEPT / SIWA OTS simulation and training

SIWA CONCEPT builds a computer-aided model of network infrastructure to simulate hydraulic behavior in water supply systems. The simulation allows different operating methods and complex interdependencies of the network to be viewed and investigated in a virtual environment.

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.

### **SIWA Secure Homeland Security**

Besides hydraulic parameters, SIWA Secure also calculates various chemical concentrations in the network and, in an emergency, it enables reliable assessment of the water quality in all network areas. SIWA Secure records pollutant entries and helps the operator implement appropriate countermeasures with the aim of limiting the harmful effects to the smallest possible section of a network.

### 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. In the following you will find an overview of the possible location of process instruments in a "water filtration" unit of the water industry.



Figure 2-1 - "Water filtration" plant section

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

https://w3.siemens.com/mcms/sensor-systems/en/Solutions-forindustries/Water/Pages/Water.aspx

## 3 Specific solutions / approaches

The standardization of automation engineering for process plants, such as in the water industry, is a major challenge. Different process actions and procedures, different devices and flexibility in the process make this task even 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 unit can in turn contain standardized equipment modules, also known as technical functions.

### 3.1 PCS 7 libraries

The SIMATIC PCS 7 Advanced Process Library (APL) and Industry Library (IL) are 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:

http://w3.siemens.com/mcms/process-control-systems/en/distributed-control-systemsimatic-pcs-7/simatic-pcs-7-system-components/System\_Libraries/Pages/Advanced-Process-Library.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.

### **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)
- VIvMon 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 to PCS 7

You can find further information on the Industry Library at:

http://w3.siemens.com/mcms/process-control-systems/en/distributed-control-systemsimatic-pcs-7/simatic-pcs-7-technologies/technology\_libraries/Pages/Industry-Library.aspx

#### 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 and S7-400controllers 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.

You can find further information on the supported system versions at: siemens.com/support/sitranslibrary

### 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:

http://w3.siemens.com/mcms/process-control-systems/en/distributed-controlsystem-simatic-pcs-7/simatic-pcs-7-technologies/PowerControl/Pages/SIMATIC-Power-Control.aspx

### 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:

- Typical Configurations in Water and Sewage Technology <u>https://support.industry.siemens.com/cs/ww/en/view/61024766</u>
- Remote Configurations in Water and Wastewater Technology https://support.industry.siemens.com/cs/ww/en/view/61024137
- Example project: Remote control of S7-1200 RTU with PCS 7 TeleControl (IEC protocol)

https://support.industry.siemens.com/cs/ww/en/view/109475749

 Standard PCS 7 and S7 Water Templates for the water industry https://support.industry.siemens.com/cs/ww/en/view/78604785

### 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. 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, SIMATIC WinCC or WinCC Professional (TIA Portal).

#### 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
- Programmable 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 in the automation solution
- Provision of additional monitoring functions of centrifugal pumps and control valves
- Complete drive solutions (pumps, agitators, etc.) via field bus connection with SIMOCODE pro V (incl. HW engineering)
- Complete drive solutions (dosing pumps, blowers, etc.) via field bus connection with SINAMICS G120
- Integrated solution with process instrumentation via field bus connection with SITRANS MAG 6000

### 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 ED 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.

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

### 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 Advanced Engineering System:

- 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:

https://support.industry.siemens.com/cs/ww/en/view/78604785

### 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. Controls, such as the split range control, are created in the form of a sample solution. WEMTs store data in a PCS 7 master data library, consisting of:

- a CFC
- 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:

https://support.industry.siemens.com/cs/ww/en/view/78604785

### 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 <u>https://support.industry.siemens.com/cs/ww/en/view/109478073</u>
- PCS 7 Water Unit Template Control of Biological Stage of a Wastewater Treatment Plant with Intermittent Operation <u>https://support.industry.siemens.com/cs/ww/en/view/109485916</u>

- PCS 7 Water Unit Template Efficient Management of Storm Water Tank <u>https://support.industry.siemens.com/cs/ww/en/view/109481487</u>
- PCS 7 Water Unit Template External Pump Station of a Wastewater Treatment Plant (WWTP) <u>https://support.industry.siemens.com/cs/ww/en/view/109481486</u>

### 3.3.5 Control strategy of the water-specific 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.

Operation mode description	Operation priority	Possible actions
Central remote control room(s): The operator controls one or several water stations from a central control room by means of the SIMATIC OS user interface.	1 (lowest)	<ul> <li>Manual operation</li> <li>Automatic operation</li> <li>Remote operation of every actuator</li> </ul>
Local control room: The operator controls one or several water stations from a local control room by means of the SIMATIC OS user interface.	2	<ul> <li>Manual operation</li> <li>Automatic operation</li> <li>Remote operation of every actuator</li> </ul>
Local panel: Local operation of functions via panels directly on the control cabinet. The operator controls a local sub-section of the plant via the panels.	3	<ul> <li>Manual operation</li> <li>Automatic operation</li> <li>Local panel operation</li> </ul>
Local devices: Local operation gets the highest priority and is divided into three different operating concepts.	4 (highest)	<ul> <li>Operation with panels connected to the automation system</li> <li>Operation with local software switches connected to the automation system</li> <li>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.</li> </ul>

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 via local software switch or hardware 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/109738716

## 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: <a href="http://www.iec.ch/about/brochures/pdf/about\_iec/IEC\_role\_in\_water\_management.pdf">http://www.iec.ch/about/brochures/pdf/about\_iec/IEC\_role\_in\_water\_management.pdf</a>

### 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) <u>https://support.industry.siemens.com/cs/ww/en/view/109739941</u>
- SIMATIC PCS 7 Industry Library (IL) <u>https://support.industry.siemens.com/cs/ww/en/view/109738715</u>
- SITRANS Library for PCS 7 (SL) <u>https://support.industry.siemens.com/cs/ww/en/view/109737969</u>
- PCS 7 Advanced Process Graphics (APG) <u>https://support.industry.siemens.com/cs/ww/en/view/109747809</u>
- PCS 7 Condition Monitoring Library <u>https://support.industry.siemens.com/cs/ww/en/view/109738723</u>
- **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 / WPTT / 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:

Limit	P&ID diagram	Description
L1	AHH	Alarm High-High
L2	AH	Alarm High
L3	WH (SHH)	Warning High; can also be used as SHH, Switch High-High
L4	SH	Switch High
L5	SL	Switch Low
L6	WL (SLL)	Warning Low; can also be used as SLL, Switch Low-Low
L7	AL	Alarm Low
L8	ALL	Alarm Low-Low

### 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:

- ACRON add-on (by Videc)
- Energy Manager Pro / B. Data (by Siemens)

### **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.

### 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: <u>https://support.industry.siemens.com/cs/ww/en/view/22258951</u>

### 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, WPTT 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, WPTT, WEMT)
- 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 https://support.industry.siemens.com/cs/ww/en/view/78604785

**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:



- 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

Process abbrev	s action viation	Process action		
ATV 260 DVD				
RB	RB	Rain overflow basin		
Р	PW	External pump station (medium size)		
PW	ZL	Pump station inlet		
FA	AM	External measuring station		
AS	AS	Wastewater receiving station		
RE	RE	Screen		
SF	SF	Gravel / grease separator		
VK	VK	Primary sedimentation basin		
FL	KN	Precipitating agent dosing		
MB / DN / NI	AN / DN / NI	Aeration basin (anaerobic, denitrification, nitrification)		
GS TV		Turbo compressor / fan for aeration basin		
NK NK		Secondary sedimentation basin		
RS/US RL/NI		Sludge return and discharge pumping station		
AU ???		Runout		
FK PF		Flocculation monitoring for drainage		
SE	UE	Sludge runoff drying		
FA / AY	FB	Digester and gas analysis		
GB / GF	GB	Gas reservoir and gas flame		
NA / BK	NE	Backup energy system		
VE / NE	VE	Sludge thickening and sludge treatment		
KP FS/FP		Sludge dewatering		
NS / MS		Energy system (small and medium)		
BG		Air conditioning and general systems (e.g. exterior lighting, alarm system, entry control)		
BW		Tap water		
HW HW		High water pump station		

### 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.





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

YS M xxx-nn Y2

Detail view:



### Template Y3 - Symbol for analog valve



### Template Y4 - Symbol for analog valve and control via SIMOCODE pro V





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

### Overview of WCMT based on the P&ID diagram

ltem	Template	WCMT		
1	N1	WCMT_Mot2Spd, WCMT_MotLean		
2	N2	WCMT_Mot2Spd_FbMMS, WCMT_MotLean_FBMMS		
3	N3	WCMT_MotRev, WCMT_SpdCon		
4	N4	WCMT_MotRev_FbMMS, WCMT_SpdCon_FbDrv		
5	Y1	WCMT_VIvLean		
6	Y2	WCMT_VIvLean_FbMMS		
7	Y3	WCMT_VIvMotor		
8	Y4	WCMT_VIvMotor_FbMMS		
9	Y5	WCMT_VIvAnalog		

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

Unit type	Unit	Motor
Pump	Pnn	Mnn
Fan	Vnn	Mnn
Scraper / screen	Rnn	Mnn
Sieve, press, etc.	Snn	Mnn

### 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 in demand on the norm ATV-DVWK M260.

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 in the SCADA environment.

You can also

- split the process pictures of the units between various OS clients and
- create local visualization by means of panels with restricted user rights for each unit.
- **Note** In the Online Support portal, 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.

Layer	Object type
1	Layout
2	Static objects
3	
4	
5	Piping
6	
7	
8	
9	
10	Control modules
11	
12	
13	
14	

### 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.

Material	Cdor	R	G	В	Palette	No.	HTML
RawWater	RAL 6018	079	168	051	1	0	#4FA833
Sea Water(SW)	RAL6027	125	204	189	1	01	#7DCCBD
Oily Water (OWS)	RAL 6020	038	056	041	1	02	#263829
Process Water (PW)	RAL 6025	074	110	051	1	œ	#4A6E33
Air (WTP)	RAL7001	135	148	166	1	04	#879446
Flammable gases (digester gas,							
Azylen, hydrogen, flammable exhaust	RAL 1012	227	184	056	1	05	#E3B838
gæesetc.)							
Natural Gas	RAL1018	255	214	077	1	06	#FFD64D
Nitrogen(N)	RAL 1026	255	255	010	1	07	#FHTF0A
Methand (ME)	RAL 5017	000	059	128	1	08	#003B80
Oxygen (WTP)	RAL 5015	023	097	171	1	09	#1761AB
Acids (sulfuric acid, hydrochloric acid,	DAL 2000	~	~	~	4	40	
nitric acid, etc.)	RAL2000	224	094	031	1	10	#EUCETF
Lye (Scolium Hydroxide, Ammonia	DAL 4004	120	0004	100	4	44	4004000
Water, Milk of Lime etc.)	<b>KAL</b> 4001	130	004	120	1		#024000
Flammable liquids (Desel etc.)	RAL 2004	242	059	028	1	12	#F23B1C
Fuel Cil(FO)	RAL 8016	061	031	028	1	13	#3D1F1C
Pilot Gas(FG)	RAL 1028	255	140	026	1	14	#FF8C1A
Blow down (BD)	RAL 1020	156	143	097	1	15	#9C8F61
Chemical(C) Color 2	RAL 2012	222	082	071	1	16	#DE5247
Purge Gas(PG)	RAL 4010	191	023	115	1	17	#BF1773
Relief(RF)	RAL9018	219	227	222	1	18	#DBE3DE
Drinking Water (WWTP)	RAL 6021	133	166	122	2	19	#85A67A
Chemical(C) Color 1	RAL 2011	237	092	041	2	20	#ED5C29
Heating Flow	RAL3000	171	031	028	2	21	#AB1F1C
Heating Return	RAL 5010	000	043	112	2	22	#002B70
ChlorineGas	RAL 1021	252	189	031	2	23	#FOBD1F
	DAL 0000			~	2	~~~	
Natura Gas (VVIP)	RAL2000	224	094	031	-	24	#EUCETH
Solution (Chlorine -, Neutral Salt -)	RAL 2003	255	099	054	2	25	#FF6336
Digestion Water, Turbid Water,		<b>m</b> 1	056	140	2	~	+mmm
Centrat	RAL4005	ال⊿	000	140		⊿0	#3300
Waste Water	RAL 5021	026	122	099	2	27	#1A7A63
Industrial Water	RAL6005	010	056	031	2	28	#0A381F
Drinking or Pure Water (WTP)	RAL6019	191	227	186	2	29	#BFE3BA
Air (fresh air, compressed air; Oxygen					2		
etc.) (VWVTP)	RAL 5014	077	105	153		30	#4D6999
Exhaust Air -> dashed Line	RAL 5014	077	105	153	2	30	#4D6999
Sludge/WasteWater	RAL 8001	145	082	046	2	31	#91522E
Fresh-, Activated-, Secondary-,	DAL 0000	115	070	~~~	2	~	47720204
Surplus-, Floating-, Fecal Sudge	RALOUUS	115	000	030		32	#/30524
Sudge after centrifuge	RAL 8015	077	031	028	2	33	#4D1F1C
Non-flammable Gases (nitrogen		0E4	105	~~~~	2	24	+000000
containing gases, CO2 etc.)		004		000		34	#300820
Ozone	RAL 5018	056	148	130	2	35	#389482
Steam	RAL 5024	087	140	181	2	36	#578CB5
Flocculant	RAL3015	232	156	181	2	37	#E89CB5

### Representation of cables and lines

Use the following line types in the process pictures:

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

### Figure 4-1 Examples for main process lines

	VSS Water & Waste Water				
		here tantta			
the Rest III	-	tion formation (control (CC) etc.)			
Di Sancità	The second secon				
Process Kinter(FVI)	Currinal Color 1	***			
ANT N	Autograv	Paradart			
Farmalia post (Språr po 46)	Parting Base	7			
Katora Ges	Otorna lias				
Reput	Radium Gaugetting				
Refuent(RE)	Andre Olivier, Badai Let (	Ì			
Depentity	Dynamic Take, Take Canad				
Ann halfers and, hyperblack and etc.)	Test Tar	1			
Las (Indus Apirocia, Associa Tato etc.)	Y Harris	T			
Farmatin lauth (Send etc.)	Driving or Pare Name(107)	2			
Awapa	Ar field an compression or on party				
Res foreffit	Part Tan Tan				
Chemical Chem 1	Fresh Antonio Secondary, Facal Dudge				

### 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:

https://support.industry.siemens.com/cs/ww/en/view/59062870

### **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 https://support.industry.siemens.com/cs/ww/en/view/61024137
- Creating technological functions with TeleControl and OPEN OS for a consistent Process Visualization in PCS 7 https://support.industry.siemens.com/cs/ww/en/view/109478763

## 5 Appendix

## 5.1 Glossary

Term	Explanation
AdvES	Advanced Engineering System
APL	Advanced Process Library The PCS 7 AP Library V8.1 SP1 contains all the 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 at the control module level as control modules. In PCS 7, the control module is implemented with software typicals (control module types) such as a valve, motor, or controller. The implementation in the CFC contains all the relevant building blocks, interconnections, 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. Every label of a control module 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)	U 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 <sup>™</sup> , 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 power distribution systems for infrastructure, buildings and industry.

### 5.2 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 at: <a href="https://support.industry.siemens.com">https://support.industry.siemens.com</a>

### **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. You send queries to Technical Support via Web form:

www.siemens.com/industry/supportrequest

#### Service offer

Our range of services includes, inter alia, the following:

- Product trainings
- 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: https://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: <u>https://support.industry.siemens.com/cs/ww/en/sc/2067</u>

### 5.3 Links and Literature

No.	Торіс	
\1\	Siemens Industry Online Support https://support.industry.siemens.com	
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109748869	
/3/	PCS 7 water industry solution overview https://w3.siemens.com/mcms/water-industry/en/Pages/water-industry.aspx	
\4\	Process instrumentation and analytics: Water industry https://w3.siemens.com/mcms/sensor-systems/en/Solutions-for-	

No.	Торіс		
	industries/Water/Pages/Water.aspx		
\5\	Information on Siemens automation and control systems		
	https://w3.siemens.com/mcms/water-industry/en/process-products- systems/Pages/automation-engineering.aspx		
\6\	Siemens product catalog:		
	https://mall.industry.siemens.com/goos/WelcomePage.aspx?language=en&region		
\7\	UT=/		
	http://www.iec.ch/about/brochures/pdf/about_iec/IEC_role_in_water_management. pdf		
\8\	Standard PCS 7 and S7 Water Templates for the water industry		
	https://support.industry.siemens.com/cs/ww/en/view/78604785		
\9\	Typical Configurations in Water and Sewage Technology https://support.industry.siemens.com/cs/ww/en/view/61024766		
\10\	Remote Configurations in Water and Wastewater Technology		
	https://support.industry.siemens.com/cs/ww/en/view/61024137		
\11\	SIMATIC PCS 7 overview page with specific access for the water industry		
	https://support.industry.siemens.com/cs/ww/en/view/63481413		
\12\	WUT: PCS 7 Water Unit Template - Control of Biological Stage of a Wastewater Treatment Plant with Unstream Denitrification		
	https://support.industry.siemens.com/cs/ww/en/view/109478073		
\13\	WUT: PCS 7 Water Unit Template – Control of Biological Stage of a Wastewater Treatment Plant with Intermittent Operation		
	https://support.industry.siemens.com/cs/ww/en/view/109485916		
\14\	WUT: PCS 7 Water Unit Template – Efficient Management of Storm Water Tank		
	https://support.industry.siemens.com/cs/ww/en/view/109481487		
\15\	WUT: PCS 7 Water Unit Template – External Pump Station of a Wastewater Treatment Plant (WWTP)		
	https://support.industry.siemens.com/cs/ww/en/view/109481486		
\16\	Integration of Comfort Panels, Operator Panels and S7-300 Package Units in SIMATIC PCS 7 with PCS 7 Industry Library		
	https://support.industry.siemens.com/cs/ww/en/view/50708061		
\17\	SIMATIC HMI overview		
	http://w3.siemens.com/mcms/automation/en/human-machine- interface/Pages/Default aspx		
\18\	What are the system requirements for using SIMATIC PCS 7 Industry Library?		
	https://support.industry.siemens.com/cs/ww/en/view/73133562		
\19\	SIMATIC PCS 7 Industry Library for PCS 7		
	https://support.industry.siemens.com/cs/de/en/view/81179761		
\20\	PCS 7 Libraries APL Style Guide https://support.industry.siemens.com/cs/ww/en/view/59062870		
\21\	Creating technological functions with TeleControl and OPEN OS for a consistent		
	Process Visualization in PCS 7		
	https://support.industry.siemens.com/cs/ww/en/view/109478763		

## 5.4 Change documentation

Version	Date	Change
V1.0	08 / 2017	First version