Introduction

Content

General

This is the **System Description** for CEMAT V9.0 SP1. It is part of the **Reference Manual** and it should support you in performing the work required to configure your plant.

The **Reference Manual** is part of a comprehensive CEMAT V9.0 SP1 documentation which consists of the volumes below:

Engineering Manual

Reference Manuals

System   Objects
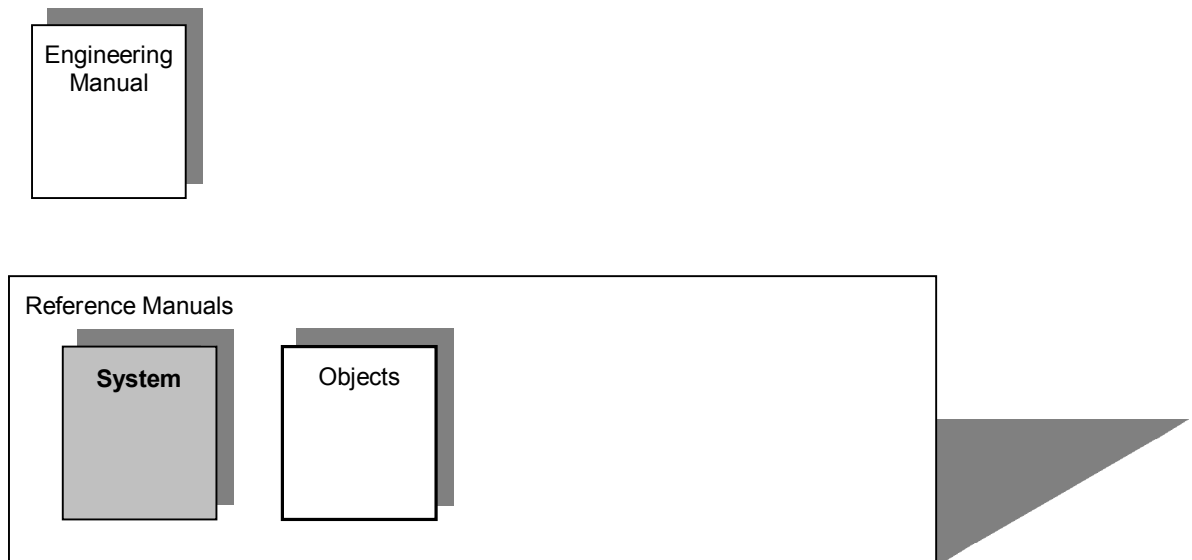
After the installation of CEMAT V9.0 SP1 the CEMAT documentation is available as PDL in directory D:\CEMAT_CS\Docu

On the following pages you will find the content of each manual.

Documentation structure

The manuals contain the following chapters:

	Engineering Manual
	Engineering Manual
1	Introduction
2	Preparations
3	Installation of a PCS 7 Project
4	Assignments
5	Engineering Examples
6	PLC Engineering
7	AS-AS Coupling
8	OS Engineering
9.	Engineering Tools
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14	Tips&Tricks
15	Update Information

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	Reference - System
1	Introduction
2	Cemat System Architecture
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	Reference - Objects
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4	Bi-Directional Drive
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29	
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34	SPC data collector C_PC_8R
35	SPC data collector C_PC_8B
36	SPC distributor C_PD_AI
37	SPC distributor C_PD_AR
38	SPC distributor C_PD_B
39	SPC distributor C_PD_RR
40	SPC distributor C_PD_RTR
41	SPC distributor C_PD_S
42	SPC module C_PM_AI
43	SPC module C_PM_AR
44	SPC module C_PM_B
45	SPC module C_PM_RR

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CEMAT MinAS
System description

Edition: 10/2018

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Content

Preface

Purpose of this documentation

This document explains the Features of CEMAT Minerals Automation Standard which is based on the Process Control System SIMATIC PCS 7.

General Information regarding SIMATIC PCS 7 is not part of this document, but you will find numerous links to the comprehensive range of documents for SIMATIC PCS 7.

CEMAT **M**inerals **A**utomation **S**tandard or short CEMAT MinAS fulfills the requirements of the Cement and Mining Industrie.
This document explains the main characteristics of CEMAT MinAS and defines what the system can provide to the Cement and Mining customers.

The documentation contains recommendations and information for planning and building a SIMATIC PCS 7 CEMAT MinAS automation solution with a content of

- System Overview and Standard system architecture

- Brief description of the system components

- Design & Engineering considerations

- Project planning example (implementation reference)

- Training requirements

- System performance calculation

- Simulation and testing

- Support

- Links to General information and Documentation

Required Knowledge

This documentation is intended for persons involved in configuration, engineering and servicing of automation systems. (Automation experts, PCS project managers and project engineers.)

System Overview
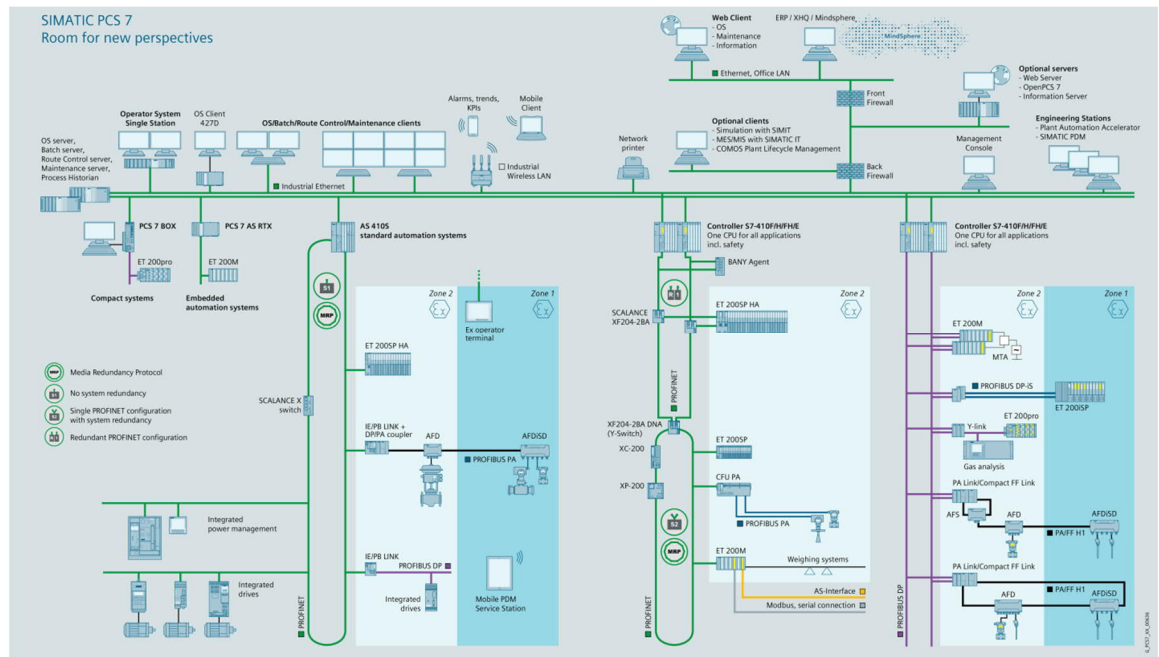
Our solution for a process control system, as it is shown in the typical layout on top, is SIMATIC PCS 7 with CEMAT MinAS.

SIMATIC PCS 7 is the process control system in the Siemens automation concept "Totally Integrated Automation". The process control system builds on standard SIMATIC S7 components. Software packages, as CEMAT MinAS, add typical control system functions to these components to form the basis for the functional scope of SIMATIC PCS 7.

The system is continuously being adapted to our customers' requirements. To protect our customers' investments, compatibility with earlier versions is always a primary consideration in this on-going improvement, enabling you to build, operate and maintain a state-of-the art control solution that will prove its benefits now and in the future.

For further information please have a look into "PCS7 V9.0 Catalog".
https://support.industry.siemens.com/cs/de/en/view/109745632

System components

Typical Example Configuration with SIMATIC PCS 7-CEMAT

The following configuration can be considered as an example configuration that covers the main components of SIMATIC PCS 7:

- OS single station/ Client

- Engineering station

- Red. Server / client structure

- Industrial Ethernet networks with switching technology

- Automation systems

- Central and distributed process I/O (Profinet)

- Devices for hazardous and non-hazardous areas
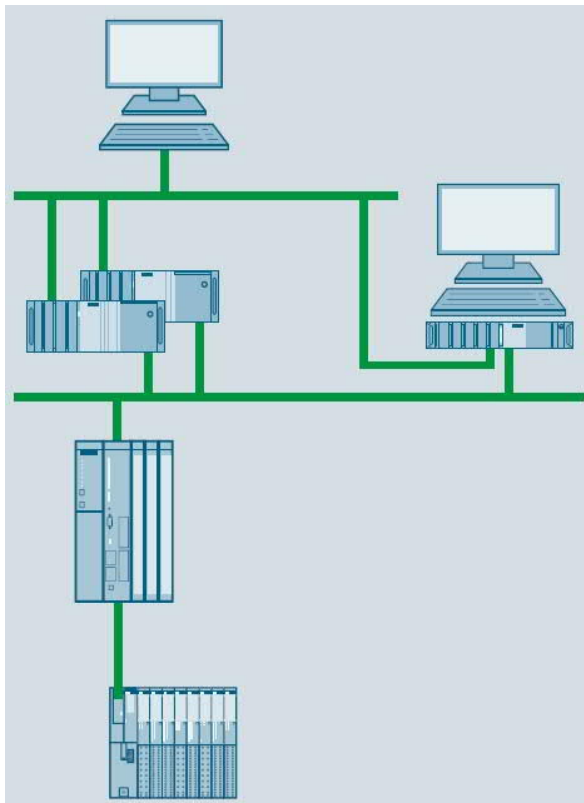
The example configuration doesn't cover properties like

- Coupling with Office LAN

- SIMATIC IT framework

- AS-Interface (AS-I)

- Distributed I/O: controller modules

- Operator panels

If you need information about these features, please contact one of your regional SIEMENS partners.

Typical plant configurations

Due to it`s scalability, PCS 7 and CEMAT can be use for small, medium size up to very big configurations.

Example for a small configuration:
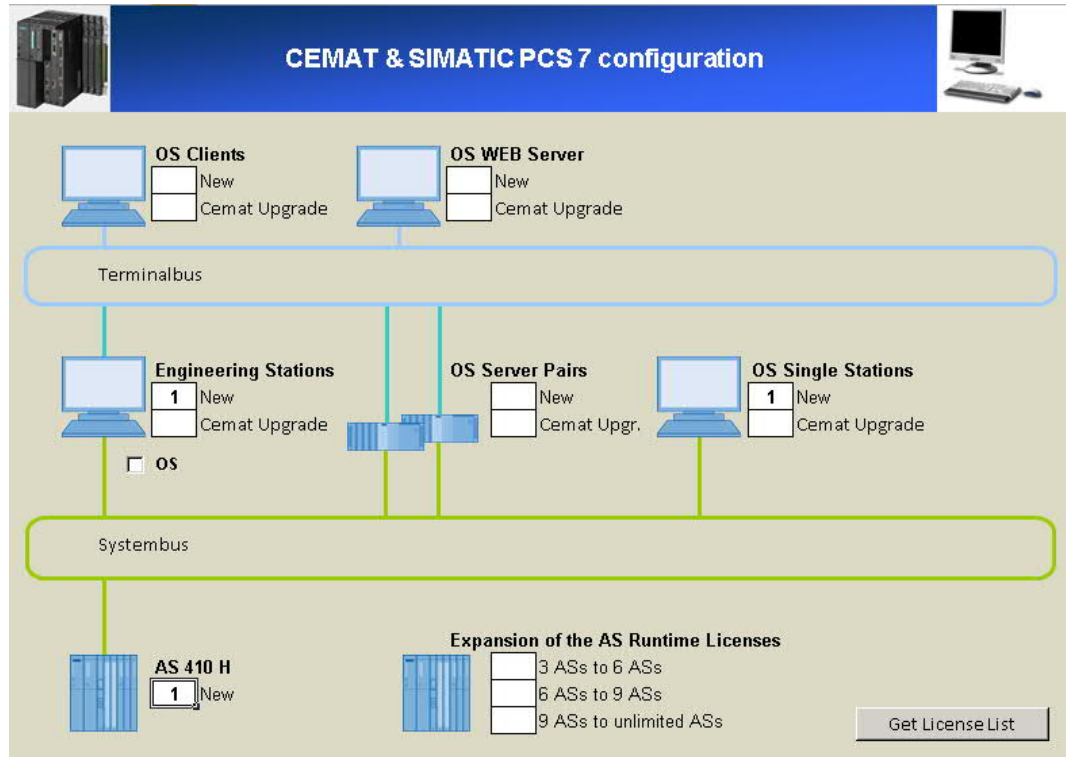
Required CEMAT Licenses:

	Product Name	Article Number
	CEMAT Engineering Software	
1	Minerals Automation Standard V9.0 Engineering	6DL5436-8AX58-0XA0
	CEMAT OS Software for Single Station incl. AS Runtime-License (PLC)	
1	Minerals Automation Standard V9.0 Single Station (3 AS)	6DL5434-8AA58-0XA0

Example for a medium size configuration:

Required CEMAT Licenses:

	Product Name	Article Number
	CEMAT OS Software for Client	
3	Minerals Automation Standard V9.0 Client	6DL5435-8AX58-0XA0
	CEMAT Engineering Software	
1	Minerals Automation Standard V9.0 Engineering	6DL5436-8AX58-0XA0
	CEMAT OS Software for redundant Server incl. AS Runtime Licenses (PLC)	
1	Minerals Automation Standard V9.0 Server Redundancy (6 AS)	6DL5433-8AB58-0XA0
	CEMAT OS Software for Single Station incl. AS Runtime-License (PLC)	
1	Minerals Automation Standard V9.0 Single Station (3 AS)	6DL5434-8AA58-0XA0

Example for a medium large configuration:

Required CEMAT Licenses:

	Product Name	Article Number
	CEMAT OS Software for Client	
3	Minerals Automation Standard V9.0 Client	6DL5435-8AX58-0XA0
	CEMAT Engineering Software	
1	Minerals Automation Standard V9.0 Engineering	6DL5436-8AX58-0XA0
	CEMAT OS Software for redundant Server incl. AS Runtime Licenses (PLC)	
1	Minerals Automation Standard V9.0 Server Redundancy (9 AS)	6DL5433-8AC58-0XA0
	CEMAT OS Software for Single Station incl. AS Runtime-License (PLC)	
1	Minerals Automation Standard V9.0 Single Station (3 AS)	6DL5434-8AA58-0XA0

With the CEMAT Order Tool the requirement of CEMAT Licenses can be determined and the number of POs can be calculated.

Central and distributed Process I/O Systems

The SIMATIC PCS 7 process control system offers a variety of possibilities for detecting and outputting process signals via sensors and actuators as well as for connecting process I/O to the automation systems:

• Signal and function modules in remote I/O stations on the fieldbus
- PROFIBUS DP (ET 200M, ET 200iSP, ET 200pro)
- PROFINET IO (ET 200SP HA, SIMATIC CFU, ET 200M, ET 200SP)

• Analog and digital I/O modules of the S7-400 operated centrally in the automation system

SIMATIC S7-400 signal modules used centrally in the automation system are suitable for small applications or plants with few remote locations. In practice, however, distributed process I/Os are mainly used which, depending on the type, also support redundant configurations or operation in explosive gas/dust atmospheres:

• SIMATIC ET 200 remote I/Os in conjunction with classic field devices and HART field devices
• Intelligent field/process devices for direct fieldbus connection (PROFIBUS PA, Foundation Fieldbus H1)

Especially convincing arguments for distributed process I/O include:
• Modularity and consistency
• Flexible adaptability to the plant structure
• Minimum cabling and engineering requirements
• Low commissioning, servicing and lifecycle costs
• Wide technical bandwidth

Possible online modifications among the process I/Os		
Remote I/O	**PROFIBUS DP**	**PROFINET**
SIMATIC ET 200SP HA		• Adding ET 200SP HA stations • Adding I/O modules to the station • Changing the parameter settings of I/O modules • Configuration of connected HART field devices with SIMATIC PDM
SIMATIC CFU		• Adding CFU • Adding field devices to CFU • Changing the parameter settings of the CFU and connected PROFIBUS PA field devices over SIMATIC PDM
SIMATIC ET 200M	• Adding of ET 200M stations • Adding of I/O modules to the station • Changing the parameter settings of I/O modules • Parameterization of connected HART field devices with SIMATIC PDM	
SIMATIC ET 200iSP	• Adding of ET 200iSP stations • Adding of modules for the station • Re-configuration of modules • Parameterization of connected HART field devices using SIMATIC PDM	
SIMATIC ET 200pro	• Adding of ET 200pro stations	
PROFIBUS DP, PROFIBUS PA, FOUNDATION Fieldbus H1	• Adding of PROFIBUS DP stations • Adding of PA links and PA field devices • Parameterization of PA or FF field devices with SIMATIC PDM	

Comparison of distributed I/O systems for SIMATIC PCS 7

I/O system	SIMATIC CFU	ET 200SP HA	ET 200iSP	ET 200M	ET 200SP	ET 200pro
Design						
Degree of protection	IP20	IP20	IP30	IP20	IP20	IP65/IP66/IP67
Design	Compact	Modular	Modular	Modular	Discretely scalable	Modular
Assembly	Mounting rail	Mounting rail	Mounting rail	Mounting rail	Standard mounting rail	Mounting rail
Connection system for sensors/actuators	Multi-wire connection screw-type connections	Multi-wire connection Push-in terminals	Multi-wire connection Spring-loaded/ screw-type connections	Single-wire connection Spring-loaded/ screw-type connections, FastConnect, TopConnect	Single/multi-conductor connection Push-in terminals	M8, M12, M23
Special applications						
Safety engineering	–	–	●	●	–	●
For use in hazardous areas	Zones 2, 22	Zone 2	Zones 1, 21	Zone 2	Zone 2	–
Increased availability	Redundant	Switched, redundant	Switched, redundant	Switched, redundant	–	–
Temperature range	-40 to +70 °C (horizontal)	-40 to +70 °C (horizontal)	-20 ... +70 °C	0 ... +60 °C[1]	0 ... +60 °C[1] (horizontal)	-25 ... +55 °C
Vibration resistance (continuous)	1 g	1 g	1 g	1 g	Up to 5 g	5 g (module-dependent)
Communication						
PROFIBUS (Cu/FO)	– / –	– / –	● / – (1.5 Mbps)	● / – (12 Mbps)	– / –	● / ● (12 Mbps)
PROFINET (Cu/FO)	● / ●	● / ●	– / –	● / –	● / ●	– / –
System functions						
Permanent wiring	●	●	●	● (plugging and removal)	●	–
Hot swapping	–	●	●	● (with active backplane bus)	●	●
Expansion/ configuration during ongoing operation	●	● / ●	● / ●	● / ●	– / –	– / –
Diagnostics (module-dependent)	Channel-discrete	Channel-discrete	Channel-discrete	Channel-discrete	Channel-discrete	Channel-discrete
Functions						
Digital channels	●	●	●	●	●	●
Analog channels	●	●	●	●	●	●
incl. HART	PROFIBUS PA	●	●	●	●	–
Motor starter	–	Available soon	–	–	–	–
Pneumatic interface	–	Available soon	●	–	–	–
Technological functions	Available soon	Available soon	Counting, frequency measuring	Counting/measuring, controlling, weighing	–	–

[1] Also available as a SIPLUS component for extended temperature range -25/-40 ... +60/+70 °C and corrosive atmosphere/condensation (see details at www.siemens.com/siplus)

Integration of process I/O in the hazardous area

¹⁾ With DC power supply PS 405
²⁾ SIMATIC CFU in aluminum housing also for dust environments in Ex zone 22
³⁾ Dust atmospheres: installation of components always in an enclosure with IP6x degree of protection
⁴⁾ Also complies with FM/UL according to Class I Division 2
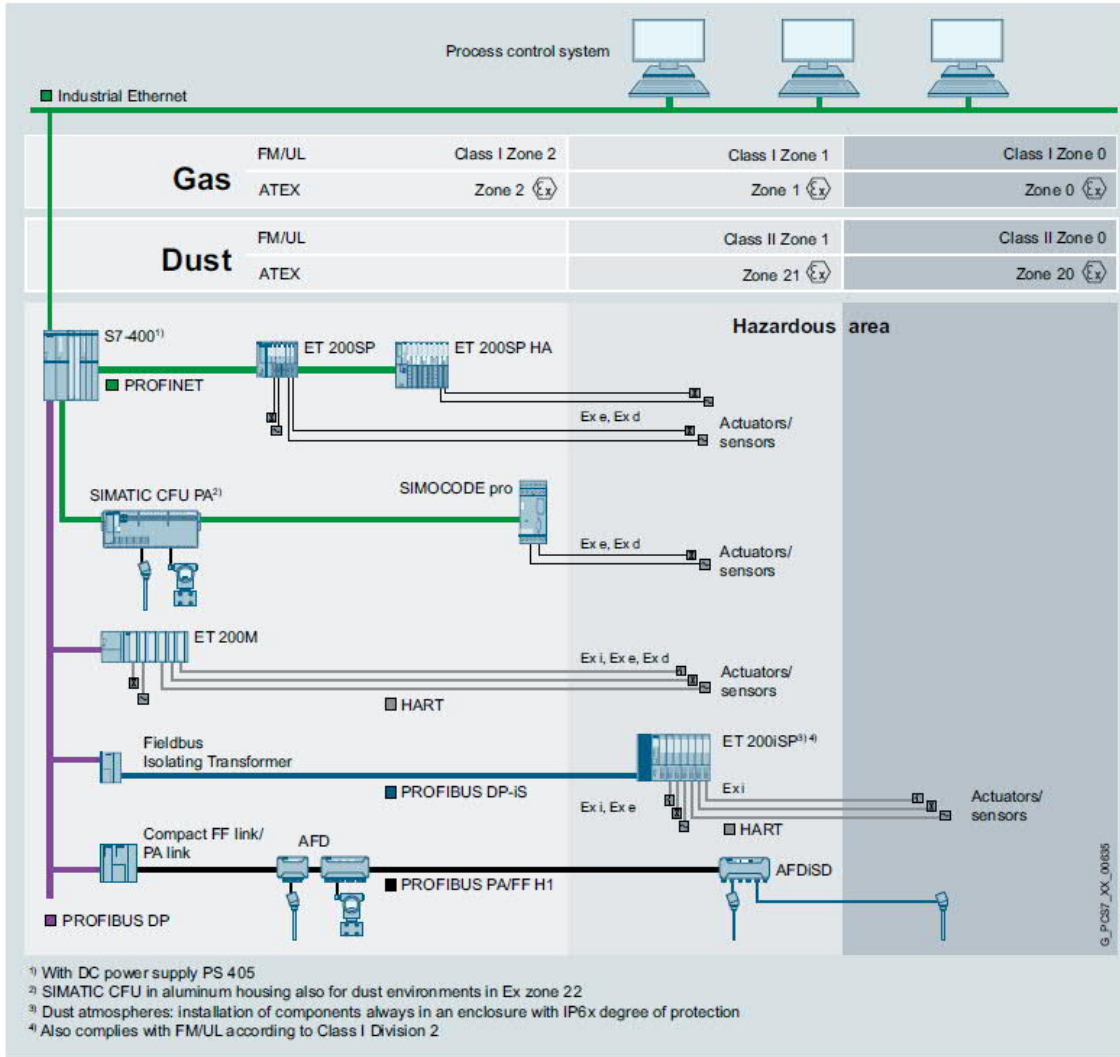
SIMATIC CFU (Compact Field Unit; for PROFINET)

The SIMATIC CFU was specifically designed to meet the requirements of the process industry in the Industrie 4.0 environment:

• **System interfacing over the Industrial Ethernet standard**

- Redundant PROFINET connection (S2) for maximum availability
- Connection versatility with PROFINET bus adapter (for example electrical, optical or mixed)

• **Combination of digital fieldbus and discrete I/O**

- 8 × digital fieldbus (PROFIBUS PA)
- 8 × digital inputs/outputs, freely configurable

• **Ready for distributed use and easy to use**

- For installation in hazardous areas up to zone 2-22
- Extended temperature range of -40 to +70 °C
- Conformal coating
- Can be used at altitudes of up to 4 000 meters
- Enhanced interference immunity in accordance with NAMUR recommendation NE21
- Automatic addressing of PROFIBUS PA field devices
- System-supported detection and integration of PROFIBUS PA field devices into the process control system with the use of standardized PA profiles and commissioning, device replacement and service wizards
- Implementation of diagnostic messages in accordance with NAMUR recommendation NE107
- 35-mm standard mounting rail mounting

• **Aluminium field enclosure**

The die-cast aluminum enclosure is suitable for use in zone 2/22 hazardous areas. The following are included in the enclosure's scope of delivery:
• 22 × M20 plastic cable glands (incl. blanking plugs)
• 32 mm standard mounting rail
• Rail for strain relief and shield support
The enclosure has a window for LED diagnostics.

SIMATIC ET 200SP HA (for PROFINET)

Compact design, flexible connection possibilities and high system availability with redundant PROFINET connections: the SIMATIC ET 200SP HA distributed I/O system is perfectly suited to the requirements of the process industry.

Compact I/O modules

• Up to 32 channels on a module that is 22.5 cm wide
• Up to 56 modules per station

Perfectly suited for applications in the field

• For installation in hazardous areas up to zone 2-22
• Extended temperature range: -40 to +70 °C
• Enhanced interference immunity in accordance with NAMUR recommendation NE21
• Conformal coating on all components
• Can be used at altitudes of up to 4 000 meters

Wide range of supported module types

• 16×AI/8×AO HART, 16×DI, 16×DO, AI 16xTC/8xRTD etc.
• Standard I/O terminal block for all 24 V signals AI, AO, DI, DO

Features

• PROFINET Media redundancy, System redundancy, I/O redundancy
• Configurable diagnostics (per channel / module)
• Time stamping / High precision time stamping
• Resolution up to 16 bits
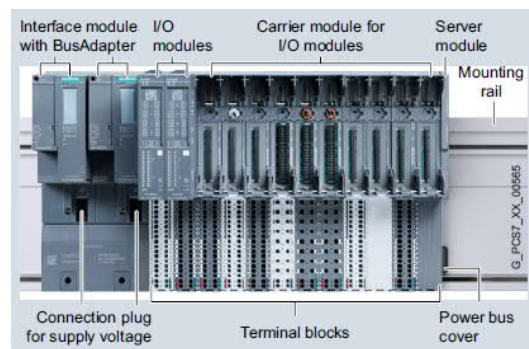
SIMATIC ET 200iSP (in up to zone 1/21; for PROFIBUS DP)

The ET 200iSP is a modular, intrinsically-safe I/O system with IP30 degree of protection which can be operated in gas and dust atmospheres in zone 2 / 22 or 1 / 21.

Features

• Possible connection of sensors/actuators in Ex area to zone 0 / 20
• Connection via PROFIBUS-DP, also redundant
• Redundant pluggable power supply 24V DC or 120/230 V AC
• Direct connection to intrinsically safe PROFIBUS DP via RS485-iS coupler
• PROFIBUS DP transmission rate up to 1.5 Mbit/s
• Max. 32 modules per station
• DI, DO, AI, AO, HART-AI and HART-AO modules
• Failsafe modules F-DI, F-DO, F-HART-AI
• Watchdog module and Reserve module
• 4 or 8 digital channels per module
• 4 analog channels per module
• Diagnostic alarm
• Time stamping
• Temperature range –20°C to +70°C (horizontal mounting) or –20°C to +50°C (other mounting position)
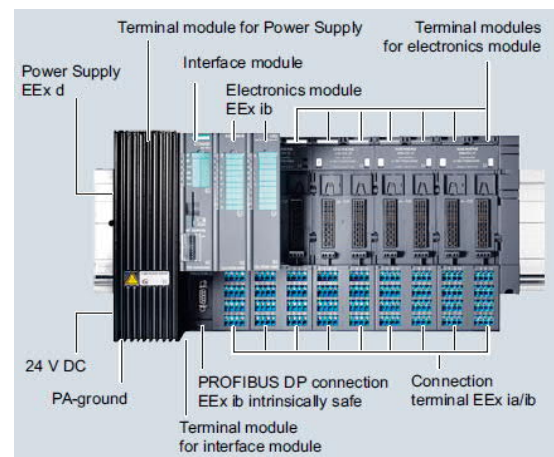
SIMATIC ET 200M (for PROFIBUS DP or PROFINET)

Within the SIMATIC ET 200 range, ET 200M represents one of the main series of distributed I/O systems for process control applications with SIMATIC PCS 7 in S7-300 design.

General Features:

• Single or redundant PROFIBUS DP connection
• PROFIBUS DP transmission rate up to 12 Mbit/s
• PROFINET S2 redundancy
• Max 12 I/O modules per station
• Temperature range 0°C to +60°C

I/O modules with special I&C functions:

• Standard analog and digital modules (DI, DO, AI, AO, AI RTD/TC)
• Redundant I/O modules
• Up to 64 digital channels per module
• Up to 8 analog channels per module
• I/O modules with enhanced diagnostics capability
• Ex I/O modules (mix with standard I/O modules possible) for connection of intrinsic safe devices
• Controller and counter modules
• HART AI, AO modules
• Failsafe modules for safety-related applications
• High precision time stamping (1ms)
• Resolution up to 15 bits
• SIPLUS modules for ambient temperature range from -25°C to 60 / 70°C

SIMATIC ET 200SP (for PROFIBUS DP or PROFINET)

SIMATIC ET 200SP is a highly flexible and scalable I/O system with IP20 protection with an extremely compact design.

General Features:

• PROFINET S2 redundancy
• Max 64 I/O modules per station
• Temperature range 0°C to +60°C
• Standard analog and digital modules (DI, DO, AI, AO, AI RTD/TC)
• HART AI modules
• 4, 8 or 16 digital channels per module
• 2 or 4 analog channels per module
• Overall height 117-141 mm, depth 75 mm
• Temperature range 0°C to +60°C (horizontal installation) or 0°C to +50°C (vertical installation)
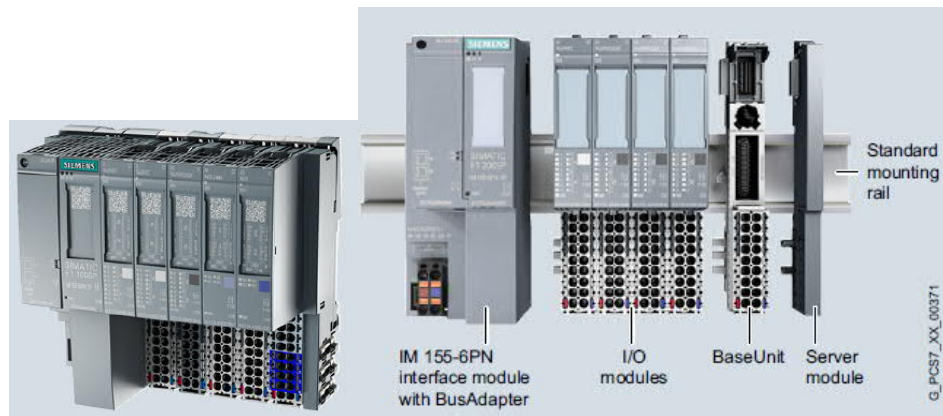
SIMATIC ET 200pro (outside of cabinets; for PROFIBUS DP)

SIMATIC ET 200pro is a modular I/O system with high IP65/66/67 protection suitable for use at machine level outside the control cabinet.

General Features:

• Single PROFIBUS DP connection
• PROFIBUS DP transmission rate up to 12 Mbit/s
• Free selection of PROFIBUS connection system: direct, ECOFAST or M12 7/8"
• Can be operated as DP-V1 slave on Y link
• Max 16 I/O modules per station (max. station width 1 m)
• Standard analog and digital modules (DI, DO, AI, AO, AI RTD/TC)
• Digital failsafe modules for safety-related applications
• 4 or 8 digital channels per module
• 8 or 16 F-DI channels per F-DI module (double width)
• 4 analog channels per module
• Temperature range 0°C to +55°C (-25°C on request)

Automation Systems (Controllers)

The SIMATIC PCS 7 process control system offers a wide range of automation systems whose performances are finely matched to one another within wide limits.

Modular automation systems of the S7-400 range

In these "Automation system bundles", selected components of the SIMATIC S7-400 are combined together.

The following characteristics make the SIMATIC S7-400 predestined for use as a SIMATIC PCS 7 automation system:
- Modular design without fans
- High expansion capability and ruggedness
- Single or redundant design
- Comprehensive communication facilities
- Integral system functions
- Integrable safety functions (Safety Integrated)
- Simple linking of central or distributed I/O

In accordance with their functionalities, the modular automation systems of the S7-400 range can be classified into:
- Standard automation systems
- Fault-tolerant automation systems
- Safety-related automation systems

Various automation systems are available with a price/performance ratio which can be tailored to your system requirements.
The CPU of the automation systems is already equipped as standard with an onboard PROFIBUS DP fieldbus connection and with 2 PROFINET IO interface (2-port switch).

The preferred CPU is the AS 410 which has an Industrial Ethernet interface onboard and is easily expandable to a redundant system.
With the rugged all-round system AS 410, the SIMATIC PCS 7 process control system for the first time offers an exclusive automation system from the SIMATIC S7-400 series, which can be used in all domains due to its versatility. For specific requirements, you can configure it as a:
- Standard AS 410S automation system
- Fault-tolerant AS 410H automation system
- Safety-related AS 410F/FH automation system

With its high-performance hardware, the innovative CPU 410-5H Process Automation of the AS 410 covers the entire spectrum of conventional AS 412 to AS 417 automation systems. Its automation performance can be flexibly scaled based on the number of SIMATIC PCS 7 process objects (PO). System expansion cards are available for
- 100 PO
- 500 PO
- 1 000 PO
- 1 600 PO
- $\geq$ 2 000 PO (PO 2k+)

The type reduction to a single CPU offers numerous advantages. It significantly simplifies selection and configuration of the automation system as well as spare part inventory and plant expansion.

Note:
The configuration of the CPU 410-5H Process Automation of the AS 410 and the loading of the user blocks is only possible with SIMATIC PCS 7 engineering software as of V9.0 (including hardware upgrade package HUP CPU 410-5H).

The AS410-5H is equipped with a PROFINET IO interface (2-port switch) for up to 250 I/O devices and a PROFIBUS DP interface for up to 96 PROFIBUS DP slaves. Two integrated slots

allow the synchronization of two redundant subsystems via sync modules and sync cables (FOC).
CPU 410‑ 5H Process Automation supports NTP as well as S7 time synchronization.

Other features include:
· Integrated 48 MB load memory and 16 MB RAM each for program and data
· Cycle time up to 10 ms/9 process tasks
· Total number of I/Os (on PROFIBUS DP and PROFINET IO) approx. 7 500 (16 KB each for inputs and outputs)
· Additional protection of the circuit board with coating (conformal coating)
· High-precision time stamping
· Recessed RESET button
· Preset hardware parameters (PCS 7 skinning)

Preferred Hardware is:
SIMATIC PCS 7, CPU 410-5H PROCESS AUTOMATION,
CENTRAL UNIT FOR S7-400 AND S7-400H/F/FH, 5
INTERFACES: 1X PN, 1X DP, 2X FOR SYNC-MODULE AND
1X SERVICE
6ES7410-5HX08-0AB0

For further Information please have a look into the Internet
https://support.industry.siemens.com/cs/ww/en/view/74736822

and

http://www.automation.siemens.com/simatic/controller/index_76.htm

Entry CPU SIMATIC CPU 410E

The CPU 410E 6ES7410-5**HM**08-0AB0 is suitable for small applications, e. g. for low cost grinding systems.

Features

Flexibility

- Standard-, High Availability and Fail-Safe applications
- Identical hardware as the CPU 410-5H

Robustness

- Conformal Coating
- 70° C

Secure invest

- One PROFIBUS and two PROFINET-interfaces
- Innovations via updating the firmware

Differences	**410-5H**	**410E**
Process Objects	100 … 2k+ (2600)	200 (fixed)
Work memory (Code/Data)	32 Mbyte	4 Mbyte
Process area	DP: 6 kbyte PN: 8 kbyte	DP: 1536 byte PN: 1536 byte

Bus Systems (Communication)

The plant bus and the terminal bus for multi-user systems with client/server architecture are implemented with Industrial Ethernet, a powerful area and cell network for industrial applications in line with the international IEEE 802.3 standard (Ethernet). Bus structures with optical rings are particularly suitable for this because of their high noise immunity and high availability.

In medium-sized and large plants with high requirements, SIMATIC PCS 7 applies modern FastEthernet and Gigabit technology. This combines the high reliability of optical rings with the scalable performance of switching technology and high transmission rates of up to 10 Gbps.

Communication at field level with PROFIBUS

Distributed peripherals such as remote I/O stations with their I/O modules, transmitters, drives, valves or operator terminals communicate with the automation systems (controllers) at field level through a powerful real-time bus system. This communication is characterized by:

- Cyclic transmission of process data
- Acyclic transfer of interrupts, parameters and diagnostics data

PROFIBUS is predestined for these tasks because it enables high-speed communication with the intelligent distributed I/Os by means of a communications protocol (PROFIBUS DP) as well as communication and simultaneous power supply for transmitters and actuators (PROFIBUS PA).

PROFIBUS is simple, rugged and reliable, can be expanded online by further distributed components, and can be used in both standard environments and hazardous areas. It supports the coexistence of field devices from different vendors on one line (interoperability) as well as the vendor-independent exchangeability of devices from one profile family.

PROFINET in the process industry

PROFINET combines the benefits of PROFIBUS, the most widely distributed bus system worldwide, with the latest Ethernet technology. PROFINET supports easy setup of flexible communication networks and ensures integrated, reliable and secure communication throughout the plant – in real time!

Greater flexibility, efficiency and performance in industrial communication – PROFINET has been established for many years in the manufacturing and machine environment and is the preeminent global standard in automation.

PROFINET more than meets the special requirements of the process industry regarding availability, flexibility, real-time capability and ruggedness. At the same time, the Ethernet-based technology provides easy handling.

With version 9.0 of SIMATIC PCS 7, the process industry can now also benefit from the latest communication technology; the conditions for this are now in place:

- Scalable system redundancy
- Changes possible in runtime ("Configuration in Run")
- High-precision time-of-day synchronization for sequence of events ("SoE")

System Bus

The system bus of the SIMATIC PCS 7 process control system is based on Industrial Ethernet, a powerful area and cell network for industrial applications in line with the international IEEE 802.3 standard (Ethernet).

	Industrial Fast Ethernet	
Data transmission	IEEE 802.3 (electric)	IEEE 802.2 (fiber optic)
Protocol	TCP/IP or ISO	TCP/IP or ISO
Transmission rate	10/100/1000 Mbit/s	10/100/1000 Mbit/s
Cable	Shielded 8-wire	Fiber optic
Topology	Line, ring, star	Line, ring, star
Stations	1023	1023
Cable length per segment	100 m	> 10 km
Cable length (Local Area Network - LAN)	Approx. 1.5 km	Approx. 150 km
Cable length (Wide Area Network)	Worldwide with TCP/IP	Worldwide with TCP/IP

Industrial Ethernet is used as the "Plant automation bus" as well as "Plant Control bus" for multi-user systems with client/server architecture.
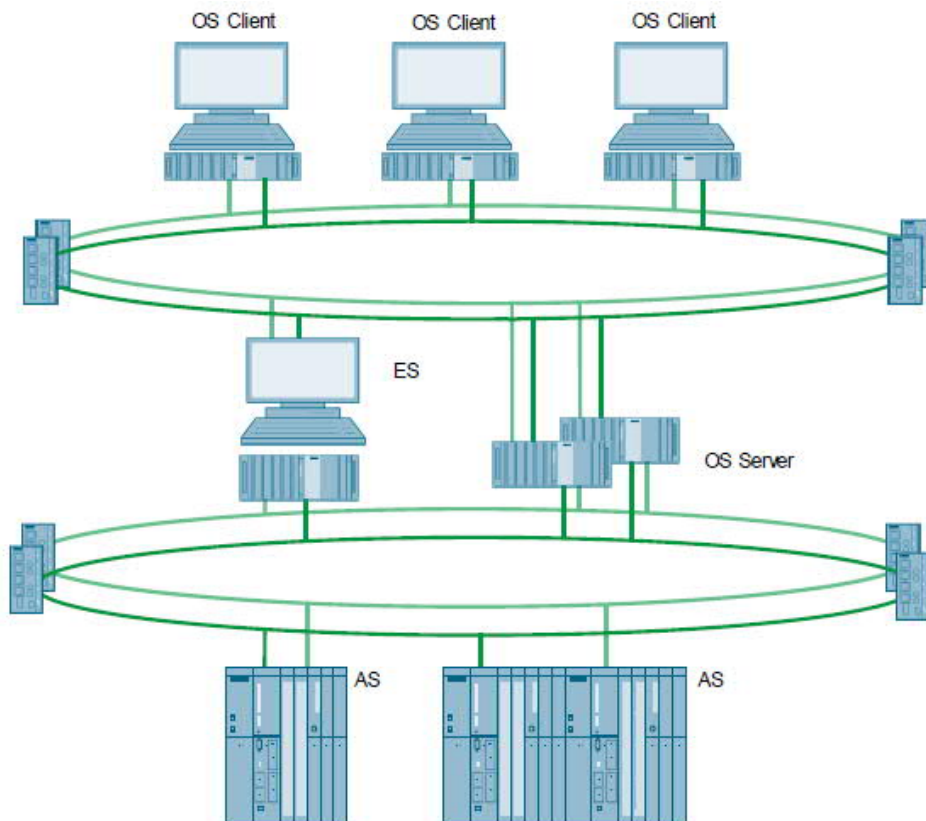
Decision aid for Industrial Ethernet switches

Different types of switches can be used for the Industrial Ethernet communication within the SIMATIC PCS 7 process control system. Here are some examples.

SCALANCE XM-400 Switches

The switches in the SCALANCE XM-400 product line allow for the flexible design of electrical or optical Industrial Ethernet networks with high availability. They are ideally suited for configuring the plant bus and the terminal bus of the SIMATIC PCS 7 process control system in electrical or optical Gigabit ring technology (non-redundant and redundant rings). The network topology and number and type of ports can be easily adapted to the structure of the system.

SCALANCE XR-300 managed

The functions of the SCALANCE XR-300 Industrial Ethernet switches correspond to those of the SCALANCE X-300 switches. Designed as rack switches, they are particularly suitable for use in 19" control cabinets. They are also fully modular, and can be adapted to the respective task using 2-port media modules (electrical and optical).

EEC versions (Enhanced Environmental Conditions) in compact and rack design can be used in power engineering systems and under difficult environmental conditions.

SCALANCE XC-200 managed

The managed Industrial Ethernet switches of the SCALANCE XC-200 product line are optimized or setting up Industrial Ethernet networks with data transfer rates of 10/100 Mbps in a line, star or ring topology. High-performance optical structures with up to 1 000 Mbps can also be set up with the SCALANCE XC206-2SFP.

SCALANCE X Overview

There are a lot of more SCALANCE X devices you can use with PCS 7!

For further Information please have a look into the Internet.
http://w3.siemens.com/mcms/industrial-communication/en/ie/industrial-ethernet-switches-media-converters/Pages/industrial-ethernet-switches-media-converters.aspx

Time synchronization

The central plant clock is the central component for the time synchronization of plants. It controls the time for the complete plant, and synchronizes all time-dependent plant components via its interfaces. The interfaces supported by SICLOCK central plant clocks offer a wide range of possible applications.

SICLOCK TC serves as a central plant clock for highly exact time control, and distributes the time to all systems to be synchronized via 4 Industrial Ethernet ports.

The plant central clock SICLOCK TM is connected to the plant control bus. The connection is usually to a Scalance X408 switch via twisted pair RJ45 interface.

The figure shows the synchronization of the AS stations on the plant bus:
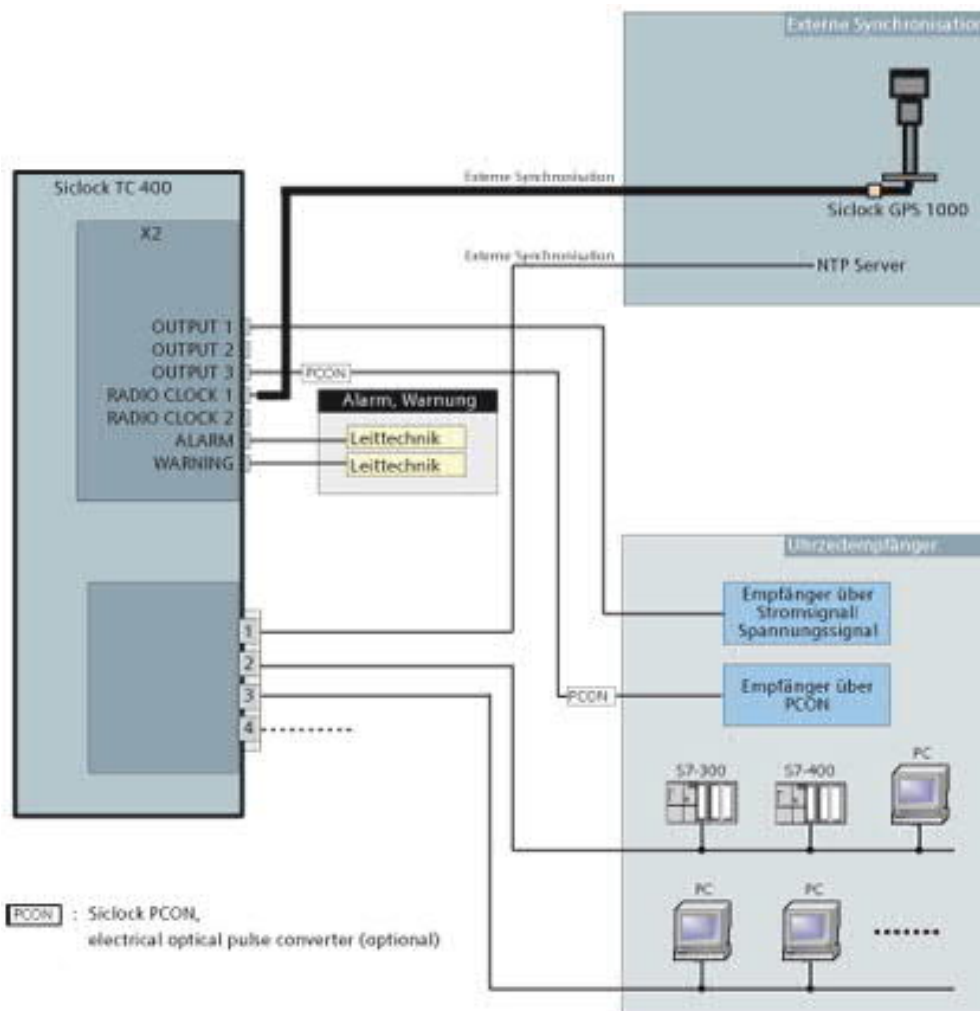
SICLOCK TC sends periodically synchronization telegrams as broadcast in Simatic method on the plant Control bus. The AS stations receive these and synchronize. The protocol used is „layer 2 – GMT".

The SICLOCK TC 400 central plant clock is used in a Windows domain for time synchronization of the OS.
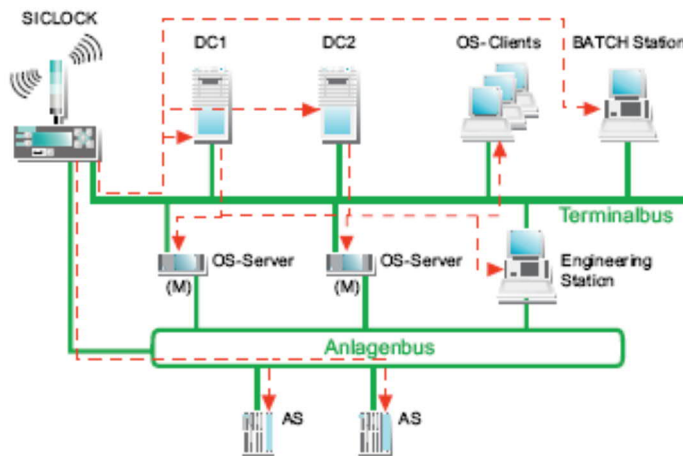
- All operator stations must be installed in one domain.

- The SICLOCK TC 400 must be connected to the terminal bus and the plant bus.

- For the CP of the OS server the "Time tracking" option is selected in NetPro.

- The OS server must be equipped with a communication module:
  - CP 1613 or CP 1623 (more than 8 AS or high-availability AS)
  - BCE (up to 8 AS)

- All automation systems must be configured as time slaves
  (exceptions: CPU 416-3 PN/DP, CPU 414-3 PN/DP).

Field Bus

The PROFIBUS DP fieldbus enables the SIMATIC PCS 7 automation systems to communicate with distributed I/Os from the ET 200 range (remote I/Os) as well as with field/process devices, CPUs/CPs and operator terminals that have a PROFIBUS DP interface.

It is possible to route the PROFIBUS DP into Ex zone 1 by using a fieldbus isolating transformer (RS 485-iS coupler) and the RS 485-iS transmission technology. Connection of the intelligent, distributed field/process devices and operator terminals on PROFIBUS PA to the automation system takes place likewise through PROFIBUS DP.

Depending on the type of automation system and the number of available slots, 1 PROFIBUS DP lines can be connected to a SIMATIC PCS 7 automation system through internal interfaces in the CPU410-5H, and up to 10 PROFIBUS DP lines through additional CP 443-5 Extended communications processors.

On a PROFIBUS DP line it is possible to operate up to 126 devices (including repeaters and Optical Link Modules), and on a bus segment up to 32 devices (including repeaters and Optical Link Modules), with PROFIBUS DP interface.

Electrical and optical transmission technologies offer many different configuration options for PROFIBUS DP networks.
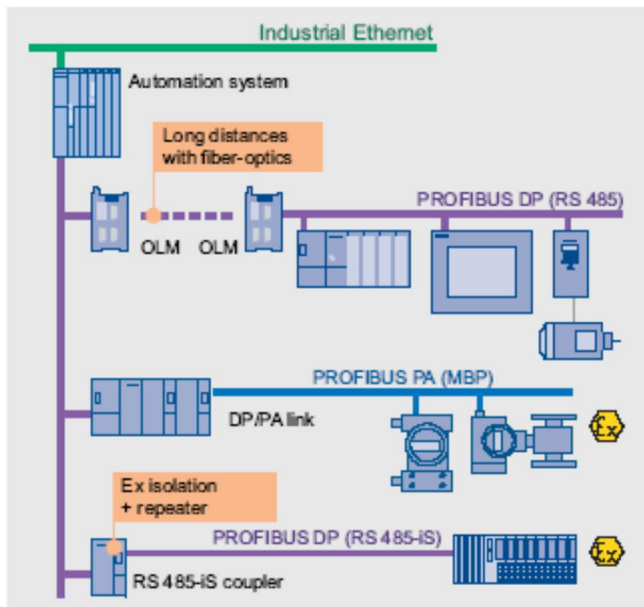
PROFIBUS transmission systems

Electrical networks can span up to 10 km for transfer rates <= 187,5 kBit/s
(12 km for transfer rates <= 93,75 kBit/s).

With optical transmission systems, the total size of the network is governed primarily by the cycle times as a result of the almost loss-free transmission.

Table sub-line length:	PROFIBUS DP			PROFIBUS PA
Data transmission	RS485	RS485-IS	Fiber optic	MBP
Transmission rate	9.6 kBit/s - 12 Mbit/s	9.6 kBit/s -1.5 Mbit/s	9.6 kBit/s - 12 Mbit/s	31,25 kBit/s
Cable	Shielded 2-wire	Shielded 2-wire	Plastic, Hybrid, Glass	Shielded 2-wire
Type of protection		Ex ib		Ex ia/ib
Topology	Line	Line	Ring, star	Line, tree, ring
Stations per segment	32	32	32	32
Stations per network (incl. Master)	126	126	126	(64 per PA Link; 4 per CFU)
Cable length per segment	1.000m at 187.5 kbit/s 400m at 500 kbit/s 200m at 1.5 Mbit/s 100m at 12 Mbit/s	1.000m at 187.5 kbit/s 400m at 500 kbit/s 200m at 1.5 Mbit/s	Plastic fiber: max. 80 m Hybrid fiber: max. 400 m Glass fibers: Multimode fiber: max. 3 km Single mode fiber: max. 15 km	1,900m: Standard 1,900m: Ex ib 1,000m: Ex ia
Signal refresh repeaters	Max. 9	Max. 9	Max. 122	(4)

Max. Permissible Capacitance	Transfer rate	Total Length of Stub Lines
0 nF	> 1.5 Mbps	0 m
0.2 nF	1.5 Mbps	6.60 m
0.6 nF	500 kbps	20 m
1.0 nF	187.5 kbps	33 m
3.0 nF	93.75 kbps	100m
15 nF	9.6 and 19.2 kbps	500 m

For further Information see
https://support.industry.siemens.com/cs/ww/en/view/90880058
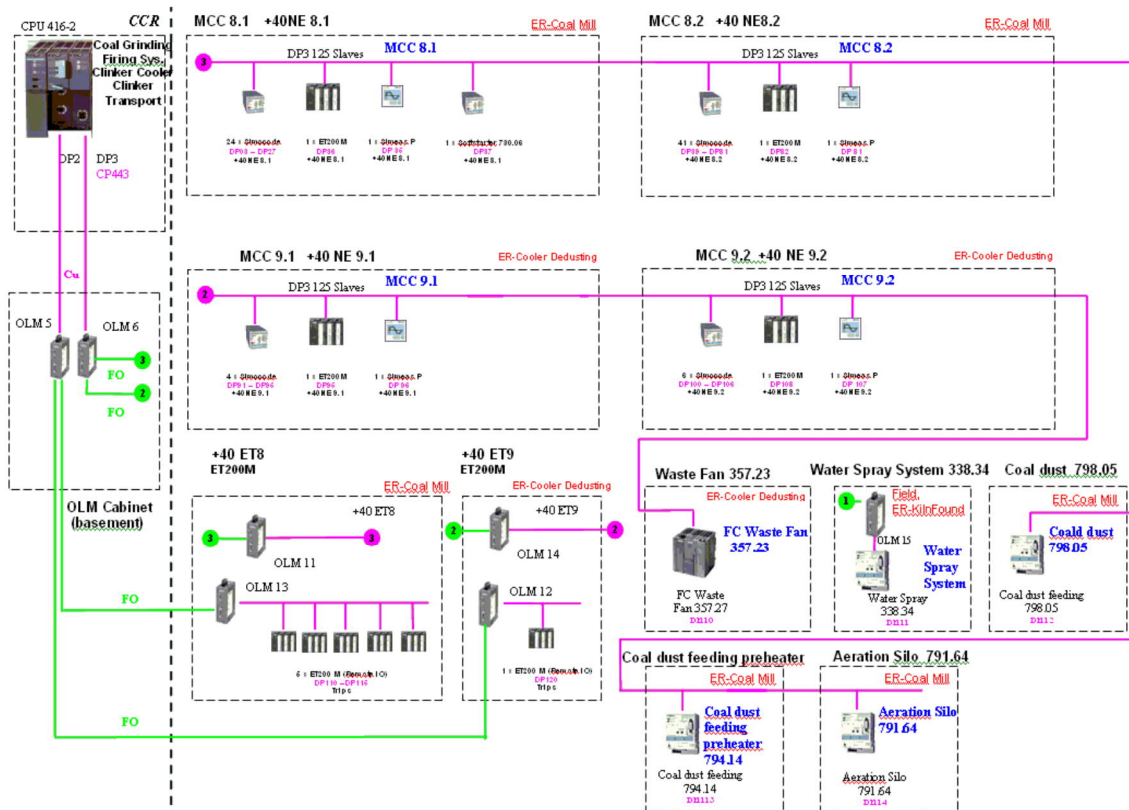
We recommend the usage of "Diagnostic Repeaters" for online diagnostics (6ES7 972-0AB01-0XA0).

PROFINET is an open standard for fieldbus communication that combines the advantages of the PROFIBUS DP fieldbus standard with those of the Industrial Ethernet network standard. It enables the SIMATIC PCS 7 automation systems to communicate with PROFINET devices, e.g. remote I/O stations and switches.

Besides the prevailing simple line structures and rings via PROFIBUS DP's optical link modules (OLM), PROFINET also supports ring, tree and star topologi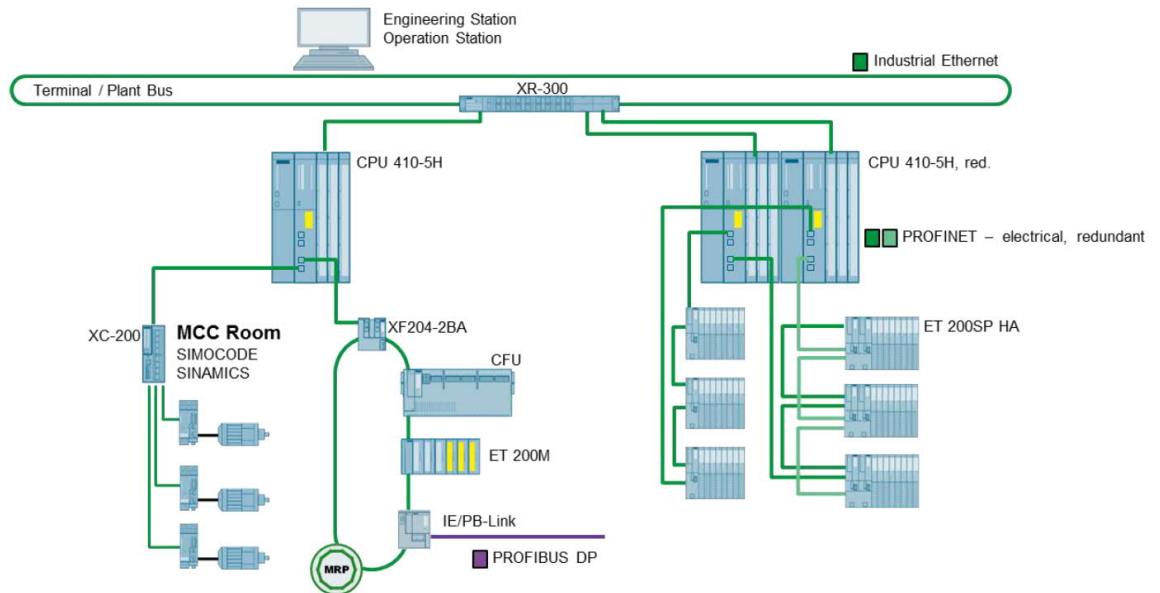es with one or more IO controllers by default. This makes the network architecture more individually adaptable to the plant and facilitates the implementation of future system extensions.

PROFINET allows up to 1440 bytes of cyclic user data per device as opposed to PROFIBUS DP, which allows 244 bytes. These larger data sets are easily handled by PROFINET thanks to a higher transmission rate of 100 Mbps full duplex, when compared to PROFIBUS DP's maximum of 12 Mbps (typically 1.5 Mbps).

For process automation PROFINET system redundancy S2, redundant PROFINET configuration R1, MRP (Media Redundancy Protocol) and CiR (Configuration in Run) are most important functionalities of the PROFINET devices.

Depending on the type of automation system and the number of available slots, 2 PROFINET lines can be connected to a SIMATIC PCS 7 automation system through internal interfaces in the CPU410-5H.

On a PROFINET line it is possible to operate up to 250 devices.

Electrical and optical transmission technologies offer many different configuration options for PROFINET networks.

For further Information see
https://support.industry.siemens.com/cs/de/en/view/72887082

OpenPCS 7

Use the OpenPCS 7 interface in order to exchange data between the SIMATIC PCS 7 process control system and host systems for production planning, process data evaluation and management. These higher-level systems (OPC clients) can access SIMATIC PCS 7 process data by means of the OpenPCS 7 server. However, access to the SIMATIC BATCH data is not possible.

The OpenPCS 7 server collects data for the OPC clients. Depending on the system configuration, these data may be distributed across different SIMATIC PCS 7 stations (OS server, Process Historian). It covers the distribution of data with respect to

- time period (OS1/OS2/...)
- location (OS1/OS2/...)
- redundancy (OS1 master/OS1 standby ...)
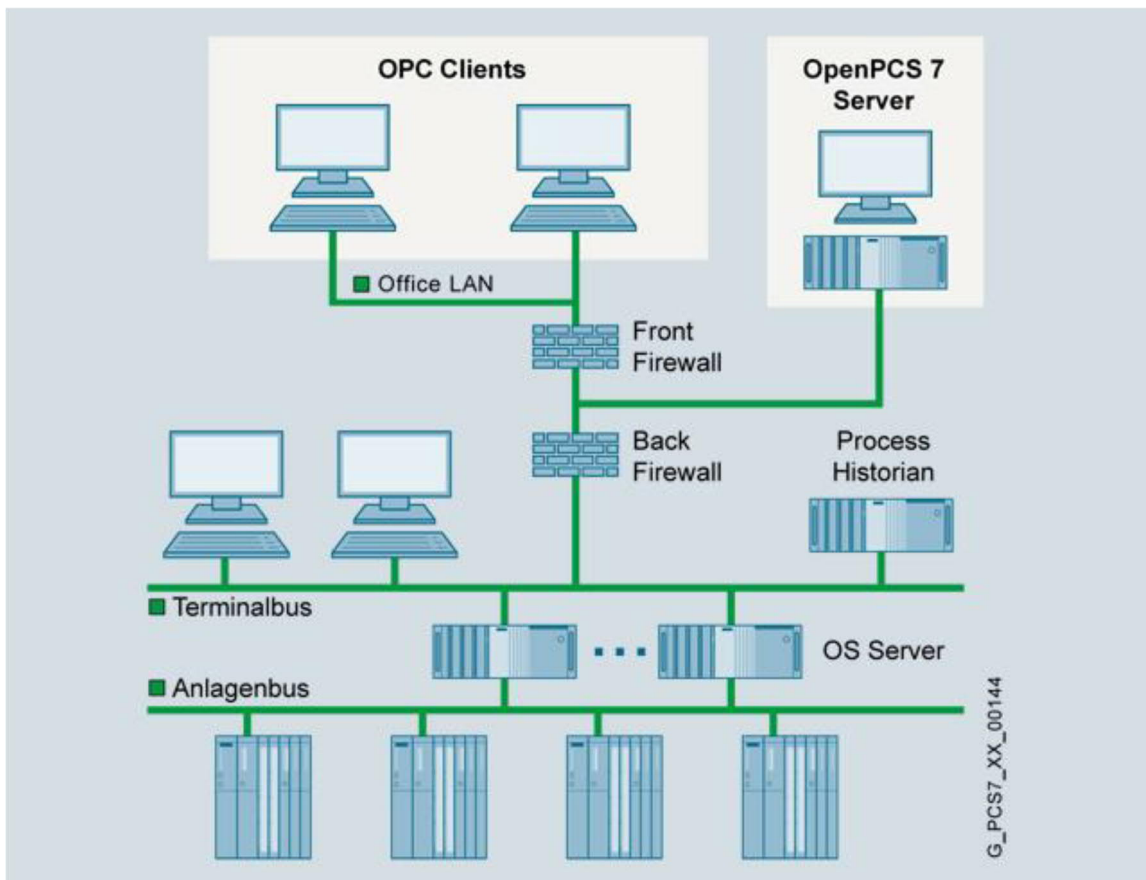
The OpenPCS 7 interface is based on various OPC specifications (openness, productivity, collaboration). In addition to Microsoft's DCOM technology (Distributed Component Object Model), it also supports the more sophisticated OPC UA (Unified Architecture) protocol for communication between applications.

For further detailed information, please check the Open PCS 7 product manual:
https://support.industry.siemens.com/cs/ww/en/view/109746548

Operator Station CEMAT Server

Overview

A multiple station system consists of operator terminals (OS clients) which receive data (project data, process values, archive data, alarms and messages) from one or more OS servers over a terminal bus. The terminal bus can share the transmission medium with the plant bus or it can be designed as a separate bus (Industrial Ethernet with TCP/IP).

In this architecture, redundant OS servers may be set up to meet higher availability requirements. Critical applications running on the OS server are monitored by Health Check for software faults. If a fault is detected, switchover to the redundant system is triggered. Synchronization of the redundant OS servers takes place automatically and at high speed. OS clients can access the data of not only one OS server/server pair, but from several OS servers/pairs of servers simultaneously (multi-client mode). This makes it possible to divide a plant into technological units and to distribute the data accordingly to several OS servers/pairs of servers. In addition to scalability, the advantage of distributed systems is the ability to decouple plant areas from each other, which results in higher availability.

The OS servers are designed in addition with client functions which permit them to access the data (archives, messages, tags, variables) from the other OS servers of the multi-user system. This means that process graphics on one OS server can also be linked with variables on other OS servers (area-independent displays).

Like the OS single stations, the OS servers can be connected to the Industrial Ethernet plant bus using one of the following network components:

- IE: CP 1623 communications module (pre-installed in SIMATIC PCS 7 Industrial Workstation) or CP 1628 communications module for communication with max. 64 automation systems

- BCE: Standard Ethernet network adapter (10/100/1000 Mbps) and Basic Communication Ethernet for communication with up to 8 automation systems (no redundancy stations)

OS quantity framework:

Max. number of OS single stations	8
Max. number of OS servers/pairs of servers	18
Max. number of automation systems per OS server/pair of servers	64
Max. number of OS clients in multiclient mode, per multi-user system	40
Max. number of monitors per operator station with multi-channel operation	4
Max. number of OS areas	64
Max. number of windows per monitor	1 to 16 (adjustable)
Number of trends per trend window	10
Selection time for OS area display (100 process symbols)	< 2s
Max. number of configurable messages per server	200 000
Max. number of configurable process objects	Approx. 216 000
Max. number of configurable process tags	Approx. 128 000 (Approx. 300 000 I/O)
Integral high-performance archive system (circular buffer), based on Microsoft SQL server, for: • Process value archiving (per OS server/single station) Approx. 1 500/s • Alarm logging (per OS server/single station)	Permanent load approx.. 10/s Message burst approx.. 3000 / 4s

Redundancy

The Operator Systems (single stations or servers) communicate with the automation systems via the Industrial Ethernet plant bus. The following special points must be observed for redundant configurations:

BCE communication with the 10/100/1000 Mbps Ethernet card is generally sufficient even for redundant operator stations. This allows the connection of up to 8 automation systems per server pair (AS single stations only, not AS redundancy stations). The BCE license is included for the BCE versions of the SIMATIC PCS 7 Industrial Workstation. It is also valid for an additional desktop adapter network adapter.

Industrial Ethernet communication via CP 1623 (pre-installed in the IE version of the SIMATIC PCS 7 Industrial Workstation) or CP 1628 (with extra security functions) is required in the following cases:

- The number of automation systems per OS is larger than 8.

- Redundant automation systems (AS redundancy stations) are used.

The IE versions of the SIMATIC PCS 7 Industrial Workstation are equipped with a CP 1623 and SIMATIC NET HARDNET-IE S7 communication software, licensed for up to four CP 1623/ CP 1628 (4x license). If lower-level AS redundancy stations are to be connected, however, SIMATIC NET HARDNET-IE S7-REDCONNECT is required. The SIMATIC NET product HARDNET-IE S7REDCONNECT PowerPack (license for 4 units) can be used to upgrade features.

If an operator station with BCE communication is to be upgraded for operation with AS redundancy stations, a CP 1623 or CP 1628 communication module is required in addition to the SIMATIC NET HARDNET-IE S7-REDCONNECT (4x license).

If the plant bus is to be designed as a redundant dual ring, you require two interface modules (2 x Ethernet network adapters 10/100/1000 Mbps or 2 x CP 1623/CP 1628) per OS single station or OS server.

The communication software for CP 1623 or CP 1628 is always supplied with the SIMATIC PCS 7 software and installed in line with the operating system.

Operator Station CEMAT Client

Overview
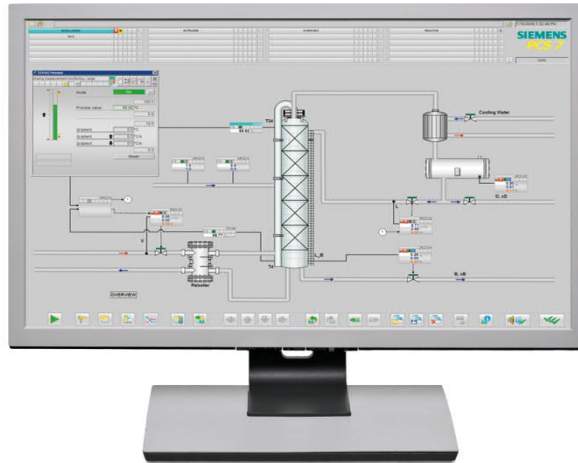
Abbildung 1 OS Client

The operator system of the SIMATIC PCS 7 process control system allows easy and safe control of the process by the operating personnel. The operator can observe the process sequence by means of various views and intervene to control the system when necessary.

The operator system architecture is extremely variable and can be flexibly adapted to different plant architectures and customer requirements.

The predefined user interface of the operator system has all the features typical of a control system. It is multilingual, clearly structured, ergonomic and easy to understand. The operator can survey the process extremely easily, and rapidly navigate between different views of the plant. He is supported by a picture tree manager, which organizes the picture hierarchy according to user requirements and permits direct selection of subordinate areas.

The basis is perfectly coordinated operator stations for single user systems (OS single stations) and for multi-user systems with client/server architecture.

- High-performance operator stations based on versatile, rugged SIMATIC PCS 7 Industrial Workstations, optimized for use in industrial environments

- Flexible, modular architecture with scalable hardware and software components for - Single-user system (OS single station) with up to 8 500 process objects - Flat system configurations based on a redundant OS Single Station pair, expandable with reference stations to up to 8 OS Single Stations. - Client/server multi-user systems with up to 18 OS servers/ pairs of servers for every 12 000 process objects (PO) and up to 40 OS clients

- High-performance archiving system based on Microsoft SQL Server with short-term archives and integrated archive backup, can be optionally expanded for long-term archiving with the Process Historian

- Self-diagnostics of important OS server applications

- Integration of modifications without interrupting runtime operations, and online testing through selective loading of redundant servers

- Optimized AS/OS communication: data transmission only following change in data, independent of AS reply cycle; suppression of nuisance alarms

- User-friendly process control and high operational reliability with support of multi-screen technology

- Extended status displays through combination of status/ analog values with alarm information

- Highly effective alarm management provides support for operating personnel - Assignment of priorities with up to 16 message priorities as additional attribute to the message classes - Visual and audible suppression of messages which are irrelevant to a specific operating state (dynamic or manual) - Suppression of sensor/actuator alarms during startup or in event of malfunction

- Centralized user administration with access control and electronic signature

- Sign-of-life monitoring for subordinate systems connected to the plant bus

- System-wide time synchronization based on UTC (Universal Time Coordinated)

Functions

Graphical user interface (GUI)

The predefined user interface of the operator system has all the features typical of a control system. It is multilingual, clearly structured, ergonomic and easy to understand. Operators can survey the process extremely easily, and rapidly navigate between different views of the plant. The system supports them in this process with hierarchical display structures that can be configured as required. These facilitate the direct selection of lowerlevel areas during process control. The current position within the hierarchy can always be recognized in a window of the Picture Tree Manager. Process displays and process tags can also be called directly by their name, or by a "Loop-in-alarm" starting from a selected message. An online language selector permits the user to change the display language during runtime.

The project editor in the operator system offers a wide range of different image formats and resolutions for displaying process graphics:

Graphic standard	Format	Resolution *)	Support of multi-monitor mode	
SXGA	5:4	1280 x 1024	Yes	
UXGA	4:3	1600 x 1200	Yes	
WSXGA+	16:10	1680 x 1050	Yes	
HD 1080 (Full HD)	**16:9**	**1920 x 1080**	**Yes**	**recommended**
WUXGA	**16:10**	**1920 x 1200**	**Yes**	**recommended**
WQXGA	16:10	2560 x 1600	…	

*) Smaller Screen resolutions exist, but they are not suitable for CEMAT

Process tag browser

The SIMATIC PCS 7 process tag browser enables status information from APL-based process tags to be displayed, filtered and sorted. Process tags that have a certain status can then be quickly identified and selected. The faceplate of a process tag can be selected directly in the process image via the Loop In function. The query results of the process tag browser can be saved and printed out.

TrendControls function for table displays and curve displays

With TrendControls the operator can display archived values:

- Archive tags from the process value archive
- Online values of process tags from tag management

The display is in relation to time (table/trend window) or in relation to another value (function window).

The time can be defined statically (absolute, as configured) or dynamically (in relation to the actual system time) as:

- Start and end times
- Start time and period
- Start time and number of measuring points

All TrendControls have scrolling functions and a function for directly selecting the start or end.

During runtime, operators can individually adapt the TrendControls functions which have already been predefined during plant configuration and save the settings globally or user-specific. They are able to change the data link during runtime, and to access other data. It is also possible to integrate exported archive databases online.

Another special feature is that the operator can set a setting called "private". By means of this feature the trend control is only visible to the operator, who set this setting. He can use this feature in order to secure his own created Online Trend Control.
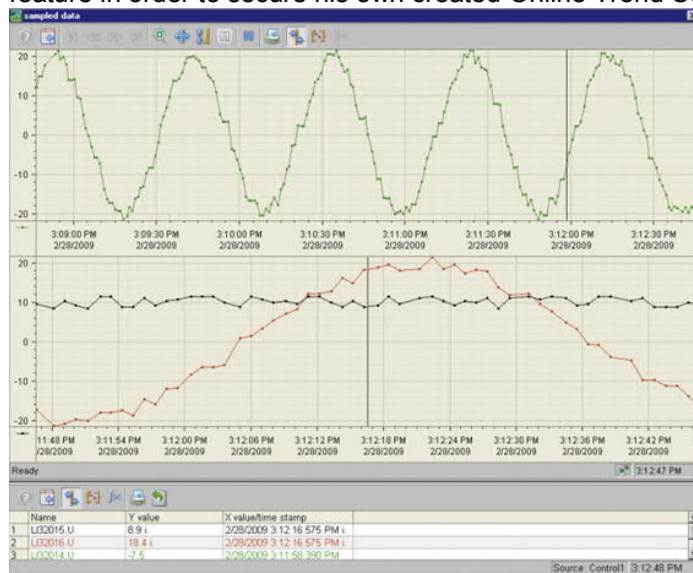
APL Operator Trend Control

The APL Operator Trend Control coordinated with the Advanced Process Library offers another option to the operator for flexible online compilation of trends. The values for the trend display are selected with a simple mouse click, in which case the value range and unit are adopted automatically by the process tag. The selection made can be subsequently adjusted by adding and removing values. In addition, messages corresponding to the trend selection can be called.

4 quadrant view

In connection with the Trend Controls PCS 7 offers a new special view, where up to 4 Trend Controls can be displayed on one picture ordered in a 4 quadrant view. By means of this feature the operator can display his Trend Controls even on a separate monitor in full screen. Both, Trend Controls and APL Operator Trend Controls are supported. Additionally the operator is also able to save his screen composition.

AlarmControl function for message display and processing

Up to 200 000 messages can be configured per OS single station/OS server:

- Predefined system messages, triggered by a system event
- Individual or group messages, initiated by a change in process states
- Operator input messages, resulting from the manual operation of objects

The message system integrated in the Operator System records these process messages and local events, saves them in message archives, and displays them using freely configurable message lists.

Flexible setting options for audio output support message signaling with a sound card or by controlling external horns via a signal module.

The "Loop-in-alarm" and "Select display using process tag" functions support the quick evaluation and resolution of faults. Using "Loop-in-alarm", the operator can jump directly from a message selected in the message window to the process display with the object which caused the fault and can then call up the associated faceplate (loop display) through the process tag whose block icon is colored (cyan). The faceplate window (loop display) can be anchored so that it remains visible even when the display is changed.

Group displays visually signal the messages currently present in the process display. They also provide information on whether messages are disabled or not.

Reporting and logging system

The project created during configuring is documented with the reporting system. The logging system allows an easy-to-read printout of data acquired during operation. Different types of predefined logs are available:

- Message sequence log
- Message and archive log
- Measured value log
- Operator activity log
- System message log
- User log

However, a page layout editor can be used to create completely new page layouts or to individually adapt predefined ones. Log objects to be printed are simply selected from the editor's object palette, positioned and configured.

Data archiving
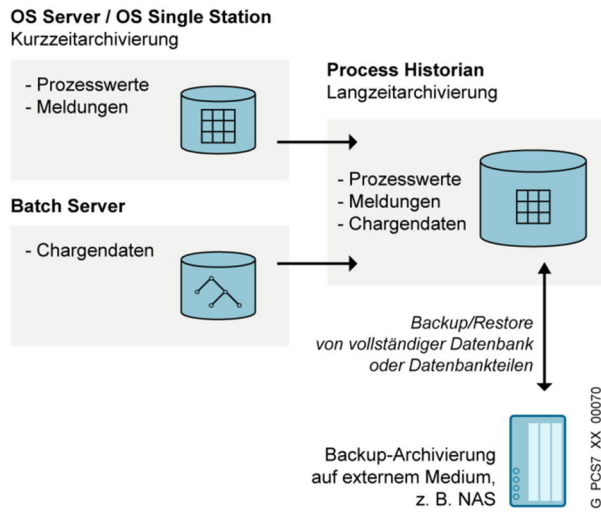
Abbildung 2 OS Archivierung

The high-performance archiving system, configurable at runtime, in the OS standard software of OS Single Stations and OS Servers temporarily records process values and messages/ events (alarms) in cyclic archives. Intervals of approximately 1 to 4 weeks for process values and approximately 2 months for alarms are typical for this short-term archiving. Data from the cyclic archives can be exported time-controlled or event-controlled to the Process Historian for permanent archiving. See the "Process data archiving and reporting" section for information on this.
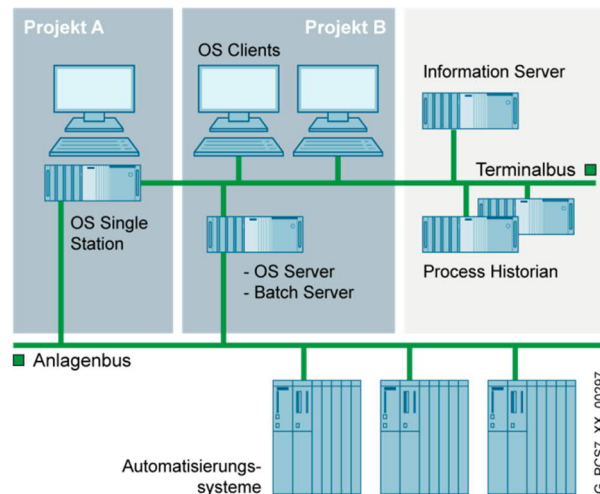
Abbildung 3 Process Historian

Central user administration, access control, electronic signature

With SIMATIC Logon, the operator system has central user administration with access control that complies with the validation requirements of 21 CFR Part 11. The administrator can divide the users into groups and assign differently defined access rights (roles) to these groups. The operator obtains the specific rights when logging on within the scope of the access control. Apart from the keyboard, an optional smart card reader, for example, can be used as the logon device. In addition, SIMATIC Logon offers the "electronic signature" function. SIMATIC Logon is fully integrated in SIMATIC PCS 7. In the context of SIMATIC PCS 7, no software licenses need be ordered for this. For more information on SIMATIC Logon and ordering data for an optional smart card reader, see "Expansion components, smart card reader" in "Industrial Workstation/IPC".

Engineering Stations

The SIMATIC PCS 7 engineering system contains tools which are optimally matched to one another for system-wide project-oriented engineering, and which simultaneously provide the basis for asset management of the I&C equipment. These permit you to carry out the engineering of standard automation functions as well as the configuration of consistent safety functions for safe, fault-tolerant and high-availability process applications.

The engineering toolset comprises the following tools for engineering:

- Hardware and field devices

- Communication networks

- Continuous and sequential process operations

- Operation and monitoring strategies
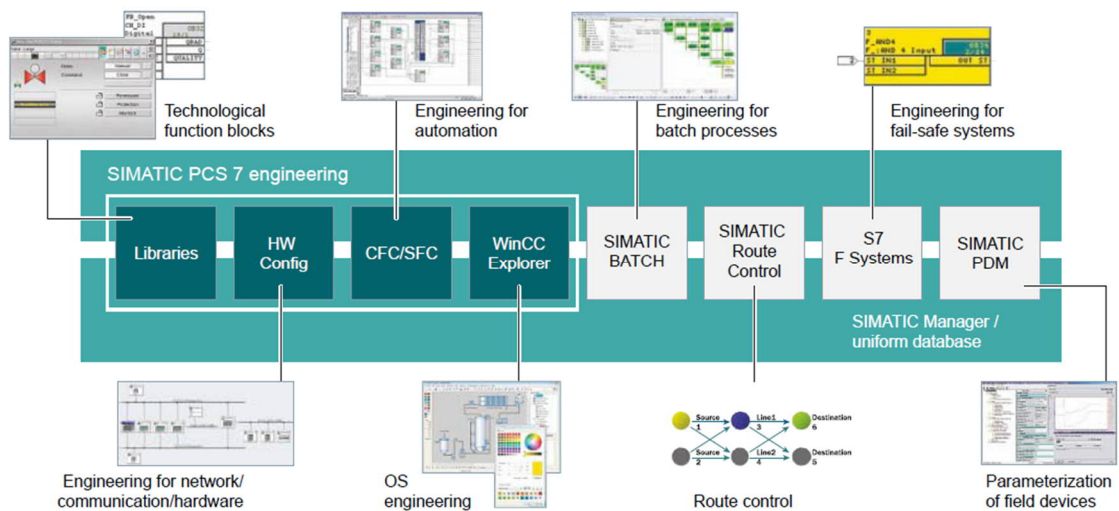
Technologists as well as process and production engineers can plan and configure in the environment they are familiar with by utilizing the engineering toolset designed for technological needs together with the predefined blocks and plans.

The engineering system supports the implementation of large projects and the related processing of bulk data by providing appropriate functions such as:

- Plant hierarchy (plant view)

- Project library for process tag types as well as the import and export of process tags (process object view)

- Multi-project engineering

- Branch & merge

- Extended rename

- PCS 7 PID-Tuner for controller optimization

The following software options expand the basic system with special functions:

- Version cross-manager

- Engineering Process Safety for engineering of fail-safe systems, including SIMATIC Safety Matrix engineering tool

- SIMATIC PCS 7 asset management Engineering

- SIMATIC PDM Process Device Manager for SIMATIC PCS 7

- S7-PLCSIM for the functional testing of CFC/SFC programs

For a Project should be used:

- as Basic Station -> a Rack PC IPC 547G IE

- as transportable Station -> an Field PG M

http://www.automation.siemens.com/simatic/programmiergeraete/index_76.htm

Test and Training Stations

Simulation Structure with PCS 7 and SIMIT

SIMIT is a simulation tool which can simulate all levels of automation: From the signal level down to the process level. The easy to use HMI makes it possible that one can do signal test quite easy via control/display elements for inputs and outputs. In addition, the Standard library provides a huge spectrum of components to great simulation for Actors/Sensor as well as easy process models, like filling and heating of reactors.

SIMIT has in general two basis structure types: Hardware-In-The-Loop and Software-In-The-Loop. The second one is basically consisting out of SIMIT SP and a virtual controller which is replacing the real PLC (300/400). The first option is directly connected to a real PLC, via additional hardware, the so-called SIMIT Unit. This would be also the solution which fulfills the requirements above. The advantage is to have a realistic feedback of the performance and behavior of the plc, which therefore also maintain a better testing quality.

The PLC itself is connected to the HMI Level via standard S7-communication, that means Server-/Client resp. Single Station is possible.
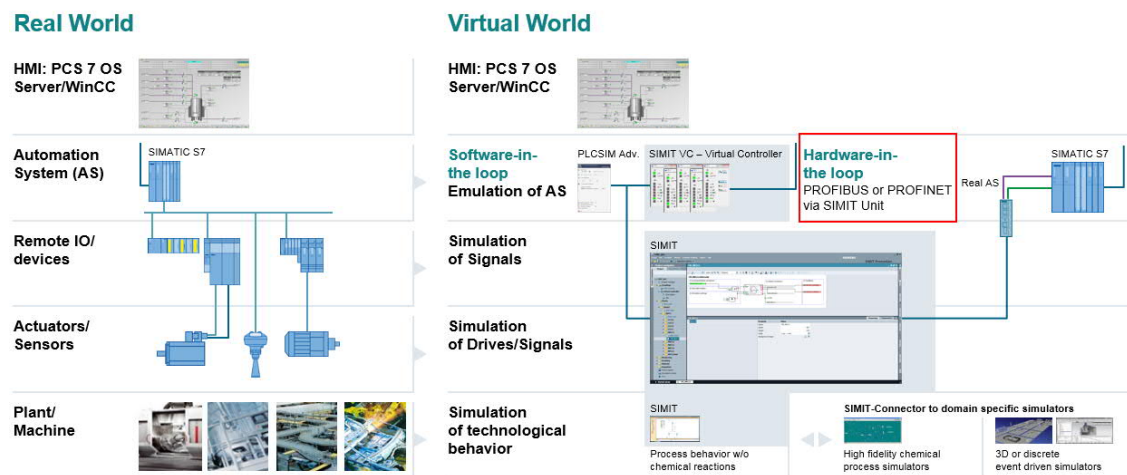
There are two different types of SIMIT Units available; one for Profibus and one for Profinet. The preferred one for Profibus has two PROFIBUS channels and can handle up to 125 PROFIBUS device in each channel. This device has also an Ethernet connection which is directly connected to an PC where SIMIT SP is installed. SIMIT SP can be installed on the same or on a different PC as the Engineering Station.

Since V10 SIMIT has one Platform which provide all the functionalities. In the picture below, one can see the spectrum:

SIMIT Product-Line –
Scalable with the Customer Needs

SIMIT Simulation Platform Engineering S – XL

· Portal view	· Couplings	· Virtual Controller	· Remote control interface and
· Standard Library	· Virtual Controller	· Snapshots	virtual time management
· 3D Viewer	· PROFIBUS/PROFINET	· Virtual Time	· Automatic generation
· Trend and Messaging	· PRODAVE	· Engineering efficiency	of models and connections
· Scripting	· OPC DA	for PCS 7 (IEA/CMT)	based on XML interface
· Macro Components Editor	· PLCSIM	· Automatic generation	
· Dynamic Graphics Editor	· PLCSIM Adv.	on template/typical	
· Automatic gen. of signal lists	· OPC UA (Client)	base (e.g. .xls)	
for SIMATIC	· Shared Memory (High	· Automatic device level	
Manager data	performance coupling)	simulation	
· Bulk engineering	· External coupling	· Modify in run	

SIMIT Component type editor

· Development of own
 components (CTE)

SIMIT Virtual Controller 1 Controller
· Configuration Environment
· 1 Soft-S7 300/400 Controller
· Also as extension

SIMIT Virtual Controller 5 Controller
· Configuration Environment
· 5 Soft-S7 300/400 Controller
· Also as extension

SIMIT UNIT PB-2
· 2 channels
· Simulation of maximum
 125 slaves per channel

SIMIT UNIT PN
· SIMIT UNIT PN-128 and PN-256
· Simulation of up to 256 devices
 per controller

SIMIT FLOWNET Library
Library to build models in the schematics of a P&ID to simulate a piping network with single component liquids/gas (e.g. water) including pressure, temperature and flow

SIMIT CONTEC Library
Library to build conveyor simulation models

SIMIT CHEM BASIC Library
Library to build chemical or pharmaceutical plant simulation models

The Size of the simulation Platform is scaled by Simulation Tags which are the sum of all the inputs and outputs, plus the states. For typical process industry applications, it is recommended having an "L" package size. The PC where SIMIT is installed can be a standard PC.

Summary:

Product Name:	MLFB:
SIMIT SP V10.0 ENGINEERING L	6DL8913-0CK00-0AB5
SIMIT SUS ENGINEERING (SUS keeps your Software always up to date, recommended)	6DL8913-0CX00-0AL8
SIMIT UNIT PB, 2-KANALIG	9AE4122-2AA00

Hardware Requirements

In order to work with SIMIT, you need a PC with the following minimum requirements for processor speed/performance (recommendations from Microsoft), RAM and graphics capability:

Processor	Expanded memory configuration	Graphics
2 GHz	4GB *)	DirectX 9-raphics device with WDDM 1.0- or later driver

*) At least 8 GB expanded memory configuration is recommended

In addition, you will need a CD drive and a free USB port.

The performance of your graphics architecture as well as memory configuration may have considerable influence on the performance of SIMIT. In case you work with large SIMIT projects with e.g. several hundred diagrams you should use a PC with up-to-date performance.

Operating System

SIMIT is a 32-bit application that is released for the following operating systems:

- MS Windows 7 SP1 (Professional, Ultimate, Enterprise, 32 and 64 bit versions)
- MS Windows 10 LTSB 2015
- MS Windows Server 2012 R2 (64 Bit)
- MS Windows Server 2016

You may use one of these operating systems as a virtual machine under the control of a VMware host (ESXi V6.0).

SIMIT has not been tested for use in other environments; use at your own risk.

Display of PDF files

To read the supplied PDF files, you need a PDF reader that is compatible with PDF 1.7 (ISO32000-1:2008 PDF).

Security Settings

In project directories as well as in the SIMIT workspace, all users need to receive write permission in case of non-exclusive use by one user only. These rights have to be set up by an administrator.

Note: The standard rights available in the operating system depend on the operating system in use. Tools used for the creation of partitions will implement their own security guidelines.

Hibernation mode

Shifting to hibernation mode is generally prevented by SIMIT.

Modifying date and time

Please do not modify the date or time of your computer while SIMIT is running since this could cause unpredictable errors.

Memory Requirements

SIMIT requires approx. 350 Mbytes of memory on your hard disk. The exact value depends on your operating system and on the file system used on your personal computer.

Additionally, on the drive your project data is located you need to make sure enough hard disk space is available. If during an operation (e.g. saving a SIMIT diagram or starting the simulation) disk space is insufficient, this may lead to corruption of project data.

We also recommend that you do not store the project data on the same drive as the Windows swap file.

SIMATIC PCS 7 Virtualization

Virtualization refers to the creation of a virtual machine that acts like a real computer with an operating system. It is possible to run several virtual machines on a real computer. Each virtual machine can run applications such as SIMATIC PCS 7.

Virtualization is getting more important in automation technology because of its advantages which are of great importance to many operators. Reducing energy consumption and space requirements are decisive advantages compared to the utilization of real computers.

The following document provides an overview over the possibilities of virtualization and its usage in automation technology. The following main points are discussed in the documentation:

- Display typical configurations
- Display special features
- Experiences of practical area of PCS 7 in virtual environment

https://support.industry.siemens.com/cs/ww/en/view/51975791

CEMAT Design and Engineering

Overview

CEMAT is a Control System based on SIMATIC PCS 7, the mainstream process control system of Siemens. It offers a unique, open architecture for modern, future-proof and economic solutions for the Minerals industry.

CEMAT makes use of all features of SIMATIC PCS 7 and it further adds the philosophy of plant operation and fault diagnosis.

Special function blocks and faceplates are designed for all kind of operation, interlocking and supervision functions as typically required in Minerals Plants.

The functions are preconfigured and well proven over many years. This makes engineering easy, fast and reliable.

Diagnosis functions such as **diagnostic dialog**, **loop-in-alarm function and information dialog** lead to the information very fast and help to reduce down-time to a minimum.

CEMAT contains a powerful **message system** with special filter functions and sophisticated plausibility logic:

- Alarms will only be given for plant sections which are "in operation".
- In case of general faults like power supply failure, the alarms from the modules can be blocked in order to give no misleading information to the operator.

A **status report** gives an overview of all unsolved problems within a plant section (group) and prevents unnecessary group starts. This saves time and energy.

An **object list** shows all objects of a plant section (group). This function can be used to see the status of the objects and to search for potential simulations or software jumpers.

The **information dialog** of each object provides additional information. It displays the hardware's installation location, I/O data, Additional I/O Information (including Signal Addresses), MCC data, AS data, notes and object related messages.
An open user interface in the information dialog offers access to sound files, videos, PDF descriptions and CAD drawings.

The **maintenance dialog** shows Statistic values like Operating hours and Maintenance data information.

CEMAT provides assistance in all phases of the project:

- Project planning and ordering:
  - CEMAT DEMO systems offline and online
  - Order information for the calculation of the automation components

- Engineering and Commissioning:
  - Training in the SIMATIC training center or, if desired, on site
  - Extensive documentation (Object description and Engineering Manuals)
  - Engineering tools

- Trouble shooting
  - FAQs and information to latest versions in the internet
  - Special contact partners in the PCS 7 Hotline

- Migration
  - Migration tools for connecting old systems to newer versions
  - Upgrade procedures and engineering tools for the upgrade to the latest versions.

Modules of the CEMAT Minerals Automation Standard

A CEMAT Module is a combination of a control program in the automation system (function block) and the appropriate visualization in the operator station, the so-called faceplates.

The CEMAT Modules are designed for all kind of operation, interlocking and supervision functions as required in a Cement or Mining Plant:

Modules for drive functions

C_DRV_1D	Unidirectional drive
C_DRV_2D	Bi-directional drive
C_DAMPER	Damper
C_VALVE	Valve

Modules for supervision of process signals

C_ANNUNC	Annunciation module
C_ANNUN8	Annunciation module for up to 7 Messages
C_PROFB	Process feedback block
C_PROFBx	Process feedback block for multiple process feedbacks
C_MEASUR	Measuring value
C_STAT8	Status display of up to 8 Signals
C_ANASEL	Analog Value Selection

Modules for control and supervision functions

C_GROUP	Group module
C_MUX	Additional block for group/route
C_SEND_G	Send Object list to a different AS
C_RECV_G	Receive Object list from a different AS
C_ROUTE	Route module
C_SELECT	Selection module

Special functions

C_LINK	Adapter to integrate any function block as CEMAT object
C_INTLK2	Interlock block with 2 inputs
C_INTLK4	Interlock block with 4 inputs
C_INTLK8	Interlock block with 8 inputs

Modules which provide data for the information system

C_RUNNT	Runtime supervision (MIS)
C_COUNT	Counter block (MIS)
C_TIS_B	Send the bit status to the OS to use them in TIS *)
C_TIS_N	Send a Integer variable to the OS to use them in TIS *)
C_TIS_S	Send a string variable to the OS to use them in TIS *)

*) LafargeHolcim only

Modules for Scalable Production Control (SPC)

C_P_MGR	SPC Manager
C_P_MAT	SPC Material Manager
C_P_RCV	SPC Mat_Link receive block
C_P_SND	SPC Mat_Link send block
C_PC_8B	SPC data collector for 8 Setpoints and Process values, BOOL
C_PC_8I	SPC data collector for 8 Setpoints and Process values, INT
C_PC_8R	SPC data collector for 8 Setpoints and Process values, REAL
C_PD_B	SPC data collector, BOOL
C_PD_AI	SPC data collector Absolute, INT
C_PD_AR	SPC data collector Absolute, REAL
C_PD_RR	SPC data collector ,Relative, REAL
C_PD_RTR	SPC data collector, Relative, Totalizing, REAL
C_PD_S	SPC data collector, Storage selection
C_PM_B	SPC Recipe module, BOOL
C_PM_AI	SPC Recipe module, Absolute, INT
C_PM_AR	SPC Recipe module, Absolute, REAL
C_PM_RR	SPC Recipe module, Relative, REAL
C_PM_RTR	SPC Recipe module, Relative, Totalizing, REAL
C_PM_S	SPC Recipe module, Storage selection

AddOn

The following blocks are open (no KNOW_HOW_PROTECT) and may need to be adapted by the user. Therefore they are delivered in a separate program folder of the Minerals_CEMAT Library:

C_SIMOS	Adapter for SIMOCODE cyclic
C_SINA	Adapter block for SINAMICS
C_ROBI	Adapter block for ROBICON

The detailed description of the CEMAT MinAS Functions you find in the object description an in the only help.
In addition to the CEMAT MinAS functions, all other blocks from the PCS 7 AP Library can be used as well.

General Function Description

Operating Modes

In the CEMAT Minerals Automation Standard the following operating modes exist:

In normal operation the drives of a technological plant section are started and stopped group-wise, in the so-called **Automatic Mode**. The start/stop commands are carried out by the operator in the control room via the faceplate of the group or can be initiated by program (by a process condition).
With a group start the group module generates a start-up warning. After the start-up warning time has elapsed, all affiliated drives are started sequentially according to the interlocking conditions.
With a group stop all affiliated drives are stopped according to the interlocking conditions.

In the **Manual mode** the drives can be started and stopped individually from the operator station. In the Manual mode the drive module itself generates a start-up-warning. After the start-up warning time has elapsed the start command is given.
In the Manual mode all interlocking conditions (start and operating interlocks as well as protection interlocks) are effective.
Remark: Interlocking grades can be adjusted via Feature bit settings according to customer's design criteria.
The Manual mode can be enabled/disabled per group (or route), or individually for the drive.

Drives can be switched into (interlocked) Manual mode and back into Automatic mode while the drive is running. As long as the interlocking conditions are fulfilled running devices continue to run.

The **Local mode** allows starting and stopping from the field, either via a field switch or via locally installed push buttons. The Local mode is mainly used for maintenance and must be enabled by the operator in the control room.
The local mode is a non-interlocked mode, which means that start and operating conditions of the drive are not effective, except the essential process interlocks and protection interlocks. (Interlocking grades can be adjusted via Feature bit settings)
The Local mode can be enabled/disabled per group (or route), or individually for the drive.

Switching into Local mode is only possible if the drive is not running. Switching drive from Local mode into Automatic mode or Manual mode is possible (if the field switch allows).

The **Out of Service Mode** inhibits the drive start. In Out of Service Mode the blocks don't carry out any control function and no output is set.
The Out of Service mode cannot be enabled/ disabled group-wise; this is only possible individually per drive.

Changing feature and OS permission bits is only possible in Out of Service.

Mode feedback of the drives is returned to the group for visualization purpose (indication in the group block icon and faceplate).

Operating Methodology

Start in automatic mode

In order to accept the automatic start command (normally coming from the superordinate group), the drives must either be in automatic mode or allow "change to automatic via automatic start command".
The group start can either be carried out via operator faceplate of the group or via program. The group triggers a start-up warning and after the start-up warning has elapsed the automatic start command is given to the drives. For the start sequence, the drives consider the interlocking conditions and time delays, configured at the drive blocks.
After the startup is completed and the last drive in the sequence is running, the group must receive a feedback ON signal in order to indicate "completely running".

Group interlocking conditions or an unacknowledged fault for one of the objects blonging to the group prevent the group start. After making sure that all faults are acknowledged, the operator can use the status call function in order to check for availability of the group.

Static faults in one of the objects belonging to the group don't prevent the group start. (The fault may come from a signal or device which is at the moment not affecting the process.)
But any incoming (dynamic) fault during the start-up of the group leads to an interrupt of the start command. In order to avoid unnecessary group starts the operator may carry out a status call in order to display the list of all the faulty objects and in order to decide whether any action is required before group start.

Stop in automatic mode

In order to accept the automatic stop command (normally coming from the superordinate group), the drives must be in automatic mode.
The group stop can either be carried out via operator faceplate of the group or via program. The group gives a stop command to the drives. For the stop sequence the drives consider the interlocking conditions and the time delays configured at the drive blocks.

Immediate stop in automatic mode

If the automatic mode of the drive is enabled (default setting) the drive accepts the immediate stop command from the group. Immediate stop can be carried out via operator faceplate of the group or via program. After pressing immediate stop, all drives are stopped instantaneously, without time delay.

Manual start/stop of a drive

Once the Manual mode is enabled, the drives can be started/ stopped individually via drive faceplate.
Pressing the start button a start-up warning is generated and after the start-up time elapsed the drive gets started. Pressing the stop button leads to an immediate stop.

Local start/stop of a drive

Once the local mode is enabled, the drives can be started/ stopped via field switch (locally installed switch or push buttons). The local mode is a non-interlocked mode and should be used for Maintenance only and not for normal operation.
By default no start-up warning is generated, but via a change in the feature bit settings this option exists.
Pressing local start and presuming that there is no fault, the drive starts immediately (or after the start-up warning has elapsed). Pressing local stop will stop the drive.

Further details about mode change options you will find under "Operating modes for drive functions".

Fault diagnosis and Messages

A number of indications are used in CEMAT MinAS in order to show the operator the actual status of the plant and to allow fast and reliable trouble-shooting in case of a fault.

- The **group** block has **summarizing indications** for "Faults" or "Warnings" in any of its affiliated objects.

- The group **status call function** shows a list of all faults and interlocks.

- The group **instance list** shows a list of all objects, including an indication for software jumpers and simulations (override function).

- The block icons of the **plant objects** (drives, measures or process signals) show the operating mode and fault status.

- The **diagnosis picture** shows the detailed information of the fault type.

- The **information dialog** shows additional information about the object regarding location, I/O addresses, MCC etc.

- The **alarm dialog** shows all messages created by the specific object (events and operations).

If a plant fault needs the attention of the operator (e. g. something has been stopped by a wrong process condition) an alarm message will be generated. Each incoming alarm must be acknowledged individually by the operator.

One of the main features of CEMAT MinAS is that no unnecessary alarms are generated.

- Alarms are filtered per section (AREA): Only the operator who is authorized for a plant sections will see the alarms.

- A plausibility logic prevents fault messages caused by another fault

- In case of general faults like power supply failure, the alarms from plant objects can be inhibited and only the alarm for power supply failure will be given.

- If the drives are enabled for local operation, no alarm message is created.

- Alarm messages are only created in Automatic mode and in Manual-start mode <u>and</u> only if the drive is started or already running. Drives which are not in operation do not create alarms.
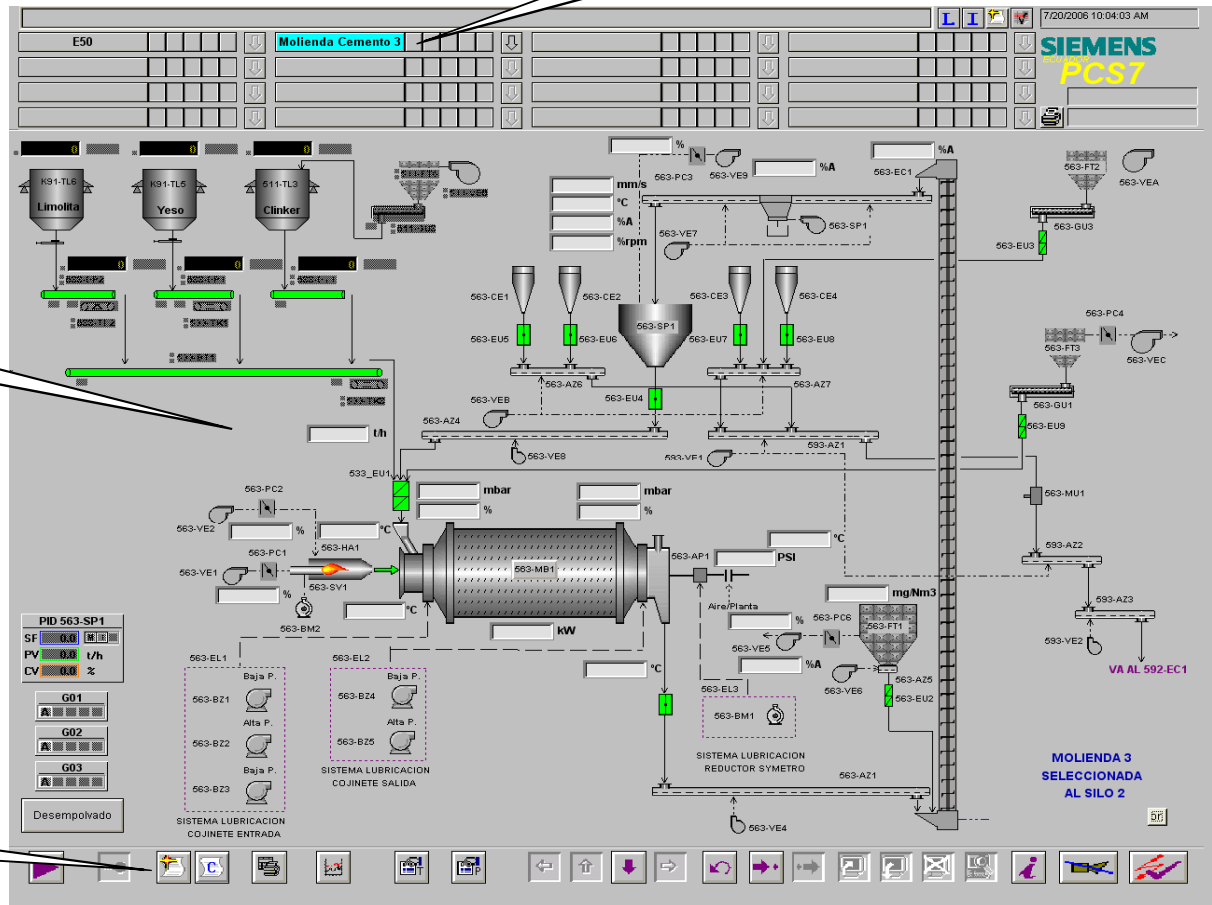
CEMAT MinAS Operator Interface

Process pictures

Screen division

General

All displays and graphics that show real time data are automatically updated when the display or graphic is on a screen. Updates do not require operator initiation.

The system provides an overview of the alarm status of all areas which can be viewed by an operator, no matter which graphic is displayed.

Working area design

Schematic display of all components complete with their connection by flow line to reflect the relationship in process control system. We recommend distributing the following pictures:

- Overviews   (normally shows the entire group)
- Groups   (used for group controlling, selects and more info's than the overviews)
- Details   (Shows special details of group, e.g. Hydraulic of a C-Mill)
- Trends   (Shows Trend curves)
- Services   (Handling of special process values)
- Pop-up's   (Additional information and handling of devices)

Text and color layout

For the representation of the plant objects in the pictures and for the text and layout colors the customer "Design Criteria" has to be followed.

The symbols for process pictures must be as clear understandable as possible for the operators. Process mimics, in which the plant parts like belt conveyors, bucket elevators and so on, are presented by means of graphic symbols in a simplified manner.

Block Icons and Bitmaps

A block icon is the representation of the AS module in the process picture. The block icon is linked to the object. Via mouse-click on the block icon a faceplate will open, which shows detail information and allows additional actions for operator control.

The individual block icons allow different mouse-klick operations, which are described with the block types.

The block icons must follow the customer Design criteria.
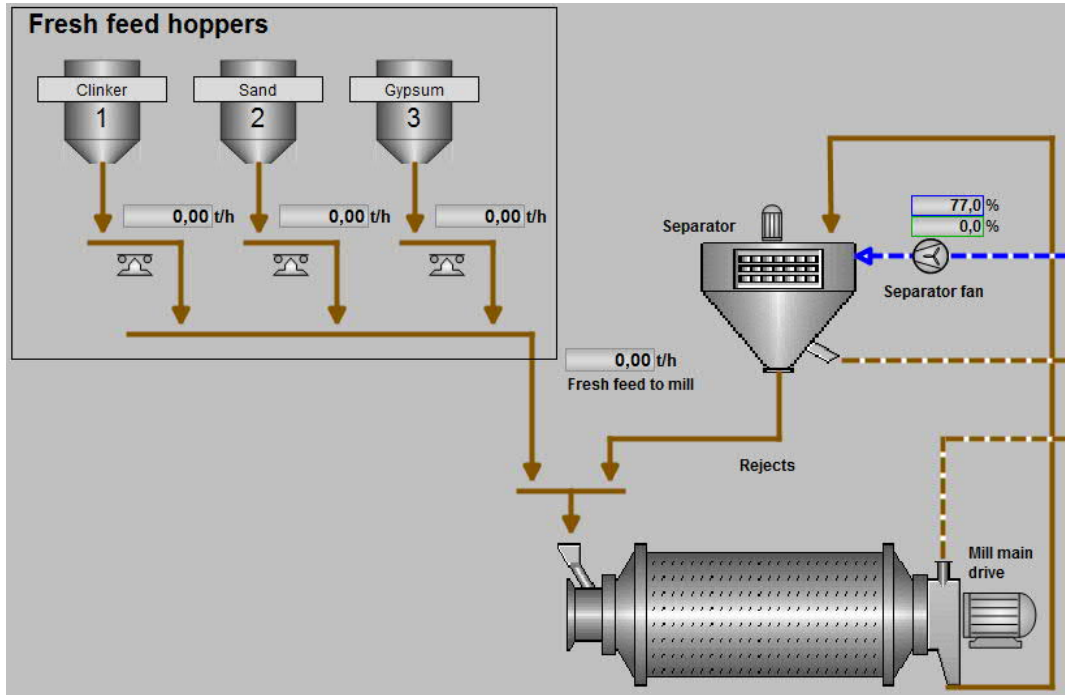
During the CEMAT Installation a number of template pictures are provided, which contain a selection of block icons for CEMAT MinAS Objects. These block icons are examples and can be customized according the the design criteria of the customer.

In accordance with the representation type the block icon can contain the following information:

- Status display of the AS module (Symbol)
- Plant identification (TagName)
- Setpoint, actual value
- Annunciation / operating status display

CEMAT MinAS block icons for general use can be found in default template picture C_@PCS7Typicals_CemV9_001.pdl

CEMAT MinAS block icons for SPC functions can be found in the default template picture C_@PCS7Typicals_CemV9_SPC.pdl

Design criteria for the CEMAT Block Icons

Replacement of Standard emf-files by CEMAT

Some of the APL-Symbols are overwritten during the CEMAT installation (because in CEMAT a different representation is used).

For details see Engineering Manual, chapter 08_OS_Engineering, General design of CEMAT block icons.

Block icons for drive functions

All drive functions (C_DRV_1D, C_DRV_2D, C_VALVE and C_DAMPER) are represented by a symbol for status display. The kind of symbol can be adjusted according to the customer design criteria.

Mouse-klick options:
Via a left mouse-click on the drive block icon the corresponding standard faceplate opens.
Via a right mouse-click on drive the block icon the rapid stop window opens (if the function is enabled).
Ctrl + left mouse-click opens the APL Operator Trend Control and adds the "Drive running" information (or "Damper position" information) to the selection.

The status of the drives is indicated with different colors according to the following definition:

Display of C_DRV_1D

Status	Display	Symbol	Basic Picture / Flash Picture
fault not acknowledged	red flashing		C_Drv_err_001.emf / C_Drv_off_blank_001.emf
fault	red		C_Drv_err_001.emf
Start up	green flashing		C_Drv_off_blank_001.emf C_Drv_on_001.emf
running	green		C_Drv_on_001.emf
Shut down	grey flashing		C_Drv_off_001.emf / C_Drv_off_blank_001.emf
Stopped	grey		C_Drv_off_001.emf
Stopped and interlocked	grey		C_Drv_off_001.emf
Out of Service	grey		C_Drv_notready_001.emf

Additional information such as Tagname, Mode, Alarmsymbol, external Warning, Simulation, Maintenance status, Info and Analog value can be attached to the block icon. The Tagname will be displayed only on demand.
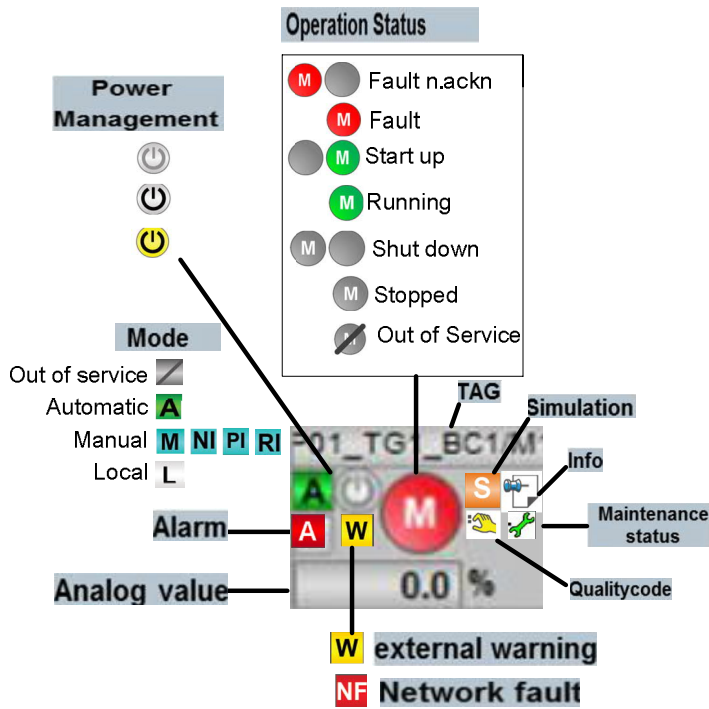
Example for Block Icons with additional information (Type 21 - 24 of C_DRV_1D, C_DRV_2D C_DAMPER and C_VALVE):
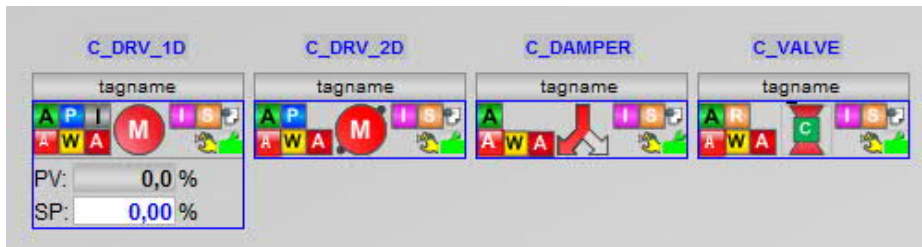
Display of C_DRV_2D

Status	Display	Symbol	Basic Picture / Flash Picture
fault not acknowledged	red flashing		C_Drv_err_001.emf / C_Drv_off_blank_001.emf
fault	red		C_Drv_err_001.emf
Start up D1	green flashing		C_Drv2_off_left_001.emf / C_Drv_2_on_left_001.emf
running D1	green		C_Drv2_on_left_001.emf
Start up D2	green flashing		C_Drv2_off_right_001.emf / C_Drv2_on_right_001.emf
running D2	green		C_Drv2_on_right_001.emf
Shut down	gray flashing		C_Drv_off_001.emf / C_Drv_off_blank_001.emf
Stopped	grey		C_Drv_off_001.emf
Stopped and interlocked	grey		C_Drv_off_001.emf
Shut down	gray flashing		C_Drv_off_001.emf / C_Drv_off_blank_001.emf
Stopped	grey		C_Drv_off_001.emf
Stopped and interlocked	grey		C_Drv_off_001.emf
Out of Service	grey		C_Drv_notready_001.emf

Display of C_DAMPER

Description	Display	Symbol	Basic Picture / Flash Picture
fault not acknowledged	red flashing		C_Damper_err_001.bmp / C_Damper_middle_001.bmp
fault	red		C_Damper_err_001.bmpf
Start up D1 closing	green flashing		C_Damper_left_001.bmp / C_Damper_middle_001.bmp
Start up D2 / opening	green flashing		C_Damper_left_001.bmp / C_Damper_middle_001.bmp
Position D1	green		C_Damper_left_001.bmp
Position D2	green		C_Damper_right_001.bmp
Out of Service	grey		C_Damper_notready_001.emf

Display of C_VALVE

Description	Display	Symbol	Basic Picture / Flash Picture
fault not acknowledged	red flashing		C_Valve_err_90_001.emf / C_Valve_closed_90_001.emf
fault	red		C_Valve_err_90_001.emf
simulation	orange		V_Valve_simu_90_001.emf
closing	green flashing		C_Valve_closing_90_001.emf / C_Valve_closed_90_001.emf
closed	grey		C_Valve_closed_90_001.emf
opening	green flashing		C_Valve_opening_90_001.emf / C_Valve_opened_90_001.emf
open	green		C_Valve_opened_90_001.emf
Out of Service	grey		C_Valver_notready_90_001.emf

For further information and symbol adjustment see Engineering Manual, chapter 08_OS_Engineering

Block icons for control and supervision functions

Control and Supervision functions such as C_GROUP, C_ROUTE and C_SELECT are represented by the following block icons:

In the status indications the following information is given:

- Operating mode (C_GROUP)

- Starting or stopping active (C_GROUP)

- Summarizing fault indication (C_GROUP and C_ROUTE)

- Summarizing warning indication (C_GROUP and C_ROUTE)

- Selections (C_ROUTE and C_SELECT)

- Interlocking condition (C_GROUP, C_ROUTE and C_SELECT)

Mouse-klick options:
Via a left mouse-click on the block icon of C_GROUP, C_ROUTE and C_SELECT the corresponding standard faceplate opens.
Some types of block icons for C_ROUTE and C_SELECT are configured for direct control:
- left mouse click on the block icon changes the selection
- right mouse click on the block icon opens the corresponding standard faceplate.

Status Display C_GROUP

Group Status	Description	Symbol	Apl Basic Picture / Cemat Picture
Mode	local mode	L	apl_bi_local.emf
	manual mode	M	apl_bi_manual.emf
	manual mode	A	apl_bi_automatic.emf
Operation	startup green / flashing	⬆	C_bi_up_green_001.emf
	startup white / flashing	⬆	C_bi_up_white_001.emf
	operation	O	apl_bi_on.emf
	shut down / flashing	⬇	C_bi_down_green_001.emf
Fault	static fault	A	apl_bi_alarm.emf
	dynamic fault / flashing	A	apl_bi_alarm.emf
Warning	warning	W	C_bi_warning.emf
	dynamic warn/ flashing	W	C_bi_warning.emf
Interlock	blocked	⏻	C_bi_PM_blocked.emf

	stopped by interl. / flashing	I	C_bi_interlocked.emf
	interlocking	I	C_bi_interlocked.emf
	Interlock bypassed	I	C_bi_bypassed_interlock.emf
Standby	permission for auto start	S	C_bi_group_AS_Start_Interlock.emf
Bypass	Interlock bypassed	B	Apl_bi_bypassed.emf

Status Display C_ROUTE

Route Status	Description	Symbol	Apl Basic Picture / Cemat Picture
Locked	locked	L	C_bi_locked_cyan.emf
Operation	deselected	D	C_bi_deselected_white.emf
	preselected	P	C_bi_preselected_green.emf
	Selected and not preselected	S	C_bi_selected_white.emf
	selected	S	C_bi_selected_green.emf
	operation	O	apl_bi_on.emf
Fault	static fault	A	apl_bi_alarm.emf
	dynamic fault / flashing	A	apl_bi_alarm.emf
Warning	warning	W	C_bi_warning.emf
	dynamic warn/ flashing	W	C_bi_warning.emf
Interlock	interlocked	I	C_bi_interlocked.emf
Bypass	Interlock bypassed	B	Apl_bi_bypassed.emf

Status Display C_SELECT

Route Status	Description	Symbol	Apl Basic Picture / Cemat Picture
Operation	deselected	S	C_bi_deselected_white.emf
	selected	S	C_bi_selected_green.emf
Interlock	interlocked	I	C_bi_interlocked.emf

Reference Manual System MinAS

For further information and symbol adjustment see Engineering Manual, chapter 08_OS_Engineering

Block icons for binary process signals

Blocks for C_ANNUNC, C_ANNUN8, C_PROFB and C_PROFBx are represented in the process picture by a symbol for status display (Signal ok, Warning, Fault). The kind of symbol can be adjusted according to the customer's design criteria.

Mouse-klick options:
Via a left mouse-click on the block icon of the binary process signal the corresponding standard faceplate opens.

The status of the binary process signal is indicated with different colors according to the following definition:

Status Display C_ANNUNC

Status	Display	Symbol	Basic Picture / Flash Picture
fault	red		C_Annu_err_001.emf
fault not acknowledged	red flashing		C_Annu_err_001.emf / C_Annu_off_001.emf
on	green		C_Annu_on_001.emf
off	grey		C_Annu_off_001.emf
warning	yellow		C_Annu_warn_001.emf
warning not acknowledged	yellow flashing		C_Annu_warn_001.emf / C_Annu_off_001.emf
OoS	grey		C_Annu_OoS_001.emf

Status Display C_ANNUN8

Status	Display	Symbol	Basic Picture / Flash Picture
fault	red		C_Annu_err_001.emf
fault not acknowledged	red flashing		C_Annu_err_001.emf / C_Annu_off_001.emf
warning	yellow		C_Annu_warn_001.emf
warning not acknowledged	yellow flashing		C_Annu_warn_001.emf / C_Annu_off_001.emf
off	grey		C_Annu_off_001.emf
OoS	grey		C_Annu_OoS_001.emf

Status Display C_PROFB, C_PROFBx

Status	Display	Symbol	Basic Picture / Flash Picture
fault	red		C_Annu_err_001.emf
fault not acknowledged	red flashing		C_Annu_err_001.emf / C_Annu_off_001.emf
on	green		C_Annu_on_001.emf
off	grey		C_Annu_off_001.emf
warning	yellow		C_Annu_warn_001.emf
warning not acknowledged	yellow flashing		C_Annu_warn_001.emf / C_Annu_off_001.emf
OoS	grey		C_Annu_OoS_001.emf

For further information and symbol adjustment see Engineering Manual, chapter 08_OS_Engineering

Block icons for analog process signals

The block icon for C_MEASUR shows the actual measuring value, the dimension and eventual limit violations (color change).

23,00 %
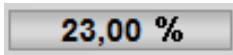
Mouse-klick options:
Via a left mouse-click on the block icon of C_MEASUR the corresponding standard faceplate opens.
Via a right mouse-click on the block icon C_MEASUR the quick trend view opens.
Ctrl + left mouse-click opens the APL Operator Trend Control and adds the value to the selection.

The following colors are used to indicate the status of the measure:

White/ gray	Measuring Value ok
Yellow	Warning
Red	Fault
Blue	Measuring Value bypassed

Additional information such as Tagname, Mode, Bad Quality (Driver) can be attached to the block icon. The Tagname will be displayed only on demand.

tagname	tagname	tagname		
0,00 ...	0,00 ...	0,00 ...	0,00 ...	0,00 ...
1	2	3	4	5
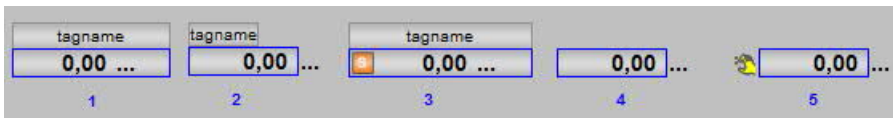
Block Icon @C_MEASUR/21 shows a bar graph:

ME1		
	Limit indicators	
	AlarmHigh	inactive – gray, active – red
	WarningHigh	inactive – gray, active – yellow
	ToleranceHH	inactive – gray, active – blue
	ToleranceH	inactive – gray, active – blue

	WorkingRange	

	ToleranceL	inactive – gray, active – blue
	ToleranceLL	inactive – gray, active – blue
	WarningLow	inactive – gray, active – yellow
	AlarmLow	inactive – gray, active – red
	PV - process value	
	UNIT	

82,00 GradC

Block icons for multiple measurements (CematSpider)

Between 3 and 10 measurement values can be displayed in the form of a polygon with appropriate number of vertices.
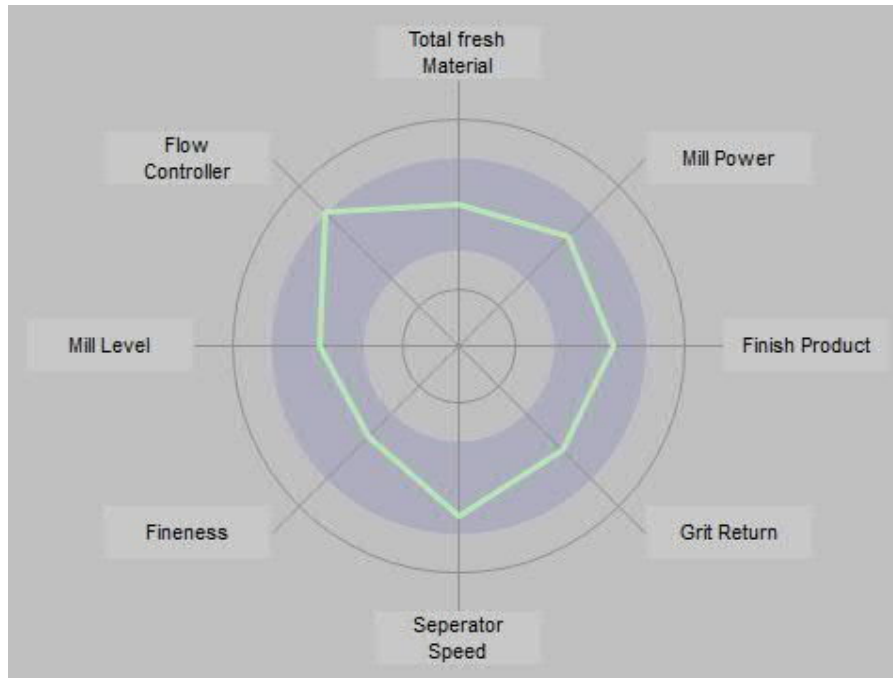
Block icons for Status display function

For the status display function C_STAT8 the following block icon exists:

In the status indications the following information is given:

- Status of Signal 1 to Signal 8
- Status "running"
- Status "fault"
- Status "warning"

Mouse-klick options:
Via a left mouse-click on the block icon of C_STAT8 the corresponding standard faceplate opens.

The status is indicated with different colors according to the following definition:

Status Display C_STAT8

Status	Display	Symbol	Basic Picture / Flash Picture
InSig1 – InSig8 = FALSE	grey		C_STAT8_1_false_001.emf C_STAT8_2_false_001.emf C_STAT8_3_false_001.emf C_STAT8_4_false_001.emf C_STAT8_5_false_001.emf C_STAT8_6_false_001.emf C_STAT8_7_false_001.emf C_STAT8_8_false_001.emf
InSig1 – InSig8 = FALSE	green		C_STAT8_1_true_001.emf C_STAT8_2_true_001.emf C_STAT8_3_true_001.emf C_STAT8_4_true_001.emf C_STAT8_5_true_001.emf C_STAT8_6_true_001.emf C_STAT8_7_true_001.emf C_STAT8_8_true_001.emf
fault	red	A	C_STAT8_Fault_001.emf
warning	yellow	W	C_STAT8_Warning_001.emf
running	green	O	C_STAT8_Running_001.emf
off	grey		C_STAT8_Off_001.emf

Block icons for controller functions

For the block PIDConL beside the block icons from PCS 7 AP Library two additional block icons have been created for CEMAT MinAS.
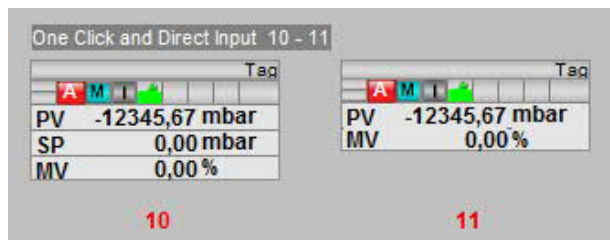
Below the status information it shows the process value, the Setpoint, and the Output (Manipulated Value). The Tagname will be displayed only on demand.

Mouse-klick options:
Via a left mouse-click on the block icon of PIDConL the standard faceplate opens.
Via a left mouse-click on the Setpoint or Output value the values can be entered directly.
Ctrl + left mouse-click opens the APL Operator Trend Control and adds the controller values to the selection.

Block icons for other CEMAT MinAS functions

For all other CEMAT MinAS block types block icons exist as well but are not mentioned in detail in this manual. You will find them in template picture C_@PCS7Typicals_CemV9_001.pdl and most of them just have faceplate-open function and do not need further explanation.

Mouse-klick options:
Via a left mouse-click on the block icon the corresponding standard faceplate opens.

Bitmaps

A wide range of bitmaps for Minerals Applications are available in the Standard Directory D:\CEMAT_CS\Bitmaps\ and can be used for the design of the Process pictures.
The bitmaps must be copied into the <WinCC-Project directory>\GraCS of the Server Project.
The distribution to other OS Projects can be done with a batch file.

Under D:\CEMAT_CS\Bitmaps\CEM_DRAFTS you find Bitmaps and Example Pictures from existing plants.

Under D:\CEMAT_CS\AddOn\CEM_EMF you find the Visio-File C_Icons_emf_001.vsd, which was used in order to create the symbols for the block icons.
This file can be used as an example in order to create additional symbols for block icons.

Buttons for General CEMAT Functions

The template picture C_@PCS7Typicals_CemV9_001.pdl contains general CEMAT Functions. The buttons can be inserted in any process picture (e. g. in the system overview) in order to call superordinate functions.

Zoom buttons and indication

Via the zoom buttons the size of the faceplates can be adjusted. The actual zoom factor can be displayed.
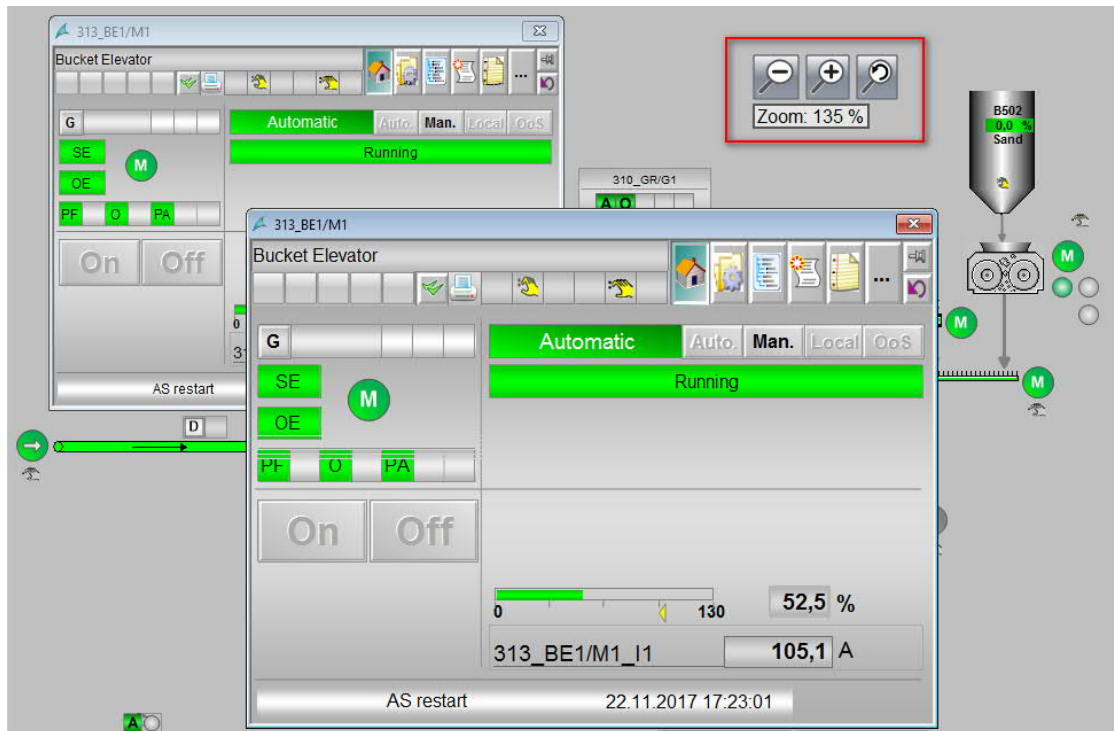
Call of the Maintenance Overview

Via button "C_BtMaintenanceList" the Maintenance Overview will open:
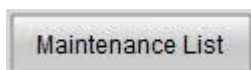
Close all open windows

Button "C_BtCloseAllFaceplates" closes all the open faceplates at a time.

Faceplates

A single mouse-click on the block icon opens the standard faceplate of the object. The faceplate provides detailed information and allows control and monitoring of the associated AS module.

The Faceplate is divided in general sections:
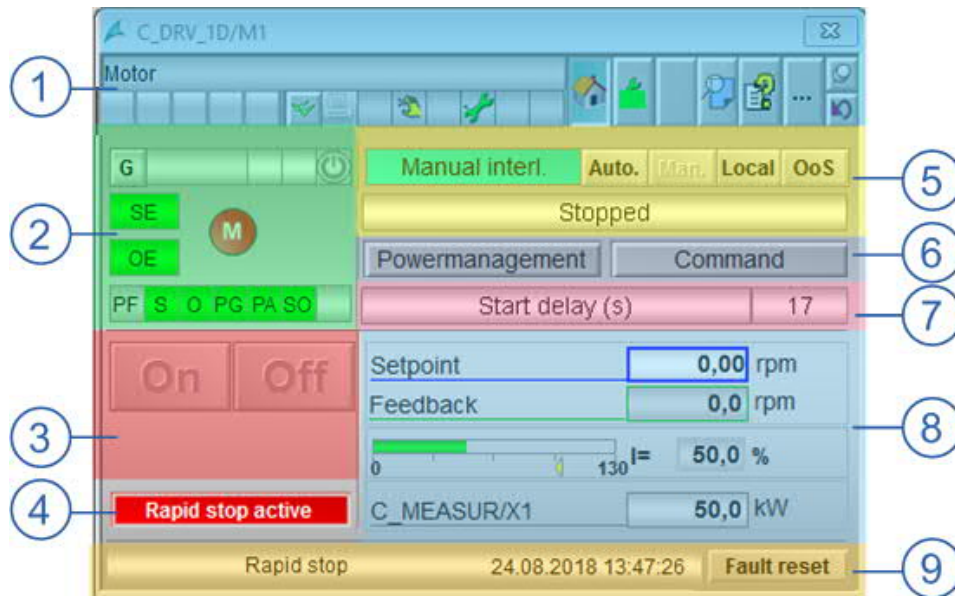
(1) *Displays and operator controls*
with Tag/ Comment/ Alarm symbols/ Status and Toolbar

(2) *Status information and Links to related Objects*
Link function to Group and other connected modules
Status and Link of Interlocks and Object Symbol status itself

(3) *Single step operation in manual Mode*
Manual mode direct commands

(4) *Rapid stop indication*
The "Software Rapid stop" button is shown.

(5) *Mode selection and status text*
Operating mode selection and display of Status text

(6) *Multi-Step operator commands (optional)*
Button for Power management and operation in Manual mode with 3-Step dialog

(7) *actual timer name and value*
active timer name and reverse counted value

(8) *Analog values*
if released or connected
- the setpoint-, and feedback -value is shown
- current or power bar with value is shown
- additional Analog value is shown

(9) *Last stop reason and Object Fault reset*
if the function is released in Feature word 2
- the last stop reason will be shown with Text and Time
- button "Fault reset" button is activated

For detail Information please follow the next pages.

ad 1) Detail Information to "Displays and operator controls":
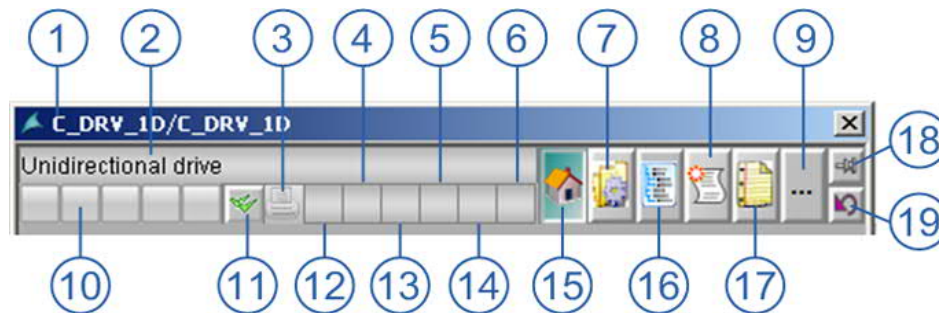
(1) Tag of the object.

(2) Comment of the object.

(3) Print Dialog

(4) Worst signal status

Hex	Sym.	comment/ kommentar	Prio
80H		good or unknown / Gut oder unbekannt	8
60H		simulated / Simulation	0
00H		bad or not usable / Schlecht, ungültiger Wert	1
44H	123	Last valid value/ letzter gültiger Wert	3
48H	123	Substitute value/ Ersatzwert	4
28H		bad process related / Schlecht, prozessbedingt	2
68H		uncertain / Unsicher, gerätebedingt	5
78H		uncertain process related / Unsicher, prozessbedingt	6
A4H		maintenance request / Wartungsanforderung	7

(5) Maintenance activated and Maintenance Alarm

(6) Information text available for this Object

(7) Open Diagnosis Dialog (RMK with separate Dialog)

(8) Open Message Dialog (RMK with separate Dialog)

(9) Change Toolbar Level (see next page)

(10) The message status (Group display):

Alarm, Warning, Tolerances, Faults, and Operator prompts

(11) If there is an alarm in the module, it can be acknowledged using this button.

(12) Empty

(13) User right "5" missing

(14) Process Feedback Signal in simulation mode

(15) Open Standard Dialog (RMK with separate Dialog)

(16) Open Objectlist Dialog (RMK with separate Dialog)

(17) Open Information Dialog (RMK with separate Dialog)

(18) Fix the Dialog on top

(19) back to the Flow mimic (block icon)

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Overview of CEMAT Object related Toolbars

Open Standard Dialog

Open Diagnosis Dialog

Open Object browser Dialog

Open Status or Message Dialog

Open Information Dialog

Open Maintenance Dialog.

Open Message Dialog/ Calibration

Open Preset Dialog

Open Object Help file
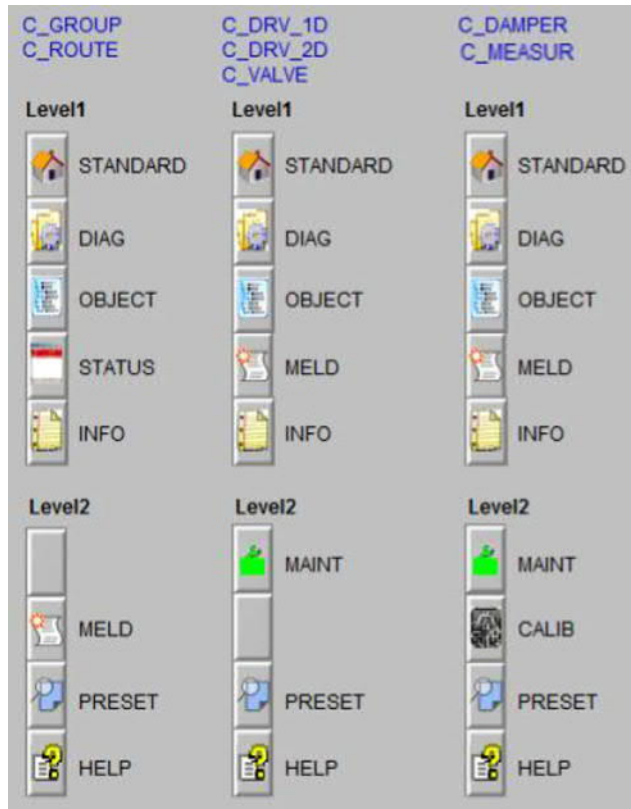
Open Standard Dialog

Open Diagnosis Dialog

Empty

Open Message Dialog

Open Information Dialog

Open Maintenance Dialog

Empty

Open Preset Dialog

Open Object Help file
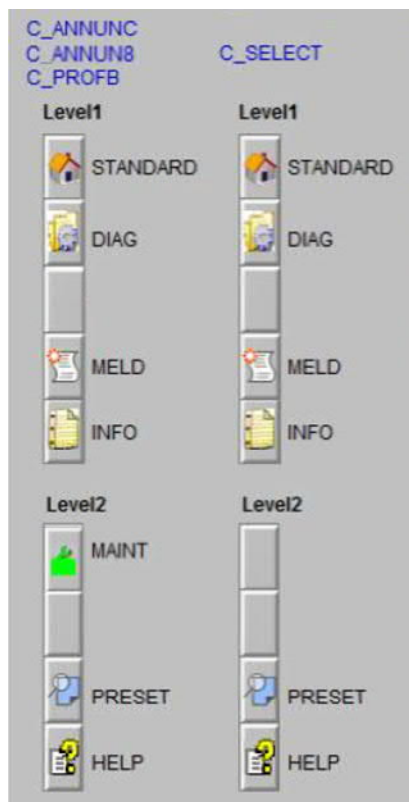
ad 2) Detail Information to "Status information and Link to related Objects ":
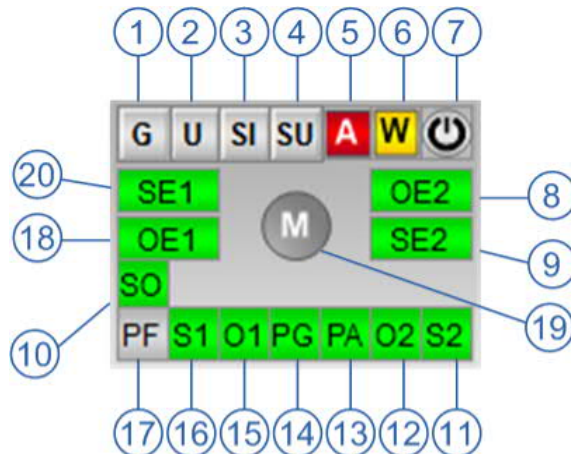
(1) open the Group faceplate of the first group
(2) open the Faceplate of connected "user defined Object"
(3) open the Faceplate of connected SIMOCODE
(4) open the Faceplate of connected Subcontrol

(5) Summarizing Fault

A	Fault from related Objects

(6) Summarizing Warning

W	Warning from the related Objects
NF	own Network fault

(7) Indication of **P**ower **M**anagement Status

PM connected and involved

PM for this object is released

PM blocked or has switched of the object

(9,20) Essential Start up interlock (D1,D2) status indication and link to the connected Object
(8,18) Essential operating interlock (D1,D2) status indication and link to the connected Object
(11,16) Start up interlock (D1,D2) status indication and link to the connected Object
(12,15) Operating interlock (D1,D2) status indication and link to the connected Object
(13,14) Protection interlocks General / only Remote status indication
(10) Stop interlock status indication and link to the connected Object
(17) Process Feedback Signal status indication and link to the connected Object
(19) Object Symbol indication (status color definition see "Block Icon")

Presentation of Interlock Interfaces:
- If the Interface is not connected the Symbol will not be shown.
- If it is connected to another Object (Interlock/ Drive…), a Jump to this Object is possible with "mouse click" onto the Symbol.
- Status color definition:
  green = Signal ok
  violet = not ready
  gray = Signal = "0" or not used
  red = faulty

Process Feedback shows only the status

PF	"off" = grey
PF	"on" = green

"Startup-" or "essential startup Interlock"

S	"green" = the interlock has "1" status
S	"gray" = the interlock has "0" status

"Operation-" or "essential Operation Interlock"

O	"green" = the interlock has "1" status, object is not interlocked
O	"gray" = the interlock has "0" status, the drive is interlocked

"Protection Interlock general"

PG	"green" = the interlock has "1" status, all ok
PG	"gray" = the interlock has "0" status, object is stopped and faulty

"Protection Interlock automatic and manual"

PA	"green" the interlock has "1" status
PA	"grey = the interlock has "0" status

"Switch-off Interlock automatic and manual"

SO	"green" the interlock has "1" status
SO	"grey = the interlock has "0" status

Example for Object Status Symbol:

Depending of Object Status the corresponding colored Symbol is shown. The status color definition you will find on chapter "Block Icon".

Drive faulty	Drive stopped in sporadic mode	Drive in Out of Service
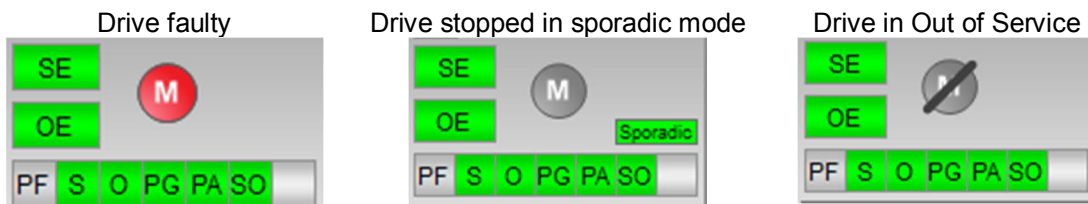
ad 3) Detail Information to "direct Object operation in manual Mode"

Operation commands like start/stop/select/deselect can only be given if the operator has the corresponding permission. Normal operation commands like "start" and "stop" of a group or a device require permission "Operator control".

The default operation option in CEMAT MinAS is the "single step operation", because it is the fastest way. Settings can be modified via OS Permissions of the block.

Single step operation

If the "operations" should be done "with one Mouse click", the OS Permission Bit 8 has to be set to "1". With this setting the command buttons in the standard faceplate get visible.

With one of the selected "Manual" modes and depending "OS Permission Log Bits" the direct Command Buttons are ready to be operated. (Black colored Text)

For example:

Drive "On" is released   Drive start to Direction 1 or Direction 2 is released
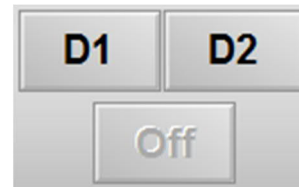
Drive "Off" is locked   "Off" is locked

With "Mouse click" on the Button, a Command is send to the Object.
For each operation an "Operator Message is generated which includes the User name, the ToolTippText and the button text information.

	Date	Time	Tagname	Event	FCL	Status	Info
1	22/08/2018	16:48:39	TG1_BC1/M1	Cemat01: Drive Stop command Off new = 1 old = 0		C	
2	22/08/2018	16:48:13	TG1_BC1/M1	Cemat01: Drive Start command On new = 1 old = 0		C	

ad 4) Detail Information to "Rapid stop indication"

With "right mouse click" **(2)** on the Drive Symbol the single step operation dialog **(1)** is shown.
A mouse click on the "Stop button" **(4)** will activate the "Rapid stop".
A running object will be stopped and interlocked to start again. The symbol changed to "fault" and shows the red "R" **(3)**

If the "fix it" button **(6)** was pressed, the dialog will be still open after pressing the "STOP" button.**(4)**

With the "Cancel" button **(5)** the dialog will be closed.
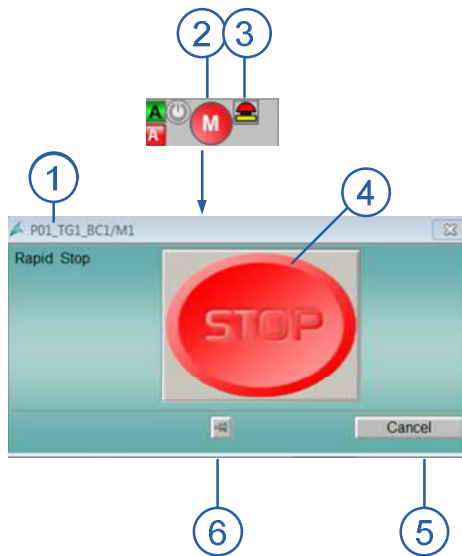
Inside the Faceplate an additional button "Rapid stop active" **(1)** is shown together with the Text "fault rapid stop" **(6)**.

A Click on the "Rapid stop active" button will open the 3 step operation dialog with indication of "Rapid stop active" **(2)**

With pressing the "reset Stop" button **(3)** following by the click on the "Ok" button the Rapid stop will be reset.

If the "fix it" button **(4)** was pressed, the dialog will be still open after pressing the "Reset Stop" button.

With the "Cancel" button **(5)** the dialog will be closed.
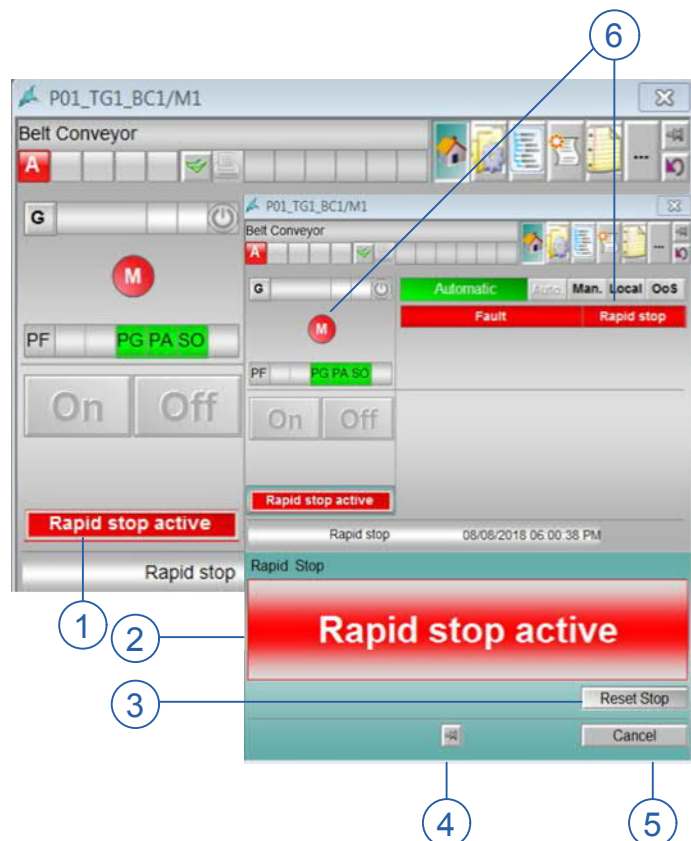
PLC Sequence test mode

If the PLC is switched to "Sequence test mode, it is indicated in the standard faceplate of the group.
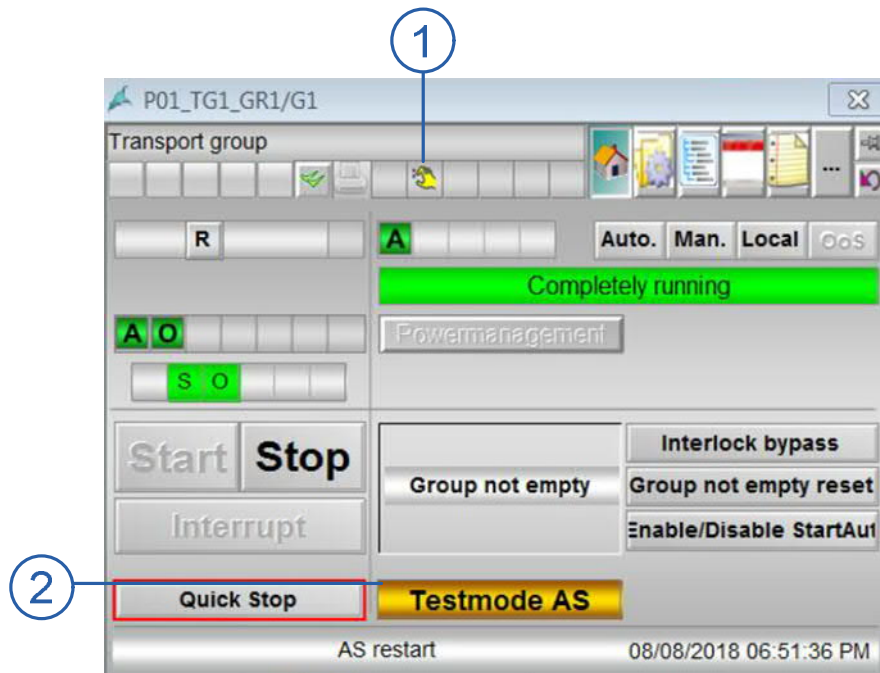
(1) The group shows that the connected blocks (drives, process feedback blocks, annunciations and measurements) are switched into internal simulation

(2) In addition the group displays "Testmode AS", in order to show that the system is not functioning "real".

In the sequence test mode the output for contactor on commands are never set and the contactor feedback signals and process feedback signals of the drives are simulated internally.

Digital and analog process signals as well as drive inputs (MCC or Field signals) can be simulated via the Runtime System (via the Diagnosis Window).

See Sequence test mode at the end of this document.

ad 5) Detail Information to "Mode selection and Object status"

Mode change is only possible if the operator has the corresponding permission. Mode change to Automatic mode, Manual interlocked mode and Local mode requires permission "Operator control". For less interlocked Manual modes the permission for "System Operations" is required (see chapter "Operator authorization").

The default mode change option in CEMAT MinAS is the "single step mode change", because it is the fastest way. Settings can be modified via OS Permissions of the block.

Single step mode change

If the "Mode change" should be done "with one Mouse click", the OS Permission Bit 18 has to be set to "1".

With this permission the Standard Dialog shows the mode change buttons for "Auto." **(2)**, "Man." **(3)**, "Local" **(4)** and "OoS" **(5)** as shown below.
The actual mode is indicated beside the mode change buttons **(1)**.
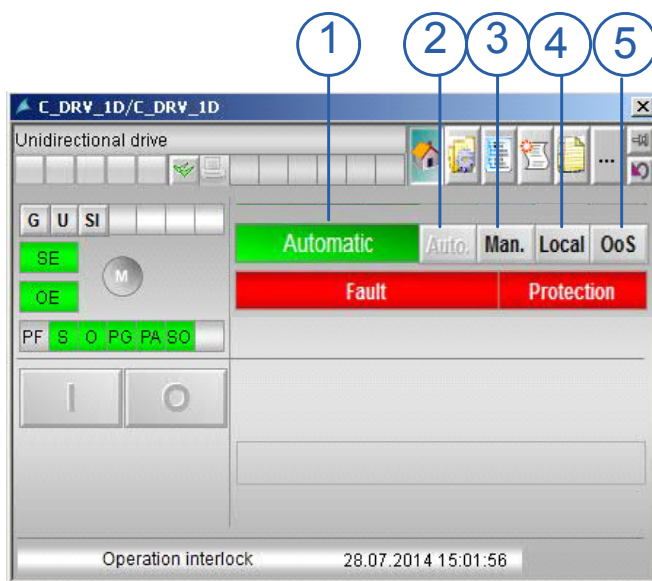
If there is more than one "Manual Mode" released an additional choice is needed and and the mode change can not be carried out directly. The Standard Mode Execution Window will be opened.
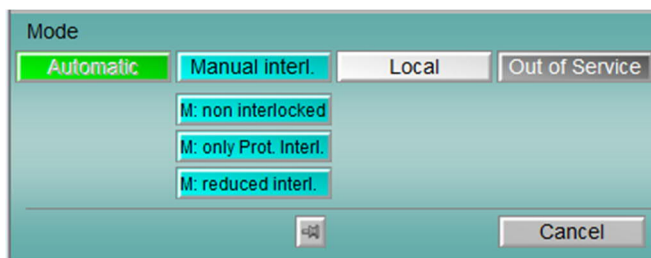
Additional selections are required and must be confirmed.

Multiple step operation

If you prefer using a mode change "with confirmation", OS Permission Bit 18 must be set to "0".

The CEMAT Standard Faceplate is represented as follows:
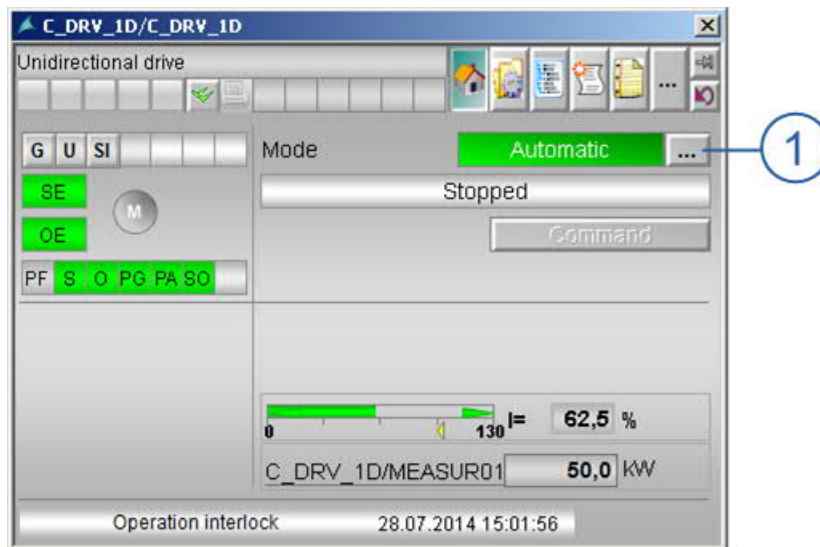
(1) The mouse cursor changes when you place it over the following button:

The mouse pointer now looks as follows:

When you click on the button with the mouse pointer, the faceplate is expanded by the Mode Execution dialog, which asks for further actions (and confirmation).

PCS 7 settings for the multiple step operation

Internal tag @APLCommandExecutionSteps in the Tag Management of the WinCC Explorer can be used in order to specify if command, mode change or values are to be changed in **two** or **three** steps.

Follow the steps outlined below:

Double-click on the internal tag @APLCommandExecutionSteps

Change the start value to 2 or 3 in the Limits/Reporting tab.

Start value = 2: It is no longer necessary to confirm the selected button or value in the Execution faceplate by clicking "OK"; commands or values are applied immediately.

Start value = 3: Each Command or value change in the Execution faceplate (with the exception of those for direct control) needs to be confirmed with "OK".

After the CEMAT Standard faceplate expands, you will see the field for changing the operating mode, for example.
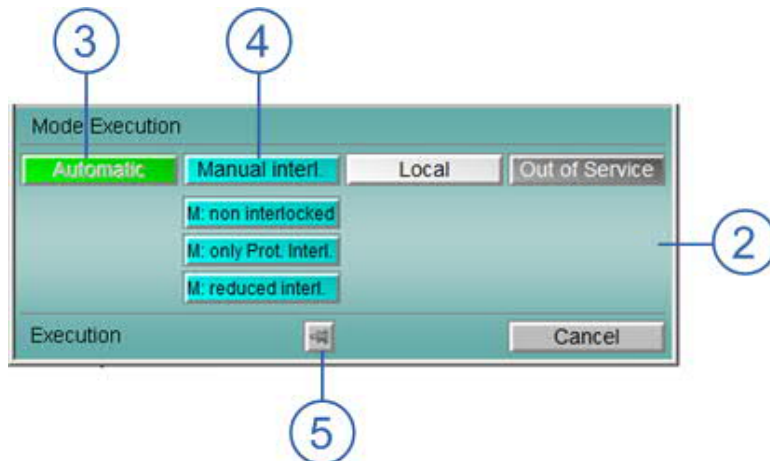
(2) Field for changing the operating mode, operating state etc. This example describes changing the operating mode.

(3) The text on this button is gray. You cannot select this operating mode to one of the following reasons:

The Operator control permission for this operating mode is missing.

or

The operating mode is already selected at this time.

or

Due to the technology, you cannot switch from the operating mode currently set and the desired operating mode. (E.g. switching device which is running in automatic mode into a reduced interlocked manual mode or into local mode is not permitted).

How to change the operating mode:

Click one of the selectable buttons in the operating mode field.

Confirm your selection by clicking "OK".

The mode change becomes activated and the new mode is shown in the top line.
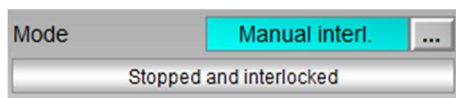
If you do not want to apply your selection, click "Cancel".

After clicking the "OK" or "Cancel" button, the faceplate is reduced again to its original form.

Multiple operations

If the operating window is not to close after the confirmation of a command, it can be "attached". The following button **(5)** is located below the operating window for this purpose:

    Operating window is closed after the value is applied

    Operating window remains open after the value is applied

Operation Messages

For each mode change operation an "Operator Message is generated which includes the User name and the button text information:

	Date	Time	Tagname	Event	FCL	Status	Info	Comment
1	22/08/2018	18:19:20	313_BE1/M1	Cemat01: Manual interl. new = 1 old = 0		C		X
2	22/08/2018	18:19:15	313_BE1/M1	Cemat01: Out of Service new = 1 old = 0		C		X
3	22/08/2018	18:19:10	313_BE1/M1	Cemat01: Automatic new = 1 old = 0		C		X
4	22/08/2018	18:19:06	313_BE1/M1	Cemat01: Local new = 1 old = 0		C		X
5	22/08/2018	18:19:03	313_BE1/M1	Cemat01: Manual interl. new = 1 old = 0		C		X

Status Text displays:

In addition to the symbol of the device the status is displayed below the mode in form of a one line status text.
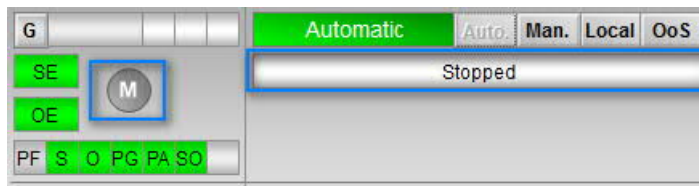
The following status texts are indicated for the drives:

Status Text line of C_DRV_1D   Status Text line of C_DRV_2D

C_DRV_1D
Start up
Running
Shut down
Stopped
Stopped and interlocked
Warning
Warning not ackn.
Fault not acknow.
Fault
Network fault

C_DRV_2D
Start up direction 1
Start up direction 2
Running direction 1
Running direction 2
Shut down direction 1
Shut down direction 2
Stopped
Stopped and interlocked
Warning
Warning not ackn.
Fault not acknow.
Fault
Network fault

Status Text line of C_DAMPER   Status Text line of C_VALVE

C_DAMPER
Moving to limit position 1
Moving to limit position 2
Limit position 1
Limit position 2
Stopped
Stopped and interlocked
Limit position 1 and interlocked
Limit position 2 and interlocked
No limit position
Warning
Warning not ackn.
Warning limit position 1
Warning limit position 2
Fault not acknow.
Fault
Fault limit position 1
Fault limit position 2
Network fault

C_VALVE
Moving to limit position 1
Limit position 1
Moving to limit position 2
Limit position 2
Moving to limit position 1
Limit position 1
Moving to limit position 2
Limit position 2
Limit position 1 and interlocked
Limit position 2 and interlocked
Warning
Warning not ackn.
Fault not acknow.
Fault
Network fault

ad 6) *Detail Information to "Three Step operator commands"*

Below the status text display the buttons for three step operator commands are displayed. For drive blocks you will find here the Power Management button (if configured) and the Command button (in case the Single step operation is deselected).

Mode	Manual interl.	...
Stopped		
Powermanagement	Command	

Via these buttons, if the Permission is granted, the corresponding "Command execution Dialogs" can be opened.

Power management release

A click on button "Powermanagement" opens the following dialog (in the example below variable @APLCommandExecutionSteps = 3):

Powermanagement			
	PM rel. on/off		
Execution	◄◙	OK	Cancel
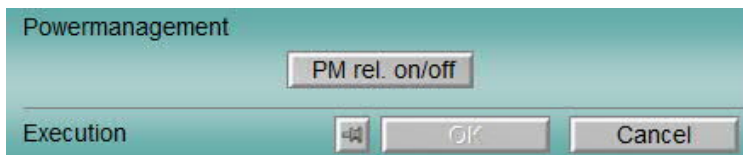
With a second click on the button "PM rel.on/off" followed by a third click on "Ok" it is possible to set or reset the release of "Power management Control" via Module Interface (PMblock).

At the same time an "Operator Message" with the button Text is generated in the message System.

	Date	Time	Tagname	Event	FCL	Status	Info
1	22/08/2018	19:33:01	C_DRV_2D/M1	Cemat01: PM rel. on/off new = 1 old = 0		C	
2	22/08/2018	19:32:58	C_DRV_2D/M1	Cemat01: PM rel. on/off new = 0 old = 1		C	

Operations

A click on button "Commands" opens the Command execution dialog

Manual mode command			
On		Off	
Execution	◄◙	OK	Cancel

With a second click on the button "On", followed by a third click on "Ok" it is possible to start the Drive in "Manual mode".

Or, if it is possible, with a second click on the button "Off", followed by a third click on "Ok" it is possible to stop the Drive in "Manual mode".

At the same time an "Operator Message" with the button Text is generated in the message System.

	Date	Time	Tagname	Event	FCL	Status	Info	Comment
1	22/08/2018	18:19:20	313_BE1/M1	Cemat01: Manual interl. new = 1 old = 0		C		X
2	22/08/2018	18:19:15	313_BE1/M1	Cemat01: Out of Service new = 1 old = 0		C		X
3	22/08/2018	18:19:10	313_BE1/M1	Cemat01: Automatic new = 1 old = 0		C		X
4	22/08/2018	18:19:06	313_BE1/M1	Cemat01: Local new = 1 old = 0		C		X
5	22/08/2018	18:19:03	313_BE1/M1	Cemat01: Manual interl. new = 1 old = 0		C		X

Each CEMAT MinAS Object has several internal timers for start/stop delays, supervision, etc. These timers are displayed in the standard faceplate, after the commands for starting, stopping, moving etc are given and can there be observed by the operator.

The same line is used for several timers which will be displayed the moment they are active.
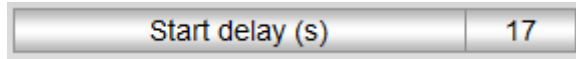
Start delay (s)	17

The following timers are displayed for the drive functions:

For drive blocks C_DRV_1D and C_DRV_2D:

- Start delay (s)
- Stop delay (s)
- Contactor feedback time (s)
- Start up warning (s)
- Waiting time for direction change (s) (only for C_DRV_2D)

For block C_DAMPER:

- Contactor feedback time (s)
- Runtime supervision (s)
- Limit switch delay time (s)
- Start up warning (s)

For block C_VALVE:

- Start delay (s)
- Stop delay (s)
- Runtime supervision (s)
- Limit switch delay time (s)
- Start up warning (s)

ad 8) Detail Information to "Analog value handling"

Example: C_DRV_1D
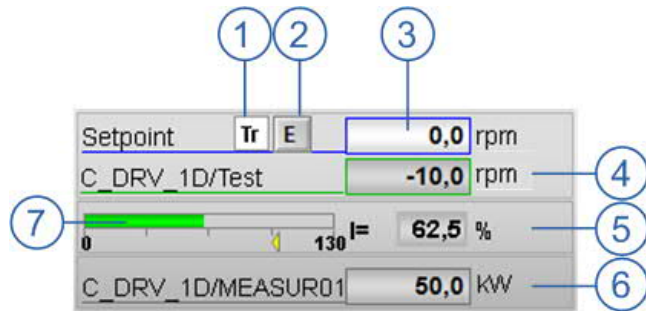
Setpoint functions: **(1-4)**

With the enable Interface signal on the AS module the Setpoint input function is activated (visible).The button for **(2)** external Setpoint, the display of the **(3)** actual Setpoint (input field), and the **(4)** Process value is shown with the associated units.

The Setpoint can either be entered via Input field ore as an external Setpoint. If the external Setpoint is connected and enabled the button "E" is blue and with click on it, the Faceplate of the external Object will be shown.
If also the Setpoint tracking is on, the external Setpoint value is shown in the „actual Setpoint" field. Without Setpoint tracking the OS Setpoint will be shown and the external Setpoint is only in the Diagnosis Dialog visible.
Without external Setpoint the Setpoint Input is checked for Low limit "SP_LoLim" and High limit "SP_HiLim" (see diagnosis dialog). There is no further evaluation in the drive block, the Setpoint is directly written to the output SP_Out.
With click on the "Process value" field the Faceplate of the connected Analog value will be open.

If the OS Permission Bit 27 = "1" it is possible to write the Setpoint directly into the Input field (without Execution dialog).

Current or Power functions: **(7+5)**

If a measure block for the motor current exists or a SIMOCODE is used and the function is enabled, the **(5)** percentage value of the motor current (or power) can be displayed as value and **(7)** bar. In case of a measuring value the upper limit 1 of the measure corresponds to 100% value of motor current. In the bar of the drive faceplate 0-130% are displayed.

Analog Process Value: **(6)**

If one or more measuring values are used as additional process signals of the drive (e. g. winding temperatures, bearing temperatures, power, current, etc.), these measures can be linked to the drive and will be shown as follows:
TAG and Value, Comment as Tooltip, Unit, upper and lower limits.
With click on the Value the Faceplate of C_MEASUR or C_ANA_SEL can directly be opened.

Example: C_DAMPER

Analog view with C_DAMPER in "control" mode **(7)**

The Damper Faceplate shows
always the scale begin **(1)**, scale end
(3) and set point
limit **(2)** values. The "Set point
Output value" is shown with a bar **(5)**
and value **(4)**
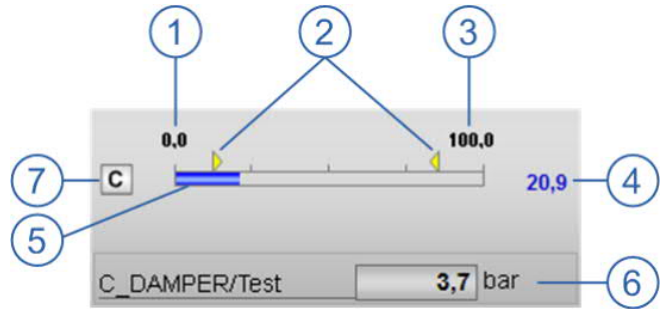
Analog Process Value: **(6/8)**
If one ore more measuring values are used as additional process signals of the damper (e. g.
power, current, etc.), these measures can be linked to the drive and will be shown as follows:
TAG and Value, Comment as Tooltip, Unit, upper and lower Limits .
With click on the Value the Faceplate of C_MEASUR or C_ANA_SEL can directly be opened.

Analog view with C_DAMPER in "inching" mode

If the C_Damper operates in
"inching mode" **(10)** then additional
information's are shown.

(6) Process value with bar and
value in %.
(7) Inching "up" button
(9) Inching "down" button
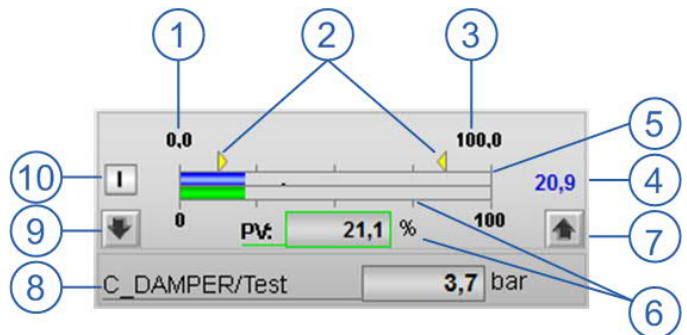
Left mouse click on the button will
modify the Set point in short steps.
Right mouse click on the button will modify the Set point in 10 times short steps.

The step value is depending from "Actuator run time", "minimum pulse length" and cycle time.

Analog view with C_DAMPER in "Positioner" mode
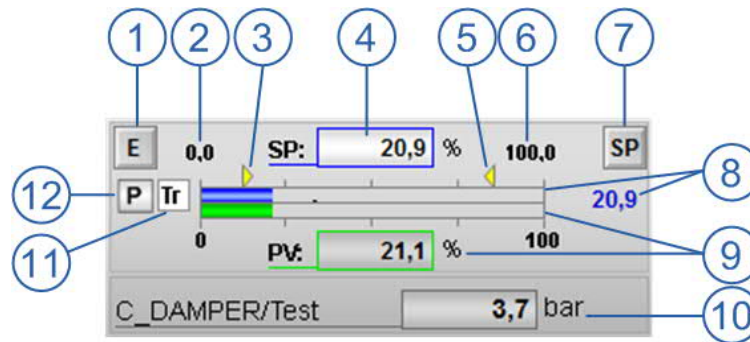
Positioning Setpoint functions: **(1-9+11+12)**
With the enable Interface signals on the AS module the "Positioner mode" **(12)** indication is shown and the Setpoint input function is activated(visible)(InchEn+PosMoEn).The button for **(1)**external Setpoint, the display of the Setpoint Operational Scale for low **(2)** and high **(6)** together with the **(4)**actual Setpoint (input field) and the **(9)** Process value is shown with the associated units.
The Setpoint can either be entered via Input field or as an external Setpoint. As internal Setpoint the Setpoint Input is checked for **(3)** Low limit "SP_LoLim" and **(5)** High limit "SP_HiLim".(see diagnosis dialog).
If the external Setpoint is connected and enabled the button "E" is blue and with click on it, the Faceplate of the external Object will be shown. If also the Setpoint tracking **(11)** is on, the external Setpoint value is shown in the „actual Setpoint" field and the field is blocked. Without Setpoint tracking the OS Setpoint will be shown and the external Setpoint is only in the Diagnosis Dialog visible. The Setpoint is directly written to the **(8)** output SP_Out and with an Object connection on that Output it is possible to follow the Value with the button "SP" **(7)**. With click on the "Process value" field **(9)** the Faceplate of the connected Analog value will be open.

If the OS Permission Bit 27 = "1" it is possible to write the Setpoint directly into the Input field. (without the green Input box on the Bottom)

Analog Process Value: **(10)**)
If one or more measuring values are used as additional process signals of the damper (e. g. power, current, etc.), these measures can be linked to the drive and will be shown as follows: TAG and Value, Comment as Tooltip, Unit, upper and lower Limits .
With click on the Value the Faceplate of C_MEASUR or C_ANA_SEL can directly be opened.

ad 9) Detail Information to "Last stop reason and Object Fault reset"

Local stop fault	28.07.2014 15:43:20	**Fault reset**	

① ②

(1) If the function "Last Stop reason" is enabled it will be displayed in the drive faceplate with date and time, independent whether it was caused by a stop command, a missing interlocking condition or a trip.

Stop reasons for drives/devices could be as follows:

Code	Stop reason	C_DRV_1D	C_DRV_2D	C_DAMPER	C_VALVE
0	AS Restart	x	x	x	x
1	Automatic stop command	x	x	x	x
2	Manual stop command	x	x	x	x
3	Local stop command	x	x	x	x
4	Quick Stop from Group	x	x		x
5	Rapid Stop	x	x	x	x
6	Stop by Mode Change	x	x	x	x
7	Stop by MonOnly	x	x	x	x
8					
9					
10	Available fault	x	x	x	x
11	Overload fault	x	x	x	x
12	Local switch fault	x	x	x	x
13	Contactor feedback fault	x			x
14	Contactor feedback D1 fault		x	x	
15	Contactor feedback D2 fault		x	x	
16	Process feedback fault	x	x		
17	Local stop fault	x	x	x	x
18	Simocode fault	x	x	x	x
19	Subcontrol fault	x	x		
20	Operation Interlock	x			x
21	Operation Interlock essential	x			x
22	Operation Interlock D1		x	x	
23	Operation Interlock essential D1		x	x	
24	Operation Interlock D2		x	x	
25	Operation Interlock essential D2		x	x	
26	Sporadic interface	x	x		x
27	Protection Interlock general	x	x		x
28	Protection Interlock auto/manual	x	x		
29	Stop by Powermanagement	x	x		
30	Move time				x
31	Position lost				x
32	Mechanical D1			x	
33	Mechanical D2			x	
34	Torque D1 fault			x	
35	Torque D2 fault			x	
36	Internal limit switch D1			x	
37	Internal limit switch D2			x	
38	Process feedback start-up fault	x	x		

Stop reasons for drives/devices could be as follows:

Code	Stop reason	C_GROUP	C_ROUTE
0	AS Restart	x	x
1	Automatic stop command	x	
2	Manual stop command	x	
20	Operation interlock	x	x
29	Stop by Powermanagement	x	
39	Stop command from control desk	x	
40	Quick Stop	x	
41	Deselection via program		x
42	Manual deselection		x
43	Interrupt	x	

(2) If the function "Fault reset" is enabled, additionally to the fault acknowledgement the drive fault must be reset via button "Fault Reset".
Fault Reset is only possible after the acknowledgement and after the signal is healthy again.

Faceplates - secondary dialog 'Diagnosis'

The diagnostic dialog is available for all object types and can be opened via button

The diagnostic dialog shows status and parameter values in the automation system for the current module. If the user has the permission for this action, the diagnostic dialog also allows the modification of the process parameters.

Example for a C_DRV_1D diagnosis display
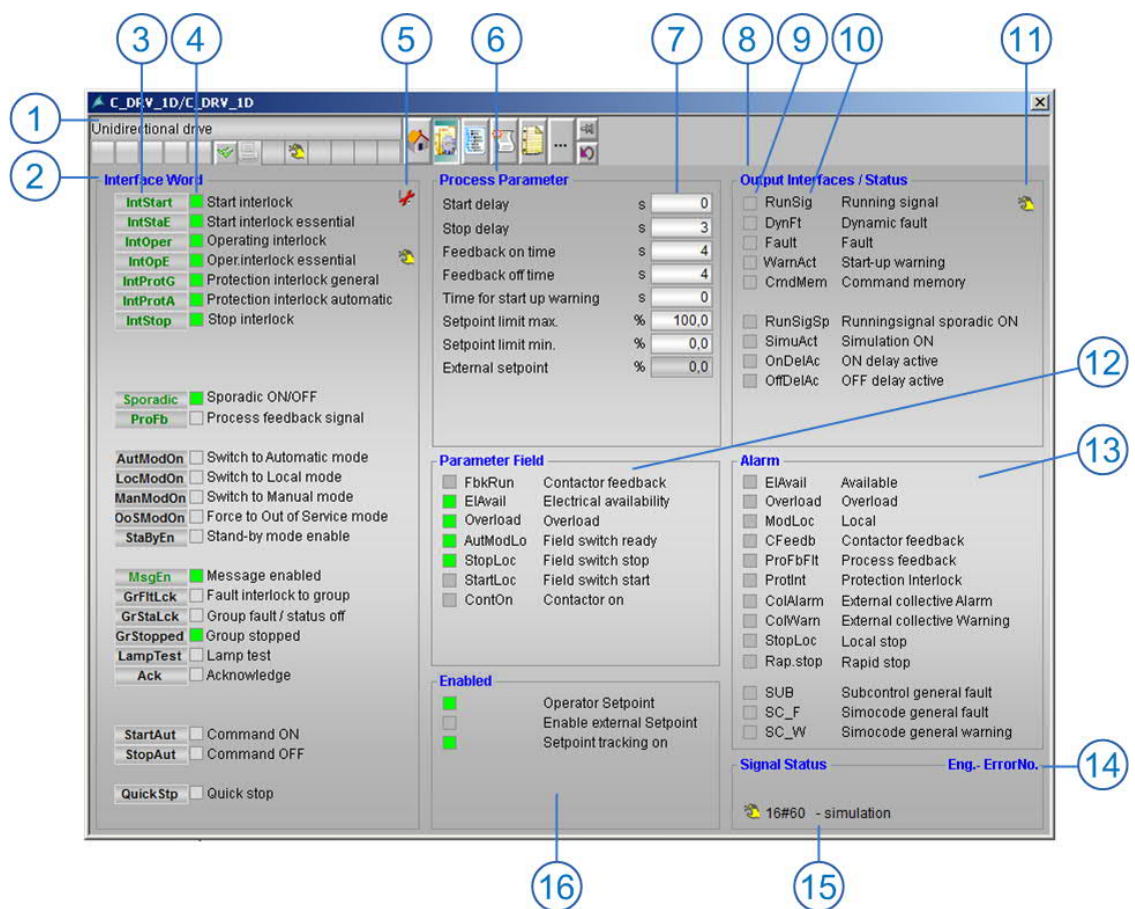
The diagnostic dialog has the following structure:

(1) *Displays and operator controls*

with Tag/ Comment/ Alarm symbols/ Status and Toolbar

(2) *Interface word display*

This displays the interface status of the AS module assigned to the picture module.
(4) The Input signal states are indicated using colored boxes.

Signal state: "0" = gray
                        "1" = green

(3) To indicate the default signal states, these interfaces are listed in "green" with a "dark gray background".

The interlocking interfaces (IntStart, IntOper, IntProt, etc.) only get visible if a connection to the input exists.

(5) *Signal Status of interlock Signals*

Quality code or bypass status

(6) *Process parameter operator control*

(7) Display of the actual process values. If the respective authorization is available the process values can be modified by click on the value itself.

(8) *Module outputs*

The **(10)** output signals, important for diagnostic evaluation, are displayed together with their **(9)** status. The running Signal output shows the worst Signal Status **(11)** of all inputs.

(12) *Parameter field*

This displays the hardware signal states of the object.

(13) *Alarm*

Colored squares indicate Alarm or Warning.

Signal status   "0" = gray (no Alarm)
                      "1" = red (Alarm)/ yellow (Warning)

(14) *Eng.-ErrorNo.*

If there is something wrong with the presetting of feature word or the connection to the Group module is missing, then a "Engineering Error Number" will be shown and the Object is forced to "Out of Service" mode.

(15) *Signal Status.*

Under "Signal Status" is shown:
- status of Interface Input " driver signal(s) bad quality
- status of Interface Input " driver signal(s) simulation
- worst signal status of interlock structure inputs

(16) *Enabled*

Under 'Enabled' it can be seen which functions are enabled. Some functions can be enabled/ disabled only by the program; other functions can be enabled/ disabled via Operator System.

Faceplates - secondary dialog 'Extended Diagn. with Interlock'

The interlocking interfaces (IntStart, IntOper, IntProt, etc.) only get visible if a connection to the input exists. **(1)**

If a CEMAT interlock block C_INTLK2, C_INTLK4 or C_INTLK8 is connected to an interface, click on the interface name opens the faceplate of the CEMAT interlock block. **(2)**

Interlock blocks may be connected to any other interface of the drives/devices, groups or routes, but these interfaces will be visible in the diagnosis view at any time.

(3) Shows the name of the connected block

(4) Shows the status of the interlock.
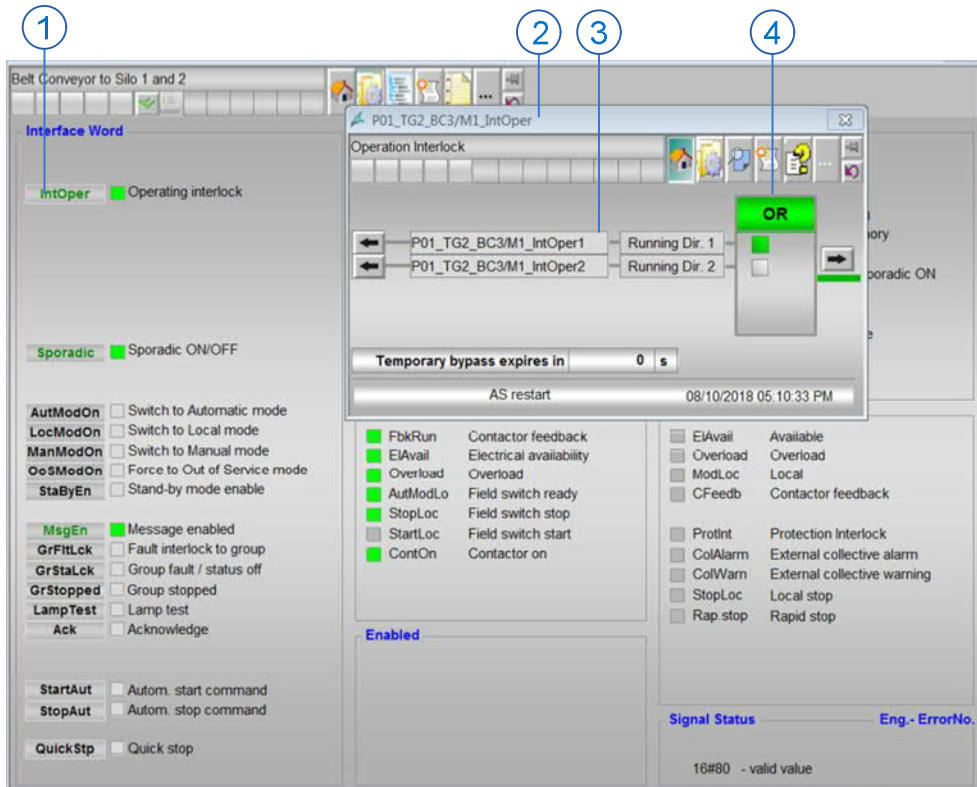
Faceplate details CEMAT interlock

Standard Dialog of the CEMAT interlock block:
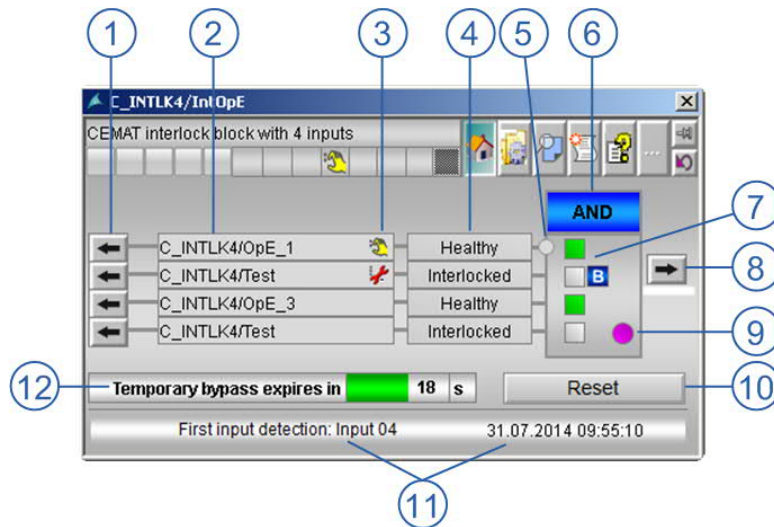
(1) Call of the upstream block and Signal-Comment as Tooltip

(2) Tagname of the connected (upstream) block

(3) Input signal status

(4) Additional signal text or value state

(5) Signal inverted

(6) Interlock status

(7) Input value and bypass status

(8) Call the faceplate connected to the output

(9) First trip relevant signal

(10) Reset of latched output

(11) Last stop reason (signal indicated as first-up relevant)

(12) Remaining time until temporary bypass expires.
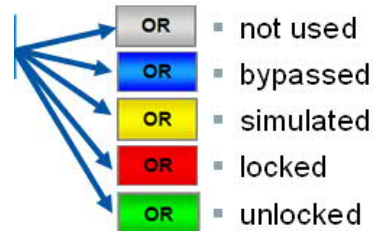
Bypass Dialog of the CEMAT Interlock block:
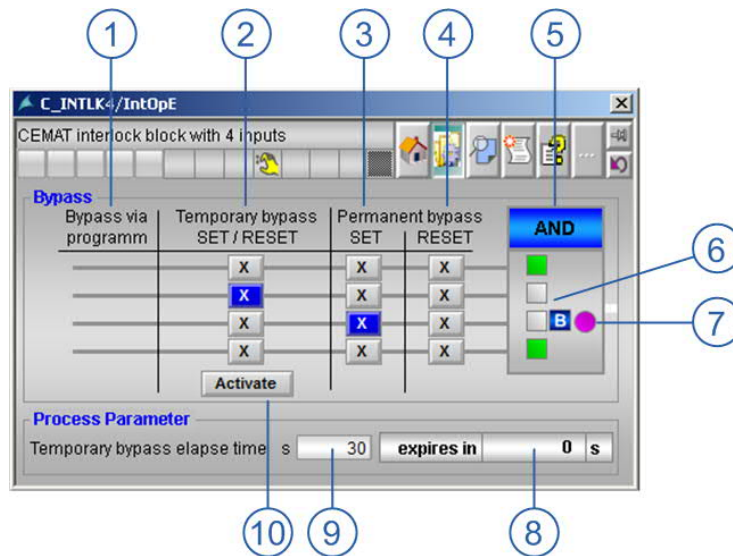
(1) Indication of bypasses set via program

(2) Selection of input signals that shall be temporary bypasses

(3) Set permanent bypass for single signals

(4) Reset permanent and temporary bypass for single signals

(5) Interlock status

(6) Input value and bypass status

(7) First trip relevant signal

(8) Remaining time until temporary bypass expires

(9) Configuration of temporary bypass elapse time

(10) Activate temporary bypass for selected signals

Faceplates - secondary dialog 'Alarm'

The Alarm dialog is available for all object types which create messages and and can be opened via button

The Alarm dialog shows all messages for the specific object and allows switching between actual messages and short-term archive list and to filter for process alarms or operations (see PCS 7 message system).

Opening the alarm dialog will show the **actual messages** of the block:

	Date	Time	Tagname	Event	FCL	Status	Info
1	23/08/2018	13:29:54	P01_TG1_BC1/M1	Available	E	⚠ C	
2							
3							
4							
5							
6							
7							

Further Actions can be carried out via the toolbar buttons:

Icon	Function
	Single acknowledgement
	Group (multiple) acknowledgement
	Message list
	Short-term archive list
	Toggle between Journal and Operations
	Hit List
	Display options dialog
	Selection dialog (for the definition of a user-defined filter)
	Printing
	Export data

Further toolbar functions are described under CEMAT Message Functionality

Example for the display of the **short term archive list, process alarms**:

	Date	Time	Tagname	Event	FCL	Status
1	22/08/2018	16:37:05	P01_TG1_BC2/M1	Contactor feedback	E	G
2	22/08/2018	16:37:05	P01_TG1_BC2/M1	Contactor feedback	E	QS
3	22/08/2018	16:36:59	P01_TG1_BC2/M1	Contactor feedback	E	C
4	21/08/2018	09:49:39	P01_TG1_BC2/M1	Contactor feedback	E	C
5	21/08/2018	09:49:39	P01_TG1_BC2/M1	Contactor feedback	E	Acknowledg
6	21/08/2018	09:49:39	P01_TG1_BC2/M1	Contactor feedback	E	C
7	21/08/2018	09:48:59	P01_TG1_BC2/M1	Contactor feedback	E	G
8	21/08/2018	09:48:59	P01_TG1_BC2/M1	Contactor feedback	E	QS
9	13/08/2018	15:14:17	P01_TG1_BC2/M1	Rapid stop	s	G
10	13/08/2018	15:14:06	P01_TG1_BC2/M1	Rapid stop	s	QS
11	13/08/2018	15:14:01	P01_TG1_BC2/M1	Rapid stop	s	C

Example for the displa of the **short term archive list, operations**:

	Date	Time	Tagname	Event	FCL	Status	Info
1	22/08/2018	16:38:10	P01_TG1_BC1/M1	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C		C	
2	21/08/2018	09:50:04	P01_TG1_BC1/M1	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C		C	
3	13/08/2018	17:44:40	P01_TG1_BC1/M1	Cemat01: Automatic new = 1 old = 0		C	
4	13/08/2018	17:06:01	P01_TG1_BC1/M1	Cemat01: Drive Start command new = 1 old = 0		C	
5	13/08/2018	17:05:50	P01_TG1_BC1/M1	Cemat01: M: reduced interl. new = 1 old = 0		C	
6	13/08/2018	16:34:45	P01_TG1_BC1/M1	Cemat01: Automatic new = 1 old = 0		C	
7	13/08/2018	16:34:20	P01_TG1_BC1/M1	Cemat01: Out of Service new = 1 old = 0		C	
8	13/08/2018	16:29:24	P01_TG1_BC1/M1	Cemat01: Local new = 1 old = 0		C	
9	13/08/2018	16:27:38	P01_TG1_BC1/M1	Manual mode	O	C	
10	13/08/2018	16:27:32	P01_TG1_BC1/M1	Automatic mode	O	C	
11	13/08/2018	15:20:49	P01_TG1_BC1/M1	Cemat01: Manual interl. new = 1 old = 0		C	

Faceplates - secondary dialog 'Statistics and Maintenance'

The Maintenance dialog is available for all object types for drives/devices and instruments. This includes drives, dampers and valves as well as for annunciation blocks, process feedback blocks and measurement blocks.

The Maintenance dialog can be opened via button

The Maintenance dialog shows the **Statistic Values** and the **Maintenance Information** (Maintenance settings, Status and Device Information) for devices and instruments.

Example for a C_DRV_1D maintenance display:
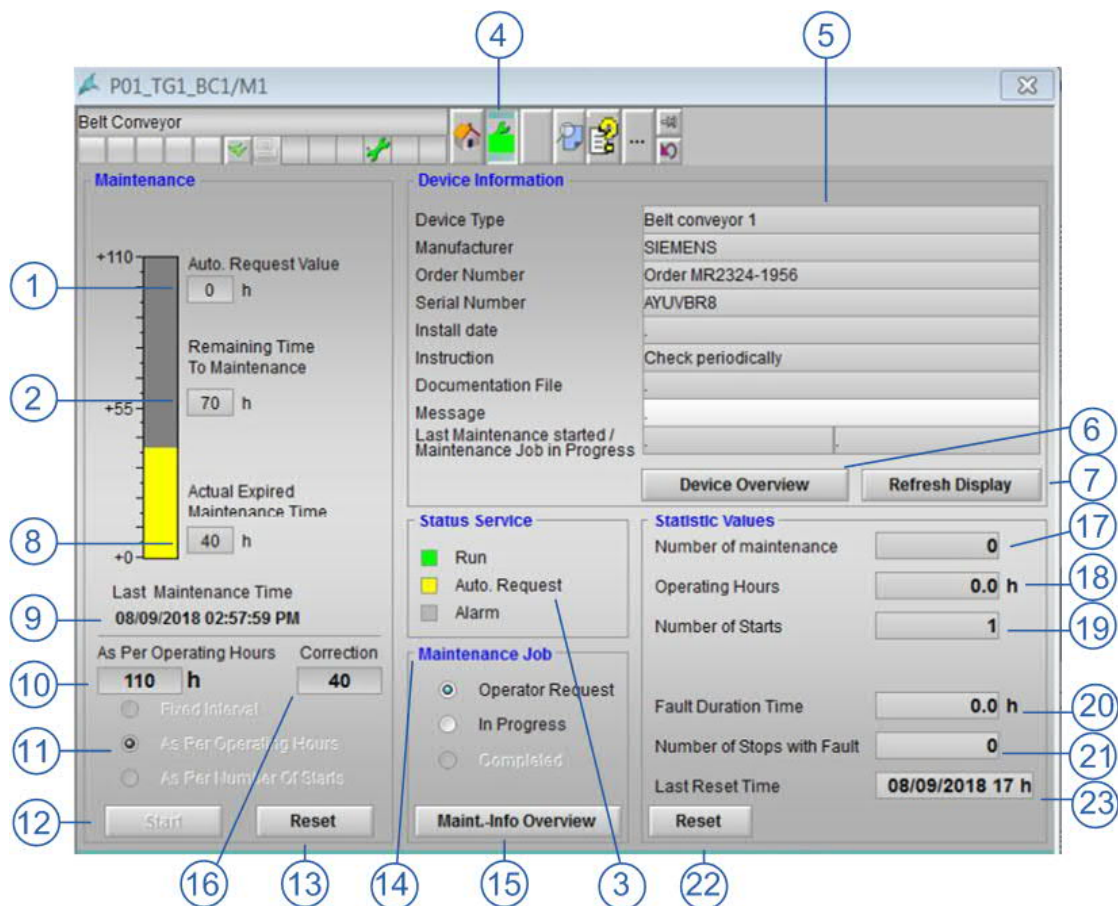
The following **Maintenance Information** can be displayed:

- Maintenance interval (fixed, operation hour, no. of Starts) **(10+11)**

- Actual Maintenance values (expired time, remaining time, auto request time) **(8,2,1)**

- Status (Run, Alarm, Auto Request) **(3)**

- Maintenance Job (Operator Request, In Progress, Completed) **(14)**

- The Device Information (Type of equipment and last Maintenance starting time) **(5)** can be entered via a secondary dialog and will be stored in a user Archive.

Function description for Maintenance configuration:

1. Under "Maintenance Interval" the maintenance cycle **(10)** has to be entered and one of the following options **(11)** has to be selected:

   - Fixed Interval: Maintenance request after a number of hours
   - As Per Operating Hours: Maintenance request after the drive was running a number of hours (default setting)
   - As Per No. Of Starts: Maintenance request after the drive has been started a number of times.
   - An Auto Request Value must be entered in order to indicate that the maintenance cycle is nearly complete.

2. If a drive has already been running for some hours (or started several times) before the maintenance function is activated, it is possible to input a correction value (=offset) with **(16)**.

3. The "Start" button **(12)** enables the Maintenance function. The **(3)** status shows "Run". After this, the Maintenance interval cannot be modified any more.

4. The "Stop/Reset" button **(13)** disables the Maintenance function and all timers and counters for Maintenance are reset. The Maintenance interval can now be modified.

5. After the Maintenance function is enabled the actual expired maintenance time **(8)** and the remaining time **(2)** to maintenance are displayed.

6. If the Auto Request Value is exceeded the bar shows yellow color and status bit "Auto Request" is set.**(3)**
   The information is also available as module output and can be connected to an annunciation block in order to create a warning message.

7. If the Interval Value is exceeded the bar shows red color and status bit "Alarm" is set.
   The information is also available as a module output and can be connected to an annunciation block in order to create a fault message.

8. With "Auto Request" the Operator Actions are enabled.**(14)**
   The Maintenance person has to select "in Progress" and to enter his comments into the Device Information Dialog (This Information will be saved in the user Archive with a time stamp).

9. After the Maintenance work is done the Maintenance person has to select "completed" in order to start the new maintenance cycle. (The time of completion is saved in the user archive).

The Dialog "Maintenance Info Overview" **(15)** opens the CEMAT Maintenance List dialog in order to show all active Objects with the status (see next page)

The **CEMAT Maintenance List** shows all drives which are enabled for Maintenance (each object with Interval value > 0) and its Maintenance status.

The list can be opened using the button "Maintenance Info Overview" in the Maintenance faceplate or via a separate button from any process picture.

The filter function can be used to search for specific objects. Use "Refresh" button on order to update the list.

Scroll bar can be used to scroll fore and back. You will always see the 20 objects before ore behind.

Double-click on the Tag opens the Faceplate of the Object.

Device information:

The "Device Overview" button **(6)** opens the following Dialog where the **Device Information** can be entered. Closing the window the information is stored in the User Archive C_Info.

Caution: In the Maintenance Dialog the Device information is not automatically refreshed. You have to press "Refresh Display" in order to display the actualized data.

The Device Information is part of the user Archive C_Info and can also be imported via CSV file.

In Section **Statistic Values** the following information is displayed:

- The number of maintenance happened wil be showned **(17)**
- Operating Hours **(18)**
- Number of Starts **(19)**
- Fault duration time **(20)**
- Number of Stops with faults **(21)**

Function description Statistic Values:

For C_DRV_1D, C_DRV_2D and C_VALVE the operating hours and the number of starts (in each direction) are displayed.

For C_DAMPER the number of starts in each direction is displayed.

For C_ANNUNC, C_ANNUN8, C_PROFB, C_PROFBx and C_MEASUR the operating hours and are displayed.

For all drive functions the fault duration time and the number of stops with fault is displayed.

With "Reset" button **(22)** all counters under Statistic values are reset and the date and time of this action will be shown under **(23)** "Last Reset Time".

Faceplates - secondary dialog 'Info'

The information dialog is available for all object types and can be opened via button

It is organized as follows:

Header lines:	**(1)** The header lines display the general location designations and the installation location of the object within the plant structure.
Registers:	They contain standard information about - Input/output descriptions **(2)** - MCC descriptions **(3)** - AS hardware and software modules **(4)** - Service inputs for Loop in Alarm, etc.**(5)**
User notes:	**(8)** The user is also given the capability to store his own information text.
Message output:	**(7)** The object-related messages are output in a message window.
I/O Info	**(6+9)** Input and Output information with absolute and symbolic address, DP Bus/ Address and Slot.
Save	**(10)** save the changes
Print	**(11)** a preview dialog with all Information's of this Object will be shown.
Multimedia	**(12)** call up of external documents, video, drawings

Sample display (including I/O Info):
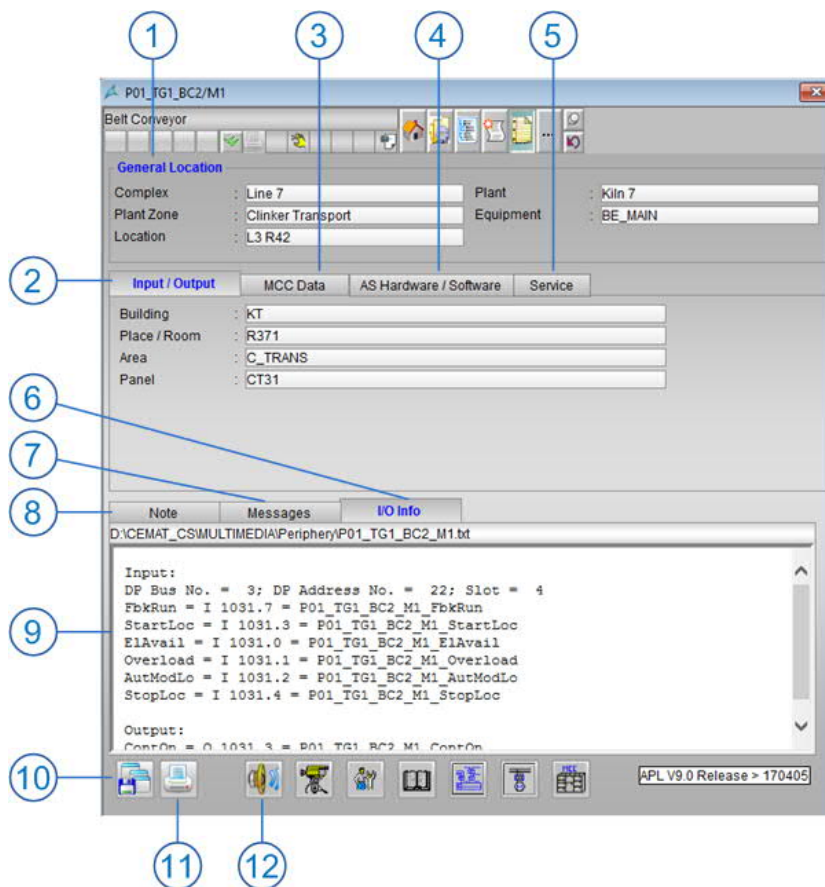
The Text files for I/O Info can be created with an Excel Macro based on the data from the HW-Configuration and the Process object view. Refer to chapter 09_Engineering_Tools.

Sample display (Print preview)

From there the print out **(1)** to the standard printer is possible.

Sample display (with operator notes):
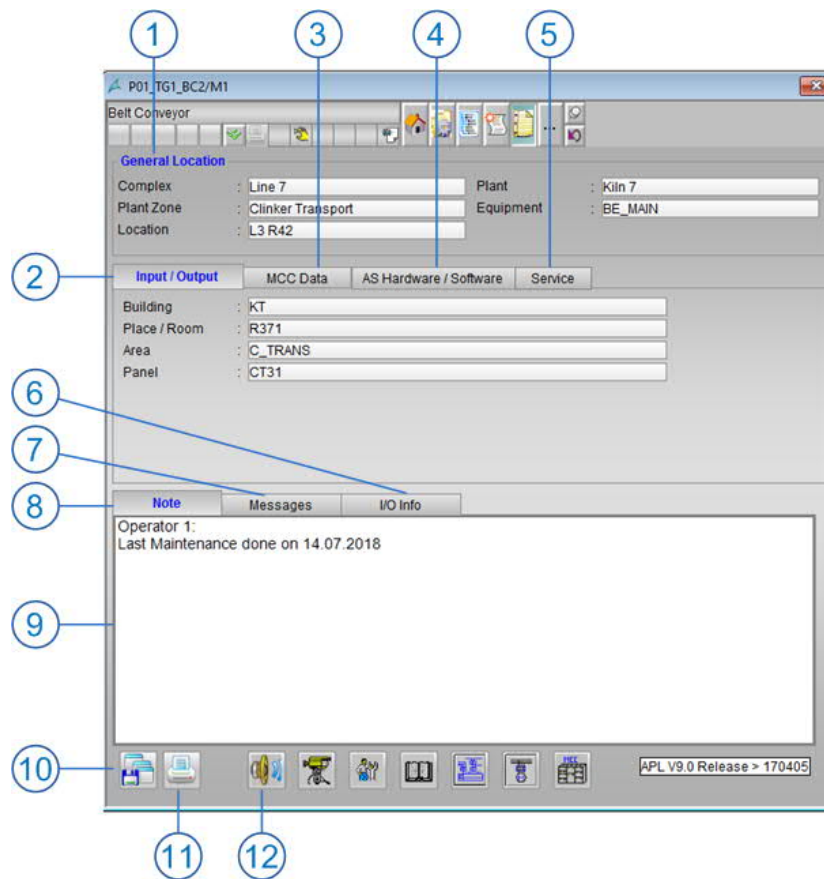
(9) Input field for Object information from Operator

An overview of Object- Notes can be called as separate list.

(5) Service information with settings for the multimedia buttons.
The multimedia files can be stored on a local station or on the Server

Sample display (with messages):

(3) MCC Data with information about the location and Fuse and Bimetal setting

(9) The chronological messages of the Object will be shown together. (alarm and operation)

(13) Open file with MCC information (only .jpg)

Additional User Documents can be linked to each Object via Information Dialog.
(The function is optional and must be configured accordingly):

In the Folders Input/Output, MCC Data and AS Hardware and Software a button will open respective drawings:

Folder 'Input/output'   Assignment of the input/output cards (cabinet assignment)

Folder 'MCC data'   Assignment of the MCC cabinet (cabinet assignment)

Folder 'AS hardware'   Construction of the cabinet in which the AS is installed which this object belongs to (cabinet assignment).

For this function, the File names of the documents must coincide with the object name.

SIEMENS
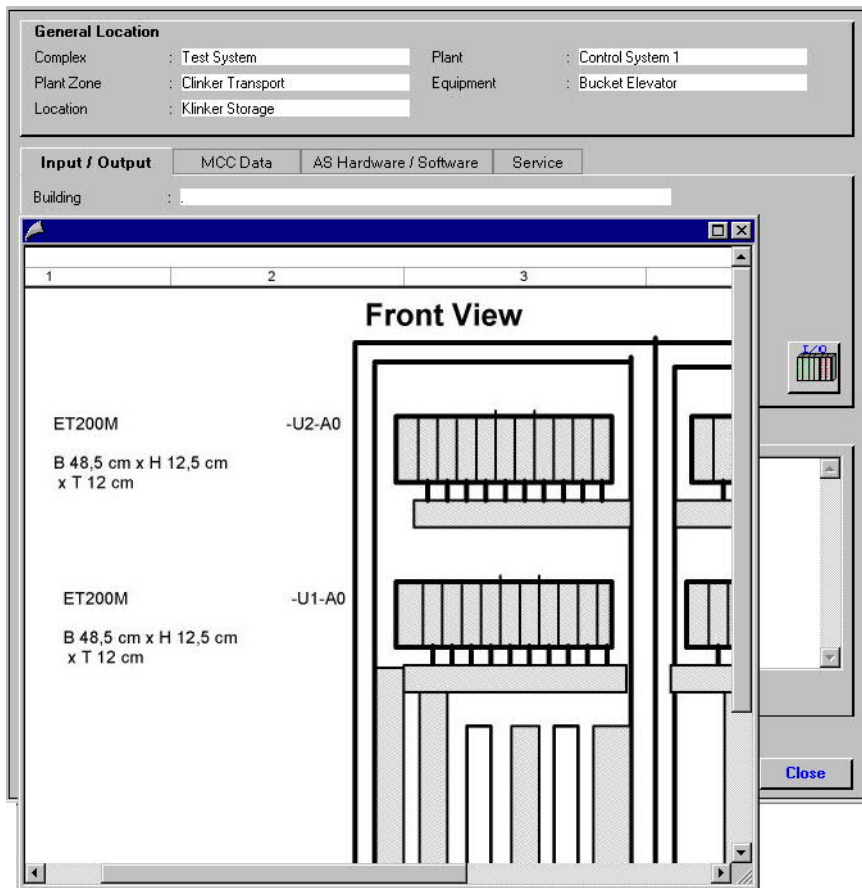
The additional Buttons at the bottom of the information dialog can be used to open a Sound file, a Video, a Operating procedure, a Function description, a Loop diagram, an Electrical schematic or a MCC Data.

Sound	Sound replay (USER)
Video guide	Video description for trouble-shooting (USER)
Operation procedures	Descriptions how to operate (USER) as doc, pdf, xls
General function desc.	Descriptions of general functions for this object (USER) as doc, pdf, xls
Loop diagrams	Process engineering- and Software interlock as CAD drawing
Electrical schematic	Electrical schematic Drawings as CAD drawing
MCC data	MCC cabinet drawings, settings as CAD drawing

For this function, the file names must be entered under 'Service'.

Input / Output	MCC Data	AS Hardware / Software	**Service**

Loop In Alarm	:	Clinkertransport.pdl
Sound File	:	BELL0003.WAV
Video File	:	ofen4.avi
Oper. procedures	:	Operation_instruction.pdf
General func.spec	:	General_Function_spec.pdf
Loop diagrams	:	Loop_diagrams.dwg
Electrical schemat	:	Electrical_diagram.dwg
MCC Data	:	MCC.dwg

Example for a Video:

Faceplates - secondary dialog 'Preset'

The preset dialog is available for all object types and can be opend via button

It shows the settings for "FeatureWord", "Feature Word2" and "OS Permissions" (both, block settings and Logical result for actual operation options).

In addition the Authorization level is displayed, which is required for the corresponding operator command.

Example for a C_DRV_1D preset display:
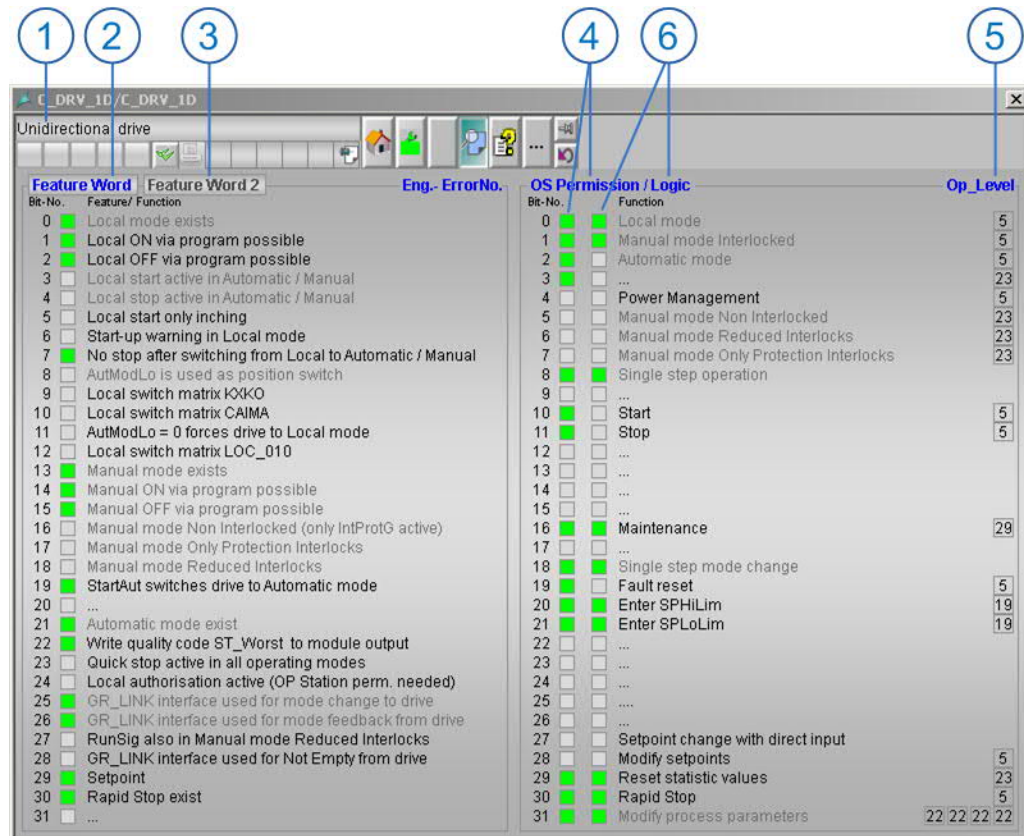
(1) *Displays and operator controls*

with Tag/ Comment/ Alarm symbols/ Status and Toolbar

Feature Word's **(2)** *and* **(3),** *OS Permission Word* **(4)***, OS Permission Logic Word* **(6)**

The characteristics (block function and operation) of the individual block can be seen.

Signal state: "0" = gray
                     "1" = green

Gray texts indicate that the settings come from the feature master block and can not be configured individually.

Op_Level **(5)**

The "Op_Level" number shows the Authorization level which is required for the operation.

Faceplates - secondary dialog 'Status'

The status call function is available for groups and routes and can be opend via button

The status call of the group can be used in order to list all existing faults, warnings or interlocking conditions of the drives, measuring values and process signals assigned to this group.

The status call of the or route can be used in order to list all existing faults, warnings or interlocking conditions of the drives, measuring values and process signals assigned to this or route.

If the group has routes, the status call of the group is related to the underline selected routes of that group. The elements of the not selected route will not be displayed.

The information will not be taken from the message system, but directly requested from the AS.

The Dialog can be opened from the "Displays and operator controls" **(1)** area with click on button "Status".
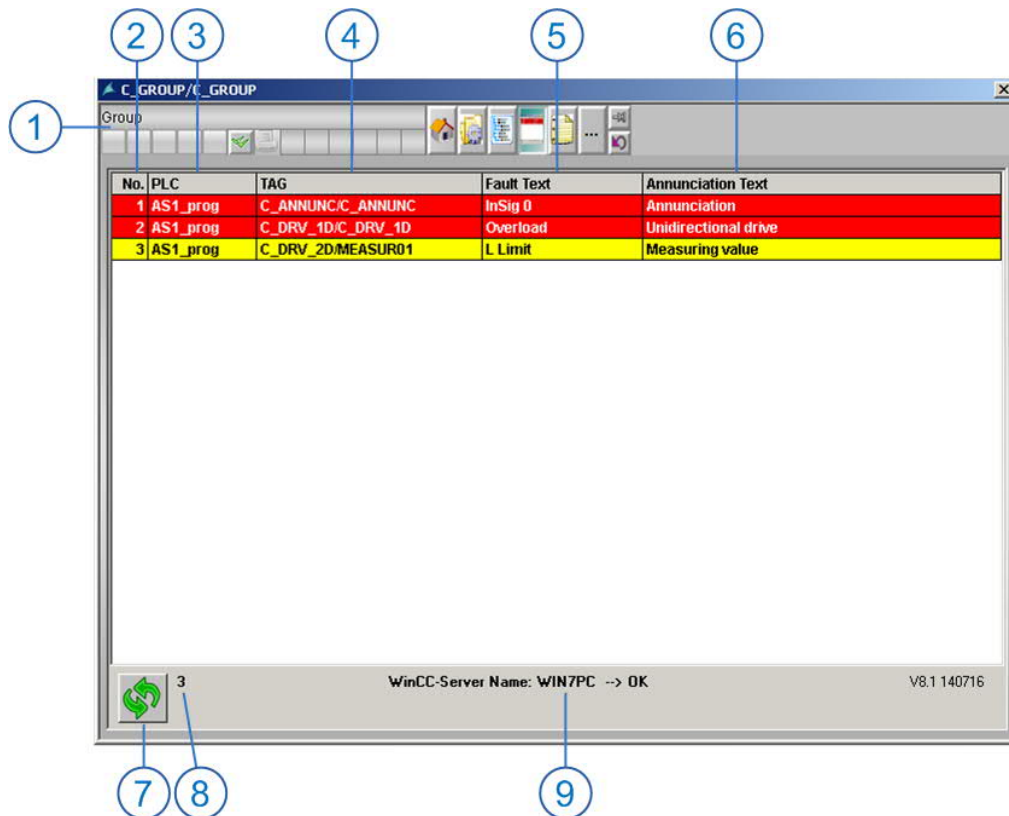
The following will be indicated in the table (from the left to the right):

(2) Index, **(3)** Tag of PLC, **(4)** Tag of the faulty object, **(5)** fault text (from Config file), **(6)** comment of the object (block comment from CFC).

The actualization button **(7)** number of messages **(8)** and the WinCC server name **(9)** are indicated at the bottom side.

Faceplates - secondary dialog 'Object'

The Object list function is available for groups, routes and parent objects and can be opend via button

The group Object list shows all drives, measuring values and process signals which are assigned to the group.

The route Object list shows all drives, measuring values and process signals which are assigned to the route.

The drive Object list shows all annunciations, measurements and process feedback blocks assigned to a drive/device.

The first time you open the Object list the information will be read from the AS and with the save button it is stored into the user archive. If you open the list again the information is read from the user archive.
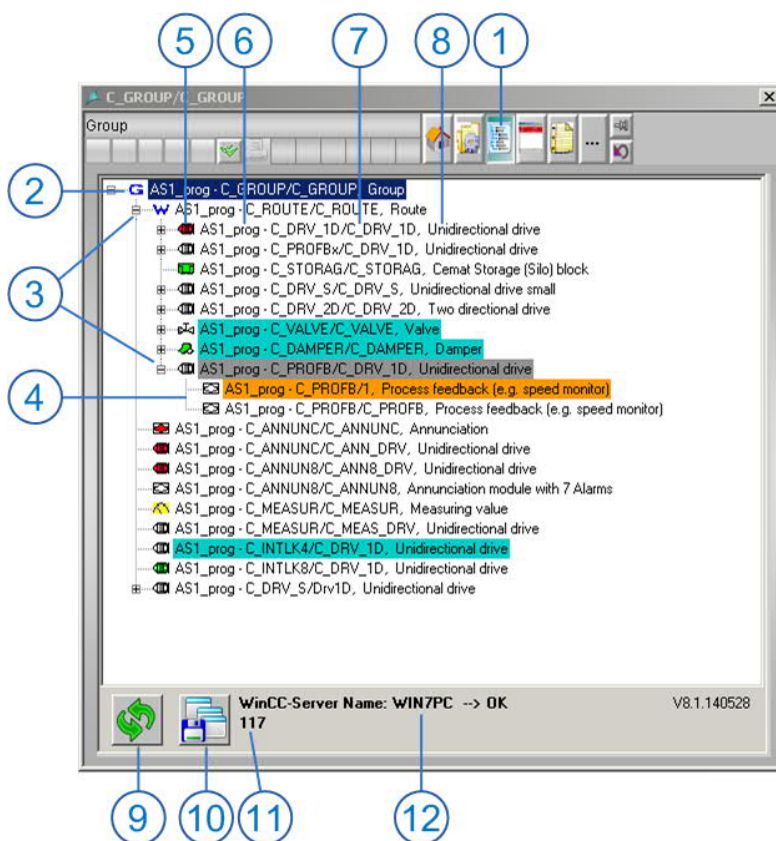
The tree structure shows (from left to right):

> Group information **(2),** Node symbol if an route or drive object is included **(3)**
> Objects belong to a Drive, Damper, Valve **(4)**
> the symbol of the object type with the status 'off', 'on', 'fault' **(5)**
> the PLC Tag **(6)**, the Object Tag **(7),** the comment to the object (block comment from CFC) **(8)**

Selecting an object with the left mouse key it can be shifted to any position. Thus, the real start-up sequence as per the interlocking can be indicated.

A click on the soft key „save"**(10)** stores the new tree structure to the user archive.

Single click on the soft key **(9)**, reads the objects again from the AS and shows them unsorted in the tree structure.

A double-click on the line opens the faceplate of the corresponding object.

Quantity of objects **(11)**, WinCC server name **(12)** are indicated if the connection is ok

If the mode of an object is not "Automatic" it will be shown with a colored line:
- bypass/ simulation -> orange
- local mode   -> light gray
- manual mode   -> cyan
- Out of Service   -> dark gray
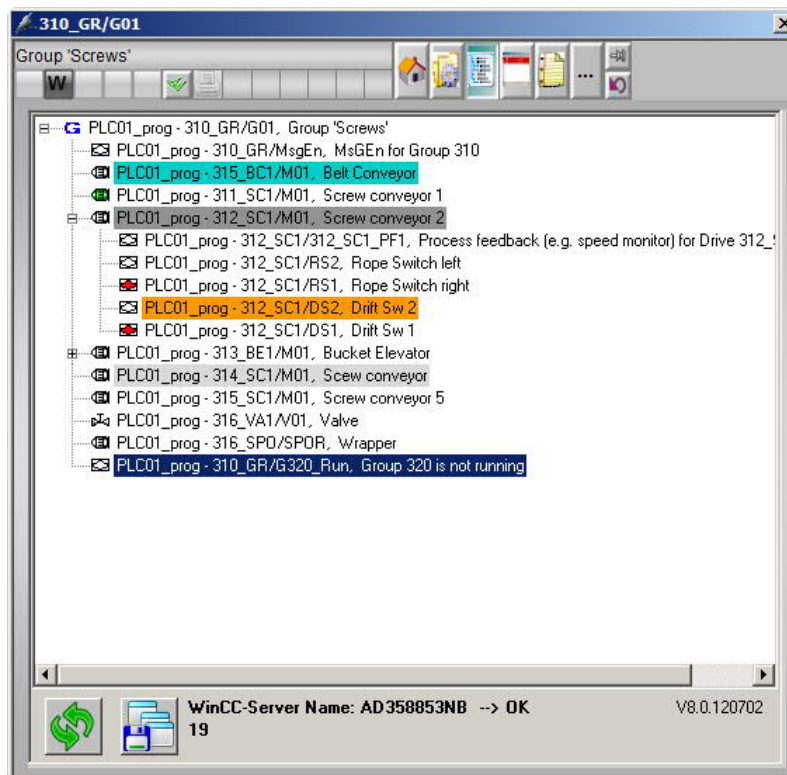
Faceplates - secondary dialog 'Help'

The online help function is available for all object types and can be opend via button

Example for C_DRV_1D help dialog:

Faceplates - secondary dialog 'Calibration'

Calibration functions are available dampers and measurements and can be opend via button

Calibrations function for C_DAMPER:

The calibration function for C_DAMPER can be used in order to adjust the Position limit values to 0% if the damper is completely closed (Limit position FbkPos1 reached) and to 100% if the damper is completely open (Limit position FbkPos2 reached).

The function must be enabled via feature bit setting and OS Permission.
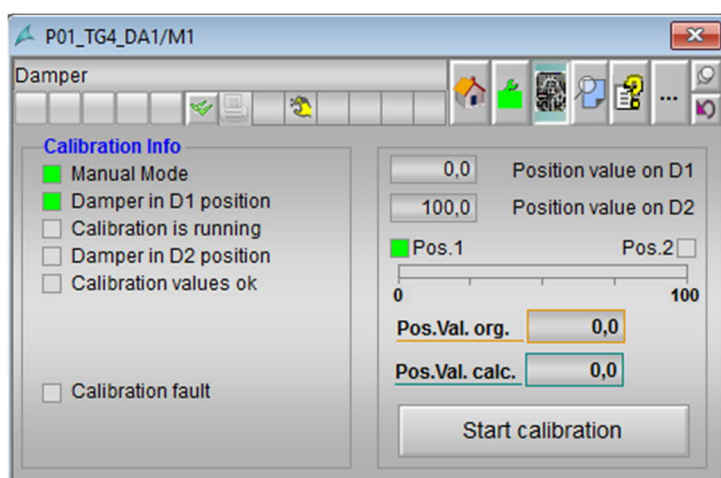
Description of the dialog and calibration procedure:

In order to start the calibration the damper must be in Manual mode and closed.

The start of the calibration activates a start-up-warningn and controls the damper to the open position.

The block memorized the Calibration values in position closed and open and uses these values furtheron for the calculation of the damper position.

Calibrations function for C_MEASUR:

The calibration function of C_MEASUR can be used in order to make adjustments for Scale low and Scale high from the Operator station, but only in case of reading the analog value via Card input interface (MV_Card). It can not be used in conjunction with channel driver block.

The function must be enabled via feature bit setting and OS Permission.

Calibration Dialog:
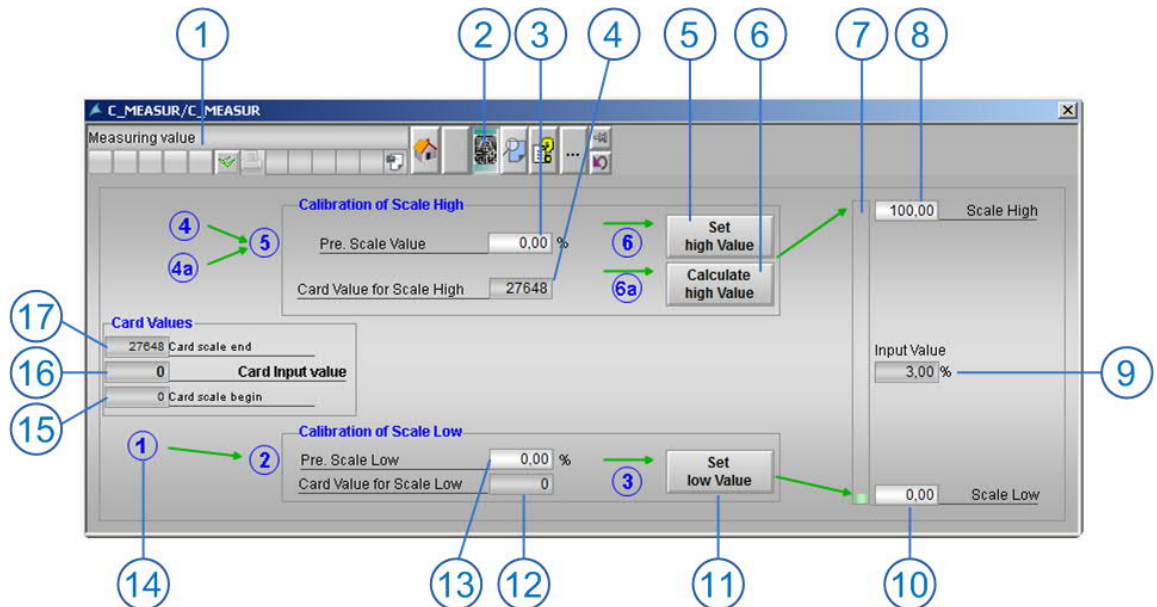
Description of the dialog and calibration procedure:

On top the "Displays and operator controls" **(1)** from the Standard Measure Module is shown. With click on the button **(2)** this Calibration dialog will be opened.

The following steps are necessary to calibrate the Scale low and high Values:

Step1: **(14)** adjust the transmitter to "begin of measurement".
The Card Input value is shown on **(16)**

Step2: enter the predefined value for "Scale Low" **(12)** that should correspond to the "Card Input value" **(16)**

Step3: Click on "Set low Value" **(11)** button to write in the "Scale low Value" **(10)** to the measure module and store the Card Input Value for Scale Low **(13)**. (3824 = 0)

Step4: adjust the transmitter to "end of measurement".
The Card Input value is shown on **(16)**

Step5: set the predefined value for "Scale High" **(3)** that corresponds to the "Card Input value" **(16)**

Step6: Click on "Set high Value" **(5)** button to write in the "Scale high Value" **(8)** to the measure module and store the Card Input Value for Scale High **(4)**. (13824 = 200)

In case it is not possible to reach the end of the measurement (20mA) there is a possibility to calculate the "Scale high" value.

Step4a: adjust the transmitter to a "known position of measurement".
The Card Input value is shown on **(16)**

Step5: enter the predefined value to "Scale High" **(3)** that corresponds to the "Card Input value" **(16)**

Step6a: Click on "Calculate high Value" **(6)** button. The "Scale high Value" **(8)** for the measure module will be calculated for the Value on "Card scale end" **(17)** and stored the Card Input Value for Scale High **(4)**. (27648 = 200)

Faceplates for Trend display – APL Operator Trend Control

With CEMAT V9 the CEMAT Online Trend function has been replaced by the APL Operator Trend Control (Ctrl + Mouse click on the Object)
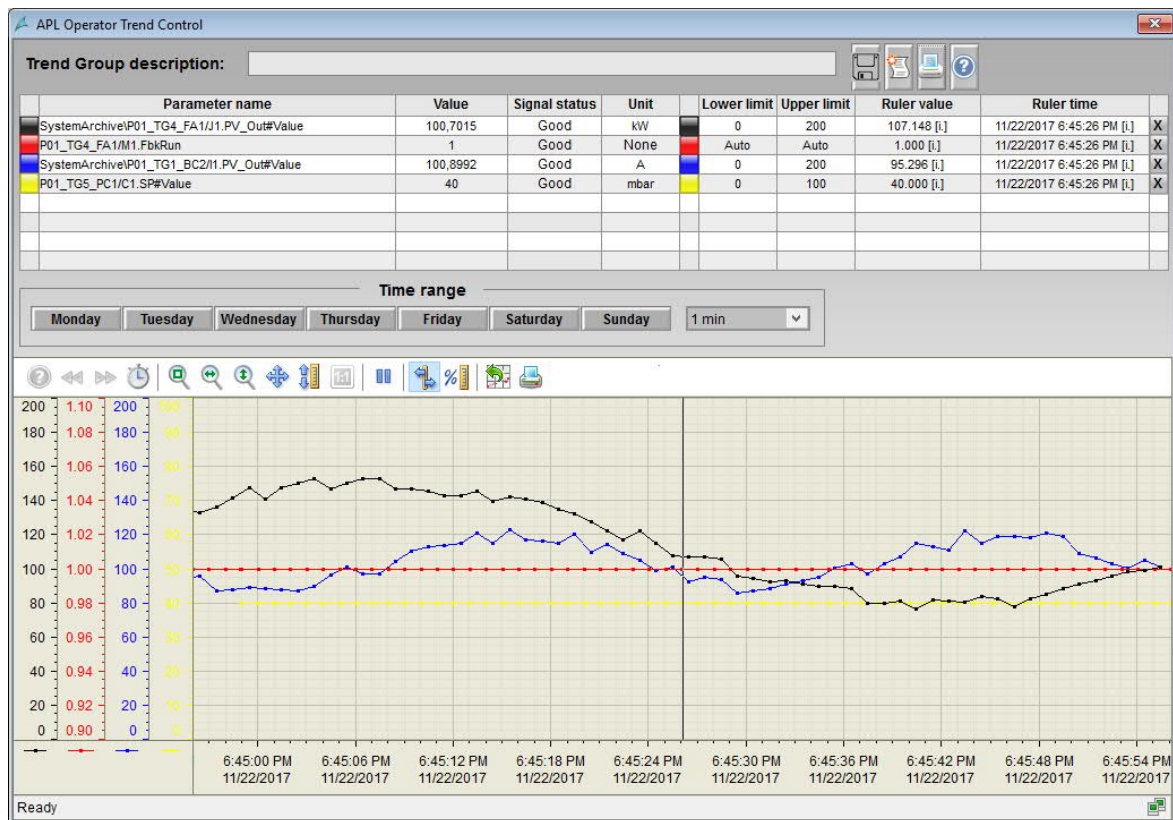
With the APL Operator Trend Control Trends for ", in addition to the Measuring values, the Values from PID Controller and Motor Running can be displayed as well.

The following functions exist:

- Display of up to 8 Values

- Each value and each Scale can be deselected and selected

- Time range can be selected

- Trend control can be saved and/or printed

Authorization levels in PCS 7 and CEMAT

In PCS 7 each operation is linked to a specific authorization level. After the definition of user groups and users in the User Administrator of WinCC the individual authorizations can be enabled, either in general or per plant section (AREA).

After Login, each user can operate the system according to his authorization level.

The following authorization levels are used in PCS 7 and CEMAT (from 18-29):

001	User administrator	
002	Authorization for the Area	
003	System change	
004	Monitoring	call-up of the faceplates
005	Process controlling	manual operation changing the operation mode changes of setpoints
006	Higher process controlling	Controller Parameters Ext. Setpoints for SPC
007	Report System	
018	Modify warning limits	Measuring value
019	Modify alarm limits	Measuring value
020	Modify switching limits	Measuring value
021	Controller parameters	Parameter change for controller blocks
022	Object parameters	Change of process values
023	System operations	Reset Functions
024	Interlocking signals	Override and Simulation functions
025	Edit Recipe	For Scalable Production Control (SPC)
026	Edit Material Assignment	For Scalable Production Control (SPC)
027	Info dialog value input	General Settings in the Info Dialog
028	Info dialog Service parameterization	Service Tab in the Info Dialog
029	Maintenance parameters	Change of Device information in the Maintenance Dialog

The operator authorizations must be specified for each Operator Station.

If additional operation levels are needed (e. g. in order to permit certain operations only to specific personal), these User rights must be defined in WinCC User Administrator as well.

User management and user groups

Authorization levels can be enabled per user group or per user.

Proposal for the definition of User Groups:

User Right	Function	Administrator	Supervisor	Master Operator	Laboratory	Operator	Guest
1	User administrator	x					
2	Authorization for the Area	x	x	x		x	x
3	System change	x					
4	Monitoring	x	x	x		x	x
5	Process controlling	x	x	x		x	
6	Higher process control	x	x	x			
7	Report System	x	x				
18	Modify warning limits	x	x	x			
19	Modify failure limits	x	x	x			
20	Modify switching limits	x	x	x			
21	Controller parameters	x	x				
22	Object parameters	x	x				
23	System operations	x	x				
24	Interlocking signals	x	x	x			
25	Edit Recipe	x	x	x	x		
26	Edit Material Assignment	x	x	x	x		
27	Info dialog value input	x	x	x		x	
28	Info dialog Service parameterization	x					
29	Maintenance	x	x				

Operator control permission

Operator commands are restricted by the following criteria:

- Feature bit settings
  → Complete function can be enabled/disabled

- OS PermissionLog
  → Decides if an operator action is allowed or not allowed,
  dependent on OS Permission & Status

- Operator authorization in WinCC
  → Operator authorization levels in WinCC User Administrator

- Instance specific Operator authorization levels
  → Operator authorization level can be modified via block parameter in the CFC

Example: Operator authorization levels for unidirectional drive block C_DRV_1D

	OS Commands	Feature Bit	OS_Permission Log	Op_Level	Block Parameter
Mode Change	Switch to automatic mode	21	2	5	AutModOn
	Switch to Out of Service mode			23	OoSModOn
	Rapid stop	30	30	5	AutModOn
	Switch to local mode	0	0	5	LocModOn
	Switch to manual mode	13	1	5	ManModOn
	Manual mode: non interlocked	16	5	23	COMMAND
	Manual mode: only protection	17	7	23	COMMAND
	Manual mode: reduced interlocks	18	6	23	COMMAND
Start/Stop/Select	Start		10	5	ManModOn
	Stop		11	5	ManModOn
	Enable Power Management		4	5	PMinvol
Acknowledge	Fault Reset	FW2-19	19	5	AutModOn
Setpoint	Setpoint	29	28	5	SP_Os
	Setpoint low limit		20	19	SP_LoLim
	Setpoint high limit		20	19	SP_HiLim
Process Parameter	Start delay time		31	22	StaDelTi
	Stop delay time		31	22	StpDelTi
	Time for feedback monitoring		31	22	FbkMonTi
	Time for feedback off monitoring		31	22	FbkOffTi
	Time for startup warning		31	22	WarnTi
Maintenance	Reset statistic values			23	RelTimOS
	Start Maintenance		16	29	MaiInt
User Command	User Pulse		29	29	UserPulse

Switching to manual mode requires Feature bit13 = TRUE, OS_PermLog bit 1 =TRUE and Access to Operator Authorization level 5 (Process controlling).

The Authorization level can be adjusted at block parameter "ManModOn" of block C_DRV_1D.

Detailed information about authorization levels can be found in the Engineering Manual, chapter 06_AS_Engineering and chapter 08_OS_Engineering as well as in the Object description for the individual block type.

Acknowledgement in CEMAT

Talking about acknowledgement in CEMAT, it must be differentiated between the acknowledgement of the message in the alarm line and the acknowledgement of the dynamic fault in the CEMAT block.

The **messages in the alarm line** can only be acknowledged one by one,

- either via the acknowledge button in the alarm line
  (only the visible alarms will be acknowledged)

- or via the acknowledge button in the Object Faceplate.

- or via the acknowledge error button in the button line
  (all alarms of the selected Picture will be acknowledged)

For the **fault acknowledgement in the AS** (dynamic fault of the CEMAT blocks) different options exist. It may be carried out

- together with the acknowledgement of the alarm line or the acknowledge button in the button line (for the selected area) or via acknowledgement button in the object faceplate.

- for the complete AS, group-wise or for the individual object.

- via HMI or by program

The general configuration of the fault acknowledgement from HMI is configured in the System chart SYSPLCxx at block C_FB_PLC, interfaces *ACK_GR* and *ACK_OB.* The settings are valid for the complete PLC and the default setting is "AS-wide acknowledgement".

AS-wide Acknowledgement (Default)

With the acknowledgement of the message in the alarm line, an acknowledgement command is sent to the AS which produced the message, and all blocks within this AS are acknowledged at the same time.

Via the acknowledgement button of any Cemat Object Faceplate an acknowledgement command is sent to the corresponding AS, and all blocks within this AS are acknowledged at the same time.

Group-wise Acknowledgement

The acknowledgement of the message in the alarm line is independent of the fault acknowledgement in the block.

For fault acknowledgement in the AS the Operator must press the Acknowledgement button in the group faceplate. The acknowledgement command is sent only to the group. From the group it is transmitted to all connected objects. (Programming required!)

Acknowledgement of individual Objects via its faceplate is possible as well.

If annunciations, process feedbacks or measurements are child objects to a drive, the acknowledgement of the drive block leads to the acknowledgement of the child objects at the same time.

Object-wise Acknowledgement

The acknowledgement of the message in the alarm line leads to the acknowledgement of the block which generated the alarm.

In this mode the acknowledgement of individual Objects via its faceplate is possible as well.

Fault acknowledgement by AS Program

All Cemat MinAS Objects have an interface *Ack* for individual fault acknowledgement by AS program. This interface is used in case of group-wise acknowledgement, but in can also be used wherever acknowledgement by AS program is needed.

By default setting, interface *Ack* works parallel to the acknowledgement command from HMI. If acknowledgement via HMI shall not be permitted, it is possible to enalbe acknowledgement exclusively via program interface *Ack.*

Block output AckQ

Block output *AckQ* is available for all CEMAT MinAS blocks with acknowledgement function and contains the status of the internal acknowledgement bit of the block (according to the acknowledgement settings in SYSPLCxx and in the block).
This output can be used in order to forward the acknowledgement command to a satellite block or to an output (in order to forward the acknowledgement to an external device).

Additional Fault Reset via Object Facplate (optional)

For all Objects types for drives, annunciation blocks and measurements, there is an option to memorize the trip until an additional "Fault Reset" button in the object faceplate is pressed. Resetting the fault on object level forces the operator to look at the equipment to be reset.

Only dynamic faults are memorized, static faults don't require additional Fault Reset.

The Fault Reset can only be carried out after the fault is cleared (after the fault is acknowledged **and** gone).

The Fault Reset Function is enabled via feature bit and OS Permission at the individual objects:

For details to the acknowledgement functions see Engineering Manual, chapter 06_AS_Engineering under "Acknowledgement modes".

CEMAT Message Functionality

Two types of messages are stored in the message system of CEMAT:

▪   Messages that are initiated by malfunction in the process (process specific values are reached or violated).
    These messages need the attention of the operator. They appear in the message line on top of the screen and need must be acknowledged. Parallel the messages are entered into the message archive.

▪   Messages originated by an operator action (starting, stopping, modification of a process parameter).
    These messages don't appear in the message line, but they are entered into the message archive.

Message line

13/01/2010	14:24:33	311_SC1/M01	Available	Screw Conveyor 1	🔺 🖥 📋 ✅

The message line displays the **non-acknowledged** messages from the selected plant sections.

A newly arrived message

-   always appears immediately in the message line (even when operations are being performed on the previously displayed message).

-   produces an acoustical signal that continues until it is reset by clicking an acknowledge key.

The message line contains the following information (from left to right):

-   Incoming date/time of the message

-   Plant identifier

-   Fault type

-   Message text (Comment)

The CEMAT blocks are able to analyze and prioritize the faults in order to avoid an alarm flooding. As a result only **one** alarm will be recorded and reported in detail, while all other alarms are suppressed.

Each alarm must be acknowledged individually in the Alarm line

Only activated objects can generate alarms

Each fault is classified. CEMAT distinguishes between electrical, mechanical or process faults or local emergency shutdowns.

The following events are displayed:

-   potentially dangerous process conditions

-   setpoint deviations beyond pre-selected values

-   blocking of a start, stop or changeover operation

-   operating interruptions

Color attributes

The messages are displayed in the following colors depending on the message class and message state:

	Error messages	Warning messages	Process messages
Message arrived	white / red	black / yellow	white / red
Message gone	black / light green	black / light green	black / light green

Operator Control

The three additional keys placed at the right of the message line initiate the following functions:

	- left mouse button (SC)	Invoke alarm picture (Loop in Alarm). This is the process picture in which the faulty object is displayed.
	- left mouse button (SC) *- right mouse button (SC)*	Invoke faceplate dialog for the object. From the faceplate you have the possibility to call the subsequent dialogs **Diagnosis** and **Info** Show the CEMAT Version dialog
	- left mouse button (SC)	Open the Alarm dialog (list of all non-acknowledged alarms)
	- left mouse button (SC)	Acknowledge pending messages until the message line is empty. When a message is acknowledged, an acknowledgement telegram is sent to the automation unit from which the message came and the next non-acknowledged message is displayed.

Area selections for the alarm line

The messages are filtered dependent on the operating authorization **"process controlling"** of the actually logged in user.

Loop in alarm Call

The loop in alarm function opens a predefined process picture in order to display the object which created the alarm.

The name of the Alarm Picture can be defined for each object in the Info Dialog in Register "Service". For explanation see Engineering Manual, chapter OS Engineering).
If no picture name is entered, the system looks into the 'Component list Editor' of WinCC and opens the 'Entry point picture'.

PCS 7 Message list

Button "alarm logging" opens the PCS 7 Message system

The incoming alarm list will open, showing all alarms which need acknowledgement.

At the same time a now button line gives direct access to different views of the alarm logging:

Icon	List	Content
	Incoming list	The incoming list contains the unacknowledged messages.
	Acknowledged list	The acknowledged list contains the acknowledged messages and the messages pending in the process.
	Outgoing list	The outgoing list contains the messages flagged as "exited" (special message property).
	List of pending messages	The list of pending messages shows all acknowledged and unacknowledged messages that have not gone out yet.
	Process control list	The process control list contains process control messages. Example: Rack failure
	Operation list	The operation list contains operator input messages. Example: Group start or change of a process parameter
	History list (journal)	The history list contains all messages (incoming, acknowledged and outgoing messages).
	List of hidden messages	The list of hidden messages contains all messages which were hidden manually or automatically.
	List of messages to be hidden	The list of messages to be hidden contains all the messages that are to be hidden while pending.
	Lock list	The lock list contains all messages that are locked.
	Previous graphics picture	Exits the system, opens the last displayed process picture and show button set 1.

The PCS 7 message system is defined is configured in the SIMATIC manager and can be adapted to the customer's requirements.

CEMAT default settings have been pre-defined regarding color definition and in order to show fault type, message text and fault class together with each alarm.

Display of the PCS 7 Message list

Example for Journal list:

journal list

	Date	Time	Priority	Tagname	Event (What)	Tag Comment (Who)	Wher	FCL	Area	Status	Comment	Info	Loop in	Class
1	12/07/2018	11:48:01	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
2	12/07/2018	11:48:01	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
3	12/07/2018	11:47:55	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
4	12/07/2018	11:47:55	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
5	12/07/2018	11:47:51	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
6	12/07/2018	11:47:44	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm
7	12/07/2018	11:47:43	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
8	12/07/2018	11:47:43	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
9	12/07/2018	11:47:42	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm
10	12/07/2018	11:46:51	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
11	12/07/2018	11:46:51	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
12	12/07/2018	11:46:46	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
13	12/07/2018	11:46:46	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
14	12/07/2018	11:46:44	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
15	12/07/2018	11:46:31	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm
16	12/07/2018	11:45:41	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
17	12/07/2018	11:45:41	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
18	12/07/2018	11:45:39	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm
19	12/07/2018	11:45:38	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
20	12/07/2018	11:45:38	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
21	12/07/2018	11:45:35	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
22	12/07/2018	11:45:35	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
23	12/07/2018	11:45:32	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
24	12/07/2018	11:45:31	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
25	12/07/2018	11:45:31	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
26	12/07/2018	11:45:30	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
27	12/07/2018	11:45:24	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm
28	12/07/2018	11:44:30	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	C			X	Alarm
29	12/07/2018	11:44:30	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	Ackn			X	Alarm
30	12/07/2018	11:44:25	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
31	12/07/2018	11:44:25	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
32	12/07/2018	11:44:23	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
33	12/07/2018	11:44:21	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	C			X	Warning
34	12/07/2018	11:44:21	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	Ackn			X	Warning
35	12/07/2018	11:44:20	0	TG4_FA1/J1	H Limit 80.00 kW	Fan Motor Power	P		Training	G			X	Warning
36	12/07/2018	11:44:13	0	TG4_FA1/J1	HH Limit 90.00 kW	Fan Motor Power	P		Training	G			X	Alarm

Ready   Pending: 20   To acknowledge: 3   Hidden: 0   List: 1000

Example for Operation list:

operation list

	Date	Time	Priority	Tagname	Operation	Area	Comment	Info	Typ
1	12/07/2018	11:28:00	0	TG4_FA1/J1	Cemat01: Value HH limit (HH_Lim) new = 90 kW old = 180 kW	Training	X		Ope
2	12/07/2018	11:27:57	0	TG4_FA1/J1	Cemat01: Value H limit (H_Lim) new = 80 kW old = 100 kW	Training	X		Ope
3	12/07/2018	11:27:37	0	TG4_FA1/J1	Cemat01: Value H limit (H_Lim) new = 100 kW old = 170 kW	Training	X		Ope
4	12/07/2018	11:27:16	0	TG1_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
5	12/07/2018	11:27:00	0	TG2_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
6	12/07/2018	11:26:59	0	TG2_GR1/R1	Cemat01: Select command	Training	X		Ope
7	12/07/2018	11:26:50	0	TG5_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
8	12/07/2018	11:26:47	0	TG4_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
9	12/07/2018	11:26:45	0	TG1_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
10	12/07/2018	11:25:48	0	TG1_FLT/Filter	Cemat01: Hide Manually PLC process control messages, Failure on ES0C	Training	X		Ope
11	12/07/2018	11:25:43	0	TG1_FLT/Filter	Cemat01: Hide Manually PLC process control messages, Failure on ES0C	Training	X		Ope
12	12/07/2018	11:25:34	0	TG1_FLT/Filter	Cemat01: Hide Manually PLC process control messages, Failure on ES0C	Training	X		Ope
13	12/07/2018	10:43:25	0	TG1_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
14	12/07/2018	10:42:50	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
15	12/07/2018	10:42:50	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
16	12/07/2018	10:42:50	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
17	12/07/2018	10:42:50	0	TG1_GR1/G1	Cemat01: Acknowledgment Warning, Warning - high on ES0C	Training	X		Ope
18	12/07/2018	10:42:50	0	EG7_RF1/M1_SC	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C	Examples	X		Ope
19	11/07/2018	14:34:13	0	TG1_BC2/M1	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C	Training	X		Ope
20	11/07/2018	14:34:07	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
21	11/07/2018	14:34:07	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
22	11/07/2018	14:34:07	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
23	11/07/2018	14:34:07	0	TG1_GR1/G1	Cemat01: Acknowledgment Warning, Warning - high on ES0C	Training	X		Ope
24	11/07/2018	14:34:07	0	EG7_RF1/M1_SC	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C	Examples	X		Ope
25	10/07/2018	16:22:58	0	TG1_BC2/M1	Cemat01: Show Manually Alarm, Alarm - high on ES0C	Training	X		Ope
26	10/07/2018	16:22:24	0	TG1_BC2/M1	Cemat01: Hide Manually , on ES0C	Training	X		Ope
27	10/07/2018	16:18:11	0	TG1_GR1/G1	Cemat01: Start command new = 1 old = 0	Training	X		Ope
28	10/07/2018	16:06:22	0	SPC_G/G01	Cemat01: Stop command new = 1 old = 0	SPC Example	X		Ope
29	10/07/2018	16:05:14	0	SPC_G/G01	Cemat01: Start command new = 1 old = 0	SPC Example	X		Ope
30	10/07/2018	16:04:48	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
31	10/07/2018	16:04:48	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
32	10/07/2018	16:04:48	0	TG1_FLT/Filter	Cemat01: Acknowledgment PLC process control messages, Failure on ES0C	Training	X		Ope
33	10/07/2018	16:04:48	0	321_CR1/M1_T1	Cemat01: Acknowledgment Warning, Warning - high on ES0C	Demo	X		Ope
34	10/07/2018	16:04:48	0	TG1_GR1/G1	Cemat01: Acknowledgment Warning, Warning - high on ES0C	Training	X		Ope
35	10/07/2018	16:04:48	0	EG7_RF1/M1_SC	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C	Examples	X		Ope
36	10/07/2018	16:04:48	0	321_CR1/M1_T1	Cemat01: Acknowledgment Alarm, Alarm - high on ES0C	Demo	X		Ope

Ready   Pending: 20   To acknowledge: 3   Hidden: 0   List: 117

Color attributes

Depending on the message class and message state, the messages are displayed in the following colors:

	Alarm	Warning	Process	Operator Input
Message arrived	white / red	black / yellow	white / red	black / cyan
Message acknowledged	white / red	black / yellow	white / red	-
Message gone	black / light green	black / light green	black / light green	-

Listing of the fault classes

E	Electrical
M	Mechanical
S	Safety (emergency off switch)
P	Process-conditional

Message list structure

The message list structure for **all message lists, except the operation list** is as follows:

Column text	Description
Date	Incoming date
Time	Incoming time
Prio	Priority of message (16 is always on top)
Tagname	Plant identifier as defined for the Object
Event	Depending on the object fault types (e.g. operational)
Tag Comment	Message text as defined for the Object
FCL	Fault class: E: electrical M: mechanical P: process- conditional S: safety (emergency off)
Area	AREA Code (Plant Section)
Status	C=incoming; QS=acknowledged; G=went out
Comment	Message note: Identification that a note exists for this message
Info	Info Text Identification that an info text exists for this message
Loop in Alarm	A cross indicates that the function can be executed
Class	Indicates the message class, e. g.: Alarm, Warning, Operator message, System, PLC process control message

The message list structure for the **Operation list** is as follows:

Column text	Description
Date	Date of the operation
Time	Time of the operation
Tagname	Plant identifier as defined for Object
Operation	Operation
Area	AREA Code (Plant Section)
Comment	Message note: Identification that a note exists for this message
Info	Info Text Identification that an info text exists for this message
Type	Indicates the message type, e. g.: Operator message

Toolbar

Toolbar options can be configured individually for each message list. By default the following toolbar icons exist are available:

Icon	Function	Meaning
	Acknowledge individual message	Acknowledges the message with the selection triangle in front of it.
	Acknowledge all visible messages	Acknowledges all visible messages in the message window that are queued and require acknowledgement, unless they require individual acknowledgement.
	Open user-defined filter	Displays the "Selection" dialog box in the work area. This dialog box enables you to create, modify, an call message filters. The button is only available if you have, as a minimum, been assigned the authorization level "Higher process control" for an area.
	Deactivate all user-defined filters	Deactivates all active user-defined filters. The settings for all the meassage lists are reset to the PCS 7 default.
	Sort dialog	Opens a dialog box for customizing the sorting of displayed messages, for example, based on priority.
	Print	Sends a printout to a connected printer. The messages shown in the message window are printed immediately without a print dialog box appearing.
	Display first message	The selection triangle jumps to the first/oldest message in the message window. You can only use this function after deactivating the "autoscroll" function.
	Display previous message	The selection triangle jumps up to the previous message. You can only use this function after deactivating the "autoscroll" function.
	Display next message	The selection triangle jumps down to the next message. You can only use this function after deactivating the "autoscroll" function.
	Display last message	The selection triangle jumps to the last/most recent message in the message window. You can only use this function after deactivating the "autoscroll" function.
	Info text dialog	Opens a window for displaying pre-configured, supplemental message texts. You can recognize whether or not informational text was stored in a message by the cross in the "Info" column.
	Comments dialog	Opens a dialog where the user can retroactively enter a comment for a message in the process list, operation list and journal list You can recognize whether or not by the cross in the "Comment" column.

	Loop in Alarm	Displays the process picture containing the cause of the selected message in the work area. Depending on the source of the message, a faceplate or an SFC chart can also be displayed in the work area. This function cannot be used with system messages.
	Autoscroll	Activates/deactivates auto-scrolling.
		Autoscroll activated: The current message appears at the top of the window. The old messages are moved down (default settin gin the OS Project Editor). Message processing functions are valid only for messages that are currently queued. Manual scrolling is turned off.
		Autoscroll deactivated: You can select messages using the mouse. Message processing functions only affect the selected message. Horizontal and vertical scroll bars are also available for navigating in the message lists.

The following toolbar options may be added if required:

Icon	Function	Meaning
	Hit List	Show statistical information for the messages in additional columns in the journal list.
	Hide message	Hides the message you have marked in a message list (incoming alarm list, acknowledged alarm list or outgoing alarm list).
	Unhide message	Shows hidden messages again
	Refresh	Updates all the messages in the process list, operation list and journal list. The messages are displayed again.
	Export data	Export the selected Data to Excel
	First page	Navigates to the first page
	Previous page	Navigates to the previous page
	Next page	Navigates to the next page
	Last page	Navigates to the last page
	Configuration dialog	Allows configuration of the alarm logging in the runtime system. Changes will be reset at next restart!
	Display alarm help	Displays the help texts that were configured in the property of a message. The "Help" option must be selected in the parameters of the message.

Further toolbar options exist, but not explained in this document.

Refer to Manual Process control system PCS 7 OS process control

Icon	Function	Meaning
	Message list	
	Short term archive list	
	Long term archive list	
	Lock list	
	List of messages to be hidden	
	Acknowledge central signaling device	
	Emergency acknowledgement	
	Display options dialog	
	Lock dialog	
	Lock message	
	Time base dialog	
	Copy rows	
	Connect backup	
	Disconnect backup	

PCS 7 measuring point browsers

In CEMAT MinAS V9 the Object Browser has been replaced by the PCS 7 Measuring Point Browser.
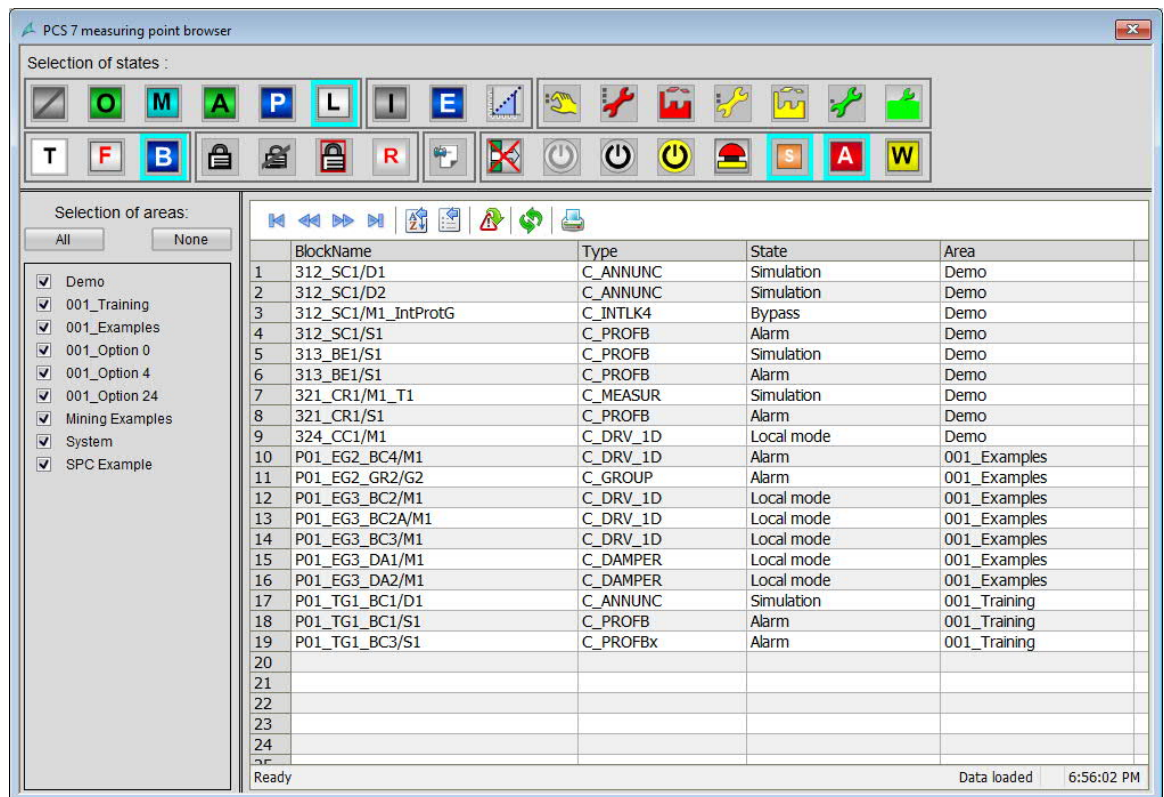
The PCS 7 measuring point browser gives a quick overview of the plant status and can be used in order to identify operation modes, to find notes or bypassed interlocks.

- Selections can be carried out per AREA and for the complete control system

- Multiple Selections are possible

- A double-click in the entry opens the faceplate of the corresponding object.

DataSets for Project specific Faceplate Adjustments

Some CEMAT faceplates (especially Standarf Faceplate and Diagnosis dialog) contain DataSets for Project specific adjustments.

The adjustments are linked to block "C_FB_PLC", parameter "OPTION" in the System chart.

Adjustments in the Standard Faceplate:
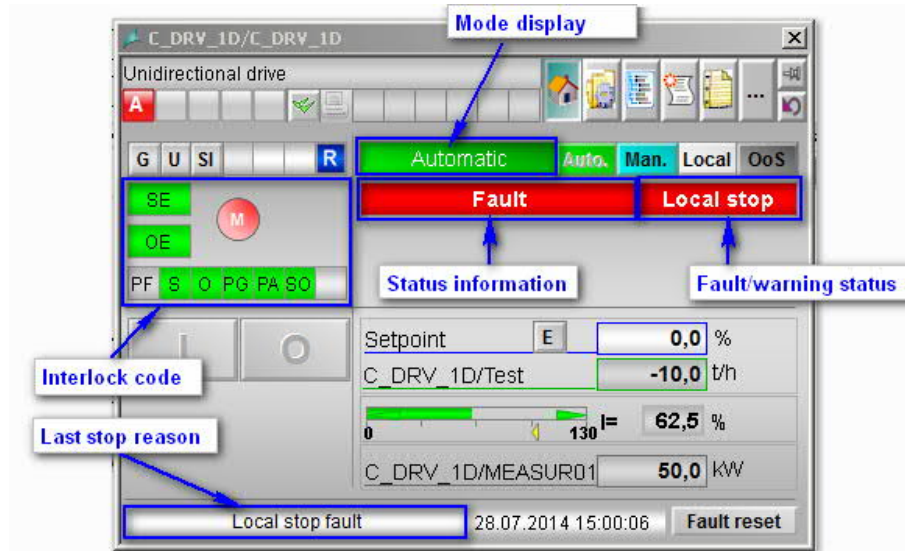
Adjustments in the Diagnosis Dialog:
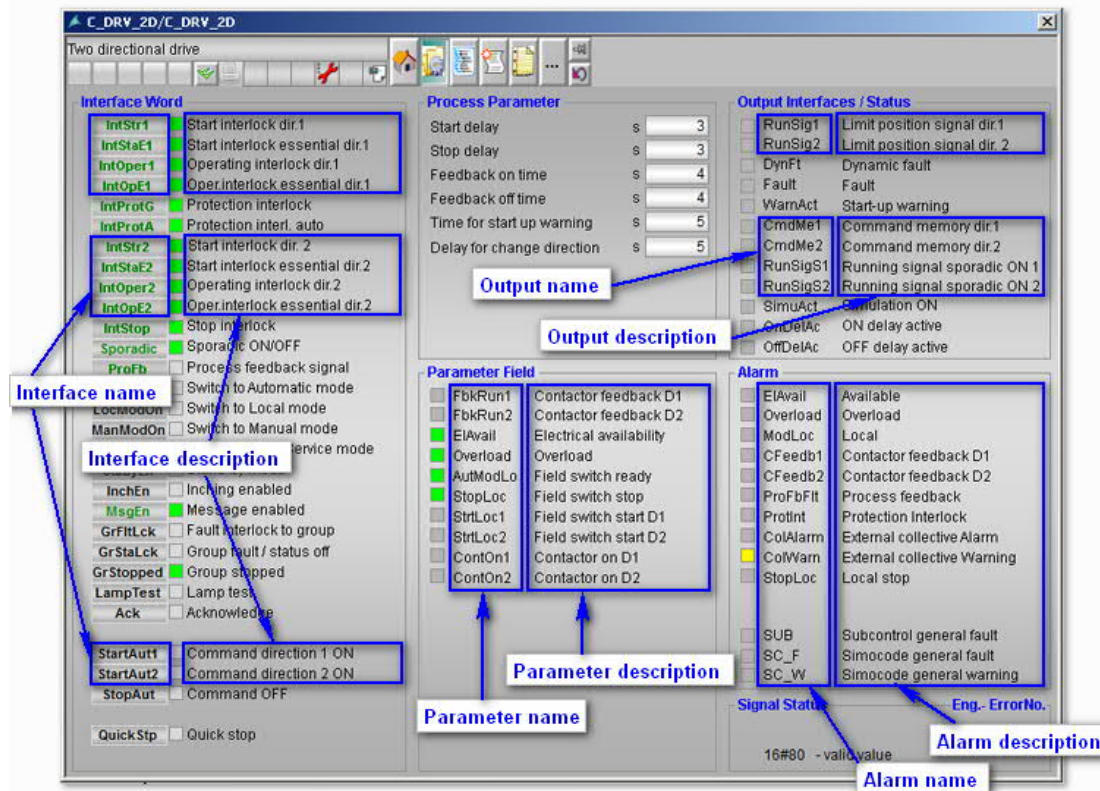
⚠ **Note:** At the moment customized Datasets only exist for LafargeHolcim (OPTION = 4) and Heidelberg Cement (OPTION = 7). OPTION = 1 is the default setting; OPTION = 6 is a copy of OPTION = 1 and not yet adapted (reserved).

Module description

General module structure

General Module Structure
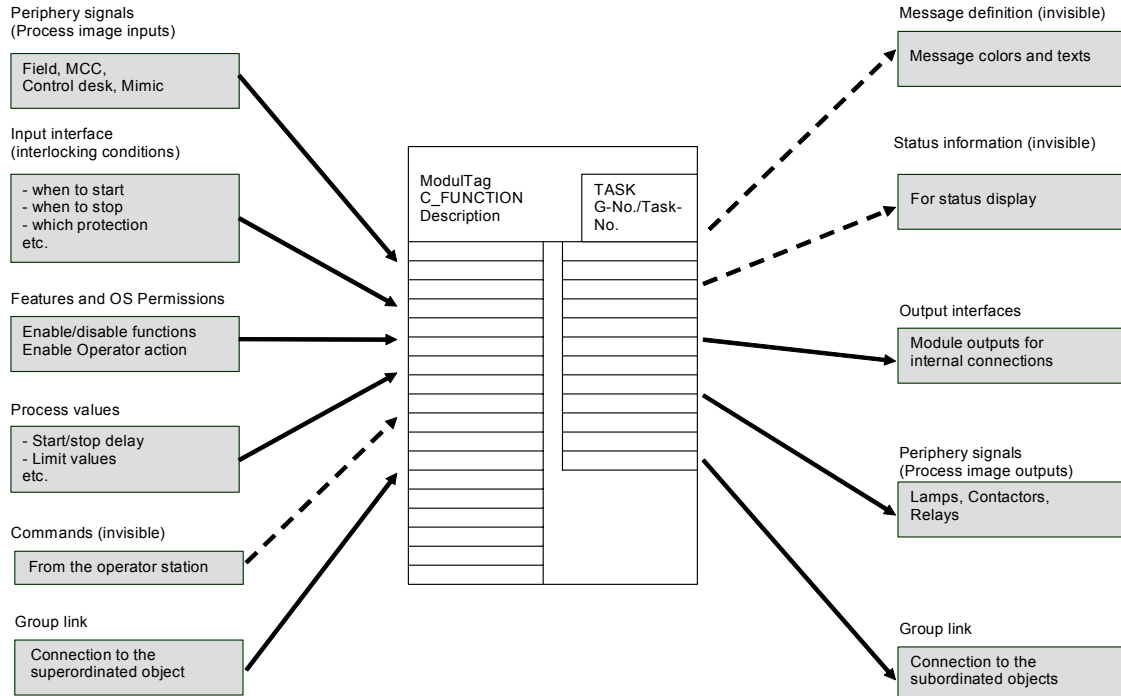
Block I/Os

Each block has a list of input and output parameters. The function of the I/Os is explained in the corresponding Object descriptions.
Dependent on the function, the I/Os may be connected with a signal (from the symobls file or an output of another block) or parameterized with a value. Unconnected inputs remain in the default status.
Some I/Os carry additional information like a Texts (Text 0 and/or Text 1), an Identifier, a Unit or an Operator authorization level. During the OS Compile this information is transferred to the internal Tag Management of WinCC and used for visualization purpose.

In Chapter "Operating Principle" of the Object description you find different types of I/Os:

- Hardware inputs

- Input interfaces

- Group and Object links

- Input/Output interfaces

- Output interfaces

- Hardware outputs

- Engineering Error

- Feature bits and OS Permissions

Hardware Inputs

These inputs are connected to the inputs of the periphery, such as contactor feedback, electrical availability, overload, contactor on command of the motor. Normally a signal from the symbols file is assigned to this interface.

Input Interfaces

Under Input interfaces you find all kind of block inputs except the Hardware inputs and Group/Object Links. Dependent on the function they either have to be connected by a block output or configured with a value:

-   Interlocking conditions:
    Inputs for interlocking conditions are of type Structure and can be connected by a signal (output such as "Running Signal" from another Cemat block) or by a logic (Interlock block). The block which is connected to the interlocking condition input can be opened in the HMI (Standard Faceplate or Diagnosis) via click on the interface.

-   Interfaces for mode change:
    Beside the mode change via HMI, the possibility exist to change the operation mode of a block by program, either via LINK interface or via individual mode change inputs.

-   Start-/Stop commands:
    To be connected with the Start/Stop command or Quick Stop of the superordinate block.

-   Feedback Signals:
    Any kind of Feedback information from a subordinated block (object belonging to a group, Subcontrol of a drive, SIMOCODE, Drive measurement, etc.).
    Some feedback information can also be given via LINK interface (if the corresponding feature bit is set).

-   Process Parameters
    All process parameters already contain default values and must be adapted for the application according to the functional description. Some values, such as Scale beginning, Scale End and Limit Values for a Measurement can be adapted in the CFC during Engineering or FAT, other values need to be adjusted during the commissioning of the plant or even later.
    Process Parameters can also be modified online via HMI, but please keep in mind that the "Read back" function must be used in order to save the modification in the offline CFC.

-   Enable/disable functions:
    The mayority of the optional block functions are enabled/disabled via Feature bit settings, because they can not be modified online.
    Functions such as "External Setpoint" or "Message Enable" need to be enabled/disabled by a process condition and therefore special interfaces are provided which need to be connected by the corresponding logic.

-   Display functions:
    The information connected to these kind of inputs has no influence in the function of the block and is only used for display in the block faceplate.

Group and Object links

Each drive, annunciation block and measuring value block must be connected to the group via the so-called group link interface. The blocks may directly be connected to the group or indirectly via route module.

Annunciation blocks C_ANNUNC or C_ANNUN8 and measuring value blocks C_MEASUR *can* also be linked directly to a drive (if the annunciation or measurement belongs to the same equipment), the C_PROFB *must* be connected to the corresponding drive. This is done via O_LINK connection.

For links between objects of one AS to a group in a different AS additional send and receive blocks are needed.
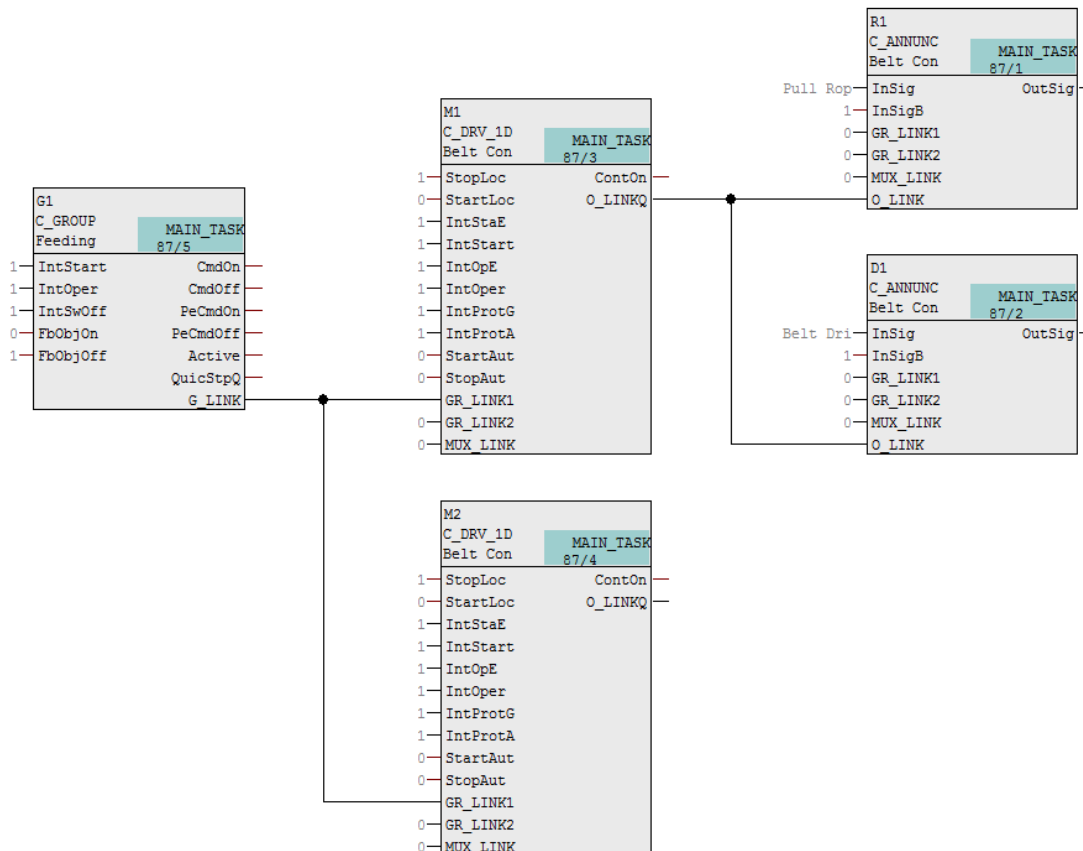
Input/Output interfaces

Interfaces of type I/O contain the result of calculations within the blocks, like counter values, runtime values, or maintenance information. The values are available for read back function.

Output Interfaces

All block stati which are needed for the connections to other blocks (e. g. start command, stop command, running, fault, etc.) are available as block outputs.

Hardware Outputs

These outputs are connected directly to the outputs of the periphery, such as contactor on command of the motor. Normally a signal from the symbols file is assigned to this interface.

Engineering Errors

In case of a wrong parameterization the block output ErrorNum contains a number different from zero (in online-mode) and the block is switched to "Out of Service". You have to check the object description and correct the fault before you proceed. Only one error per instance can be displayed at a time.

Feature bits

Via feature bits the behavior of the block can be adapted (e.g. for operating modes) and block functions can be enabled or disabled.

```
Select Structure Element                                          ×

Structure:

Feature [STRUCT] 'Status of various features'                     ^
   --- Bit0 [BOOL] 'Local mode exists':  1
   --- Bit1 [BOOL] 'Local ON via program possible ':  1
   --- Bit2 [BOOL] 'Local OFF via program possible ':  1
   --- Bit3 [BOOL] 'Local start active in Automatic / Manual':  0
```
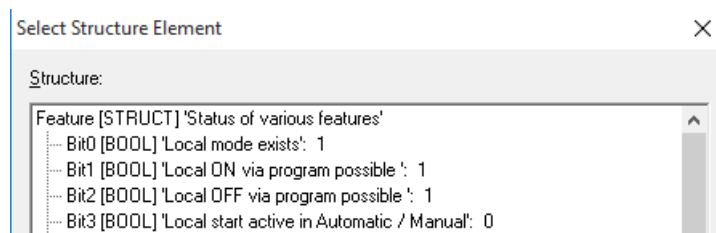
OS Permissions

Via OS Permissions the Operator actions can be enabled or disabled and the type of operation can be configured (e. g. mode change with single operation or with confirmation)

```
Select Structure Element                                          ×

Structure:

OS_Perm [STRUCT] 'Operator Permissions'                           ^
   --- Bit0 [BOOL] '1 = Operator can change to Local mode':  1
   --- Bit1 [BOOL] '1 = Operator can change to Manual mode Interlocked':  1
   --- Bit2 [BOOL] '1 = Operator can change to Automatic mode':  1
   --- Bit3 [BOOL] :  0
```
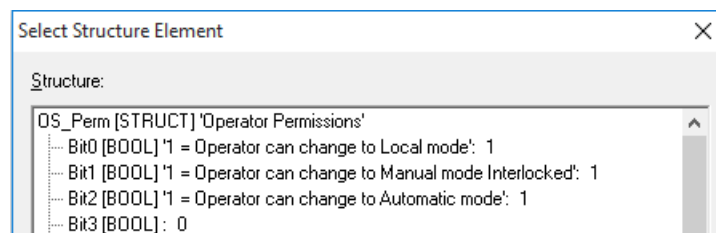
Block Functions

The following chapters contain a summary of the most important block functions of the CEMAT Objects.

For further details and programming instructions please read the CEMAT Object description for the corresponding block type.

SYSPLCxx System functions and Runtime sequence

CEMAT MinAS requires a number of infrastructure blocks for global settings and configurations, such as:

- acknowledgement mode

- customization of text displays

- behavior in warning mode

- configuration of the PLC number

- sequence test mode

- text definitions for "still faulty" message

- feature master blocks

All these settings are carried out at a central location, in the so-called "System chart" SYSPLCxx which must be installed in the S7-Program of each CEMAT AS.

```
ILS_OB1_START
OB1_SYS1
Beginn o      MAIN_TASK
              1/2
```

```
ILS_OB35_BEGIN
OB35_SYS
CFC_ILS       100MS_TAS
              1/3
```

```
CEMAT_OB1
C_OB1SY1
Beginn o      MAIN_TASK
              1/3
```

```
ILS_OB35_END
OB35_SYS
CFC_ILS       100MS_TAS
              4/1
```

```
PLC
C_FB_PLC
CEMAT PL      MAIN_TASK
              1/15
  0 — ACK_GR        OS_CNT —
  0 — ACK_OB        STANDARD —
  0 — REL_WSTP      ACK_GR_O —
'NO'— SEQ_TEST      ACK_OB_O —
  0 — SimSave       WSTP_O —
  0 — SimLoad       SEQT_STA —
  0 — SimPause      PLC_NO_O —
  0 — PLC_NO        OPTION_O —
  1 — OPTION
  0 — SYSTEST
```

```
For Sequence Test write
the String 'TEST' into the
Parameter SEQ_TEST  &
restart the PLC.

To leave this mode write
'NO' & restart the PLC
again.
```

The blocks in the System Chart as well es all other CEMAT objects require a certain runtime sequence. For further information see Engineering Manual, chapter 06_AS_Engineering.

Feature Master Concept

Features and OS Permissions related to the operating or programming philosophy must be consistent in all instances of the block. In order to ensure this, the relevant Feature bits and OS Permission bits can be selected and defined once per block type via the corresponding Feature Master block located in the system chart. These settings can be applied to all instances of the block type.

Example for Feature Master block C_M_DRV_1D for CEMAT block type C_DRV_1D:

Structure bit settings:

Via Structure Feature (Feature2 or OS_Perm) of the Feature Master block the default values for the Feature bits and OS Permission bits are defined:
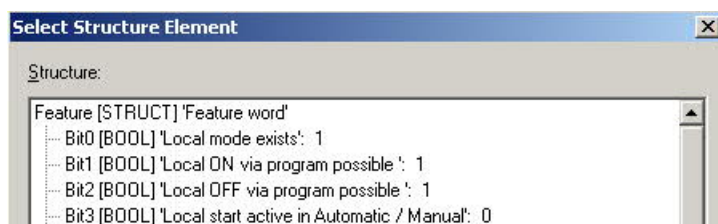
Via Structure input Feat_Copy (Feat2_Co or OS_Copy) of the Feature Master block it can be decided whether the value from Structure Feature (Feature2 or OS_Perm) is transferred to the block instances or not.
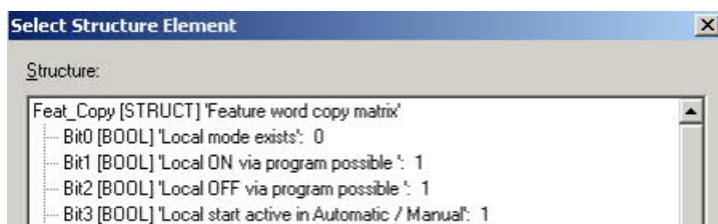
With Feat_Copy.bitxx = 1-Signal, the status of the Feature.bitxx is transferred to all instances of the corresponding CEMAT block.

Feature Master blocks exist for the following block types:

C_M_DRV_1D for C_DRV_1D
C_M_DRV_2D for C_DRV_2D
C_M_DAMPER for C_DAMPER
C_M_VALVE for C_VALVE
C_M_MEASUR for C_MEASUR
C_M_ANNUNC for C_ANNUNC
C_M_ANNUN8 for C_ANNUN8
C_M_PROFB for C_PROFB
C_M_PROFBx for C_PROFBx
C_M_GROUP for C_GROUP
C_M_ROUTE for C_ROUTE

Configuration mode and Consistency check

Feature bits and OS Permissions must always be consistent and can therefore not be modified for running (or active) devices.

Therefore, all CEMAT blocks with Feature master work with an **Internal Memory**, which is not getting updated during normal operation of the block.

The internal Memory is only updated in **Configuration mode**

-    If the block is called for the first time in the program

-    During the restart of the AS

-    If the block is in Out of Service mode

-    In Sequence test mode (PIN protected)

The HMI always shows the status of the internal memory!

In order to allow the transfer of Features and OS Permissions from the Feature Master block to the CEMAT Module, block parameter **FeatMast** of the CEMAT Module must have 1-Singal.

Update of the internal memory:
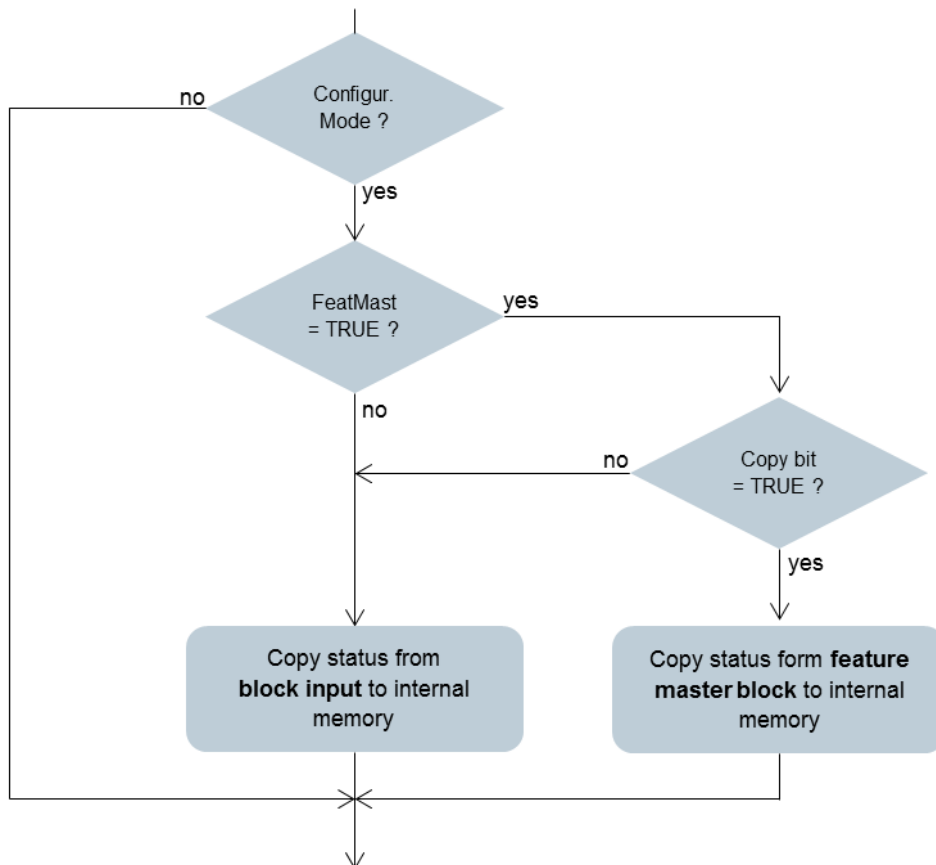
The Feature bit settings of the Feature Master blocks are checked for consistence. Only if the setting is consistent (block output ErrorNum = 0) and if the CEMAT block is in configuration state, the setting of the Feature Master is transferred to the instance of the CEMAT module.

For further details see Engineering Manual, chapter 06_AS_Engineering.

C_DRV_1D Unidirectional Drive

```
M1
C_DRV_1D            MAIN_TASK
Unidirec            119/17
0 — FbkRun          RunSig —
1 — ElAvail         ContOn —
1 — Overload        O_LINKQ —
1 — AutModLo
1 — StopLoc
0 — StartLoc
1 — ProFB
0 — StartAut
0 — StopAut
0 — QuickStp
0 — GR_LINK1
```
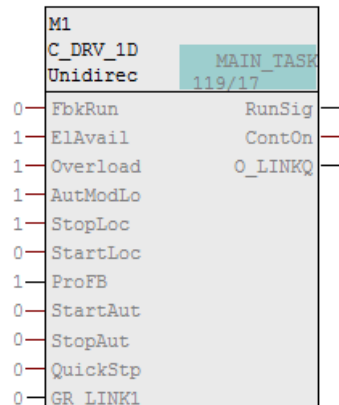
Main Function

The main function of block type C_DRV_1D is the control of <u>a unidirectional drive</u>. The block provides a contactor output signal **ContOn** and monitors a contactor feedback signal **FbkRun**. In addition the electrical availability and thermal overload can be evaluated via inputs **ElAvail** and **Overload**.

If additional protection signals (binary or analog) exist, a block type C_ANNUNC, C_ANNUN8 or C_MEASUR must be added and linked to the drive block.

For the monitoring of a process feedback signal (binary or analog), block types C_PROFB or C_PROFBx must be used.

The drive can be controlled in different operation modes:
In **Automatic mode** the drive is started and stopped via program interface, typically by a Cemat Group block
In **Manual mode** the drive is started and stopped via Operator Interface
In **Local mode** the drive is started and stopped via a Field switch
Out of Service mode disables any control function and it is required in order to permit the change of configuration settings in the program.

The drive block has a standard interface for signals from the field switch (signals **AutModLo**, **StartLoc** and **StopLoc**). The type of evaluation can be configured.

The following signals are evaluated by the drive block and lead to an alarm message (or warning message) in case of trip while the drive was running in automatic or manual mode, or during start-up in automatic mode:

- Contactor feedback   (feedback from main contactor)
- Available   (electrical availability)
- Local   (field switch ready)
- Overload   (overload or bimetal)
- Rapid stop   (emergency stop from the OS)
- Local stop   (stop from field switch)
- Subcontrol general fault (from Subcontrol)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_DRV_1D. For details refer to the object description of C_DRV_1D

Functions for Starting and stopping:

Function	Short description
Startup-warning	Process parameter for start-up warning.
Start and stop delay	Process parameters for start and stop delay in automatic mode
Feedback supervision	Process parameters for Contactor feedback monitoring during startup or shutdown
Quick stop	Bypassing stop delay
Rapid Stop	Allows an emergency stop from Operator station
Sporadic control	Permits a conditional on/off in automatic mode
Interface to Power Management	Equipment can be stopped by power management
Start interlocks	For process conditions which need to be ready before start-up of the drive
Operation interlocks	For process conditions which need to be ready while the drive is running
Switch-off interlock	For process conditions which need to be ready before stopping the drive
Protection interlocks	Different protection interlocks for evaluation depending on operating mode

Fault handling and alarming:

Function	Short description
Warning mode	Drive can be configured as "warning device", creating warnings instead of faults and not interrupting group start
Alarming/Messages	Plausibility logic for faults Alarm/warning messages are only created after a trip (while the device was running or during start-up) and only in Automatic or Manual mode. Non-running devices or devices in Local mode don't create alarm/warning messages
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Operation and Monitoring:

Function	Short description
Link to a measurement	For the display of a percentage value (e. g. for the motor current) For the display of one physical value. Link to multiple analog values can be achieved via C_ANASEL block.
Simocode Interface	Link to the Simocode Adapter block C_SIMOS
Subcontrol interface	Link to a Subcontrol, such as Adapter blocks for Sinamics C_SINA or Robicon C_ROBI
Setpoint function	Interface for providing a Setpoint via Operator Station (Internal SP) of via program (External SP)
User Output	Free configurable output. Can be set via Operator Station (button in the faceplate) or via program.
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_DRV_2D Bidirectional Drive

```
┌─────────────────────────────┐
│ M2                          │
│ C_DRV_2D         MAIN_TASK  │
│ Two dire          119/18    │
│                             │
0─┤ FbkRun1            RunSig1 ├─
0─┤ FbkRun2            RunSig2 ├─
1─┤ ElAvail            ContOn1 ├─
1─┤ Overload           ContOn2 ├─
1─┤ AutModLo           O_LINKQ ├─
1─┤ StopLoc                    │
0─┤ StrtLoc1                   │
0─┤ StrtLoc2                   │
1─┤ ProFB                      │
0─┤ StrtAut1                   │
0─┤ StrtAut2                   │
0─┤ StopAut                    │
0─┤ QuickStp                   │
0─┤ GR_LINK1                   │
└─────────────────────────────┘
```
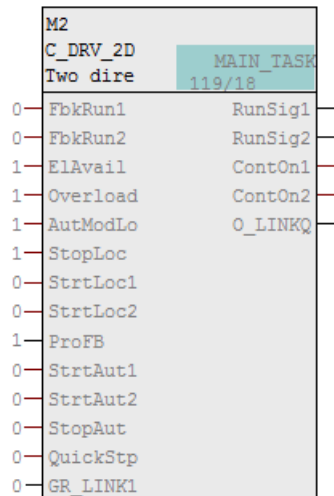
Main Function

The main function of block type C_DRV_2D is the control of a bidirectional drive. The block provides two contactor output signals **ContOn1** and **ContOn2** and monitors the contactor feedback signals **FbkRun1** and **FbkRun2**. In addition the electrical availability and thermal overload can be evaluated via inputs **ElAvail** and **Overload**.

If additional protection signals (binary or analog) exist, a block type C_ANNUNC, C_ANNUN8 or C_MEASUR must be added and linked to the drive block.

For the monitoring of a process feedback signal (binary or analog), block types C_PROFB or C_PROFBx must be used.

The drive can be controlled in different operation modes:
In **Automatic mode** the drive is started and stopped via program interface, typically by a Cemat Group block
In **Manual mode** the drive is started and stopped via Operator Interface
In **Local mode** the drive is started and stopped via a Field switch
Out of Service mode disables any control function and it is required in order to permit the change of configuration settings in the program.

The drive block has a standard interface for signals from the field switch (signals **AutModLo**, **StrtLoc1**, **StrtLoc2** and **StopLoc**). The type of evaluation can be configured.

The following signals are evaluated by the drive block and lead to an alarm message (or warning message) in case of trip while the drive was running in automatic or manual mode, or during start-up in automatic mode:

- Contactor feedback D1   (feedback from main contactor)
- Contactor feedback D2   (feedback from main contactor)
- Available   (electrical availability)
- Local   (field switch ready)
- Overload   (overload or bimetal)
- Rapid stop   (emergency stop from the OS)
- Local stop   (stop from field switch)
- Subcontrol general fault   (from Subcontrol)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_DRV_2D. For details refer to the object description of C_DRV_2D

Functions for Starting and stopping:

Function	Short description
Startup-warning	Process parameter for start-up warning.
Start and stop delay	Process parameters for start and stop delay in automatic mode and for waiting time in case of direction change
Feedback supervision	Process parameters for Contactor feedback monitoring during startup or shutdown
Quick stop	Bypassing stop delay
Rapid Stop	Allows an emergency stop from Operator station
Sporadic control	Permits a conditional on/off in automatic mode
Interface to Power Management	Equipment can be stopped by power management
Start interlocks	For process conditions which need to be ready before start-up of the drive
Operation interlocks	For process conditions which need to be ready while the drive is running
Switch-off interlock	For process conditions which need to be ready before stopping the drive
Protection interlocks	Different protection interlocks for evaluation depending on operating mode

Fault handling and alarming:

Function	Short description
Warning mode	Drive can be configured as "warning device", creating warnings instead of faults and not interrupting group start
Alarming/Messages	Plausibility logic for faults Alarm/warning messages are only created after a trip (while the device was running or during start-up) and only in Automatic or Manual mode. Non-running devices or devices in Local mode don't create alarm/warning messages
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Operation and Monitoring:

Function	Short description
Link to a measurement	For the display of a percentage value (e. g. for the motor current) For the display of one physical value. Link to multiple analog values can be achieved via C_ANASEL block.
Simocode Interface	Link to the Simocode Adapter block C_SIMOS
Subcontrol interface	Link to a Subcontrol, such as Adapter blocks for Sinamics C_SINA or Robicon C_ROBI
Setpoint function	Interface for providing a Setpoint via Operator Station (Internal SP) of via program (External SP)
User Output	Free configurable output. Can be set via Operator Station (button in the faceplate) or via program.
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_DAMPER Damper

```
┌─────────────────────┐
│ M3                   │
│ C_DAMPER             │
│ Damper      MAIN_TASK│
│             119/19   │
0─┤ FbkRun1      X_Pos_OS ├─
0─┤ FbkRun2        SP_Out ├─
0─┤ FbkPos1       PosSig1 ├─
0─┤ FbkPos2       PosSig2 ├─
0─┤ IntPos1       ContOn1 ├─
0─┤ IntPos2       ContOn2 ├─
1─┤ ElAvail       O_LINKQ ├─
1─┤ Overload             │
1─┤ AutModLo             │
1─┤ StopLoc              │
0─┤ StrtLoc1             │
0─┤ StrtLoc2             │
0─┤ TorqSw1              │
0─┤ TorqSw2              │
0─┤ StrtAut1             │
0─┤ StopAut              │
0─┤ StrtAut2             │
0.0─┤ SP_Ex              │
0.0─┤ PosVal             │
0─┤ GR_LINK1             │
└─────────────────────┘
```
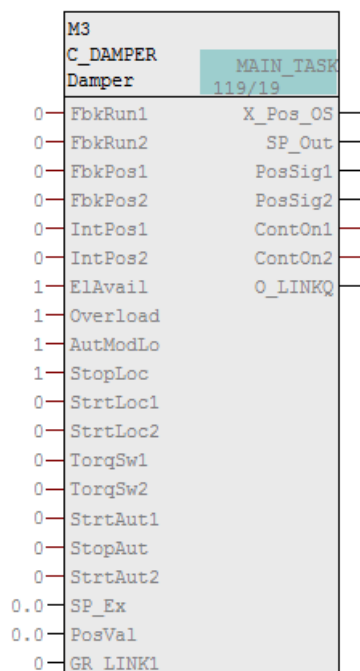
Main Function

The main function of block type C_DAMPER is the control of <u>a damper or actuator</u>, either in control mode (until it reaches the position feedback), in positioning mode (until it reaches a certain position) or in inching mode (as long as the command is given).

The block provides two contactor output signals **ContOn1** and **ContOn2** and an analog output **SP_Out** (for analog actuators) and monitors the position feedback **PosSig1** (closed) and **PosSig2** (open), provided by the limit switches, or the actual position **PosVal**, typically provided by a C_MEASUR block.

In addition the electrical availability and thermal overload can be evaluated via inputs **ElAvail** and **Overload**.
Torque switches can be evaluated via inputs **TorqSw1** and **TorqSw2**.
An option for the supervision of contactor feedback signals **FbkRun1** and **FbkRun2** and internal feedback signals **IntPos1** and **IntPos2** exists as well.

If additional protection signals (binary or analog) exist, a block type C_ANNUNC, C_ANNUN8 or C_MEASUR must be added and linked to the damper block.

The damper can be controlled in different operation modes:
In **Automatic mode** the drive is started and stopped via program interface, typically by a Cemat Group block
In **Manual mode** the drive is started and stopped via Operator Interface
In **Local mode** the drive is started and stopped via a Field switch
Out of Service mode disables any control function and it is required in order to permit the change of configuration settings in the program.

The damper block has a standard interface for signals from the field switch (signals **AutModLo**, **StrtLoc1**, **StrtLoc2** and **StopLoc**). The type of evaluation can be configured.

The following signals are evaluated by the damper block and lead to an alarm message (or warning message) in case of trip while the damper was moving in automatic or manual mode, or during start-up in automatic mode:

- Contactor feedback D1   (feedback from main contactor)
- Contactor feedback D2   (feedback from main contactor)

- Mechanical D1　　　　　　(position feedback supervision)
- Mechanical D2　　　　　　(position feedback supervision)
- Available　　　　　　　　(electrical availability)
- Local　　　　　　　　　　(field switch ready)
- Overload　　　　　　　　(overload or bimetal)
- Rapid stop　　　　　　　(emergency stop from the OS)
- Local stop　　　　　　　(stop from field switch)
- Torque D1　　　　　　　(torque trip)
- Torque D2　　　　　　　(torque trip)
- Internal limit position D1　(internal limit switch supervision)
- Internal limit position D2　(internal limit switch supervision)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_DAMPER. For details refer to the object description of C_DAMPER

Functions for Starting and stopping:

Function	Short description
Startup-warning	Process parameter for start-up warning.
Feedback supervision	Process parameters for Contactor feedback monitoring
Limit switch supervision	Process parameters for Move time supervision and for limit switch delay.
Regain lost limit position	Automatic forcing into the "lost" limit position
Safe position	Forcing into a defined "safe" position
Rapid Stop	Allows an emergency stop from Operator station
Waggle function	In case of a mechanical fault or torque switch fault during automatic control, the damper will be controlled back to the original direction and try again.
Start interlocks	For process conditions which need to be ready before start-up of the damper
Operation interlocks	For process conditions which need to be ready while the damper is moving
Protection interlocks	For additional protection signals
Simulation of limit positions	Operator can enable simulation for Position 1 and 2

Functions for Positioning mode:

Function	Short description
Internal and External Setpoint	Interface for providing a Setpoint via Operator Station (Internal SP) of via program (External SP). Process parameters for Setpoint scale and unit, Setpoint limits, Dead zone high and low
Inching in positioning mode	In order to allow adjustments in positioning mode
Calibration function	For adjustment of Position indication 0-100% based on limit position closed and open

Fault handling and alarming:

Function	Short description
Warning mode	Damper can be configured as "warning device", creating warnings instead of faults and not interrupting group start
Alarming/Messages	Plausibility logic for faults Alarm/warning messages are only created after a trip (while the device was running or during start-up) and only in Automatic or Manual mode. Non-running devices or devices in Local mode don't create alarm/warning messages
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Operation and Monitoring:

Function	Short description
Link to a measurement	For the display of one physical value. Link to different analog values can be achieved via C_ANASEL block.
Simocode Interface	Link to the Simocode Adapter block C_SIMOS
Setpoint function	Interface for providing a Setpoint via Operator Station (Internal SP) of via program (External SP)
User Output	Free configurable output. Can be set via Operator Station (button in the faceplate) or via program.
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_VALVE Valve

```
V1
C_VALVE        MAIN_TASK
Valve          119/20
0— FbkRun        PosSig1 —
1— FbkPos1       PosSig2 —
0— FbkPos2        ContOn —
1— ElAvail       O_LINKQ —
1— Overload
1— AutModLo
1— StopLoc
0— StartLoc
0— StartAut
0— StopAut
0— QuickStp
0— GR_LINK1
```
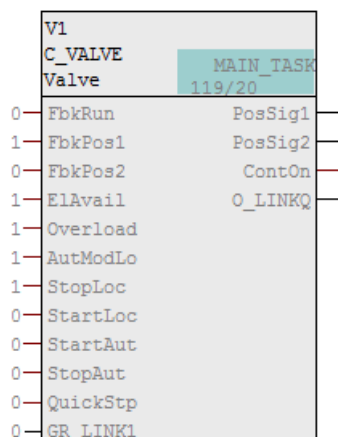
Main Function

The main function of block type C_VALVE is the control of a valve. The block provides one contactor output signal **ContOn** and monitors a position feedback signals **PosSig1** (closed) and **PosSig2** (open). By default, with a 1-Signal at output ContOn the valve is controlled to the Open direction, but this becavior can be inverted.
In addition the electrical availability and the thermal overload can be evaluated via inputs **ElAvail** and **Overload**.
An option for the supervision of contactor feedback signal **FbkRun** exists as well.

If additional protection signals (binary or analog) exist, a block type C_ANNUNC, C_ANNUN8 or C_MEASUR must be added and linked to the valve block.

The valve can be controlled in different operation modes:
In **Automatic mode** the drive is started and stopped via program interface, typically by a Cemat Group block
In **Manual mode** the drive is started and stopped via Operator Interface
In **Local mode** the drive is started and stopped via a Field switch
Out of Service mode disables any control function and it is required in order to permit the change of configuration settings in the program.

The valve block has a standard interface for signals from the field switch (signals **AutModLo**, **StartLoc** and **StopLoc**). The type of evaluation can be configured.

Alarming: Any fault/warning of the valve leads to a (red) fault or (yellow) warning indication. In Automatic mode or Manual mode, a fault (or warning) of an activated or a fault (or warning) during activation leads to a flashing fault (or warning) indication and a message is created. Acknowledgement is needed.
No message and no acknowledgement needed for non-activated valve and if the valve is in local mode.

The following signals are evaluated by the valve block and lead to an alarm message (or warning message) in case of trip while the valve was activated in automatic or manual mode, or during start-up in automatic mode:

- Contactor feedback   (feedback from main contactor)
- Move time   (position feedback supervision)
- Position lost   (position feedback supervision)
- Available   (electrical availability)
- Local   (field switch ready)
- Overload   (overload or bimetal)
- Rapid stop   (emergency stop from the OS)
- Local stop   (stop from field switch)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_VALVE. For details refer to the object description of C_VALVE

Functions for Starting and stopping:

Function	Short description
Startup-warning	Process parameter for start-up warning.
Start and stop delay	Process parameters for start and stop delay in automatic mode
Feedback supervision	Process parameters for Contactor feedback monitoring during startup or shutdown
Limit switch supervision	Process parameters for Move time supervision and for limit switch delay.
Quick stop	Bypassing stop delay
Rapid Stop	Allows an emergency stop from Operator station
Sporadic control	Permits a conditional on/off in automatic mode
Start interlocks	For process conditions which need to be ready before activation of the valve
Operation interlocks	For process conditions which need to be ready while the valve is activated
Interfaces for Protection interlocks	For additional protection signals
Simulation if limit positions	Operator can enable simulation active and idle position
Retain command	Retain command in case of Feedback fault or Position fault

Fault handling and alarming:

Function	Short description
Warning mode	Valve can be configured as "warning device", creating warnings instead of faults and not interrupting group start
Alarming/Messages	Plausibility logic for faults Alarm/warning messages are only created after a trip (while the device was running or during start-up) and only in Automatic or Manual mode. Non-running devices or devices in Local mode don't create alarm/warning messages
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the

	faceplate for acknowledgement of the fault

Operation and Monitoring:

Function	Short description
Simocode Interface	Link to the Simocode Adapter block C_SIMOS
User Output	Free configurable output. Can be set via Operator Station (button in the faceplate) or via program.
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_ANNUNC Annunciation block

```
X1
C_ANNUNC
Annuncia          MAIN_TASK
                  119/9
InSig 1─ InSig          OutSig ─
      0─ ProcSig          Warn ─
      0─ GR_LINK1
      0─ O_LINK
```

Main Function

The main function of block type C_ANNUNC is the supervision of <u>one binary process signal</u> in order to create fault of warning messages or both.

The block evaluates a binary process singal, connected to input **InSig** or **InSigB** and provides its status at ouput **OutSig**.

The kind of evaluation (immediately or delayed) can be adjusted via process parameters.

The reaction (static indication, alarm message, fault message or warning or two-level-alarm) can be configured via Feature bit settings and block interfaces.

The C_ANNUNC block can be linked to a drive block in order to exchange information with the drive (e.g. for message trigger or conditional supervision).

For signal evaluation the annunciation block must be in **Automatic mode.**
Out of Service mode disables the function and it is required in order to permit the change of configuration settings in the program.

The following signal status is evaluated by the annunciation block and leads to an alarm message (or warning message):

- Fault (to be defined)
- Warning (to be defined)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_ANNUNC. For details refer to the object description of C_ANNUNC

Evaluation of the process signal and alarming:

Function	Short description
Conditional and delayed supervision	Process parameter for supervision delay
Delayed fault/warning evaluation	Process parameters for delay for incoming or outgoing fault
Two-level-alarm	Producing first warning and after delay fault Process parameter for delay between warning and fault message
Message repetition	Process parameter for repetition time
Simulation function	Reading a simulation value instead of the input
Message trigger	Message can be triggered by a drive fault, in order to get the message at the moment of a drive stop
Alarming/Messages	Message can be disabled by a process condition in order to get only a static fault indication
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_ANNUN8 Annunciation block

```
X2
C_ANNUN8
Annuncia              MAIN_TASK
                       119/10
InSig1 1—  InSig1        OutSig1 —
InSig2 1—  InSig2        OutSig2 —
InSig3 1—  InSig3        OutSig3 —
InSig4 1—  InSig4        OutSig4 —
InSig5 1—  InSig5        OutSig5 —
InSig6 1—  InSig6        OutSig6 —
InSig7 1—  InSig7        OutSig7 —
       0—  GR_LINK1        Fault —
       0—  O_LINK           Warn —
```

Main Function

The main function of block type C_ANNUN8 is the supervision of up to 7 binary process signals in order to create fault of warning messages.

The block evaluates up to binary process signals, connected to input **InSig1** to **InSig7** and provides its status at output **OutSig1** to **OutSig7**. Each signal can be configured either as warning or as fault. Block outputs **Fault** and **Warning** provide summarizing information.

The kind of evaluation (immediately or delayed) can be adjusted via process parameters.

The reaction (static indication, alarm message or fault message) can be configured via Feature bit settings and block interfaces.

The C_ANNUN8 block can be linked to a drive block in order to exchange information with the drive (e.g. for message trigger or conditional supervision).

For signal evaluation the annunciation block must be in **Automatic mode.**
Out of Service mode disables the function and it is required in order to permit the change of configuration settings in the program.

The following signal stati are evaluated by the annunciation block and leads to an alarm message (or warning message):

- Fault/warning Signal 1 (to be defined)
- Fault/warning Signal 2 (to be defined)
- Fault/warning Signal 3 (to be defined)
- Fault/warning Signal 4 (to be defined)
- Fault/warning Signal 5 (to be defined)
- Fault/warning Signal 6 (to be defined)
- Fault/warning Signal 7 (to be defined)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_ANNUN8. For details refer to the object description of C_ANNUN8

Evaluation of the process signal and alarming:

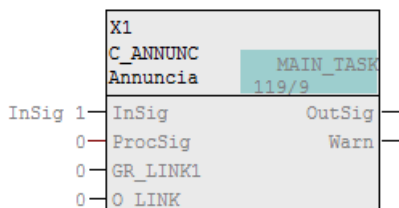| Function	Short description
Conditional and delayed supervision	Process parameter for supervision delay
Delayed fault/warning evaluation	Process parameters for delay for incoming fault
Simulation function	Reading a simulation value instead of the inputs
Alarming/Messages	Message can be disabled by a process condition in order to get only a static fault indication
Message trigger	Message can be triggered by a drive fault, in order to get the message at the moment of a drive stop
Message Enable	Message can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_PROFB Process Feedback block

```
S1
C_PROFB
Process              MAIN_TASK
                     119/12
InSig 0─ InSig              ProFB ─
  0.0─ PV
    0─ O_LINK
```

Main Function

The main function of block type C_PROFB is the supervision of <u>one process feedback signal</u>, such as speed monitor or pressure for a drive. The process feedback can be a binary signal (continuous ore pulses) of an analog value.

For the evaluation of a binary process feedback signal must be connected to input **InSig** or **InSigB,** for the evaluation of an analog process feedback the process feedback signal must be connected to input **PV** of the Process Feedback block.
In both cases the Process Feedback block provides the status of the process feedback at output **ProFB** which must be linked to input **ProFB** of the corresponding drive block.

Process feedback can be monitored during start-up, while the motor is running and during shut-down of the drive.

The C_PROFB block must be linked to a drive block in order to exchange information with the drive (e.g. for message enable or conditional supervision).

For signal evaluation the Process Feedback block must be in **Automatic mode** (mode change is carried out together with the drive).
Out of Service mode disables the function and it is required in order to permit the change of configuration settings in the program.

The following signal stati are evaluated by the process feedback block and leads to an alarm message (or warning message):

- Process feedback trip (fault)
- Process feedback trip (warning)
- Process feedback startup (fault)
- Process feedback startup (warning)
- Process feedback shutdown (fault)
- Process feedback shutdown (warning)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_PROFB. For details refer to the object description of C_PROFB
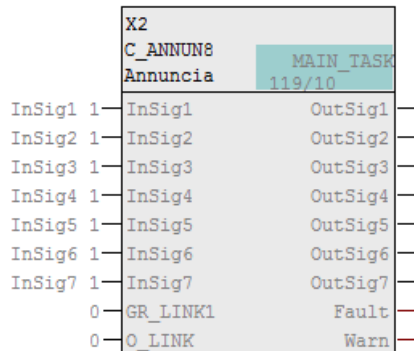
Evaluation of the process signal and alarming:

Function	Short description
Fault/warning evaluation	Process parameters for start-up monitoring time and shut-down monitoring time, Tolerance value in case of pulse evaluation, Start-up limit and shut-down limit for analog signals
Keep fault status until next startup of drive	Special function – no longer required because of last stop reason information
Simulation function	Simulating the process feedback dependent on drive status
Message Enable	Message can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_PROFBx Process Feedback block

```
S2
C_PROFBx
Process               MAIN_TASK
                      119/13
InSig1 0─┤ InSig1          ProFB ├─
InSig2 0─┤ InSig2
InSig3 0─┤ InSig3
InSig4 0─┤ InSig4
InSig5 0─┤ InSig5
   0.0─┤ PV
     0─┤ O_LINK
```

Main Function

The main function of block type C_PROFBx is the supervision of <u>up to 6 process feedback signal</u>, such as speed monitor or pressure for a drive. The block can handle up to 5 binary process feedback signals (continuous signal or pules) plus 1 analog process feedback signal.

For the evaluation of binary process feedback, the signals must be connected to input **InSig1** to **SinSig5,** for the evaluation of an analog process feedback the process feedback signal must be connected to input **PV** of the Process Feedback block.
The Process Feedback block provides the status of all process feedbacks at output **ProFB** which must be linked to input **ProFB** of the corresponding drive block.

Process feedback can be monitored during start-up, while the motor is running and during shut-down of the drive.

The C_PROFBx block must be linked to a drive block in order to exchange information with the drive (e.g. for message enable or conditional supervision).

For signal evaluation the Process Feedback block must be in **Automatic mode** (mode change is carried out together with the drive).
Out of Service mode disables the function and it is required in order to permit the change of configuration settings in the program.

The following signal stati are evaluated by the process feedback block and leads to an alarm message (or warning message):

- Process feedback 1 (fault)
- Process feedback 1 (warning)
- Process feedback 2 (fault)
- Process feedback 2 (warning)
- Process feedback 3 (fault)
- Process feedback 3 (warning)
- Process feedback 4 (fault)
- Process feedback 4 (warning)
- Process feedback 5 (fault)
- Process feedback 5 (warning)
- Process feedback PV (fault)
- Process feedback PV (warning)

- Still faulty (if the start was re-triggered after the fault was already announced).

Additional Features and Options

The following tables provide a function overview for C_PROFBx. For details refer to the object description of C_PROFBx
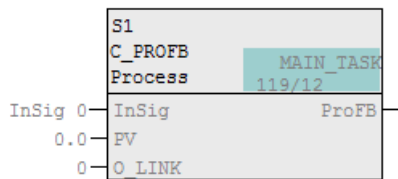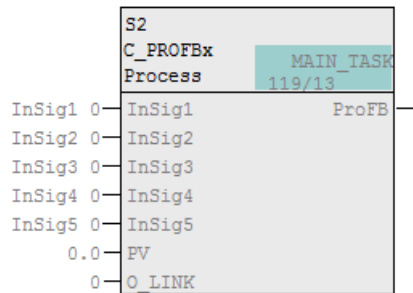
Evaluation of the process signal and alarming:

Function	Short description
Fault/warning evaluation	Process parameters for start-up monitoring time and shut-down monitoring time, Tolerance value in case of pulse evaluation, Start-up limit and shut-down limit for analog signals
Keep fault status until next startup of drive	Special function – no longer required because of last stop reason information
Simulation function	Simulating the process feedbacks dependent on drive status
Message Enable	Message can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_MEASUR Measuring value block

```
X3
C_MEASUR
Measurin          MAIN_TASK
                   119/11
100.0 — HH_Lim         PV_Out —
100.0 — H_Lim          PV_Stat —
  0.0 — L_Lim          MV_Perc —
  0.0 — LL_Lim           PV_HH —
100.0 — PV_OpSca          PV_H —
  '%' — UNIT              PV_L —
  0.0 — PV               PV_LL —
    0 — ReadCard            LZ —
 16#0 — MV_Card
    0 — GR_LINK1
    0 — O_LINK
```

Main Function

The main function of block type C_MEASUR is reading and monitoring an analog process signal, and providing the physical value and the status for indication and further evaluation in the process.

The block is able to read a card value via input **MV_Card** and to convert it into REAL format, or it directly reads a physical value in REAL format via input **PV**. The physical value is then provided at output **MV** (REAL format) and at Structure outputs **PV_Out** and **PV_Stat** (REAL value + Status).

Process parameter **OpSca.High** and **OpSca.Low** are used for the definition of the measuring range and Process Parameter **UNIT** must contain the dimension.

In order to convert the card value MV_Card into a physical value the scale for the card must be defined via Process parameter **Card_SCB** and **Card_SCE**.

For the calculation of the physical value the following formula is used:

$$\frac{(PV\_OpSca.High - PV\_OpSca.Low) * (MV\_Card - Card\_SCB)}{(Card\_SCE - Card\_SCB)} + PV\_OpSca.Low$$

Life Zero or bad quality is evaluated by the block as well and provided at output **LZ**.

In addition, limit values can be defined in order to provide binary information for undershoot of overshoot indications and messages:
one low and one high limit for generating warning messages
one low low and one high high limit for generating fault messages
two low and two high (switching) limits which only provide binary information (without message).

The C_MEASUR block can be linked to a drive block in order to exchange information with the drive (e.g. for conditional supervision).

For signal evaluation the measuring value block must be in **Automatic mode.**
Out of Service mode disables the function and it is required in order to permit the change of configuration settings in the program.

The following signal stati are evaluated by the measuring vale block and leads to an alarm message (or warning message):

- HH limit exceeded
- H limit exceeded
- L limit exceeded
- LL limit exceeded

- Live Zero / Bad quality
- Last valid or substitute value
- Value frozen

Additional Features and Options

The following tables provide a function overview for C_MEASUR. For details refer to the object description of C_MEASUR
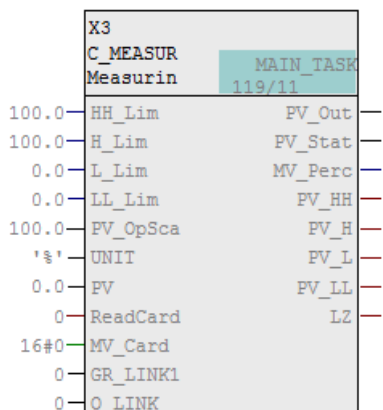
Reading and formating the Process signal:

Function	Short description
Reading a physical value	Providing the analog output at block output
Reading a card value and conversion into physical value	Conversion based on Process parameters for Scale low and high value, UNIT, Start value of the card's nominal range
Calibration function	Calibration for Card values
Conversion into Percentage value	Conversion based on OpSca.Low and OpSca.High or based on PercLow and PercHigh
Simulation function	Reading a simulation value instead of the input

Evaluation of the process signal and alarming:

Function	Short description
Conditional and delayed supervision	Process parameter for supervision delay
Limit monitoring	Process parameters for upper and lower limits for Warnings and Faults Upper and lower switching limits
Life Zero supervision	Adjustable start and end value of the card's low bad range Adjustable delay for Life Zero message The reaction in case of Life Zero or bad quality can be defined: forcing the limit bits to "1" or to "0", forcing output PV_Out and MV to Sca.Low and Sca.High
Spike suppression	In order to avoid alarm messages in case of a short peak
Smoothing	For filtering the value
Hysteresis	In order to delay the outgoing messages and so for reducing the alarms
Gradient monitoring	Function provides an indication that the process value increases or decreases too fast
Calculation functions	Squaring or route extraction
Detection of frozen value	If the value does not change by a defined percentage within a defined time
Bypass function with freezing	Freezing the input dependent on a process condition Limit bits are frozen as well
Bypass function without freezing (with Service button)	Dependent on process condition or Operator command the input is read in but not evaluated, limit

	bits are forced to "0".
Forcing Process value	Dependent on a condition, process value is forced to SCB or to "0"
Alarming/Messages	Message can be disabled by a process condition in order to get only a static fault indication
Message Enable	Message can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages
Acknowledgement	acknowledgement options: with any message within the AS, group-wise, individually
Additional fault reset	Option in order to force the operator to open the faceplate for acknowledgement of the fault

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_STAT8 Status display for up to 8 Signals

```
         E1
         C_STAT8
         CEMAT St      MAIN_TASK
                        119/22
Input Si─┤InSig1      OutSig1├─
Input Si─┤InSig2      OutSig2├─
Input Si─┤InSig3      OutSig3├─
Input Si─┤InSig4      OutSig4├─
Input Si─┤InSig5      OutSig5├─
Input Si─┤InSig6      OutSig6├─
Input Si─┤InSig7      OutSig7├─
Input Si─┤InSig8      OutSig8├─
       0─┤Fault         FaultQ├─
       0─┤Warning     WarningQ├─
       0─┤Running     RunningQ├─
       0─┤GR_LINK1
       0─┤O_LINK
```
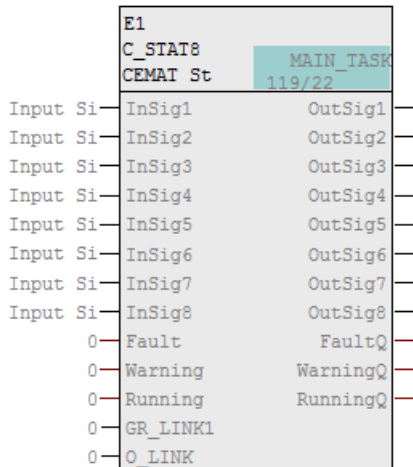
Main Function

The main function of block type C_STAT8 is a status display, e. g. for process signals provided by a subcontrol function or any equipment which in not controlled via CEMAT drive function.
Via connection of a process signal to input **InSig1** to **InSig8** the block is able to display up to 8 binary signals.
The same information is provided at the outputs **OutSig1** to **OutSig8** and can be used in the application program.

In addition, the information connected to input **Fault**, **Warning** and **Running** is displayed and provided to the CEMAT Group for summarizing indication.

Additional Features and Options

The following tables provide a function overview for C_STAT8. For details refer to the object description of C_STAT8

Evaluation of the process signal and alarming:

Function	Short description
Alarming/Messages	Non EventTs block must be connected if messages are required
Message Enable	Messages can be inhibited by program (in case of a power supply failure)
Interface for EventTS	For additional messages

Configuration and test:

Function	Short description
Sequence Test mode	Permits sequence test without periphery available

C_GROUP Group

```
G1
C_GROUP
Group            MAIN_TASK
                  119/16
0— FbObjOn          CmdOn —
1— FbObjOff       PeCmdOff —
0— StartAut         RunSig —
0— StopAut          OffSig —
0— QuickStp        QuicStpQ —
                   WarnLAct —
                   WarnHAct —
                     G_LINK —
```

Main Function

The main function of block type C_GROUP is starting and stopping of a plant section in automatic mode.

Group start can be given via Operator station, via program or via control desk buttons and is always initiated by a start-up warning. The start command is limited by a release time.

Group stop can be given via Operator station, via program or via control desk buttons.

Start and stop can be interrupted at any time.

The group shows the status of the plant section (running/off) as well as summarizing indications for faults and warnings.
Additional functions like object list or status call give more detailed information about the status of the devices / process signals within a plant section.

Mode change of the drives/devices can be carried out group-wise or individually.

The group itself must be in **Automatic mode**
Out of Service mode disables the group function and it is required in order to permit the change of configuration settings in the program.

Additional Features and Options

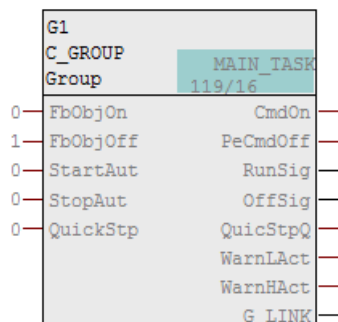The following tables provide a function overview for C_GROUP. For details refer to the object description of C_GROUP

Functions for Starting and stopping:

Function	Short description
Group start	via Operator command via program via control desk buttons
Startup-warning	Process parameter for start-up warning.
Group stop	via Operator command via program via control desk buttons
Quick stop	via Operator command via program
Interface to Power Management	Group can be stopped by power management
Start interlocks	For process conditions which need to be ready before start-up of the group

| Operation interlocks | For process conditions which need to be ready while the group is running
Missing Operation conditions lead to a sequential stop |
| Switch-off interlock | For process conditions which need to be ready before stopping the group |

Evaluation of process status and messages:

Function	Short description
Alarming/Messages	Warning messages if startup is not completed within the release time or if shut-down is not completed within the shut-down supervision time
Interface for EventTS	For additional messages
Acknowledgement	Acknowledgement required for stop by interlock

Operation and Monitoring:

Function	Short description
Summarizing indications	For faults, warnings and operation modes
Related Objects	Highlights all Objects which are linked to the group
Object list	List of all Objects which are linked to the group
Status list	List of all pending faults/warnings within the group
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_ROUTE Route

```
R1
C_ROUTE                    MAIN_TASK
Route                      119/14
0 — FbObjOn          CmdOn —
1 — FbObjOff         CmdOff —
0 — PrSelOn          RunSig —
0 — SelOff           OffSig —
0 — PrSelOff         PreSel —
0 — StartAut         Select —
0 — StopAut          R_LINK —
0 — G_LINK
```
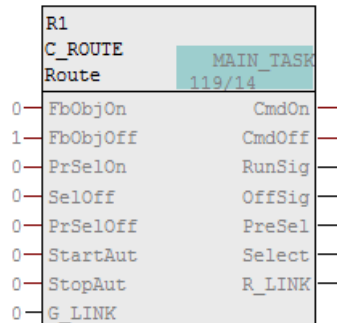
Main Function

The main function of block type C_ROUTE is the selection of certain objects within a group, e. g. all drives/devices related to a transport direction.

Group start and stop commands are "filtered" by the C_ROUTE block and only transmitted to the selected drives/devices.

Drive feedback to the group is also "filtered" by the C_ROUTE function and only transmitted for selected drives/devices.

The route shows the status of the selected devices as well as summarizing indications for faults and warnings.
Additional functions like object list or status call give more detailed information about the status of the devices / process signals within a route.

Mode change of the drives/devices can be carried out group-wise (for selected routes), route-wise or individually.

The route itself must be in **Automatic mode**
Out of Service mode disables the route function and it is required in order to permit the change of configuration settings in the program.

Additional Features and Options

The following tables provide a function overview for C_ROUTE. For details refer to the object description of C_ROUTE

Functions for Selection and Deselection:

Function	Short description
Route selection and de-selection	via Operator command via program via control desk buttons
Start interlocks	For process conditions which need to be ready before start-up of the route
Operation interlocks	For process conditions which need to be ready while the route is running Missing Operation conditions lead to a sequential stop
Manual interlock	For process conditions which need to be ready for selection/deselection

Evaluation of process status and messages:

Function	Short description
Interface for EventTS	For additional messages

Operation and Monitoring:

Function	Short description
Summarizing indications	For faults, warnings and operation modes
Related Objects	Highlights all Objects which are linked to the route
Object list	List of all Objects which are linked to the route
Status list	List of all pending faults/warnings within the route
Last Stop reason	The last stop reason is provided in the Faceplate

Configuration and test:

Function	Short description
Feature master block	Feature bits and OS Permissions can be defined at a central location (per block type)

C_SELECT Selection

```
SE1
C_SELECT
Selectio          MAIN_TASK
                  119/15
0— SelOn          Select —
0— SelOff
```
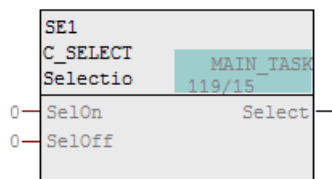
Main Function

The main function of block type C_SELECT is a set/reset function. The status of the selection is provided at block output **Select**

Selection and deselection can be carried out by the Operator or via program.

For the operation the selection block must be in **Automatic mode.**
Out of Service mode disables the function permits the change of configuration settings in the program.

Additional Features and Options

The following tables provide a function overview for C_SELECT. For details refer to the object description of C_SELECT

Functions for Selection and Deselection:

Function	Short description
Selection and de-selection	via Operator command via program via control desk buttons
Selection interlocks	For process conditions which need to be ready before selection
Seselection interlocks	For process conditions which need to be ready before selection

Messages:

Function	Short description
Messages	Operating messages for selection and deselection
Interface for EventTS	For additional messages

C_INTLK2, C_INTLK4 and C_INTLK8 CEMAT Interlock blocks
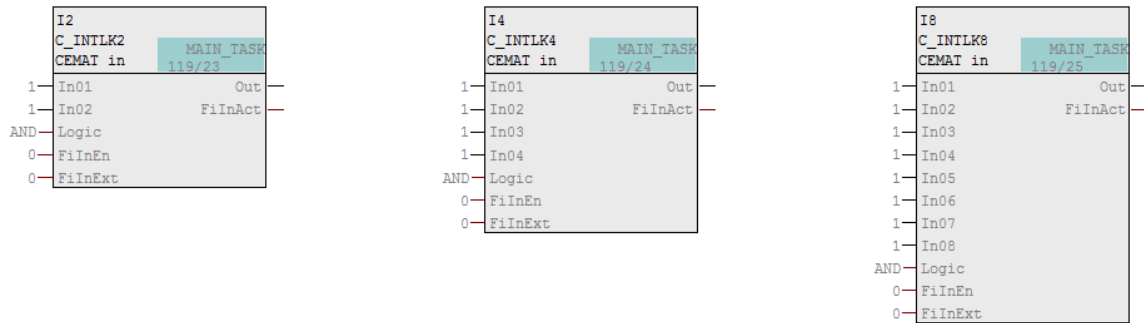
Main Function

The main function of block types C_INTLK2, C_INTLK4 and C_INTLK8 is to calculate the RLO of a standardized interlock that can be displayed on the OS. A maximum of 2 (4 or 8) input signals can be supplied to the block. They are linked using selectable binary logic. The logic can be specified as AND or OR function.

The signal status of the output signal is also determined. Non-connected inputs are not evaluated and not displayed in the faceplate.

Each input can be bypassed, either via permanent bypass or temporarily.

Additional Features and Options

The following tables provide a function overview for C_INTLK2, C_INTLK4 and C_INTLK8. For details refer to the object description of C_INTLK

Functions for Signal evaluation and indication:

Function	Short description
Bypass Function	Permanent bypass Temporary bypass
First-in detection	Detecting the first input that sets the interlock output to FALSE FirstIn Information is available at output for passing the information to further C_INTLK blocks.
Latched output after first in (option)	Output remains false until reset

Evaluation of the process signal and alarming:

Function	Short description
Alarming/Messages	Non EventTs block must be connected if messages are required
Interface for EventTS	For additional messages

C_ANASEL Analog Value selection

```
SEL
C_ANASEL
Analog v      MAIN_TASK
              119/26
0.0─ In01              Out_Val ─
'%'─ In01Stat          Out_Stat ─
0.0─ In02
'%'─ In02Stat
0.0─ In03
'%'─ In03Stat
0.0─ In04
'%'─ In04Stat
0.0─ In05
'%'─ In05Stat
0.0─ In06
'%'─ In06Stat
0.0─ In07
'%'─ In07Stat
0.0─ In08
'%'─ In08Stat
```
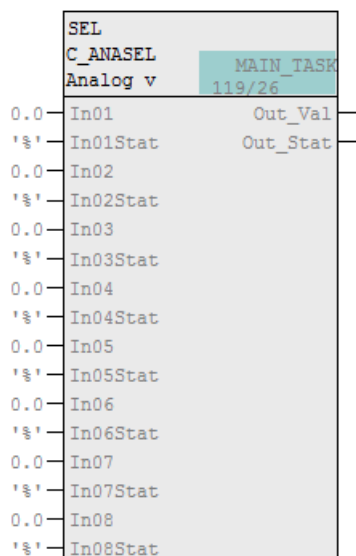
Main Function

Block type C_ANASEL provides up to 16 analog process values for the display in the drive faceplate.
One out of 16 process values can be selected either from the faceplate or via program.
The selected value is displayed in the drive faceplate together with the status information (Simulation, Limit violation)

Additional Features and Options

Functions for Signal evaluation and indication:

Function	Short description
Summarizing information	The summarizing information for the limits HH, H, L and LL is built and transferred to the corresponding outputs

For more detailed information refer to the object description of C_ANASEL.

C_LINK Adapter block

```
LINK
C_LINK
Adapter          MAIN_TASK
                 37/2
0─ DynFault          AutModQ ─
0─ Fault             ManModQ ─
0─ DynWarni          LocModQ ─
0─ Warning          FbkDynFa ─
0─ FbkRun           FbkFault ─
0─ ManModAc         FbkDynWa ─
0─ LocModAc         FbkWarnQ ─
0─ OoSModAc         FbkRun1Q ─
0─ SimuAct          FbkRun2Q ─
 ─ SelFp            FbkManua ─
0─ GR_LINK1         FbkLocal ─
0─ GR_LINK2          FbkOoSQ ─
0─ MUX_LINK         ErrorNum ─
0─ O_LINK
```

Main Function

Non-CEMAT blocks (e. g. Functions or Function blocks from APL library) don't have an interface to the CEMAT MinAS group and can therefore not directly be linked.
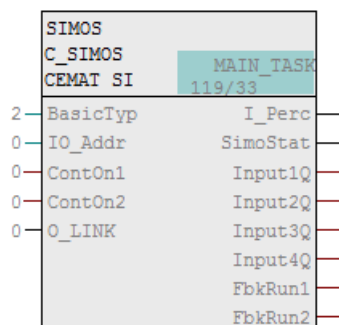
With block type C_LINK the connection of any function block (without Group link interface) to the CEMAT group or route or to a superordinate (parent) CEMAT object can be achieved.

In case of faults or warnings of the non-CEMAT block, this information is displayed in the summarizing indication for group / route.

In the Object list the non-CEMAT block is displayed. With double-click on the non-CEMAT module the faceplate is opened.

For more detailed information refer to the object description of C_LINK.

C_SIMOS Adapter block for SIMOCODE

```
SIMOS
C_SIMOS
CEMAT SI        MAIN_TASK
                119/33
2 —  BasicTyp        I_Perc  —
0 —  IO_Addr       SimoStat  —
0 —  ContOn1        Input1Q  —
0 —  ContOn2        Input2Q  —
0 —  O_LINK         Input3Q  —
                    Input4Q  —
                    FbkRun1  —
                    FbkRun2  —
```

Main Function

The SIMOCODE Adapter block C_SIMOS can be used to establish a connection between the CEMAT blocks and the SIMOCODE. Due to the modular concept the SIMOCODE Adapter block can be used for unidirectional drives, bi-directional drives, valves and dampers.

The four input signals of the SIMOCODE will be transferred to a block output and can be allocated by the user as desired (e. g. for Field Switch Signals or Available).
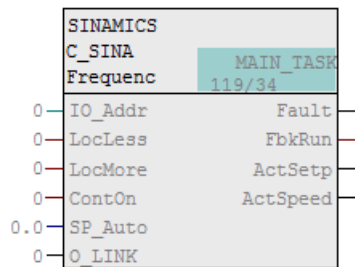
The Motor current or power can be displayed. The current value in % and the power are shown in a curve window. The process parameters for current limits have been removed and are not evaluated any more.

Basic type 1 and 2 are supported.

- Basic type 1: (12 bytes read and 4 byte write)   (with Current- and Power Value)
- Basic type 2: (4 bytes read and 4 byte write)   (with Current Value)

For more detailed information refer to the object description of C_SIMOS.

C_SINA Adapter block for SINAMICS

```
SINAMICS
C_SINA
Frequenc       MAIN_TASK
               119/34
  0 —IO_Addr         Fault—
  0 —LocLess         FbkRun—
  0 —LocMore         ActSetp—
  0 —ContOn          ActSpeed—
0.0 —SP_Auto
  0 —O_LINK
```

Main Function

The SINAMICS Adapter block C_ROBI C_SINA is designed to enable the data exchange between a SIEMENS PLC-S7 and the Siemens SINAMICS Series frequency converter with Profibus communication module using the message frame "352". The SINAMICS object may be used for all SINAMICS frequency converters (G120, G130, G150, S120 et al.) that support the message frame "352 : 6 words PCD read/write ". In the PLC – hardware configuration the corresponding GSD – type file for the used frequency converter has to be applied.

Via input and output parameters of the function block it is possible to start/stop the converter or to manipulate the set point.

The inverter status and the available analogue values are read by the function block as well and copied to output parameters for further usage in the user program.

The SINAMICS Adapter block has 3 types of operating modes:

Automatic mode   (Start/Stop is done through the associated Group and drive)

Manual mode   (Start/Stop for each converter separately is possible via the OS Faceplate of the drive)

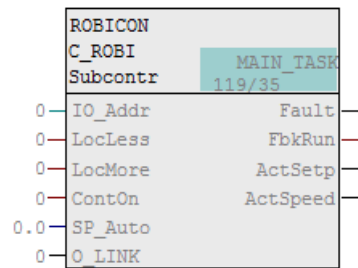Local mode via the PLC   (Start/Stop with local switch)

The operating modes are changed by the associated drive. The drive module generates a release signal for the respective operating mode. This signal must be connected to the appropriate operating mode release interface of the SINAMICS Module.

The converter conditions (faulty / ready / running) are made available for visualization on OS. There is a faceplate available to display of all SINAMICS information's as well.

The SINAMICS Adapter block generates alarm messages in case of various warnings and faults.

For more detailed information refer to the object description of C_SINA.

C_ROBI Adapter block for ROBICON

```
ROBICON
C_ROBI
Subcontr      MAIN_TASK
              119/35
0 — IO_Addr          Fault —
0 — LocLess          FbkRun —
0 — LocMore          ActSetp
0 — ContOn           ActSpeed
0.0 — SP_Auto
0 — O_LINK
```

Main Function

The ROBICON Adapter block C_ROBI is designed to enable the data exchange between a SIEMENS S7© - PLC and the ROBICON frequency converter with the "AnyBus" communication module.

Via input and output parameters of the function block it is possible to start/stop the drive or to manipulate the set point.

The drive and inverter status and the available analogue values are read by the function block as well and copied to output parameters for further usage in the user program.

The ROBICON Adapter module has 3 types of operating modes:

Automatic mode   (Start/Stop is done through the associated Group and drive)

Manual mode   (Start/Stop for each converter separately is possible via the OS Faceplate of the drive)

Local mode via the PLC   (Start/Stop with local switch)

The operating modes are changed by the associated drive. The drive module generates a release signal for the respective operating mode. This signal must be connected to the appropriate operating mode release interface of the ROBICON Adapter block.

The drive conditions (faulty / ready / running) are made available for visualization on OS. There is a faceplate available to display of all ROBICON information's as well.

The ROBICON Adapter block generates alarm messages in case of various warnings and faults.

For more detailed information refer to the object description of C_ROBI.

SPC   Scalable Production Control

Main Function

The Scalable Production control is the CEMAT Solution for Recipe and Material handling in a Plant. A recipe, in terms of CEMAT SPC (Scalable Production Control), contains different parameters/setpoints for continuous processes which may change over time (= during production).

The Main block for Scalable Production control is the Recipe Manager, which is used for the Recipe selection and can handle up to 26 recipes (independent of the number of modules per recipe.

The setpoints are maintained and stored by Recipe modules. Each Recipe module can handle up to 8 setpoints of a certain type and format.

The Data distributor modules get the actual process values and read the "Active Setpoints" from the selected Recipe moduel, in order to provide the setpoint to the plant devices.
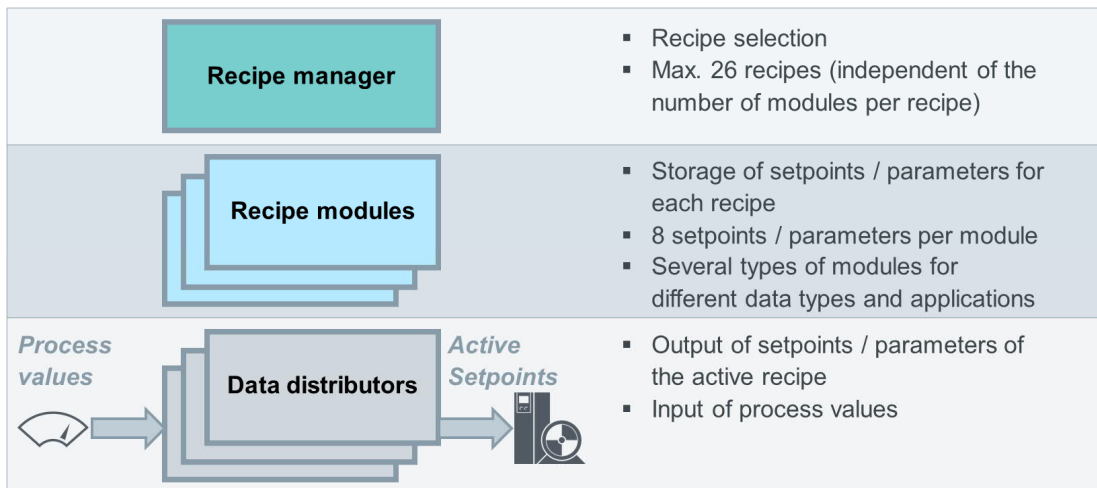
SPC Manager
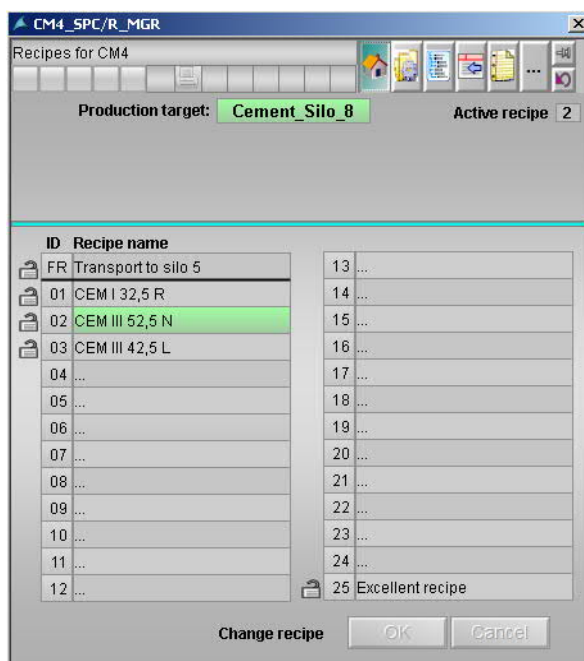
Different Recipe modules exist for different data types:

C_PM_AR   SPC module, Absolute, data type REAL

Functionality:
up to 8 independent setpoints/parameters of type REAL

Use case:
Speed setpoints, position values

C_PM_AR   SPC module, Absolute, data type INTEGER

Functionality:
up to 8 independent setpoints/parameters of type INT

Use case:
Timers

C_PM_AR   SPC module, Relative, data type REAL

Functionality:
up to 8 setpoints given in percentage of an additional physical reference
value

Use case:
Grinding aid in % of the amount of clinker (in t/h) which is fed to the mill

C_PM_RTR   SPC module, Relative, totalizing, data type REAL

Functionality:
up to 8 setpoints given in percentage of an additional physical reference
value; the first of these 8 setpoints is always the sum up to 100%

Use case:
Fresh feed (in t/h) for a cement or raw mill; components are defined in %

C_PM_B   SPC module, BOOL

Functionality:
up to 8 setpoints given in Boolean format

Use case :
Switching equipment on/off depending on the selected recipe

C_PM_S   SPC module, Sequencer

Functionality:
up to 8 setpoints which are configured as a loop; only one setpoint is active
which will automatically switch to the next available one if it gets interlocked

Use case:
Defining a sequence of cement silos as production targets

The Recipe manager can handle up to 26 recipes and the number of Recipe modules is unlimited.
The data distributor forwards the actual setpoints (from selected Recipe) to the plant devices

Block interconnection:
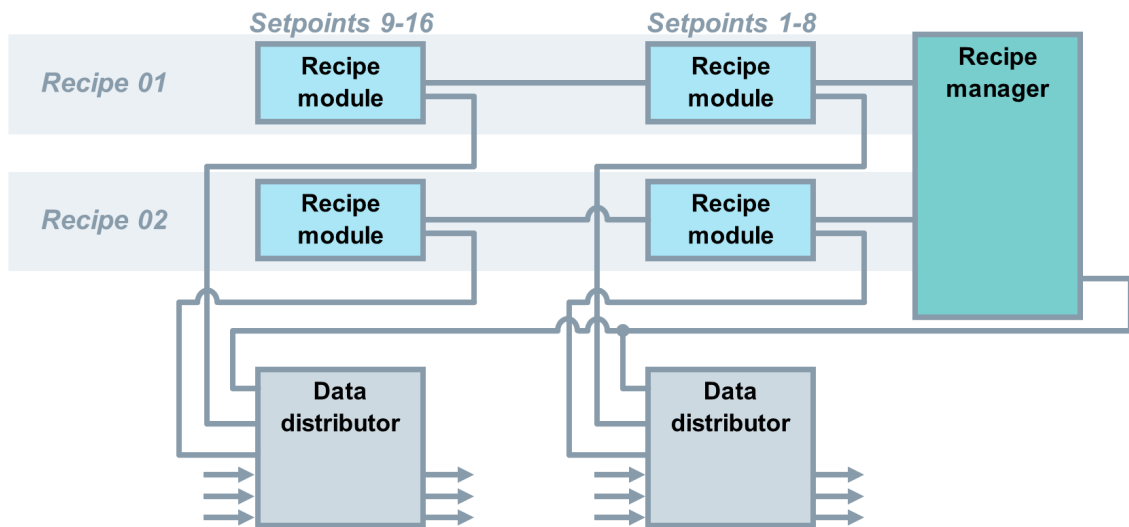
Materials handling

Depending on the composition of the products and the available equipment, like hoppers or weigh feeders, the material inside silos and hoppers may change over time.
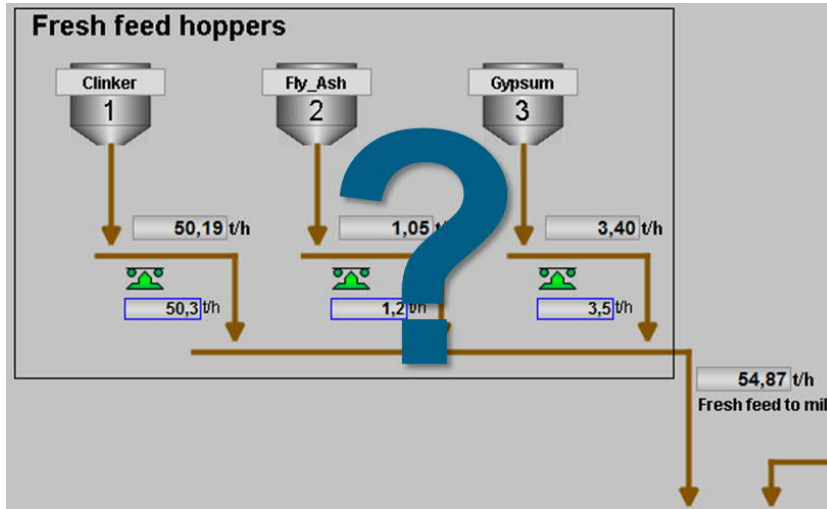
Using the Material Manager the Setpoints for the amount of material can be assigned dynamically to the corresponding weigh feeders.

Block interconnection:
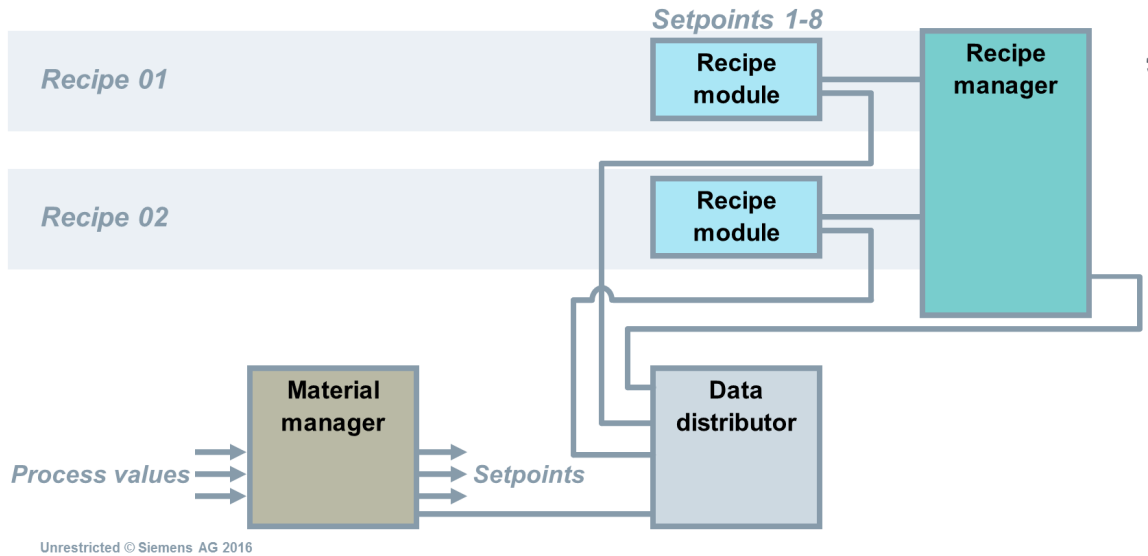
CEMAT Engineering

Setup of the PCS 7 Project

Before you start with the Engineering, please follow the Preparations in the CEMAT Engineering Manual, Chapter 2.

For the setup of the PCS 7 Project the Engineering rules of the CEMAT Engineering Manual, Chapter 3 must be followed.

A MultiProject must be created according to the actual plant configuration.

AS Engineering

After the setup of the project the CEMAT blocks are available and the application program can be created.

For bulk engineering it is recommended creating control module types.

The rest of the Programming is carried out in the continuous function chart (CFC). Sequence function chart (SFC) is not needed in CEMAT.

The block interfaces are described in the Reference Manual of CEMAT (Object descriptions).

For AS Engineering Rules refer to the CEMAT Engineering Manual, Chapter 6.

For Engineering Examples refer to the CEMAT Engineering Manual, Chapter 5 and to the Engineering Video

OS Engineering

What is shown WHERE and HOW?

Complete plant overview

Representation:	Schematic representation of the complete plant
Content:	Overview of the production plant with global status display from the running plant sections
Operation:	Selection of a production section / a sub-plant

System monitoring, plant configuration diagrams

Representation:	Schematic representation of the complete control system
Content:	Overview of the network connection of the individual control system devices with global status display of the individual components.
Operation:	Selection of an individual component for detailed analysis

Plant sections:

Representation:	Material flow of a complete production plant without secondary aggregates and details
Content:	Display of all physical variables relevant for the process control.
Operation:	Start and stop of the plant Specification of set points Assignment of recipes Invoke overviews for flow diagrams, measured values, closed-loop controllers, curves Tabular measured value listing

Process diagram overviews:

Representation:	Schematic representation of the diagram hierarchy with group states
Content:	Overview of the production plant with display of the operational groups/paths
Operation:	Selection of a process diagram

Grouping overview

Representation:	Tabular representation of the measured values, closed-loop controllers, curves
Content:	Overview of the grouping of the measured values, closed-loop controllers, curves either general or operator-specific
Operation:	Selection of a group diagram

Groups, routes, selection overview

Representation:	Tabular representation of the plant-specific groups, routes, selections
Content:	Overview of the states of the production plant
Operation:	Selection of the process diagram in which the groups, routes, selections are displayed

Process diagrams:

Representation:	Representation of the plant sections with all aggregates
Content:	Display of the operational modes, measured values, states, curves, filling levels
Operation:	Selection, operation of individual aggregates and diagnosis, information and object parameter invocations

Detail diagrams:

Representation:	Representation of the individual aggregates
Content:	Display of the operational modes, measured values, states
Operation:	Selection, operation of individual aggregates and diagnosis, information and object parameter invocations

Help:

Representation:	User's guide for the CEMAT system User's guide for the plant User key assignment
Content:	Explanations and examples of the system handling.
Operation:	Complete table of contents and search key control

For OS Engineering Rules and graphic templates refer to the CEMAT Engineering Manual, Chapter 8.

Tips & Tricks

For Tips and Tricks refer to the CEMAT Engineering Manual, Chapter 14.

## Engineering Tools

CEMAT MinAS provides Tools in all phases of the Engineering:

- CEMAT Order Tool for Project Planning

- CEMAT Info Tool for the generation of Info data

- CEMAT Check Tool for consistency checks

- Sequence Test mode for FAT

CEMAT Order Tool

With the CEMAT Order Tool you can calculate the requirement for CEMAT Licenses and POs based on number of objects or number of I/Os.
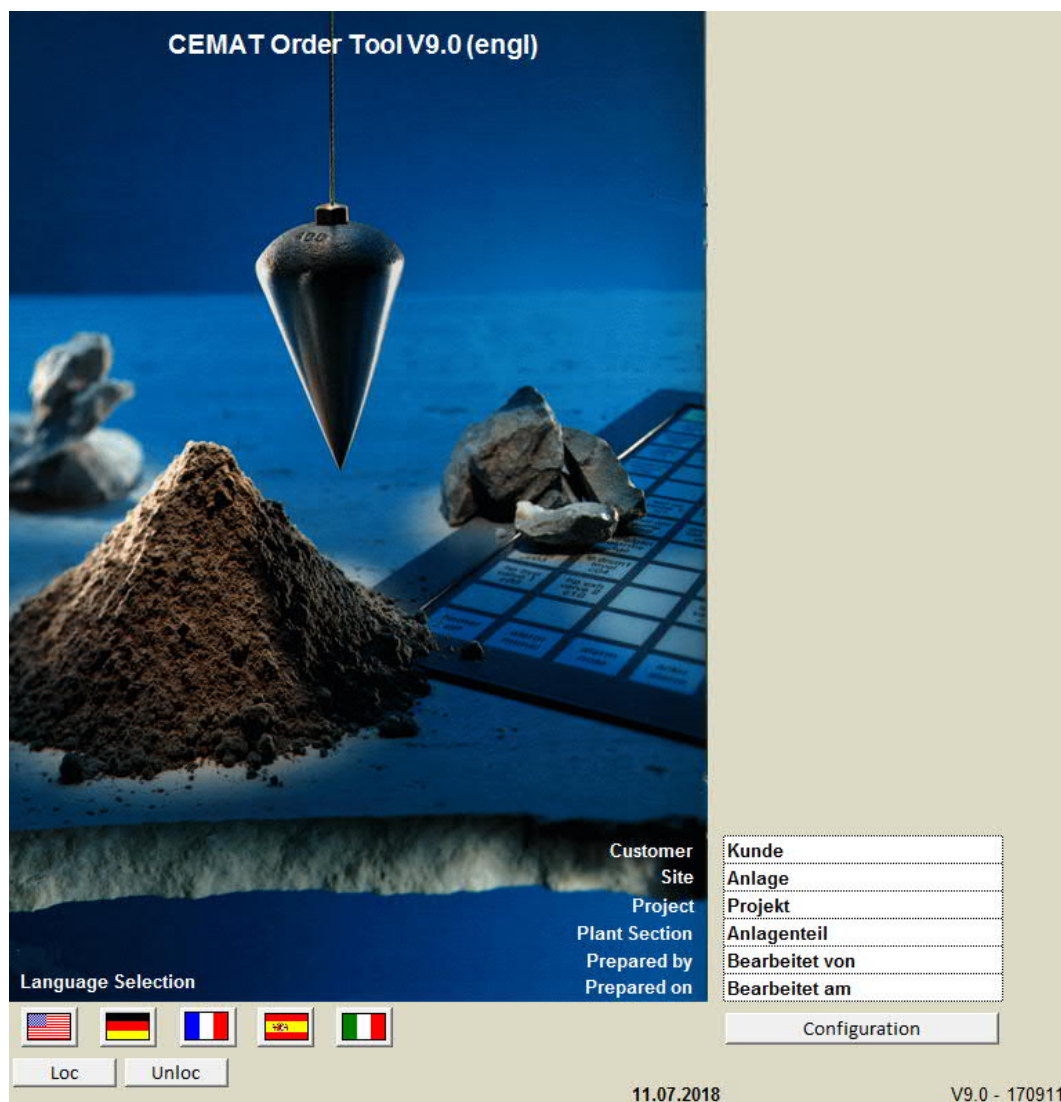
Enter the number of objects, if available

CEMAT Volume of Project Data

Description	AS01	AS02	AS03	AS04	AS05	AS06	AS07	AS08	AS09	AS10	AS11	AS12	AS13	AS14	AS15	AS16	AS17	AS18	AS19	AS20	DI	DO	AI	AO
C_DRV_1D - Unidirectional Drive																					6	1	0	0
C_DRV_2D - Bidirectional Drive																					8	2	0	0
C_PROFB																					1	0	0	0
C_PROFBx																					1	0	0	0
C_VALVE - Valve																					6	1	0	0
C_DAMPER - Damper																					8	2	0	0
C_MEASUR - Measure																					0	0	1	0
C_ANNUNC - Annunciation																					1	0	0	0
C_ANNUN8 - 8 Annunciation																					7	0	0	0
C_SELECT - Selection Module																					0	0	0	0
C_ROUTE - Route Module																					0	0	0	0
C_GROUP - Group Module																					0	2	0	0
																					0	0	0	0
PIDConL - PCS7 Controler																					0	0	0	1
																					0	0	0	0
C_SINA - Sinamics Adapter																					0	0	0	0
C_ROBI - Robicon Adapter																					0	0	0	0
C_SIMOS - Simocode Adapter																					0	0	0	0
																					0	0	0	0
																					0	0	0	0
																					0	0	0	0
																					0	0	0	0
Number of AS PO's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Number of OS PO's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		CEMAT Default I/O		

No.of I/O per area	AS01	AS02	AS03	AS04	AS05	AS06	AS07	AS08	AS09	AS10	AS11	AS12	AS13	AS14	AS15	AS16	AS17	AS18	AS19	AS20	Total
DI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Numbers of AS PO's	0
Total Numbers of OS PO's	0

If number of objects is not available, you may enter the number of I/Os. Based on the I/Os the number of CEMAT Objects is calculated.

CEMAT I/O Summary

Objects	% of DO
Drives 1D	60,00%
Drives 2D	10,00%
Valve	20,00%
Damper	10,00%
Total	100,00%

Description	#	
One Group per	20	Objects
One Route per	1	Damper

No.of I/O per area	AS01	AS02	AS03	AS04	AS05	AS06	AS07	AS08	AS09	AS10	AS11	AS12	AS13	AS14	AS15	AS16	AS17	AS18	AS19	AS20
DI																				
DO																				
AI																				
AO																				
Profibus / Profinet devices																				

Description	AS01	AS02	AS03	AS04	AS05	AS06	AS07	AS08	AS09	AS10	AS11	AS12	AS13	AS14	AS15	AS16	AS17	AS18	AS19	AS20	DI	DO	AI	AO
Drives 1D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0
Drives 2D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2	0	0
Valve	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0
Damper	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2	0	0
ProFB / Annunciation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Measure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Controler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Group	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Route	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Number of AS PO's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Number of OS PO's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	CEMAT Default I/O			

Total Numbers of AS PO's	0
Total Numbers of OS PO's	0

Enter the number of equipment according to your plant configuration…

…and press button "Get License List".

As a result you will get the CEMAT License list:

CEMAT License V9.0

	Product Name	Article Number
	CEMAT OS Software for Client	
3	**Minerals Automation Standard V9.0 Client**	6DL5435-8AX58-0XA0
	CEMAT Engineering Software	
1	**Minerals Automation Standard V9.0 Engineering**	6DL5436-8AX58-0XA0
	CEMAT OS Software for redundant Server incl. AS Runtime Licenses (PLC)	
1	**Minerals Automation Standard V9.0 Server Redundancy (6 AS)**	6DL5433-8AB58-0XA0
	CEMAT OS Software for Single Station incl. AS Runtime-License (PLC)	
1	**Minerals Automation Standard V9.0 Single Station (3 AS)**	6DL5434-8AA58-0XA0

CEMAT Info Tool

Excel Macro C_INFO.xlsm uses the PCS 7 Engineering data and generates information for the Info Dialog of the CEMAT objects.

- Each CEMAT block requires a dataset in the User Archive C_INFO, which contains the object information for the Info Dialog and the Maintenance information.

- If you want to show additional information about the connected I/Os (Card information, I/O Address and symbolic name), folder D:\CEMAT_CS\Multimedia\Periphery must contain a txt-file for each object with the corresponding I/O information.

CEMAT Info Tool C_INFO.xlsm can be found under D:\CEMAT_CS\TOOLS and works as follows:

- The PCS 7 Engineering Data (Hardware Configuration, Symbols table, Process Object view), must be exported from the PCS 7 project.

- The Excel Macro C_INFO.xlsm creates a file C_INFO.csv, and the txt-files with I/O information.

- The csv-file must be imported into user archive C_INFO, the txt-files must be copied into directory D:\CEMAT_CS\Multimedia\Periphery of the Multimedia Server.
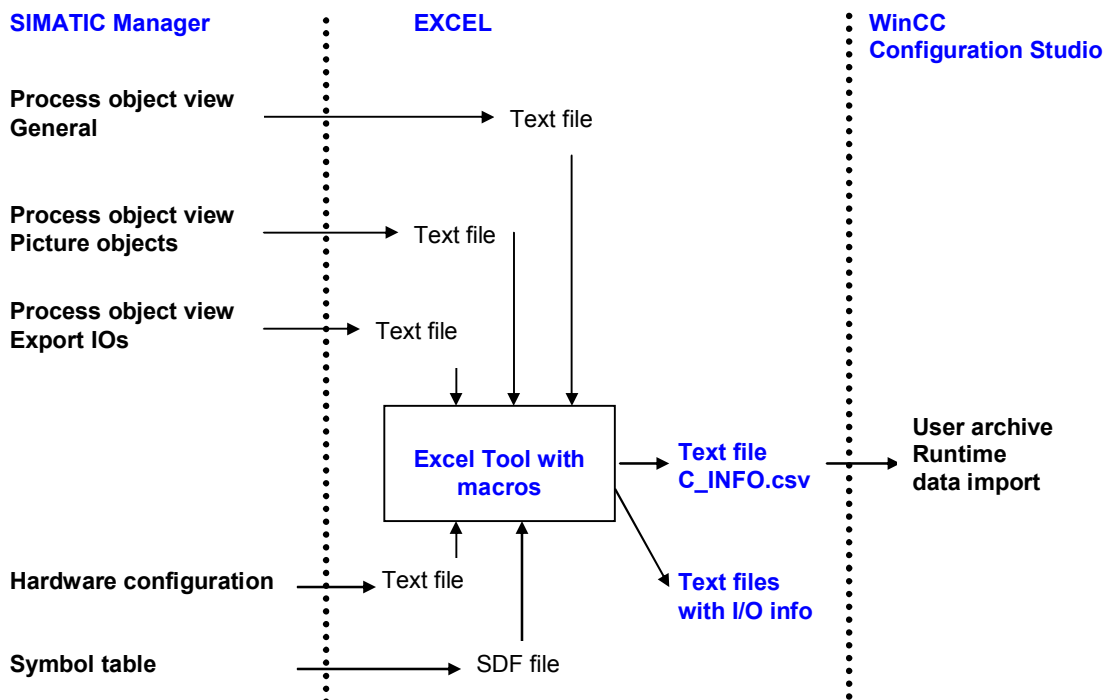
For further information refer to CEMAT Engineering Manual, Chapter 9.

CEMAT Check Tool

The CEMAT Check Tool V9.0 checks on programming errors resulting from e.g. missing or wrong connections, incorrect installation of CEMAT (system) blocks or inconsistent parameterization.

The CEMAT Check Tool V9.0 in Folder D:\CEMAT_CS\Tools\CheckTool\CEMAT_CheckTool_V90_MinAS can be used for Cemat Project Standard 001. For the classic Project Standards a different Check Tool exists.

Note: The CEMAT Check Tool V9.0 can check multiple user projects at the same time, but each single project must contain only one AS. Multiple AS per user project are not supported.

The information which is needed has to be exported from the PCS 7 project as follows:

Process object view — Export all **I/Os** and **blocks**
CFC reference data — Export **runtime sequence**
Symbol editor — Export all **symbols**

I/Os — .csv
blocks — .csv
runtime sequence — .csv
symbols — .sdf

Name	Date modified	Type	Size
AS01_B.csv	14.01.2015 16:49	CSV File	67 KB
AS01_PS.csv	06.02.2015 09:09	CSV File	6.465 KB
AS01_R.csv	14.01.2015 16:53	CSV File	107 KB
AS01_Symbols.sdf	14.01.2015 16:54	SDF File	39 KB
AS02_B.csv	22.01.2015 09:13	CSV File	4 KB
AS02_PS.csv	30.01.2015 13:54	CSV File	653 KB
AS02_R.csv	05.02.2015 13:50	CSV File	7 KB
AS02_Symbols.sdf	14.01.2015 16:47	SDF File	15 KB
CematCheckTool.exe	06.02.2015 09:58	Application	1.724 KB
CematCheckTool.ini	06.02.2015 09:12	Configuration settings	9 KB

Copy files to Check Tool Folder

If multiple projects shall be checked at the same time, the steps have to be repeated for each user project.

For further information refer to CEMAT Engineering Manual, Chapter 9.

Project Planning

Project Execution

Typically the vendor's responsibility within a project includes but is not limited to the following items:

- System engineering

- System hardware including basic operating software

- Software interfacing all foreign devices

- Application software and configuration

- All system interconnecting cabling for each plant

- System documentation

- Recommended spare parts

- Factory acceptance testing

- Packing and shipping

- Installation supervision

- Site acceptance test including site integration test

- Pre-commissioning

- Handover of a complete working system

- Warranty

- Training

- Optimization of the system resources

Failure of specifications and attachments and/or drawings to state or show materials, which are essential to make specified equipment complete, does not relieve the vendor from the responsibilities for furnishing such material.

Project Management

Projects at Siemens are carried out according to the phases and milestones defined by the PM@Siemens project management initiative.

Acquisition Phase		Offering Phase				
Pre-Acquisition	Project Acquisition	Bid Preparation	Contract Negotiation	Project Handover	Project Opening & Clarific.	Detail Planning
PM010 Acquisition Go / No Go decision	PM020 Bid / No Bid decision	PM040 Bid release	PM070 Project won / lost	PM080 Start project	PM100 Order entry clarified	PM200 Release of detailed planning

Realization Phase					Operation Phase
Sourcing & Manufacturing	Shipment	Erection/ Installation	Commissioning	Acceptance Test	Warranty Period
FAT PM300 Released for shipment	PM400 Material & Ressources on site	PM550 End of erection SAT	PM600 End of commissio-ning	PM650 Provisional Acceptance Certificate (PAC)	PM700 Final Acceptance Certificate (FAC)

The project manager is the contact person and coordinator for all technical and commercial issues throughout the period of project execution. He communicates with the project manager of the purchaser.
With the quotation, a summary project schedule, a project loading chart and an organization chart will be attached.

Milestones and Time schedule

The project manager defines milestones for the project execution while indicating scheduled (completion) dates. Milestones will include, but not be limited to the following:

- Delivery of documents by vendor and by purchaser.
- Kickoff Meeting
- Checking the project-related specifications for completeness
- Training
- Discussion about templates, images/displays, operator control authorization
- Finalization of Design (Hardware & Software)
- Preliminary testing of selected single functions prior to copying
- Submittal of the functional specification, project-specific part
- Submittal of the report of the internal test before FAT
- FAT
- Backup before delivery
- Physical delivery of the system
- Installation of the system
- Commissioning of the system
- SAT

- Start-up of the system

Training

Necessary Courses for PCS 7/ CEMAT

Basic requirement for PCS 7 / CEMAT Engineering

SIMATIC PCS 7 System Course	**ST-PCS7SYS**	**10 days**
CEMAT MinAS Basic Training	**ST-CEMATE**	**5 days**

If there are more training required please look to the following Courses.

SIMATIC PCS 7 System Overview	**ST-PCS7UEB**	**2 days**
SIMATIC PCS 7 AS Engineering	**ST-PCS7ASE**	**5 days**
SIMATIC PCS 7 OS Engineering	**ST-PCS7OSE**	**5 days**

If you already know an older version of PCS 7 an upgrade workshop may be useful:

SIMATIC PCS 7 Upgrade Workshop	**ST-PCS7V90**	**3 days**

If you already know a classic Verison of CEMAT and want to learn about CEMAT MinAS

CEMAT MinAS Migration Workshop	**VM-B6-CEMA**	**(on demand)**

For course availability, please check: http://www.siemens.de/sitrain

Requirements for CEMAT Training

Hardware and Software requirements

One **Engineering Station** per two participants.

- For the CEMAT Engineering Tools Microsoft Excel 2010 is required. If Microsoft Office is installed on the Engineering stations the Office Installation must be carried out before the PCS 7 Installation.

- As the Acrobat Reader is not part of PCS 7 installation, this (or any other PDF reader) has to be installed in addition; otherwise the CEMAT Manuals can not be opened.

- **PCS 7 V9.0** and **PLCSim** must be installed, including the licenses.
  (Additionally to the Engineering Licenses of PCS 7 we need the **License for WinCC User Archive** and the **PLCSim License**).

- The **CEMAT Software and Licenses** are provided by the Trainer and will be installed before/during the training.

- CEMAT Runtime System needs a **screen resolution of 1280x1024**

- The Engineering Station must have a C and a D Drive with sufficient memory space.
  (**CEMAT can only be installed on D Drive** and requires about 1 GB. Our Training Projects will also be installed on D and will need about 5 GB).

If the training is carried out for more than two participants, a **Projector** is needed.

- The projector must be **capable for a screen resolution of minimum 1280x1024**

Required knowledge

Basic knowledge of PCS 7 V9.0 is essential for the CEMAT Training. We recommend joining a PCS 7 Training before the CEMAT Training.

- The participants should know the Structure of a PCS 7 Project/MultiProject

- Participants should know the Simatic Manager with Component view, Plant view and Process Object view.

- Participants should know how to program with CFC.

- Participants should also have some WinCC knowledge
  (WinCC Explorer, Construction of Pictures, Customized Objects)

Training Schedule and Documentation

The **training schedules** and the **training manual** will be provided by the Trainer in PDF format. It has to be printed and copied for each participant.

The CEMAT documentation is available online after the installation of CEMAT. Printing is not needed (at least not for each participant).

Training duration and number of participants

The **duration of the CEMAT training is one week**, presuming that the required PCS 7 knowledge is available. The CEMAT Training includes the operating philosophy, the functions of the CEMAT blocks and the required configuration settings for a PCS 7Project with CEMAT.

If additional support is required (e. g. for the set-up of the real project) this has to be calculated additionally.

The **maximum number of participants for a CEMAT Training is 8 to 10 Persons** (= 5 Engineering Stations).

System Performance

System Configuration Technical Data

System Configuration

	Typical	Maximum	Comment
Control systems per shared process bus	1 to2		
Operator stations per control System	6 to 10	40	OS stations to maximum 18 server/redundancy pairs. If every OS client has access to all OS servers/pairs of servers
Engineering stations per control System	2	unlimited	At least one engineering station per plant.
AS per control system	6 to 10	64 AS per OS Server → 64*18 = 1152	
AS communications channels	2	5	
Server per control system	2 (redundant)	18	
Curve server per control system	2 (redundant)	2	Two separate curve servers (redundant) are needed when more than 5000 values are archived.

Bus Systems Technical Data

Plant Automation Bus System

Type designation	Industrial Ethernet	
Manufacturer	Siemens	
Protocol	IEEE 802.3	
Transfer speed	10 / 100/ 1000 Mbit/s	
Number of possible nodes	1024	
Maximum bus length	Up to 150 km	
Cable type **- Coaxial** **- Optical-fiber 50/125 glass fiber** **- Miscellaneous**	Yes Yes Industrial Twisted Pair	
Bus components	Network cards 3COM Intel	
Redundancy	Yes	bus in ring structure

PFK = Process Remote Component
PNK = Process Local Component

Plant Control Bus System

Type designation	Industrial Ethernet	
Manufacturer	Siemens	
Protocol	IEEE 802.3	
Transfer speed	10 / 100 Mbit/s	Fast Ethernet
Number of possible nodes	1024	
Maximum bus length	Up to 150 km	
Cable type - Coaxial - Optical-fiber 50/125 glass fiber - Miscellaneous	Yes Yes Industrial Twisted Pair	
Bus components	Network cards CP443-1 for S7 400 CP1623 for PCs	with AUI/Tp and RJ 45
Redundancy	Yes	bus in ring structure with super vision components

Field Bus System

Type	Profibus DP	
Manufacturer	Siemens	
Protocol	IEC 61158-2, EN 50170-1-2	
Transfer speed	Max. 12 Mbit/s	
Number of possible nodes	96 or 125 nodes	
Maximum bus length	2-wire: 1000 m Optical-fiber: up to 15 km	
Cable type - Coaxial - Optical-fiber 50/125 glass fiber - Miscellaneous	No Yes 2-wire (Profibus type)	
Bus components	Optical Link Module Interfaces	

Type	Profibus PA	
Manufacturer	Siemens	
Protocol	IEC 1158-2	
Transfer speed	max. 31 kbit/s	
Number of possible field devices	31 not ex-area31 10 Ex-zone 1	

Type	Profinet	
Manufacturer	Siemens	
Protocol	IEC 61158/61784	
Transfer speed	Max. 100 Mbit/s	
Number of possible nodes	typical 1024	
Max. bus length - Miscellaneous	Ethernet: up to 5km Optical-fiber: up to 150 km Industrial Twisted Pair	

Process Stations Technical Data

Process Station

Type designation	SIMATIC S7-400	
Manufacturer	Siemens	
Processor type	CPU 410-5H	
Power supply	24 VDC or 120/230 VAC	(redundancy capability)
Operating temperature	0 to +70 °C	(no fan)
Storage temperature	-40°C to +70°C	
Relative humidity	Max. 95 % at +25 °C	
Protection against ingress of solid foreign bodies and water	IP 20	
CPU clock frequency	Instruction cycle time from 0.02 µs	
Processor loading	Max. cycle time	
Total	100 ms	
Of which: - Base load - Application programs	 20 ms 50 ms	
Cycle times - Parameterizable in steps - Step size?	$\le$ 100 ms Yes 10 ms	
Installed RAM memory Load memory	32 MB 48 MB	
RAM battery backup - Type - Bridging time - Lifetime	 2x Lithium AA 2.3 Ah 712 days 5 Years	 With PS + CPU
Real-time clock?	Yes	
Calendar?	Yes	
Timestamp resolution	$\le$ 100 ms	
Where does the timestamp take place?	In the CPU	
Plant bus - Type: - Protocol:	Industrial Ethernet, Fast Ethernet IEEE 802.3	
Field bus - Type: - Protocol - Type: - Protocol	Profibus DP EN50170 IEC 1158-2 Profinet IEC 61158/61784	
Full-graphic documentation	Yes	
current program	CFC function plan	
Other field buses: - Profibus DP/PA - Profibus FMS - Interbus S - Foundation Fieldbus - MODBUS	Yes Yes No Yes, Yes,	 via DP/FF Link via add-on

Peripherals Central modules		
I/O address area - Inputs - Outputs	16 kbyte; max. 16 kbyte; max.	dependent on the System Expansion Card used dependent on the System Expansion Card used
Digital channels - Inputs - Outputs	131 072; max. 131 072; max.	dependent on the System Expansion Card used dependent on the System Expansion Card used
Analog channels - Inputs - Outputs	8192; max. 8192; max.	dependent on the System Expansion Card used dependent on the System Expansion Card used
Diagnostic capability of the I/O modules - Except I/O module? - Except channel?	 Yes Yes	

Decentral modules
- ET200S
  All modules usable?
- ET200M
  All modules usable?
- ET 200 SP HA
  All modules usable?
	
	yes
	
	Yes
	
	Yes	

Analog modules - Type - Single potential separation - 0 – 20 and 4- 20 mA	 Yes Yes	
High-performance modules, manufacturer-dependent	Counter, positioning, path acquisition modules, etc.	

Industrial Workstation for ES, Server and Client

Hardware Information for Engineering Station, Server and OS Clients you will find in the PCS 7 Catalog.

https://support.industry.siemens.com/cs/de/en/view/109745632

Volume of Project Data

	Typical	Maximum	Comment
Communication / control system			
Process objects	5500	Approx. 216000	Operable and monitorable blocks
Events (message bits)		200000	Max. Number of configurable messages per server
Number of AS on The IE (SINEC H1)	8	64	
Telegrams per second	10	approx. 15	
Acquisition cycles for measured valued (concurrently)	10%/sec. 90% > 5sec.		10 % curves with 1s 90 % curves with 5 s / 10 s
Updating cycle in the picture	< 1 s	1 - 2 s	

	Typical	Maximum	Comment
Pictures			
Number of pictures	120	Unlimited -	
Number of controls (stat. and dyn.) per picture	250	approx. 800	
Picture level	3	32	
Picture size in pixel	1280x1024	2560x1600	Max. 10000x10000 in WinCC

	Typical	Maximum	Comment
Trend curves (OS)			
- per control system	1000	5000	Typical distribution: 10% with 1s archiving cycle 40% with 5s archiving cycle 50% with 10s archiving cycle

	Typical	Maximum	Comment
User Archive			
Amount of archives	1	Unlimited	
Archive fields	60	500	The product from no. of fields and Data Records
Data records per user archive		10000	Must not exceed the value 320000
Archive view		Unlimited	

	Typical	Maximum	Comment
Curves			
Number of curve frames per graphics picture	2	25	
Number of curves per curve frame	6	80	
Number of curves per picture	12	80	
Archives per Server/ Single Station	20	100	
Archiving Values	2000	80000	Archive server necessary
Number of measured values per measuring points on HD		All	Depends on the acquisition cycle, for recording longer than 1 week
Number of measured values per measuring point in main memory	30	Time duration 10 minutes	Depends on the acquisition cycle

	Typical	Maximum	Comment
Archiving in database	200 values/sec	1500 values/sec.	10000 values/sec. with Archive server

Logs			
Number of logging printers	1	3	
Message sequence logs (active)	No	yes	
Number of message archive logs	3	5	
Number of log lines per message	3	3	
Number of variables in the log element	2	2	

Recipes	25 to 50	Unlimited	Limits set by running times

Alarms / messages			
Configurable messages per server	20000	200000	Object dependent
Message classes	10	18	
Message types		4	
Message priorities	2	17	(0…16)
Process tags per message line	1	10	
User text blocks per message line	4	10	
Number of message archives	1	1	
Number of current message archives	1000	2000	
Number of long-term message archives	8 days	30 days	
Message burst without message loss	10/sec.	3000/4sec.	
Messages permanent	20/h	10/ sec.	

Note: Some of the maximum values are significantly larger than the typical values and can normally be "approached" when other requirements are reduced. The typical values apply in combination and have been tested in this form.

Simulation and Testing

Sequence Test Mode

The sequence test mode can be used for program test without the periphery being available. This is very useful for general function tests, for the Factory Acceptance Test or for Operator Training.

The sequence test mode always applies to the complete PLC and must be enabled via System chart SYSPLCxx, block C_FB_PLC at input *SEQ_TEST*.


```
PLC
C_FB_PLC         MAIN_TASK
CEMAT PL         9/12
0─ ACK_GR           OS_CNT ─
0─ ACK_OB         STANDARD ─
0─ REL_WSTP       ACK_GR_O ─
'TEST'─ SEQ_TEST   ACK_OB_O ─
0─ SimSave           WSTP_O ─
0─ SimLoad        SEQT_STA ─1
0─ SimPause       PLC_NO_O ─
0─ PLC_NO         OPTION_O ─
1─ OPTION
0─ SYSTEST
```

```
For Sequence Test write
the String 'TEST' into the
Parameter SEQ_TEST  &
restart the PLC.

To leave this mode write
'NO' & restart the PLC
again.
```

In order to enable the sequence test mode, the string 'TEST' on parameter *SEQ_TEST* has to be entered and the AS has to be restarted.

⚠ **Note:** In the sequence test mode the output for contactor on commands are never set and the contactor feedback signals and process feedback signals of the drives are simulated internally.

⚠ **Note:** Be aware that the connection of the I/Os to the block inputs and outputs cannot be checked with Sequence test mode. This can only be achieved with a real simulation System like SIMIT.

The signal status of the binary inputs can be simulated via diagnosis view of the faceplates, where the status indications are converted into simulation buttons which allow "switching" of the inputs.

The process values can directly be entered in the faceplates and replace the real Process value.

- After the Sequence Test mode is enabled, by default all inputs are in healthy condition and the simulation buttons appear. The status can be changed by toggle function.
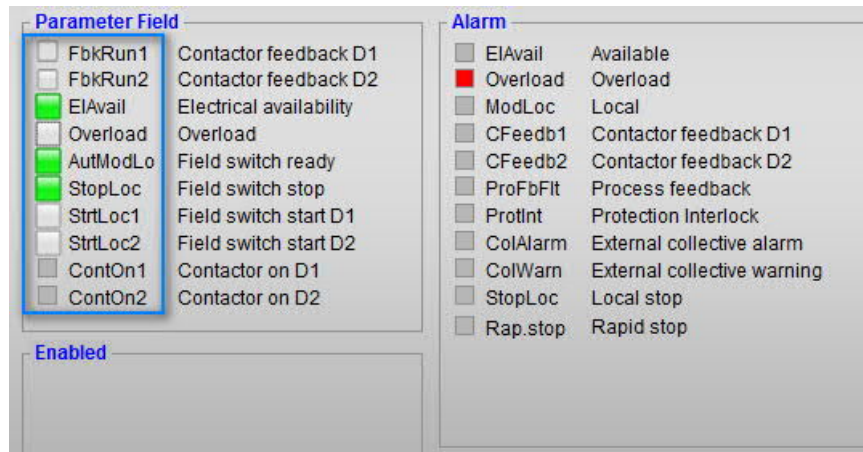
- Contactor feedback signals and process feedback signals can only be forced to an unhealthy condition; the same applies to the Analog process signals of ProFB blocks.

- Analog values are set to 50% (between low limit and and high limit) and can then be modified via the Standard faceplate.
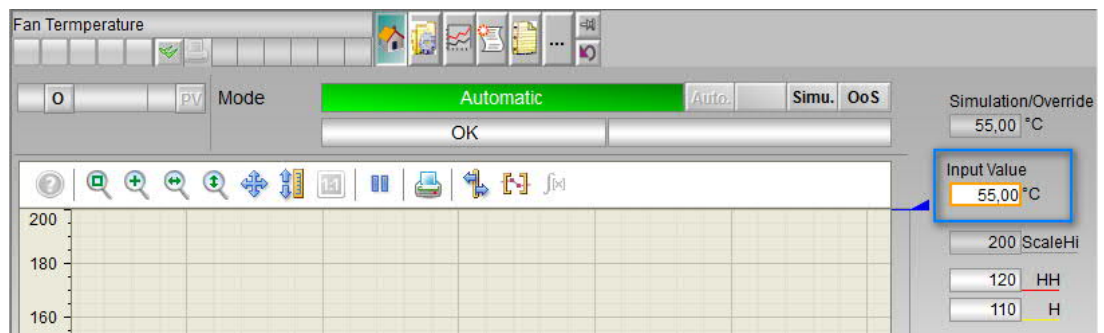
- For the blocks C_ANNUNC, C_ANNUN8, C_PROFB, C_PROFBx, C_MEASUR and for the Process value of C_DAMPER the Sequence test mode can be disabled, for example for cases where the program includes a calculation or an internal simulation.

The sequence test mode includes a function for saving, restoring or interrupting the simulation. This can be carried out via block C_FB_PLC, inputs *SimSave*, *SimLoad* and *SimPause* in System chart SYSPLCxx.

- With 1-Signal at input *SimPause* the Sequence test can be interrupted at any time. The PLC is running in kind of an idle mode, no action any more.

- With a positive edge at input *SimSave* the test situation can be saved (e. g. at the end of a day, or in order to repeat the same step several times)

- With a positive edge at input *SimLoad* the previously test situaion can be reloaded in order to proceed with the same step.

In order to leave the sequence test mode, enter the string 'NO' at the parameter SEQ_TEST and restart the AS. By this the sequence test mode of all blocks is reset.

Support

For PCS 7 and CEMAT Support worldwide follow the link

https://www.industry.siemens.com/aspa_app/?nodekey=key_518271&comptcid=o&lang=en
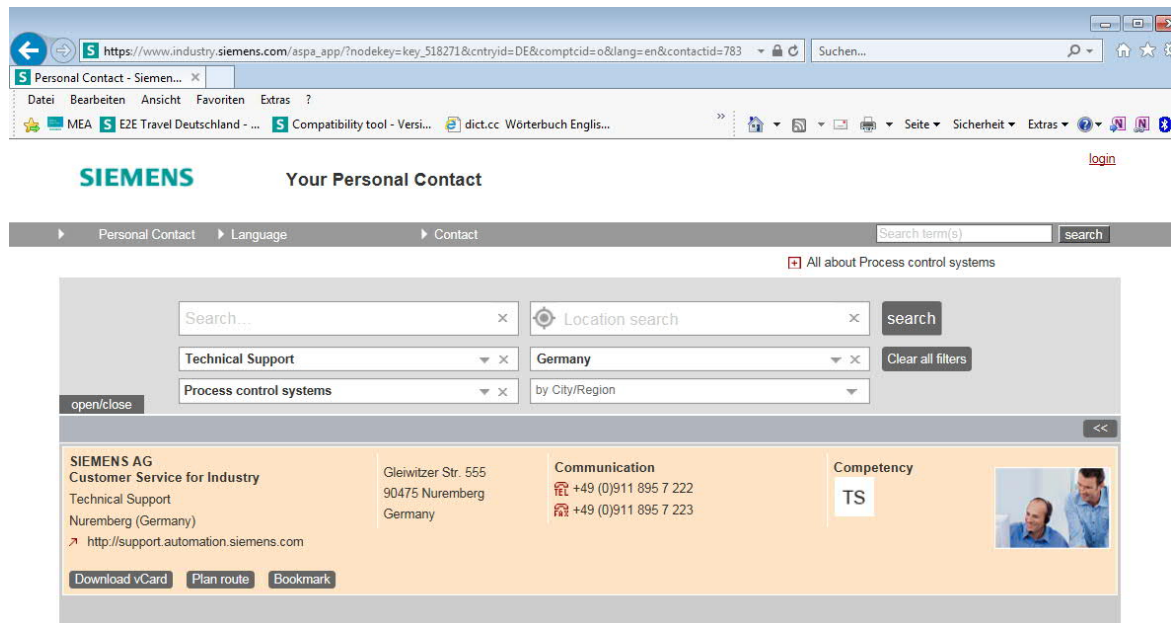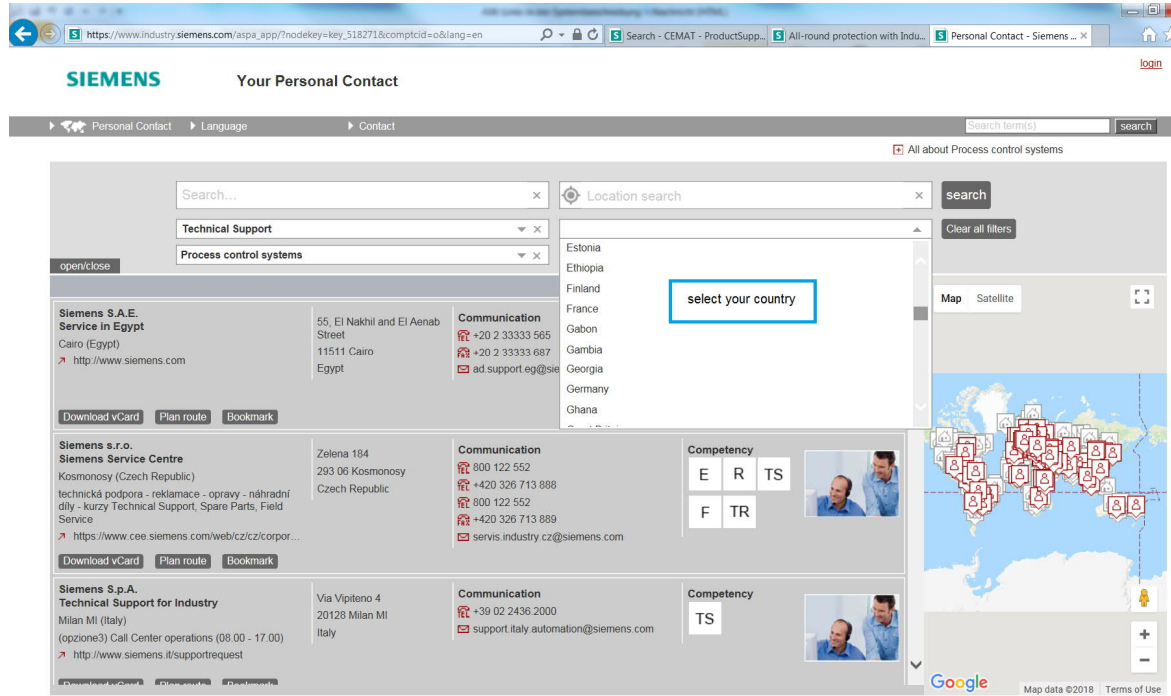
For support requests and FAQs follow the link

https://support.industry.siemens.com/My/ww/en/requests

General Information about the System

System documentation and FAQs you can find in the PCS 7 SIOS Portal

https://support.industry.siemens.com/cs/document/63481413/simatic-pcs-7-overview?dti=0&lc=en-WW

In Order to find out which software is released with which version of PCS 7 and CEMAT follow the link

https://support.industry.siemens.com/kompatool/pages/main/index.jsf?sitc=wwdfi10002

In ordert o keep your software up to following link leads to software updates:

https://support.industry.siemens.com/cs/ww/en/view/109756832

The PCS 7 and CEMAT Catalog you can find under the following link:

https://support.industry.siemens.com/cs/ww/en/view/109745634

Information about Security you can find under the following ling

https://support.industry.siemens.com/cs/document/92605897/all-round-protection-with-industrial-security-system-integrity?dti=0&lc=en-WW

Extensive information about process automation is available on the Internet:
http://www.siemens.de/prozessautomatisierung or http://www.pcs7.com

CEMAT information
http://www.siemens.com/cemat

Reference list of documentation

The following Manuals are provided with the CEMAT Installation and available under D:\CEMAT_CS\Docu:

System description
(under D:\CEMAT_CS\Docu\Referenct\System)

02_System_Description_009.pdf	CEMAT

Engineering Manuals
(under D:\CEMAT_CS\Docu\Engeineering)

02_Preparations_009.pdf	CEMAT
03_PCS7_Project_009.pdf	CEMAT
04_Assignments_009.pdf	CEMAT
05_Engineering_Examples_009.pdf	CEMAT
06_AS_Engineering_009.pdf	CEMAT
07_AS-AS_Coupling_009.pdf	CEMAT
08_OS_Engineering_009.pdf	CEMAT
09_Engineering_Tools_009.pdf	CEMAT
10_Check_list_009.pdf	CEMAT
14_Tips_Tricks_009.pdf	CEMAT
15_Update_Information_009.pdf	CEMAT

Object descriptions
(under D:\CEMAT_CS\Docu\Reference\Objects)

Description of the CEMAT MinAS blocks	CEMAT

All object descriptions are available in the runtime system via online help and via F1 in the CFC.

Links to PCS 7 Manuals (sorted by version):

https://w3.siemens.com/mcms/industrial-automation-systems-simatic/en/manual-overview/tech-doc-pcs7/Pages/Default.aspx