# Alarm management in SIMATIC PCS 7 – Smart Alarm Hiding

SIMATIC PCS 7 V9.0 SP1

https://support.industry.siemens.com/cs/ww/en/view/55699984

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# 1 Introduction

## 1.1 Overview

With the previous alarm suppression (Lock / Suppress) in SIMATIC PCS 7, the alarms at the process tag are suppressed. This means that messages from a process tag do not reach the alarm system of the PCS 7 OS and are not displayed and archived on the OS.

With the Smart Alarm Hiding, alarms of a process tag can be filtered or hidden depending on the plant state. A big advantage of this method is that the filtered and hidden alarms are still processed and archived in the alarm system of the OS.

This allows a reduction of the reporting volume in process operation and better handling for the system operator.

## 1.2 Principle of operation

This application explains how you can more effectively implement your alarm management in PCS 7 V7.0 or higher using Smart Alarm Hiding.

Automatic alarm hiding is basically controlled by status blocks in the AS that hide or show status-dependent alarms based on a hiding matrix.

Technological (messaging) blocks are assigned to a status block via the new "block group" block property.

There are two ways of implementing smart alarm hiding:

- Manual hiding and displaying of alarms
- Automatic hiding and displaying of alarms

This application example shows you how you can use and configure both options in your project.

Figure 1-1 Overview "Operating principle of automatic alarm hiding"
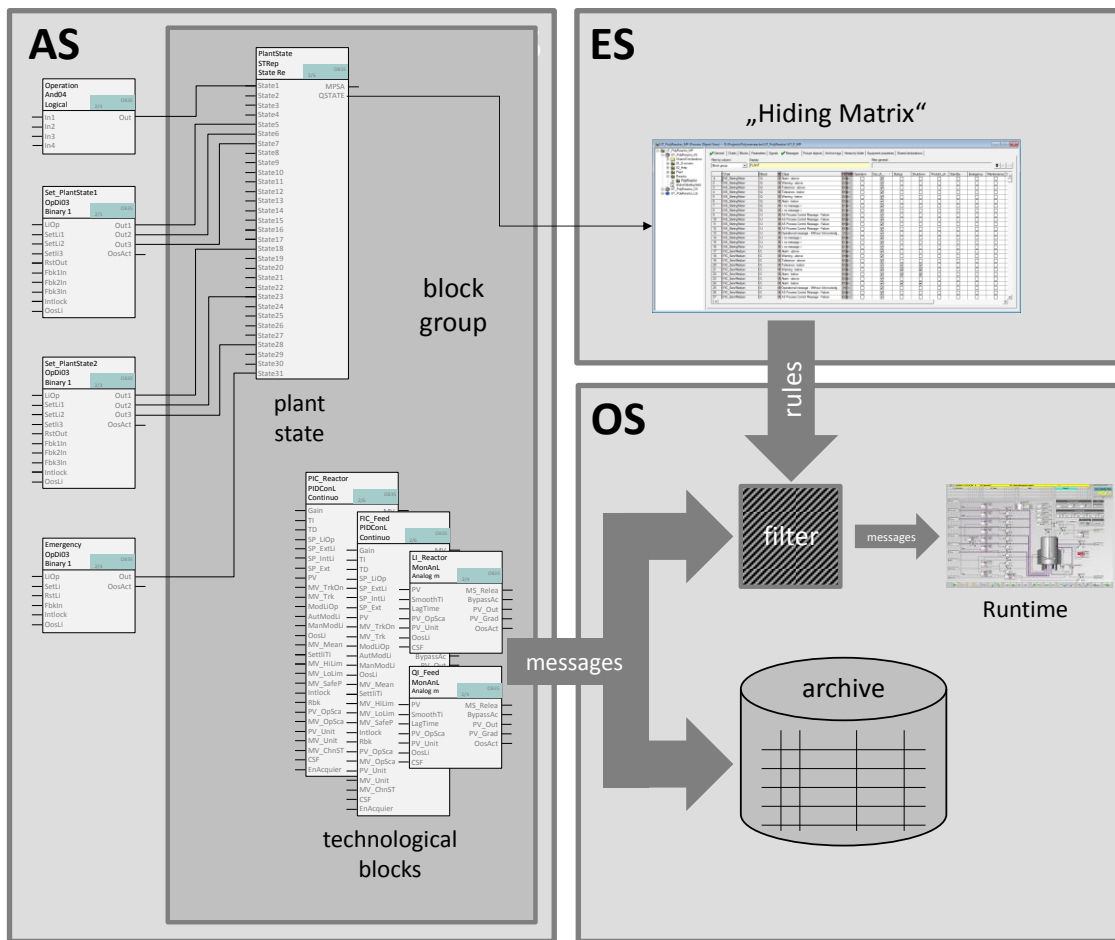
**Hiding alarms manually**

Manually hiding the alarms is characterized by the following features:

- The alarms are shown again after a defined period of time.
- Manually hidden alarms are acknowledged automatically.
- Manual alarm hiding applies to all clients of the relevant OS server.
- An operator message is triggered if alarms are hidden and shown manually.

**Hiding alarms automatically**

The goal is to hide alarms depending on specific process or system conditions to display the relevant alarms.

## 1.3 Components used

| Component | Note |
|---|---|
| SIMATIC PCS 7 ES/OS IPC547G W7 | For the PCS 7 V9.0 SP1 example project |
| SIMATIC PCS 7 V9.0 SP1 | Part of SIMATIC PCS 7 ES/OS IPC547G W7 |
| APL library V9.0 SP1 | Part of SIMATIC PCS 7 V9.0 SP1 |

| | |
|---|---|
| **Note** | If the hardware is different, observe the minimum requirements for installing the software components. The minimum requirements can be found in the PCS 7 Readme under the following link: https://support.industry.siemens.com/cs/ww/en/view/109750097. |

This application example consists of the following components:

| Component | Note |
|---|---|
| 55699984_Alarm_Hiding_DOC_PCS7V90SP1_en.pdf | This document |

# 2 Basics

The following

section gives a short summary of the Alarm Management functions

already available in PCS 7 V6.1.

## 2.1 Important alarm indicators

- Alarm line in the overview area of the OS runtime
  (Display of the highest priority alarm)

Figure 2-1 OS alarm display in the overview area
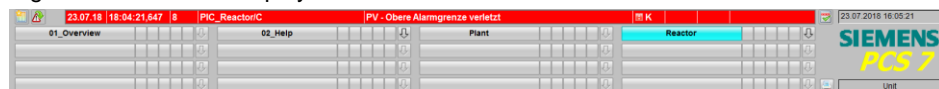


- Preconfigured alarm views (e.g. new list, old list), freely definable alarm views
  (WinCC Alarm Control)

Figure 2-2 OS alarm display



- Group displays in the overview areas and as part of the block icon

Figure 2-3 Group display in the block icon
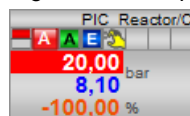


- Loop-in alarm with highlighting of the disturbed process tag

Figure 2-4 Highlighting in the block icon
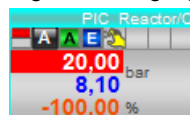
- Horn

Figure -2-5 Horn configuration in WinCCExplorer

Smart Alarm Hiding
Entry ID: 55699984,   V4.0,   11/2018

8
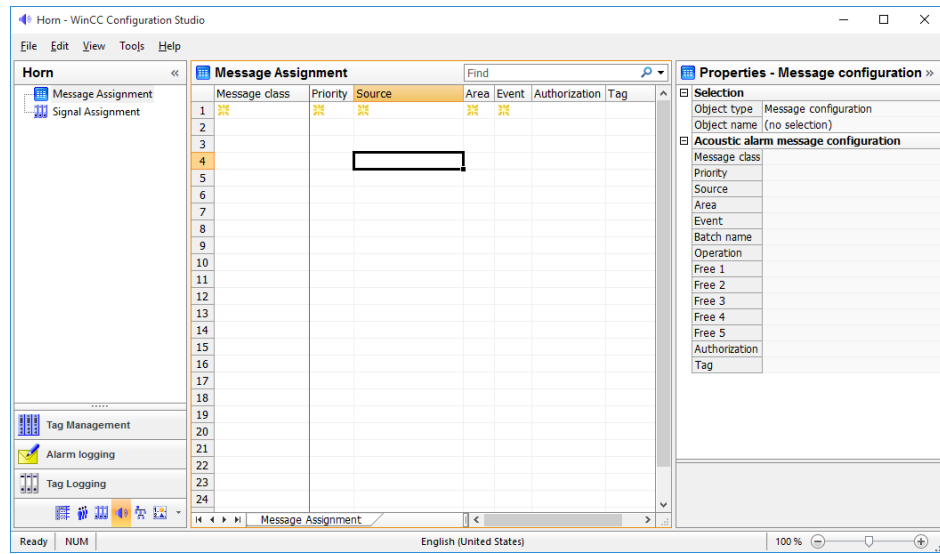
## 2.2 Suppression of alarms

There are two ways to suppress alarms:

- You can suppress these directly at the technological blocks via the MsgLock inputs for inhibiting alarms of a block (depending on the program logic).
- You can suppress alarms of an individual process tagor part of the plant hierarchy directly via the OS runtime.

Figure 2-6 Blocking of alarms specific to the area and process tag
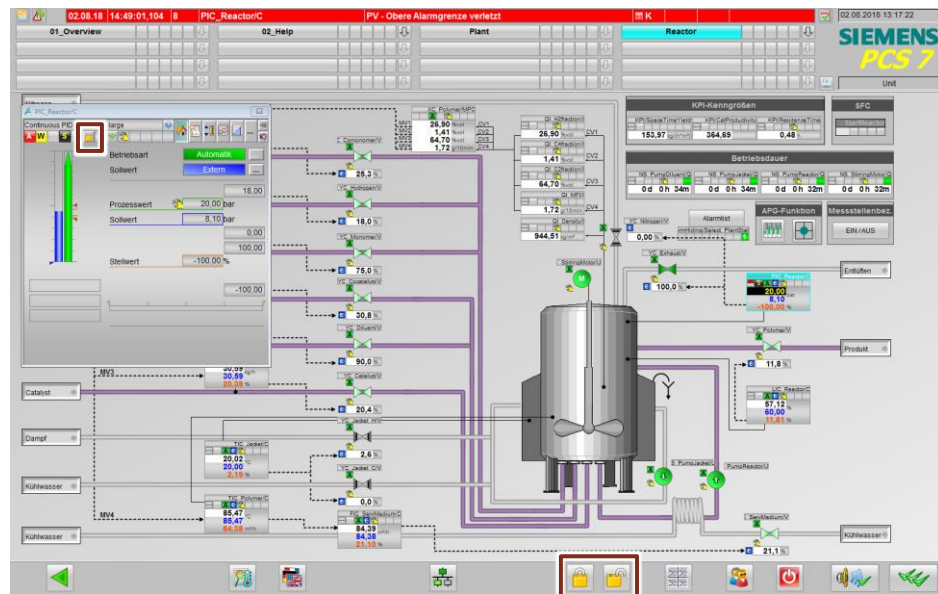


## 2.3 Acknowledgment-triggered reporting (QTM)

To reduce the message volume in the system, the PCS 7 alarm blocks ALARM_x provide the process of acknowledgment-triggered reporting.

It is based on the fact that after generating a coming message (signal change from 0 to 1) for a signal, no further messages are generated for this signal until it has been acknowledged on the OS.

## 2.4      Filtering of alarms

You can configurethe filtering of alarms within the alarm lists. The filter criteria are message properties (date, time, message class, message text, etc.).

Figure 2-7 Filtering and sorting of alarms
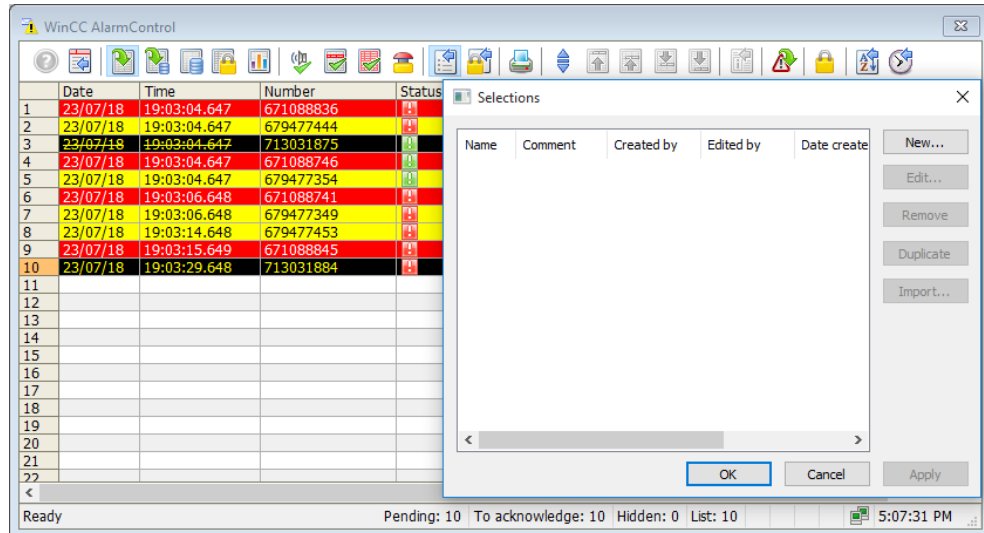


The reason for changing the filter criteria online is the temporary focussing on a certain property, e.g. time period or event, for fault analysis.

## 2.5 Analyzing alarms

The hit list allows you to display statistic calculations for archived messages in the message window.

The following statistic calculations are available for messages:

- Frequency of a message number. The frequency is only increased when a message with "Incoming" status is stored in the archive.

- The acumulated duration of an alarm number in seconds for the "incoming/outgoing"(+/-) state, the "incoming/first acknowledgment"(+/*1) state, or the "incoming/second acknowledgment"(+/*2) state.

- The average duration of a message number, in seconds, for the "incoming/outgoing"(+/-) state, the "incoming/first acknowledgment"(+/*1) state, or the "incoming/second acknowledgment"(+/*2) state.

**Note** Only the "Acknowledgment", "System Acknowledgment" and "Emergency Acknowledgment" states are included in the statistics calculation of acknowledgment times.

Figure 2-8 Hit-List



Figure 2-9 Configuration of the hit list in the alarm control

# 3 Manual alarm hiding

Manual alarm hiding allows you to temporarily hide pending alarms that are not relevant to the current state of the system.

| Note | The manual hiding of alarms is OS server-oriented. |
| --- | --- |
| | If an alarm is manually hidden on an OS client, this alarm is not visible on any client that also accesses the associated server. |

## 3.1 Configuration

Proceed as follows to configure the manual alarm hiding:

1. Open the WinCC Explorer.
2. Open the OS Project Editor.
3. Click the "Message Display" tab. The configuration dialog "Smart Alarm Hiding" opens.
4. Activate the check box for the manual hiding of alarms in the PCS 7 message lists (see Figure 3-1).

Figure 3-1 Configuration of the manual alarm hiding in the OS project editor
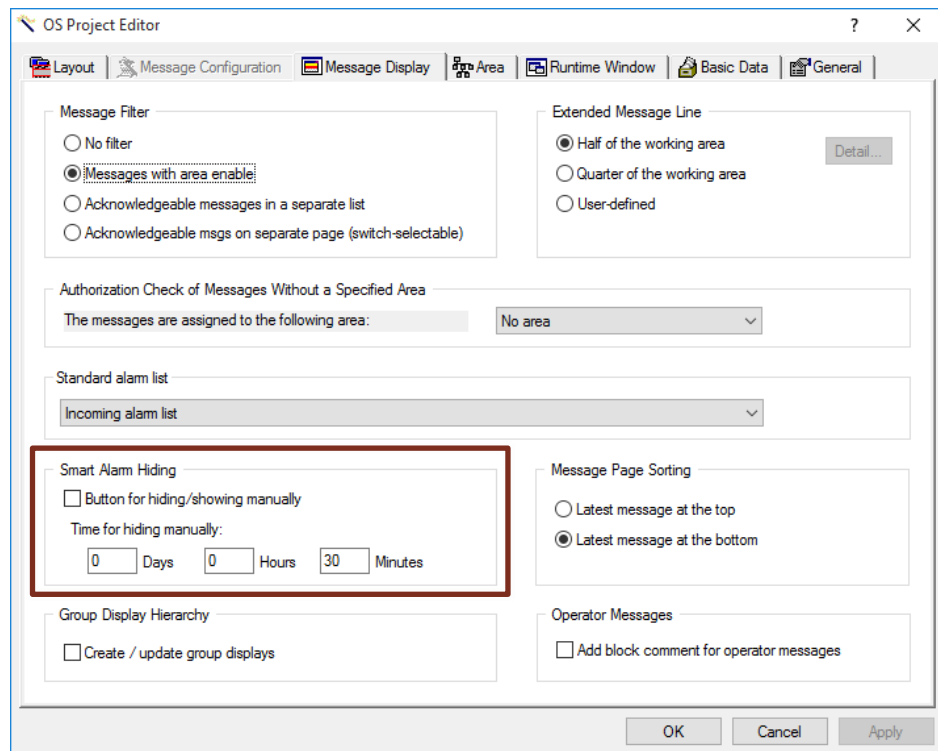


| Note | On the server, you can also set the length of time after which a manually hidden alarm is displayed again. |
| --- | --- |

| Note | Changing the hide times and displaying the manual hiding button are delta loadable. |
| --- | --- |

## 3.2 Configuration in OS runtime

Proceed as follows to configure in OS runtime:

1. Activate OS runtime.

2. Open the configuration dialog of the WinCC alarm controls.

3. Under the "Toolbar" tab, select "Hide message" and "Unhide message".

Figure 3-2 Configuration of WinCC alarm control
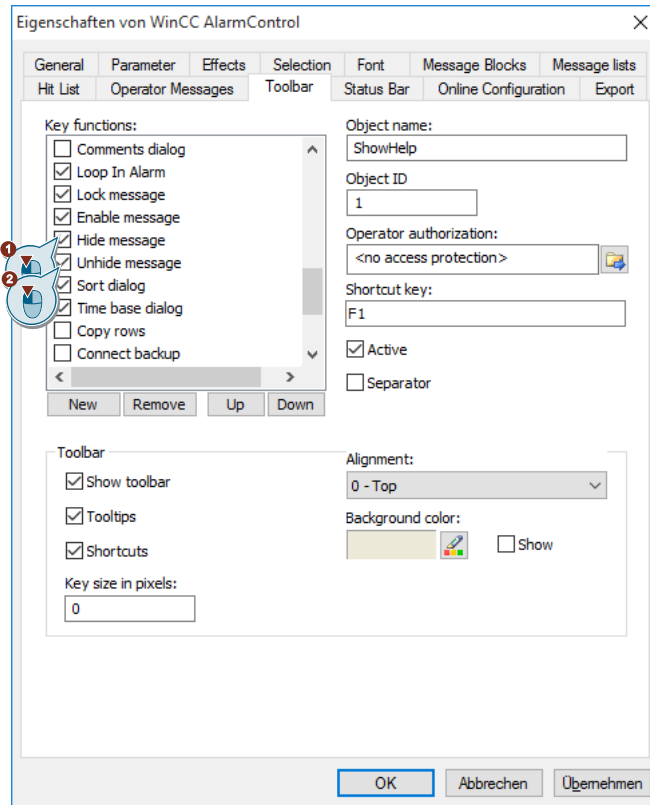


4. In the views of the WinCC alarm control "Message list", "Short-term archive list" and "Long-term archive list" you can hide messages manually (light bulb symbol).

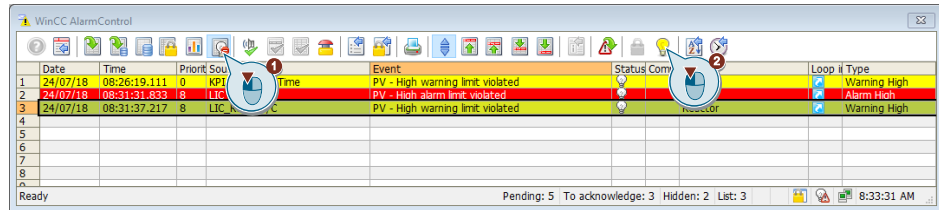Figure 3-3 Additional button for hiding alarms
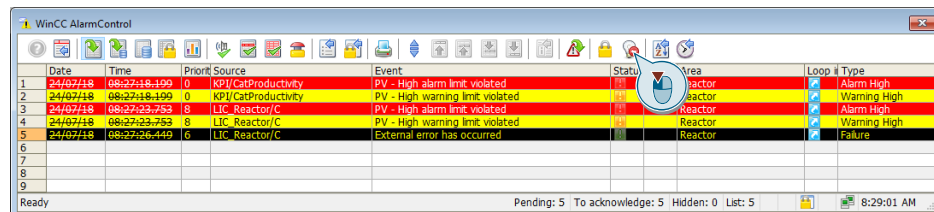


| Note | Alarms that can be manually hidden from the message list are automatically acknowledged when hiding. |
| --- | --- |
| | After the configured hide time has expired, they are displayed again. |

5. In the "List of hidden messages" view, you can manually display hidden alarms again.

Figure 3-4 Additional button for showing alarms



| | Date | Time | Priorit | Sou | | Event | Status | Comr | | Loop i | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24/07/18 | 08:26:19.111 | 0 | KPI | Time | PV - High warning limit violated | | | | | Warning High |
| 2 | 24/07/18 | 08:31:31.833 | 8 | LIC | | PV - High alarm limit violated | | | | | Alarm High |
| 3 | 24/07/18 | 08:31:37.217 | 8 | LIC_ | /C | PV - High warning limit violated | | | | | Warning High |

Ready — Pending: 5 | To acknowledge: 3 | Hidden: 2 | List: 3 — 8:33:31 AM

**Note** — Alarms that you acknowledge by manually hiding appear in the old list after displaying again if they did not come back.

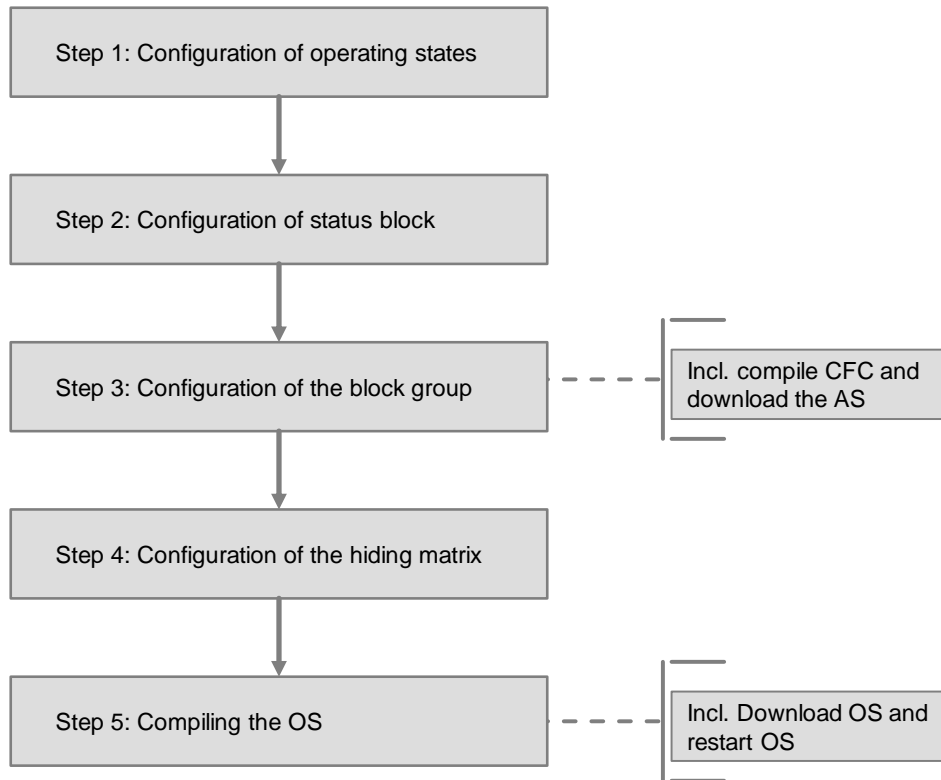## 3.3 Diagram of manual alarm hiding

Figure 3-5 Runtime Model
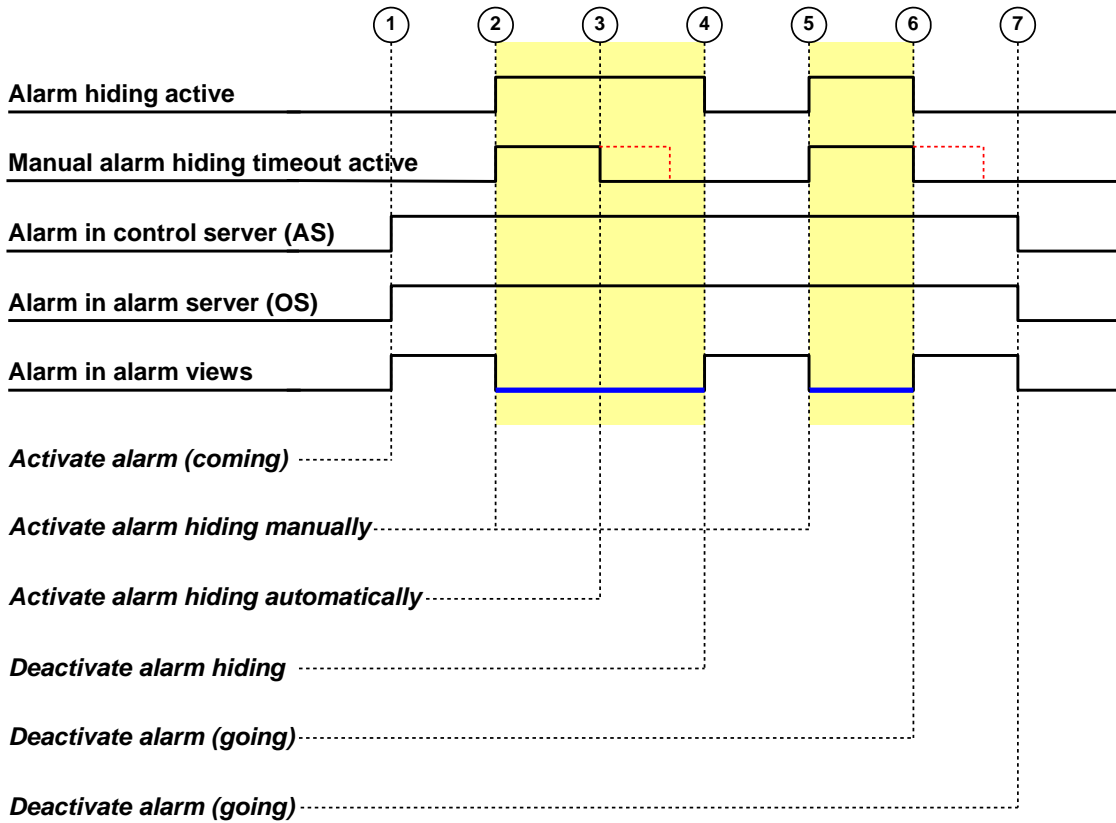
# 4 Automatic Alarm Hiding

## 4.1 Configuration

The following Figure 4-1 shows the main steps for the configuration of the automatic alarm hiding.

Figure 4-1 The 5 configuration steps for smart alarm hiding

```
┌──────────────────────────────────────────┐
│  Step 1: Configuration of operating states │
└──────────────────────────────────────────┘
                    │
                    ▼
┌──────────────────────────────────────────┐
│  Step 2: Configuration of status block     │
└──────────────────────────────────────────┘
                    │
                    ▼
┌──────────────────────────────────────────┐          ┌─────────────────────┐
│  Step 3: Configuration of the block group  │ - - - - │ Incl. compile CFC and│
└──────────────────────────────────────────┘          │ download the AS      │
                    │                                  └─────────────────────┘
                    ▼
┌──────────────────────────────────────────┐
│  Step 4: Configuration of the hiding matrix │
└──────────────────────────────────────────┘
                    │
                    ▼
┌──────────────────────────────────────────┐          ┌─────────────────────┐
│  Step 5: Compiling the OS                   │ - - - - │ Incl. Download OS and│
└──────────────────────────────────────────┘          │ restart OS           │
                                                        └─────────────────────┘
```

### 4.1.1 Configuration of the operating states

**Procedure**

To configure the operating states, proceed as follows:

1. Open the component view of your project.
2. Under "Master Data Library > Shared Declarations", right-click on "Enumerations" and select "Insert New Object > Enumeration".

Figure 4-2: Definition of the enumeration in the multiproject
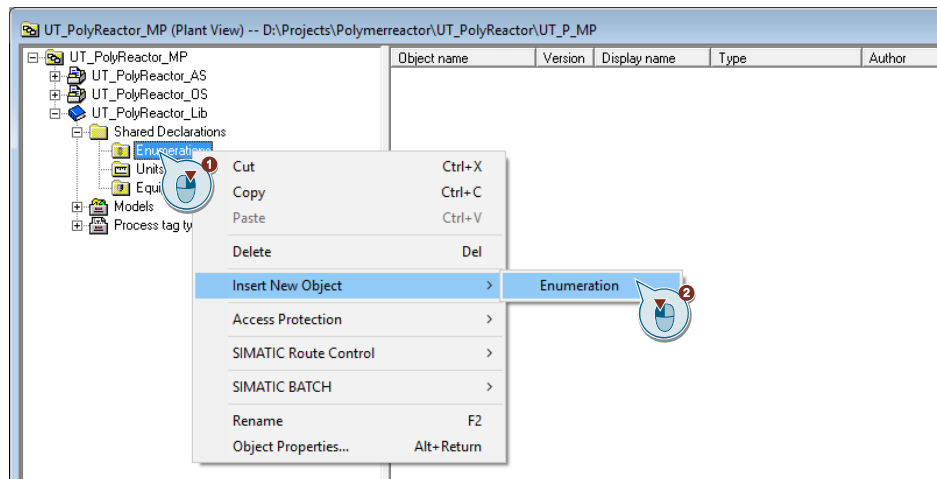


3. Assign the name "Operating State" to the enumeration.
4. Right-click on the generated "Operating State" enumeration and select "Insert new object > Value".

Figure 4-3: Definition of the operating states in the multiproject
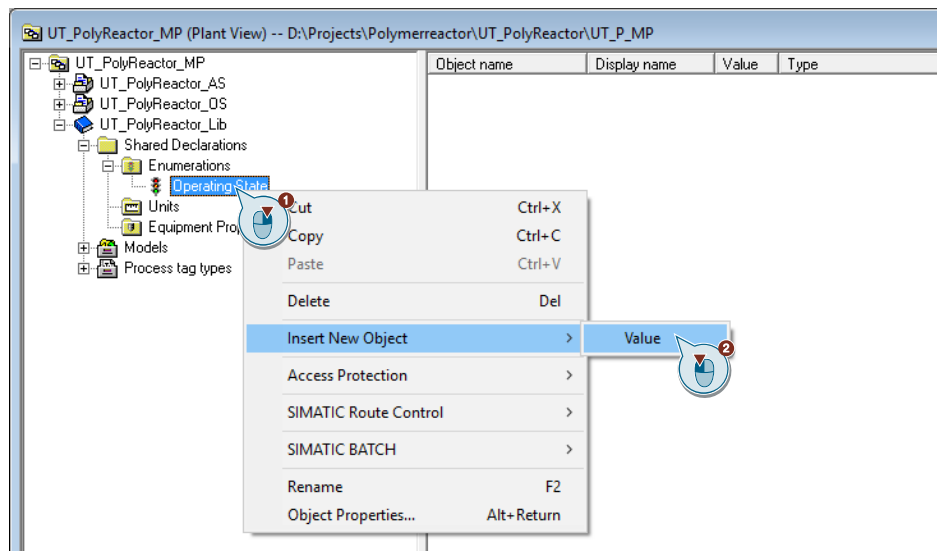


| Note | In this enumeration, you can define values from 1 to 32 for plant states. |
| --- | --- |
| | The value "0" is the default for the system status "normal". In this state, the system is in normal operation and no alarms are hidden. |

5. Name the created value according to an operating state.

6. Repeat steps 4 and 5 until you have configured all the operating states.

Figure 4-4 Example of the operating states
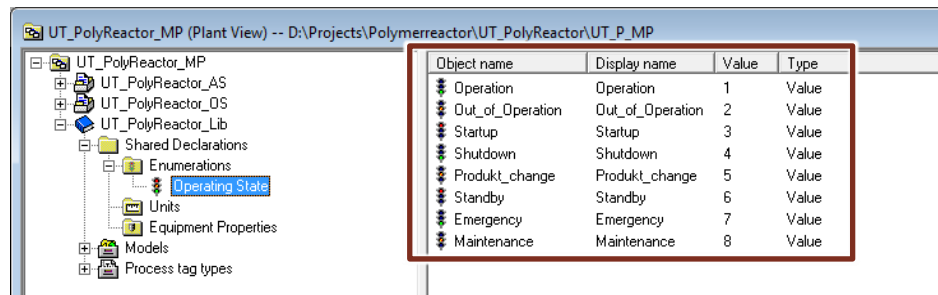


7. Right-click on "Shared declarations" and select the "Shared Declarations > Synchronize in Multiproject" command in the context menu.

Figure 4-5 Synchronizing the Shared Declaration in the Multiproject
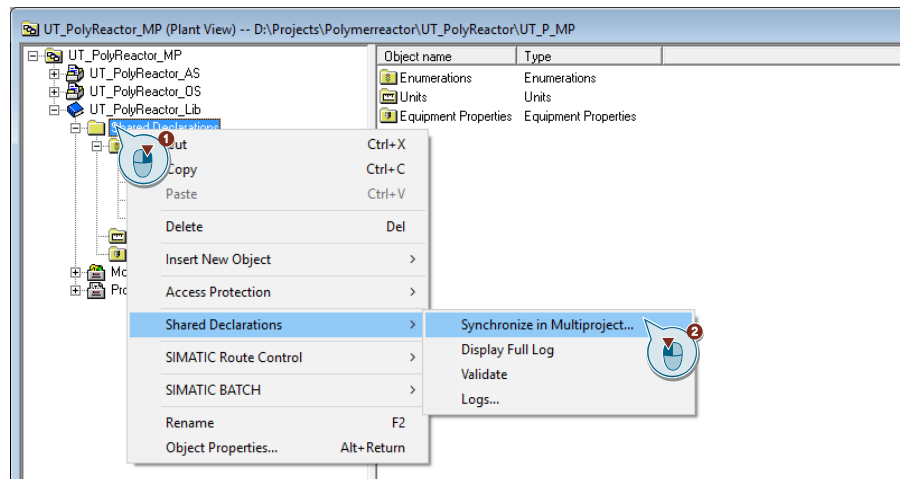
| Note | In multiprojects consisting of several sub-projects, the "Enumerations" in the Shared Declarations are created in the master data library and then synchronized in the multiproject. |
|---|---|

### 4.1.2 Configuration des status block "STRep"

This technological module is used to convert Boolean input signals into the corresponding system status.

**Procedure**

To configure the "STRep", proceed as follows:

1. Open a CFC chart of a corresponding sub-system

2. Insert the block "STRep" from the library "PCS 7 AP Library V90" and group "Maint".

Figure 4-6 Insert STRep block in the CFC chart
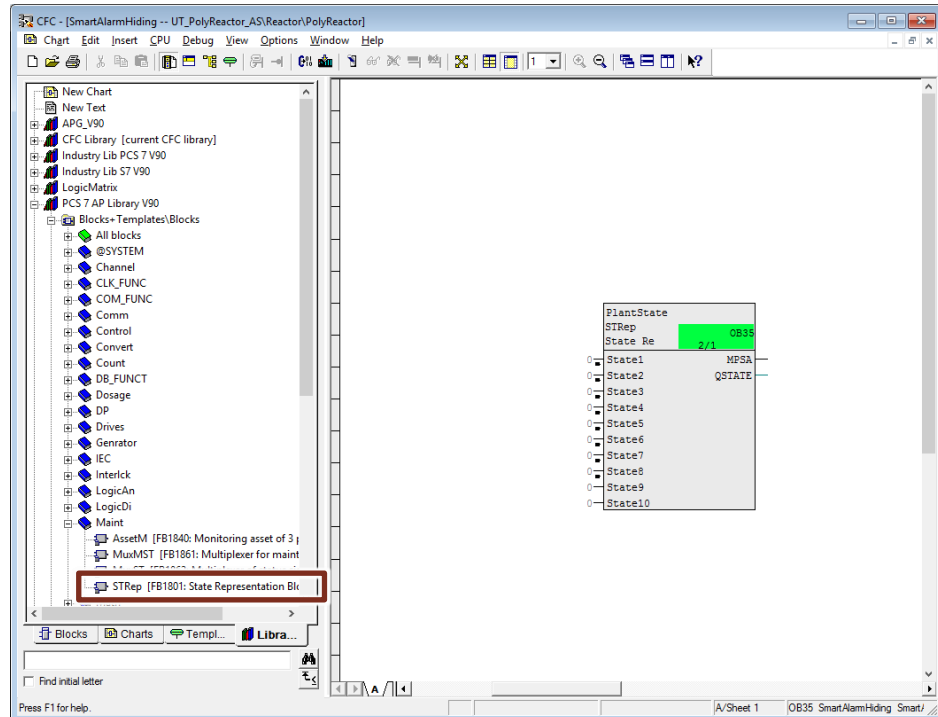


**Note** The "STRep" block has 32 Boolean inputs "StateX". These inputs correspond to the values of the enumerations that you configured in the first configuration step.

Figure 4-7 Attribute "STRep " block
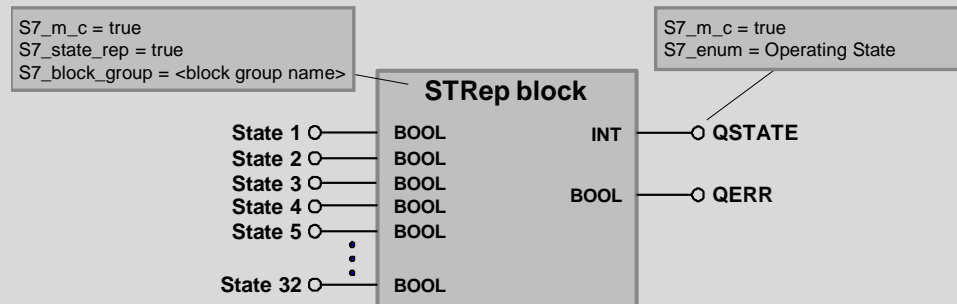


The output "QState" is linked to the values of the enumeration "Operating State" by the attribute "S7_enum = Operating State". In this way, the assignment and processing of the values / states configured in "Operating State" to the inputs of the "STRep" block is created.

If no signal is present at any input of the "STRep" block, the system is in the "Normal" state and the "QSTATE" output is 0. In this case, no messages are triggered.

If two inputs have the same status as "1" at the same time, the parameter "QERR" is set to "1" and "QSTATE" is set to "0" because a system cannot be in two different states at the same time.

3. Double click on the "QSTATE" output and assign the respective enumeration "Operating State"

Figure 4-8 Assignment of the enumeration "Operating State" to "QSTATE"
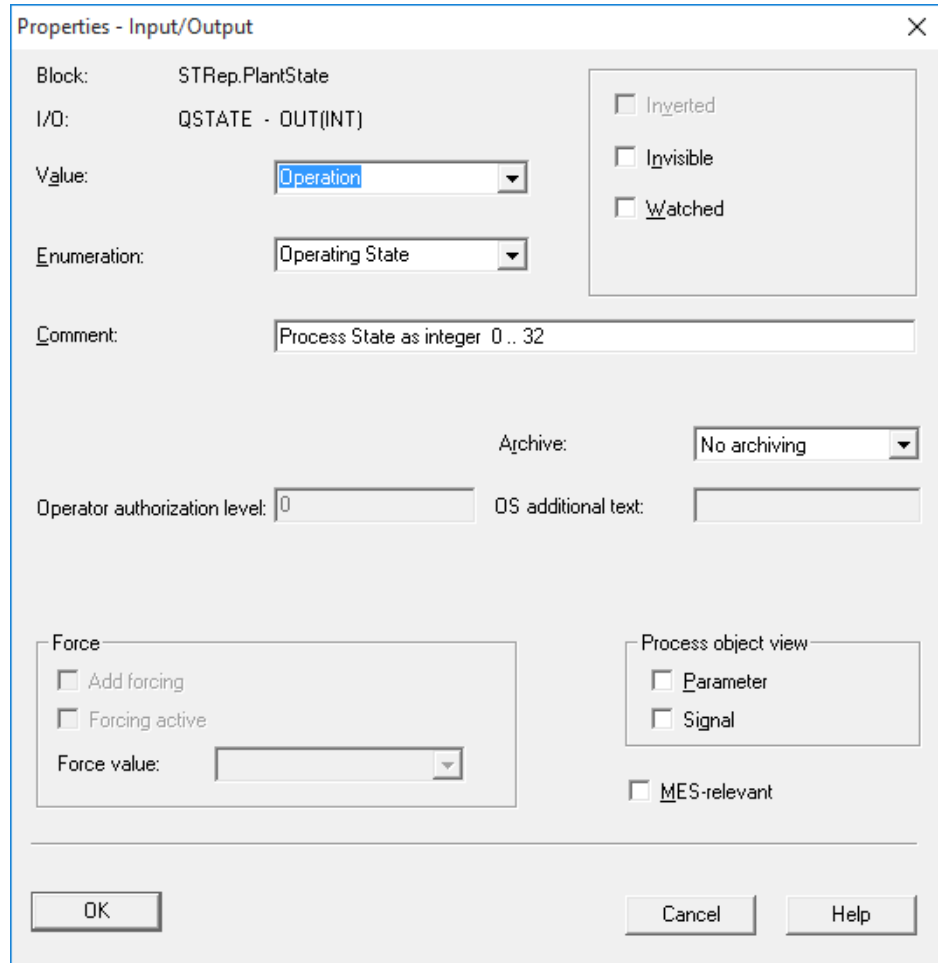
4. Interconnect the block inputs according to the plant states

| Note | If, for example, the value 3 corresponds to the system status "Startup", this corresponds to the input "State3" at the "STRep" block. If the value "1" is applied to the input "State3", this status corresponds to the system status "Startup", which is output at the output "QState" of the "STRep" block. |
|------|---|

5. Right-click on the "STRep" block and select "Object Properties" in the context menu.

6. Define a block group in the properties dialog of the "STRep" block.

Figure 4-9 Assignment of the "STRep" block to the corresponding block group
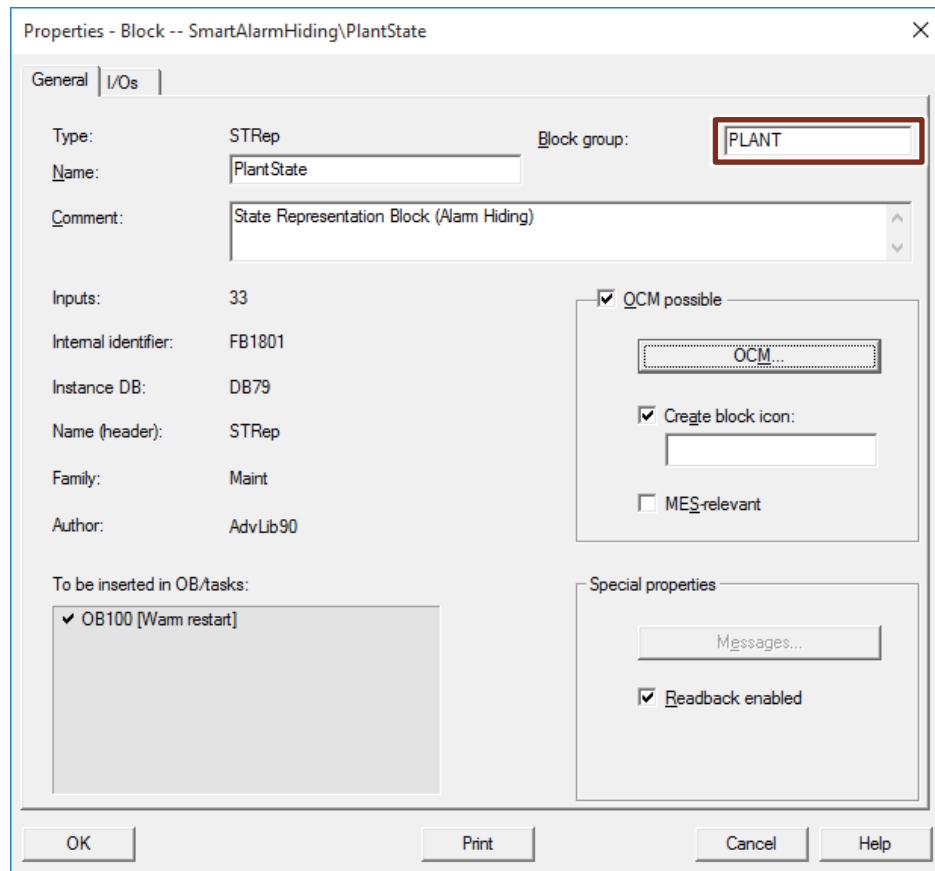
| Note | In the next step, you will define the technological area which the "StateRep" block forwards the operating state to this group. |
|---|---|
| | This means that a block "STRep" is permanently assigned to a block group. This makes it possible to hide block group granular alarms for certain operating states. |

### 4.1.3 Configuration of the block group

A technological area consists of several technological building blocks that can generate alarms. In order to hide alarms for sub-systems, you must group all the technological components of a sub-system into a block group. This allows you to hide all alarms generated by blocks of the same block group for specific plant states.

There are 2 ways to assign technological blocks to a block group:

**Procedure: Option 1**

1. Open the CFC chart containing a reportable block.
2. Right-click on the message-enabled block and select "Object Properties" in the context menu.
3. In the "Properties" dialog, define the "Block group" attribute

Figure 4-10 Definition of the block group
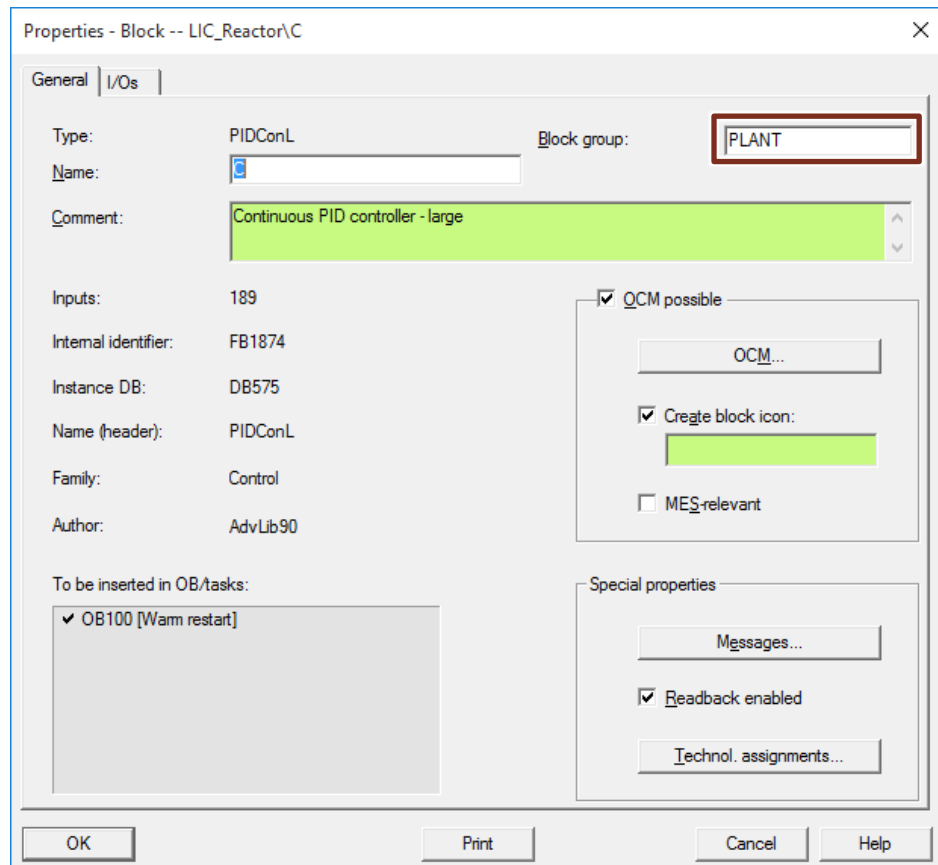
| Note | The "Block Group" attribute is an ES (CFC) attribute. When migrating your own block libraries to PCS 7 V7.0, they are automatically adopted for the technological blocks of this library. |

| Note | The block group attribute is also available in the import-export wizard. |

Figure 4-11 Block group attribute for import / export file
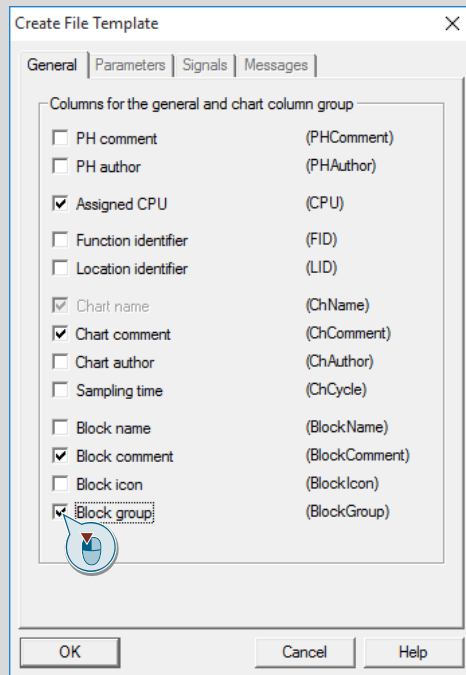


Figure 4-12 Block group attribute in the IEA editor



4. Compile the CFC charts and download the AS.

| Note | AS change compilations and change loading is possible |

**Procedure: Option 2**

1. Open the process object view of your project.

2. Assign the respective block group to the corresponding technological blocks.

Figure 4-13 Definition of the block group in the process object view
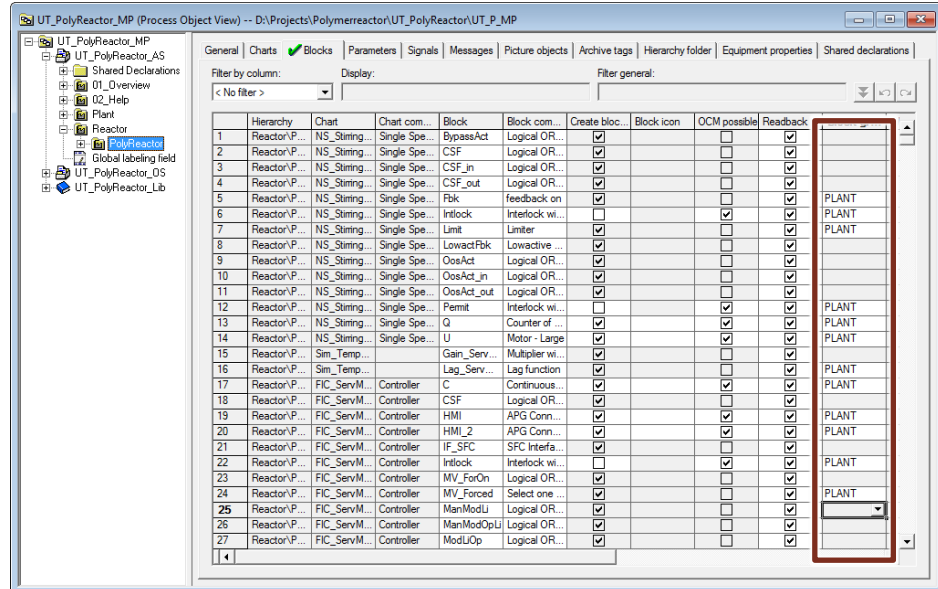


3. Compile the CFC charts and download the AS.

| Note | AS change compilations and change loading is possible |
|------|-------------------------------------------------------|

### 4.1.4 Configuration of the hiding matrix

In the process object view, you can define which messages of a block group are to be hidden in which system status.

**Requirement**

Chapters 4.1.1, 4.1.2 and 4.1.3 must be successfully gone through to configure the alarm hiding matrix in the process object view.

**Procedure**

To configure the hiding matrix, proceed as follows:

1. Open the process object view of your project.

2. Open the "Messages" tab

3. Activate the filter "Filter by column" and filter by "Block group"

4. Enter the name of the respective block group under "Display"

Figure 4-14 Filter by block group in the process object view
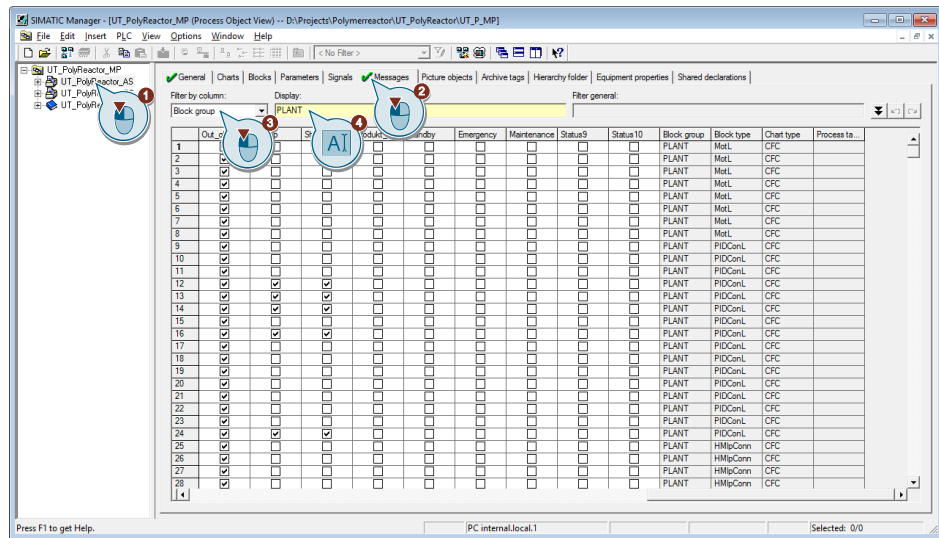


5. Configure the hiding matrix for the selected block group

Figure 4-15 Message matrix in the process object view
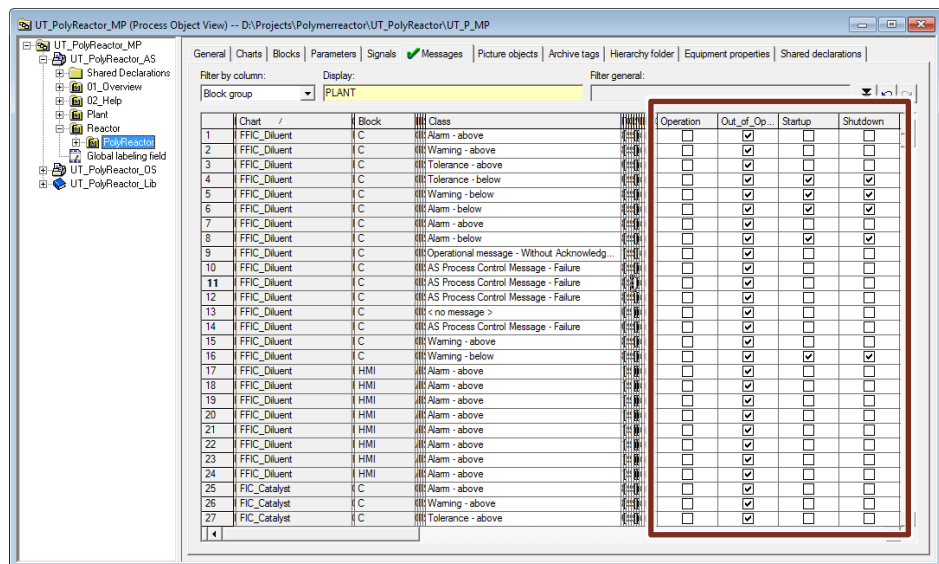


6. After completing all configuration steps in the ES, you compile and load the AS.

7. Compile and download the OS.

| Note | Changing the "Hidingmask" of an existing block is delta loadable. If a new message-capable block with a configured "Hidingmask" is added, the alarm hiding functionality is not active for this user after a change download of the OS server. To enable this functionality, the OS server must be reactivated. |
| --- | --- |

If the block group assignment for activating the alarm hiding functionality changes, the OS server must be reactivated after the downloading the changes.

### 4.1.5 Compiling the OS

Based on the "message matrix" from the process object view, when you compile the OS in alarm logging, a corresponding hide screen will be automatically generated as an additional attribute for the alarms to be generated. This is used later in OS runtime to hide the corresponding alarms in the alarm lists.

Figure 4-16 Hide screen OS alarm logging
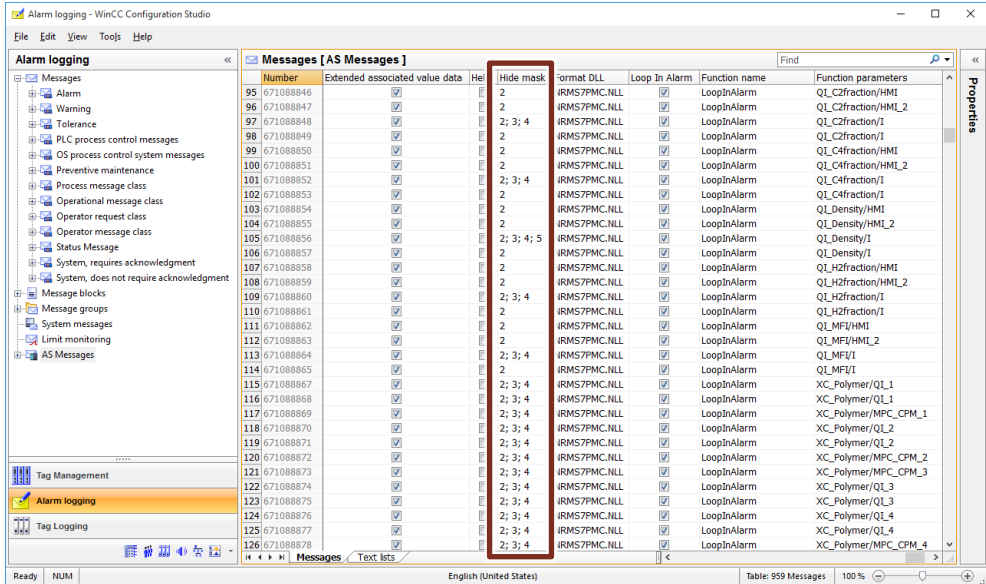


Furthermore, the corresponding block group is automatically entered as an attribute for each message and a user-specific alarm group is generated for each block group. This contains all the alarms of the blocks in a block group. The properties of the alarm group contain the status tag of the "STRep" block.

Figure 4-17 Integration of block groups, user-defined message classes and message class properties
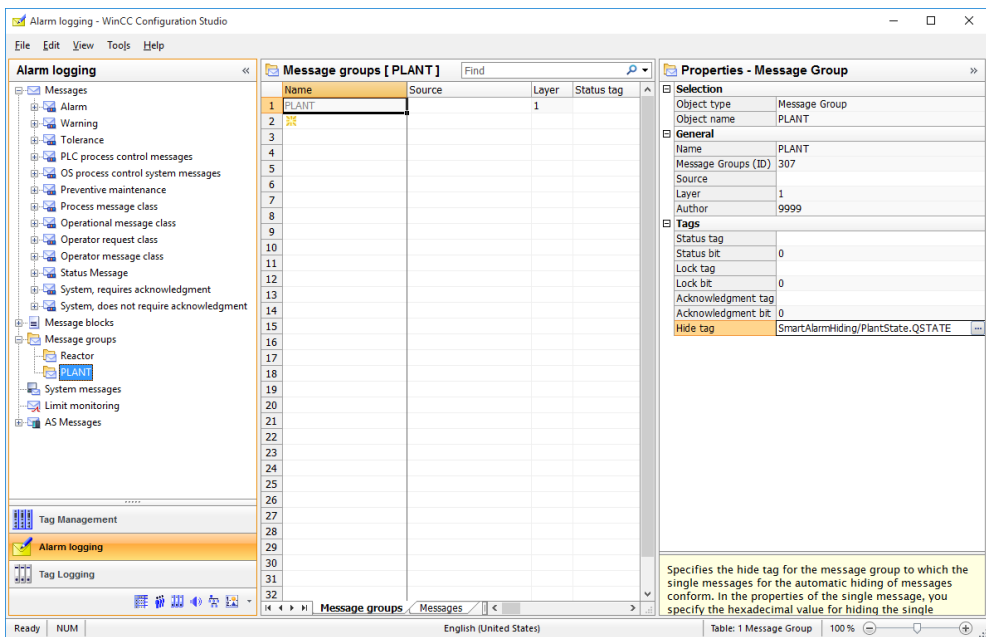
For each "STRep" block, a tag "QState" is created in the WinCC tag management during compilation. The value corresponds to the current system status. (Fig. 3-17)). In addition, there are internal tags of the text reference type, which contain the corresponding configured system status in plain text (Figure 3-18).

Figure 4-18 Tag "QSTATE" in the OS tag management
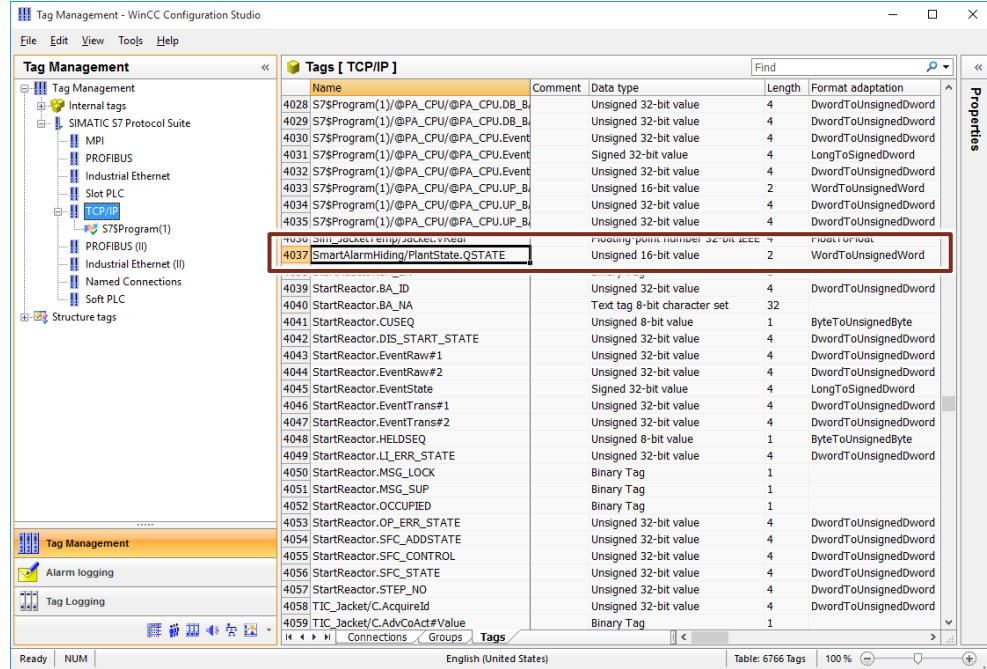


Figure 4-19 Text reference tag for configured system status
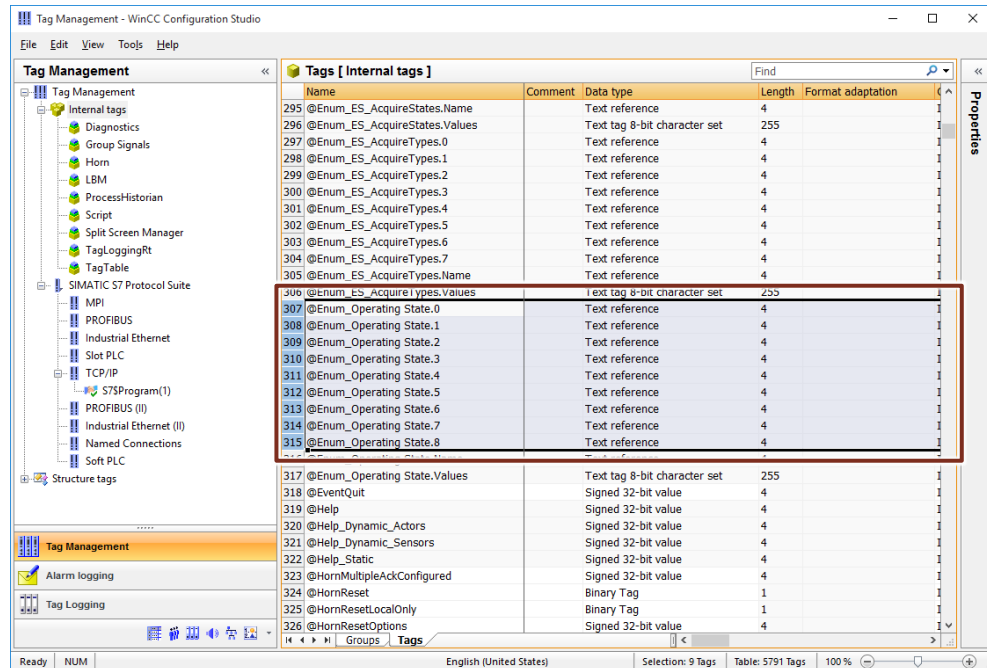
## 4.2 Behavior in OS runtime

**Alarm hiding in OS runtime**

The following figures show the behavior of alarm hiding in OS runtime. In normal operation, the alarms can be seen in the group displays of the overview area, in the message line of the overview area, as well as in the "incoming alarm list" (Figure 4-20).

Figure 4-20 Incoming list in plant state "normal"



The " hidden list" is accordingly empty, as shown in Figure 4-21.

Figure 4-21 Hidden list in the plant state "normal"



In the plant state "Startup", the messages of the plant area "PLANT" for too low a pressure as well as the alarm and warning messages of the KPIs are hidden according to the configuration. Only the non-hidden messages that the tank level exceeds the warning and alarm limits are displayed in the new list.

Figure 4-22 New list in plant state "Startup"

The messages for exceeds the low warning and alarm limits for pressure and KPIs are also not displayed in the overview screen. Only the unsuppressed messages that the tank is full are displayed.

Figure 4-23 Overview figure in the "Startup" plant state
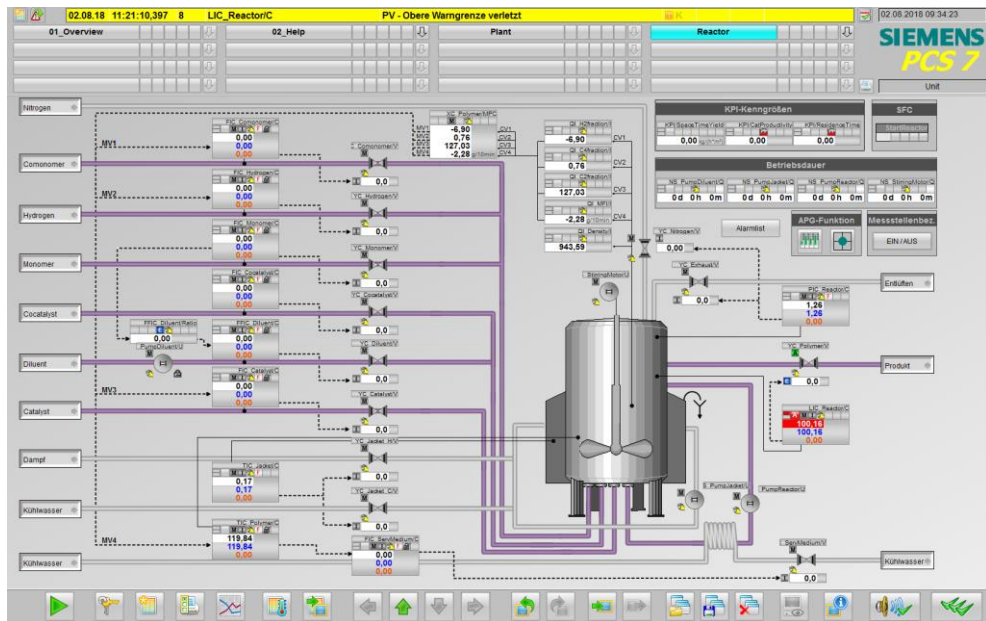


The messages for exceeds the low warning and alarm limits in the tank are filtered and moved to the "List of hidden messages" as shown in Figure 4-24.

Figure 4-24 List of hidden messages in the plant state "Startup"
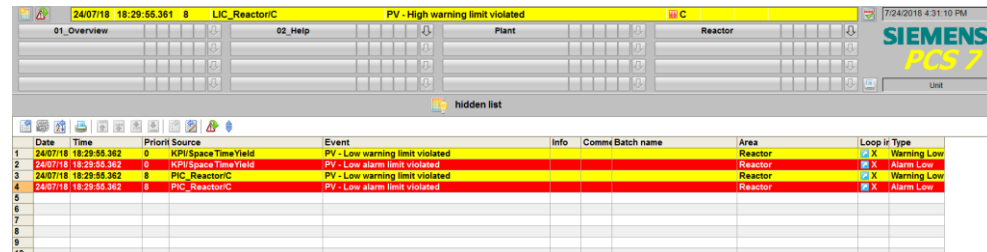


In the other plant area, no alarms are hidden by the "Startup". These will continue to be contained in the message line of the overview area and the incoming list

| Note | Alarms that are automatically hidden will be acknowledged and reappear in the old list after re-appearing if they did not come back. |

**Runtime diagram for automatic alarm hiding**

The runtime model represents the alarm behavior and the display of alarms in process mode with activated and deactivated alarm hiding.

Figure 4-25 Runtime Model
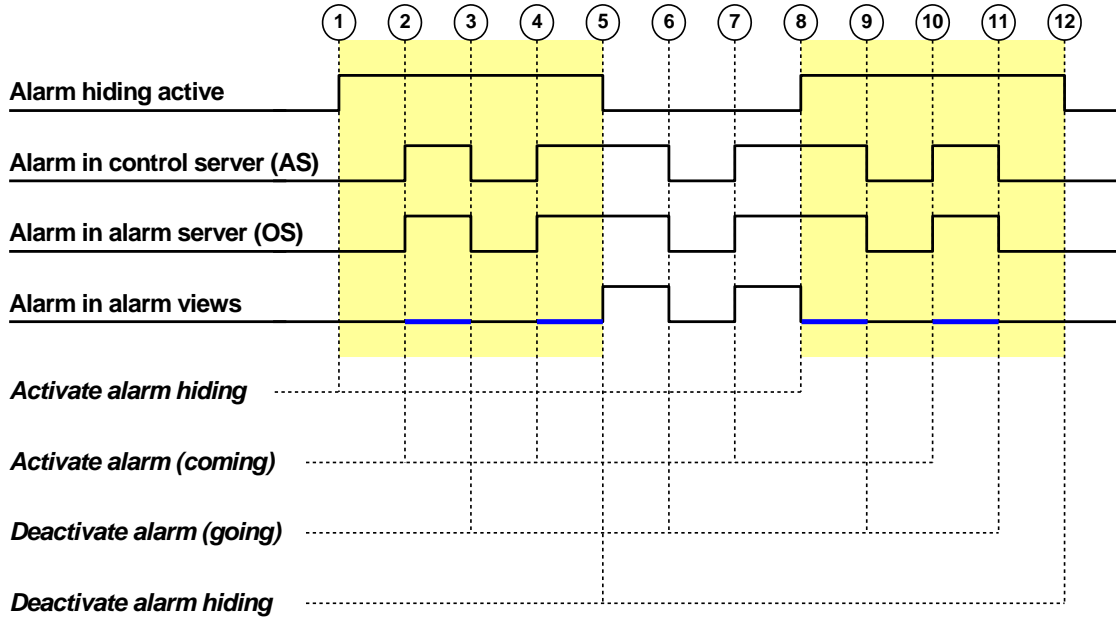


Range 1-5 shows that when alarm hiding is activated, the messages generated in the AS are processed in the OS alarm server and thus archived as well. However, they are not displayed in the alarm views and in the process pictures.

There is an alarm in the range 4-6. At point 5, the alarm hiding is deactivated and the pending alarm is immediately displayed in the message views and the process pictures.

Alarm hiding is deactivated in the range 5-8. Pending alarms are displayed in the alarm views and process pictures.

Alarm hiding is re-activated in the range 8-12. The alarm still pending at point 8 remains pending in the OS alarm server, but is immediately hidden from the alarm views and process picture.

**List of messages to be hidden**

The newly added alarm display " hidden list" lists all messages that are to be hidden in the currently pending system status.

The "hidden list" can be called up via a button in the toolbar.

Figure 4-26 List of messages to be hidden
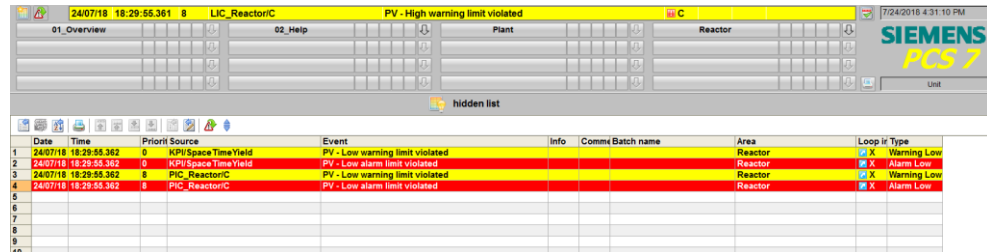


Furthermore, in the alarm control, the button for displaying the "hidden list" can be activated as shown in the following figure. This list contains all alarms that are hidden for the corresponding system status.

Figure 4-27 Configuring the "List of messages to be hidden"
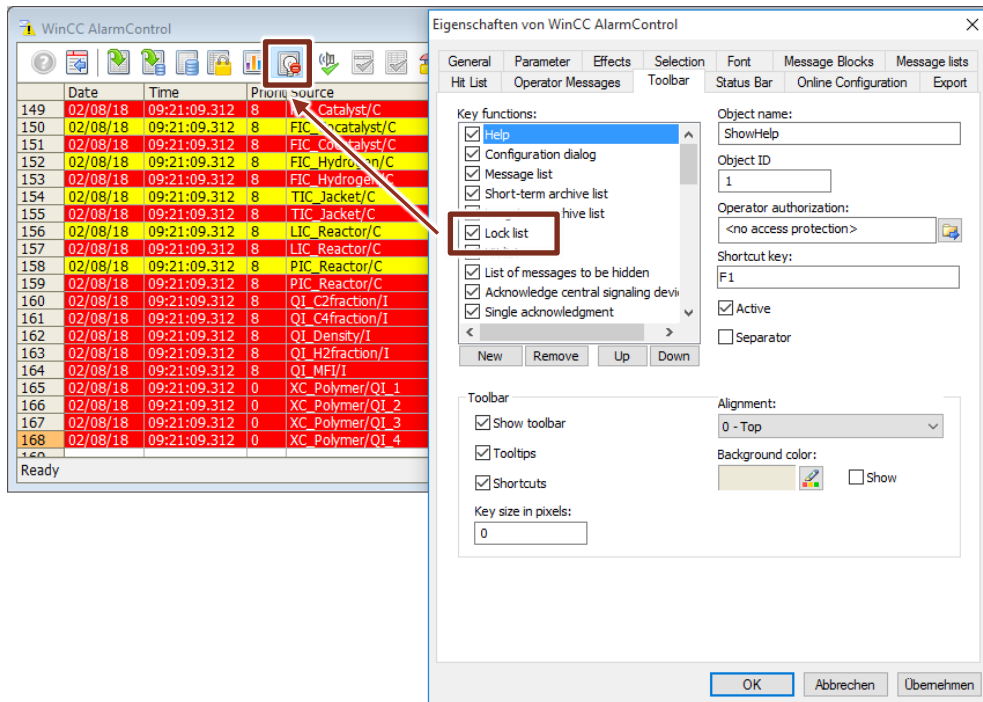
**Alarm view in the faceplate**

Automatically hidden alarms are displayed in the alarm list of the associated faceplate. These receive the status "Hidden System" as shown in Figure 4-28.

Thus, it can be recognized whether alarms are pending for a process tag, even with automatically hidden alarms.

Figure 4-28 Alarm view of a faceplate with active alarm hiding
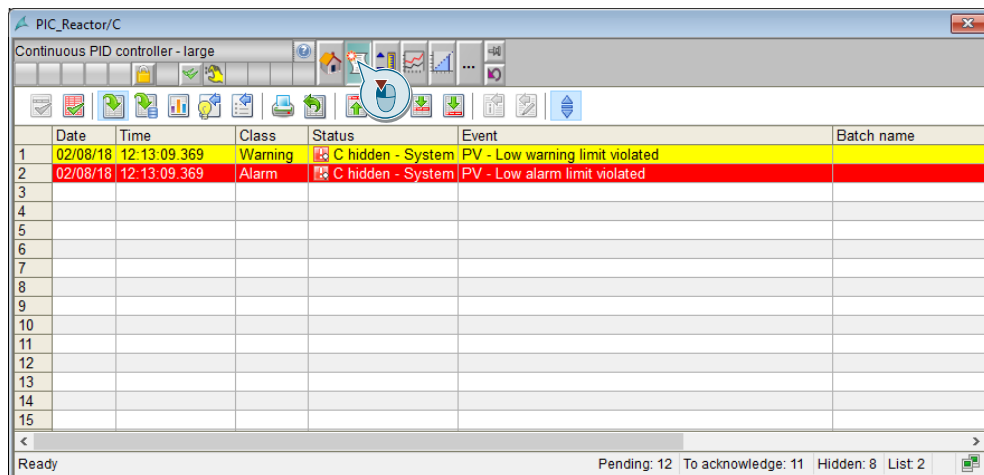


| | CAUTION | Manually hidden alarms are not displayed in the alarm list of the faceplate. |
|---|---|---|

By clicking on the "Display option dialog", button you can select which messages should be displayed. You can choose from the following options:

| Display option | Messages displayed |
|---|---|
| "All" | All active messages of the block are displayed regardless of the status of the automatic alarm hiding. |
| "Only shown" | All active messages of the block are displayed, which are not suppressed by automatic alarm hiding |
| "Only hidden" | All active messages of the block are displayed, which are suppressed by automatic alarm hiding. |

By default, all messages of the block are displayed.
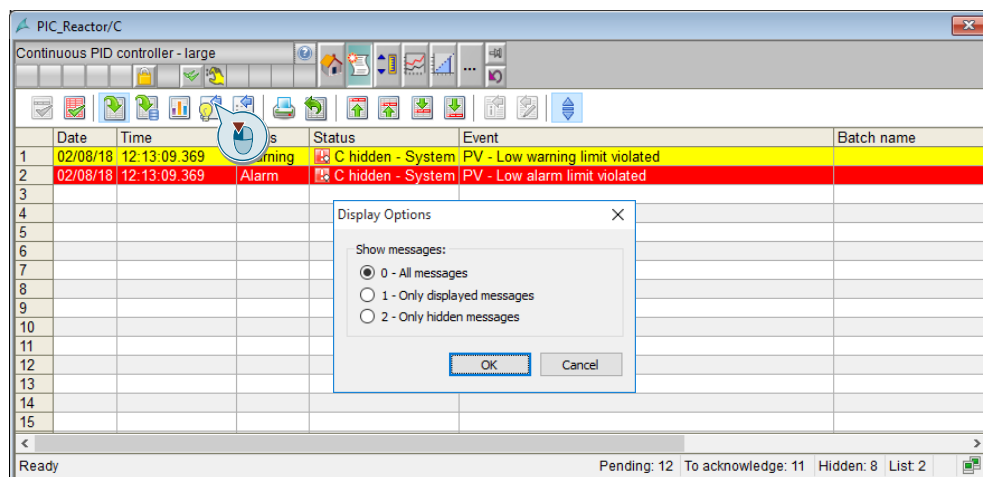
**Status of hidden alarms**

In addition to the usual message statuses, such as "arrived" or "gone", the status of "shown" or "hidden" is displayed in the list of hidden messages and the history list. If a message changes its status from "Shown" to "Hidden", it is registered in the journal list and the control panel list.

Figure 4-29 Message status Show / Hide in the journal list



Figure 4-30 Message status Show / Hide in the list of messages to be hidden

## 4.3 Principle of automatic alarm hiding

Figure 4-31 Representation of the principle of automatic alarm hiding
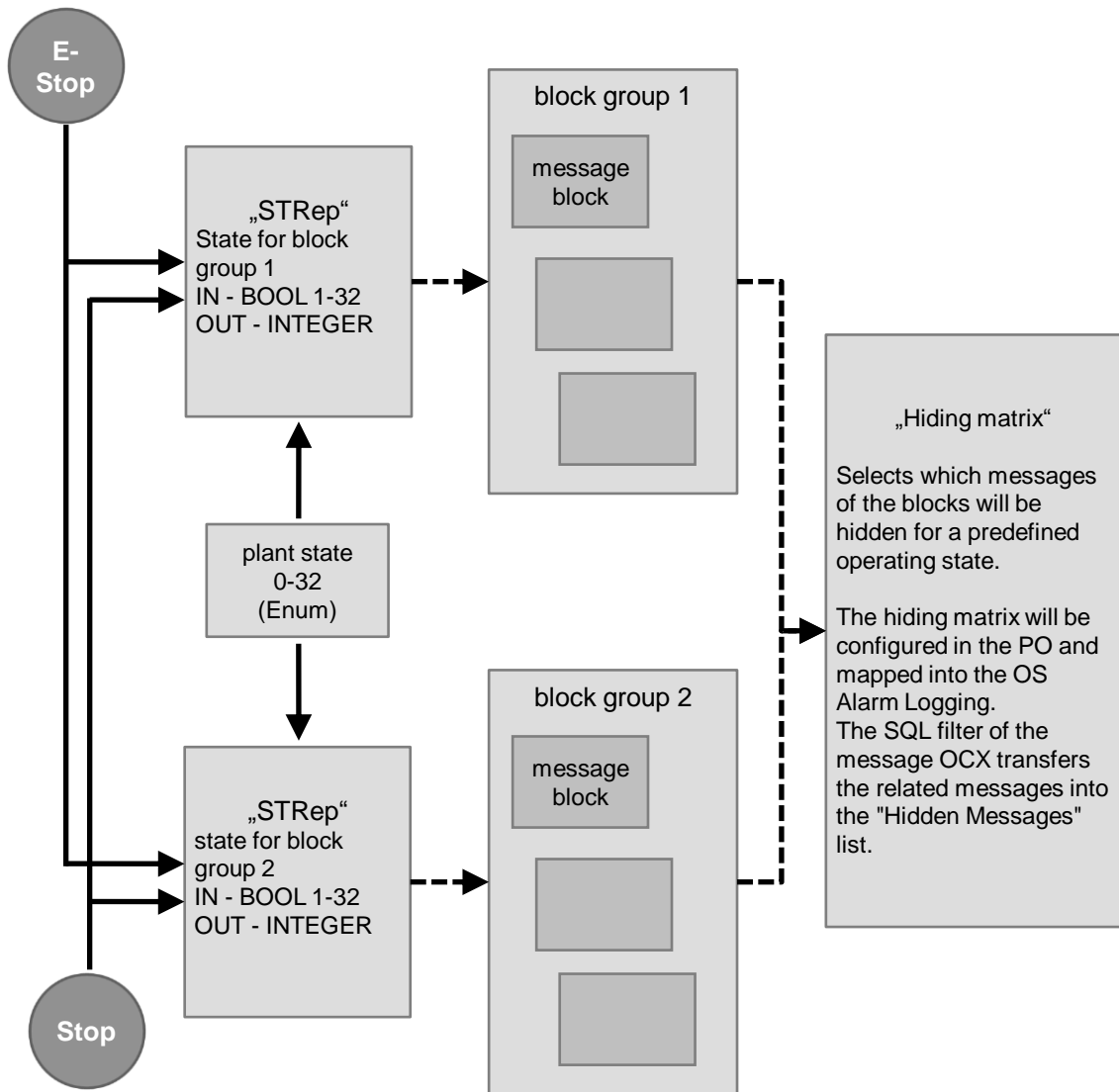
# 5      Summary of the functions

The behavior of Smart Alarm Hiding in process mode is implemented as follows:

- The messages are hidden in the alarm lists: Incoming list, acknowledged list, outgoing list and the one line (except for the journal list, process control list and operation list) and group displays.

- In process mode, you can hide alarms in the following lists manually:
  - Incoming list
  - Outgoing list
  - Acknowledged list

- Currently pending hidden messages are displayed in the "Hidden list" (with the exception of: outgoing messages).

- The "Hidden list" list displays all messages that will be hidden when they arrive.

- Hidden messages can be returned to the incoming list or the acknowledged list via the "hidden list".

- Hidden messages are archived.

- With redundant operator stations, the message archive is synchronized.

- If messages are hidden, acoustic signaling (horn) is suppressed or acknowledged.

- The status of hidden messages is not displayed in the group displays of the process pictures and faceplates.

- When a message is hidden or displayed, a message with the status "Hide" or "Display" is sent.

- Manually hidden alarms are displayed again after a defined time.

- Manually hidden alarms are acknowledged automatically.

- Manual alarm hiding is OS server-oriented.

- When messages are manually hidden or displayed by the operator, an operator message is sent

- Depending on the block group and plant status, the automatic alarm hiding messages are hidden.

- If the plant status changes during automatic alarm hiding, the messages that are no longer suppressed are displayed.

- Automatically hidden alarms are acknowledged automatically.

# 6 Appendix

## 6.1 Service and support

**Industry Online Support**

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:
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https://support.industry.siemens.com/cs/ww/en/sc/2067

## 6.2 Links and literature

Table 6-1 Links and literature

| No. | Topic |
|-----|-------|
| \1\ | Siemens Industry Online Support<br>https://support.industry.siemens.com |
| \2\ | Link to this entry page of this application example<br>https://support.industry.siemens.com/cs/ww/en/view/55699984 |
| \3\ | Alarm Systems – A Guide to Design, Management and Procurement", EEMUA, 1999 |
| \4\ | "NA 102 – Alarm Management", NAMUR, Version 15.21.2005 |
| \5\ | "Institutionalizing Alarm Management", Matrikon Inc., 01.2004 |
| \6\ | "Alarm Management White Paper", Matrikon Inc., D.Shook, 2008 |
| \7\ | "Alarm Management", EXIDA, 2006 |

## 6.3 Change documentation

Table 6-2 Change documentation

| Version | Date | Modifications |
|---------|------|---------------|
| V1.0 | 01/2007 | First edition on the DVD PCS 7 V7.0 |
| V2.0 | 11/2009 | Layout adaptation for publishing in the Service & Support Portal under "Applications & Tools" (see link in Table 6-1) |
| V3.0 | 11/2011 | Revised, example project replaced (basis example project "color_gs"; standard path: „C:\Program Files\SIEMENS\STEP7\EXAMPLES_MP\") |
| V3.1 | 12/2011 | Corrections in the context of the translation into the english language |
| V4.0 | 11/2018 | Update for PCS 7 V9.0 SP1 |