SIEMENS

SIMATIC HMI

Options

Manual

6AV6392-1DA05-0AB0

Edition August 1999

C79000-G8276-C163-01

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Printed in the Federal Republic of Germany

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Table of Contents

1 User Archives

The introduction to the User Archives Editor contains the following information:

- Applications of the User Archives
- Components of the User Archives
- Configuration and Runtime
- Functionality of the User Archives

Data from technical processes can be stored continuously on a server PC via the User Archives of WinCC. In the Graphics Designer, a WinCC User Archives Table Control can be configured that displays the online data from the User Archives in table form during runtime.

User Archives are also used to provide data to PLC's (e.g. S5, S7 or Allen Bradley). If required, data can be read by the PLC's in form of recipes or setpoint values.

The WinCC User Archives offer two types of database tables:

- Archives: Archives are database tables where users can set up their own data fields. Archives store data and provide standardized access to these data following SQL database conventions.
- Views: Views receive data from the archives and group that data, e.g. to form overviews about product groups.

There are two ways to create User Archives:

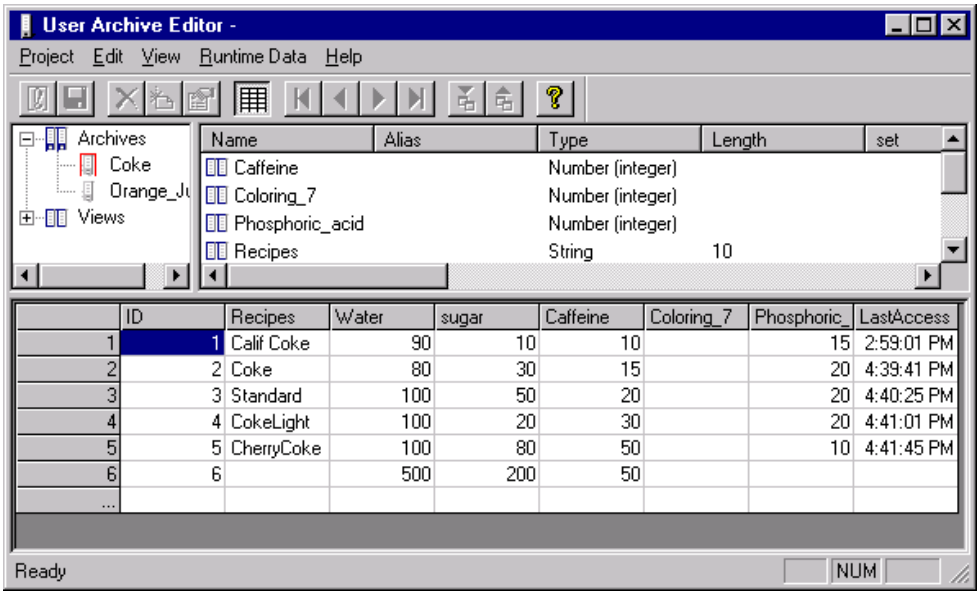
- the User Archives Editor for a convenient, interactive configuration
- **the User Archives Script Functions** for configuring in the WinCC script language

The User Archives Script Functions also allow the implementation of various actions for the runtime operation. In the runtime screen, a table can be configured, which is directly connected to the process screens of the PLC's.

1.1 Components of the User Archives

1.1.1 The User Archives Editor

The User Archives Editor, with its Windows-like user interface, makes it easy to set up and maintain User Archives. The User Archives Editor is separated into three areas:



- The **Navigation Window** (the window at the top left) for selecting archives and views.
- The **Data Window** (the window at the top right) for displaying and editing fields. The Data Window displays the fields of the archives and views, which were selected from the navigation window.
- The **Table Window** (the window at the bottom) for displaying and changing online data of the selected archives and views. In the table window of the User Archives Editor, an online connection to the process screens of the PLC's can be made.

The navigation and data windows of the User Archives Editor provide fast access to all elements of the User Archives, utilizing a Windows Explorer-like user interface. The setup and editing of User Archives is user-friendly via dialog boxes and wizards.

1.1.2 The WinCC User Archives Table Control

A User Archives Control can be configured using the Graphics Designer. The User Archives Control allows you to display and edit User Archives data in runtime. The Control is operated via icons.

The Control allows you to create, edit and delete contents of fields interactively. The page functions make navigation in large User Archives easier. Archives can be imported/exported and filter/sort conditions be defined.

Via a direct connection to the PLC's, data can be read and written online.

During configuration, a User Archives Table Control is connected to a selected archive or view and can then only access that archive or view. To permit access, the archive or view must be enabled. Specific authorization levels can be assigned to the Control in the User Administrator.

1.1.3 The User Archives Script Functions

The User Archives Script Functions can be divided into:

- **Configuration Functions** for configuring User Archives
- **Runtime Functions** for configuring various actions for the runtime operation

The User Archives functions are activated by actions in the runtime screen, for example a mouse click on a certain button. The WinCC script language has similarities to the high-level C language, and the database functions are based on the SQL standard.

1.1.4 Applications of the User Archives

During the configuration of the User Archives, you can create your own database tables using the User Archives Editor or the User Archives Script Functions.

The User Archives Editor also allows you to create new data records or edit data in existing data records while configuring.

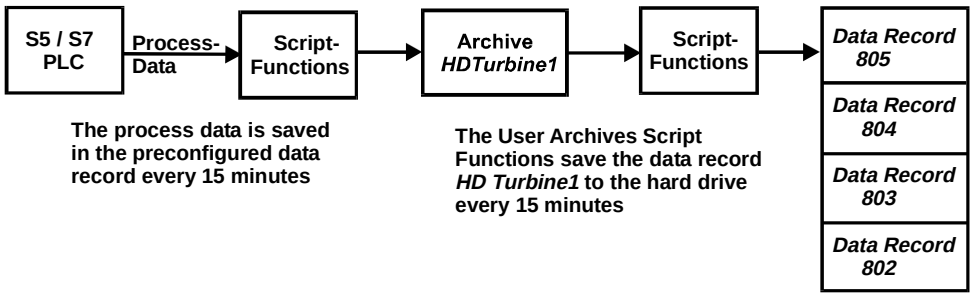
In runtime, archives (analogous to database tables) can be displayed in Table Control windows as tables. Via raw data or WinCC tags, a continuos data exchange with the PLC's can take place.

Example: Acquisition of Operating Data of a Turbine

An electric utilities company creates the "HPTurbine1" User Archive. This archive monitors the operating conditions of a high pressure turbine. The "HPTurbine1" User Archive contains the following data fields:

HPTurbine1
Index
RPM
Entry Pressure
Outlet Pressure
Steam Temperature1
Steam Temperature2
Oscillation Frequency
Oscillation Amplitude
Storage Temperature1
Storage Temperature2

In runtime, at setable time intervals, the operating data of the turbine can be stored on your hard drive in the form of User Archives data records:



Using the User Archives Script Functions, data from the User Archives can then be analyzed or be visualized through the "WinCC User Archives Table Control".

Example: Recipes of a Beverage Producer

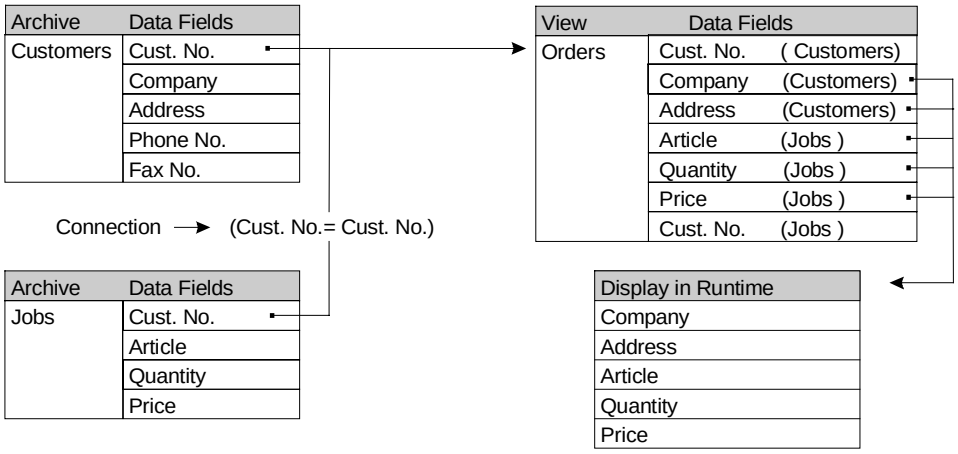
An example for a data flow to a PLC are recipes. A beverage producer, which in our example produces Coke and orange juice, uses User Archives to provide recipes of the ingredients to PLC's (S5, S7, AllenBradley, Applicom, etc.).

Archive	Data Fields
Coke	Water
	Sugar
	Coloring7
	Phosphoric Acid
	Caffeine

The User Archives use the data interfaces to the PLC's that are provided by WinCC, either via the raw data tags of the WinCC data manager or via WinCC tags. For the data transfer from/to PLC's, WinCC provides a set of action scripts.

Applications of the Views

As an additional feature, WinCC offers the "Views" to multiple archives of a server. Views allow data fields of different User Archives to be grouped. For example, connections in the SQL language can be created using data fields of different archives to display desired relationships as a view in runtime. The archives used must have at least one common characteristic.



In the following example, a view for orders is created. The required information for the orders is fetched from the "Cutomers" and "Jobs" archives. The common characteristic of both archives is the customer number, which serves as the connecting property of the view. In runtime, only the necessary fields from the involved archives are displayed.

Note

Existing software, which performed direct ODBC database accesses to the User Archives of versions older than 4.02 will not be able to access User Archives of version 4.02 or later.

For User Archives databases older than version 4.02, the User Archives Editor provides a converter for converting to the new User Archives format. Software with direct ODBC accesses, must be adapted to the new format of the current User Archives version.

1.2 Functionality of the User Archives

The following briefly introduces the features of the User Archives:

Configuration

- Archives and views can be set up in table form, which results in a simple and direct assignment of the data to the archive or view fields (arrangement into columns and lines).
- Online display in runtime in forms (process screens) or, optionally, in table form.
- Input/output of data via I/O fields (assignment of the archive fields via action scripts/control tags).

Reporting

- Reporting of the configuration and runtime data in table form using WinCC reports.
- Export of data in the CSV format (for further processing by external programs such as MS Excel).

Transfer from/to PLC's (S5, S7, etc.)

- Transfer of entire data records of an archive (via raw data tags).
- Transfer of individual data fields of a data record (via WinCC tags).
- Communication using all interfaces provided by WinCC.

Editing Options

- In the table display.
- In the forms.
- Via I/O fields (with action scripts/control tags).

Operation

- In tables via standardized buttons.
- In forms via buttons.
- With action scripts.

Creating or Deleting Data Records

- In tables, creation of data records via buttons.
- In forms via buttons.
- Creating or deleting data records using action scripts.

Control Tags

- Wizard-supported creation of WinCC tags as control tags.
- Fast access to User Archives for scripts and PLC's.
- Indirect addressing in script programs.

2 The User Archives Editor

2.1 Structure of the User Archives Editor

2.1.1 The Menus

This chapter describes the menu-driven operation. Functions complying with the Windows standard will not be explained here.
The User Archives Editor offers the following menus:

Menu	Menu Command	Shortcut
Project	Restore	Ctrl + N
	Save	Ctrl + S
	Export...	
	Import...	
	Check...	
	Convert...	
	Exit	
Edit	Cut	Ctrl + X
	Copy	Ctrl + C
	Paste	Ctrl + V
	Runtime Data	Ctrl + R
	Options	Ctrl + O
View	Toolbar	
	Status Bar	
	Divide	
	Update	F 5
Runtime Data	Import	
	Export	
Help	Help Topics	
	Log File...	
	About...	

Note

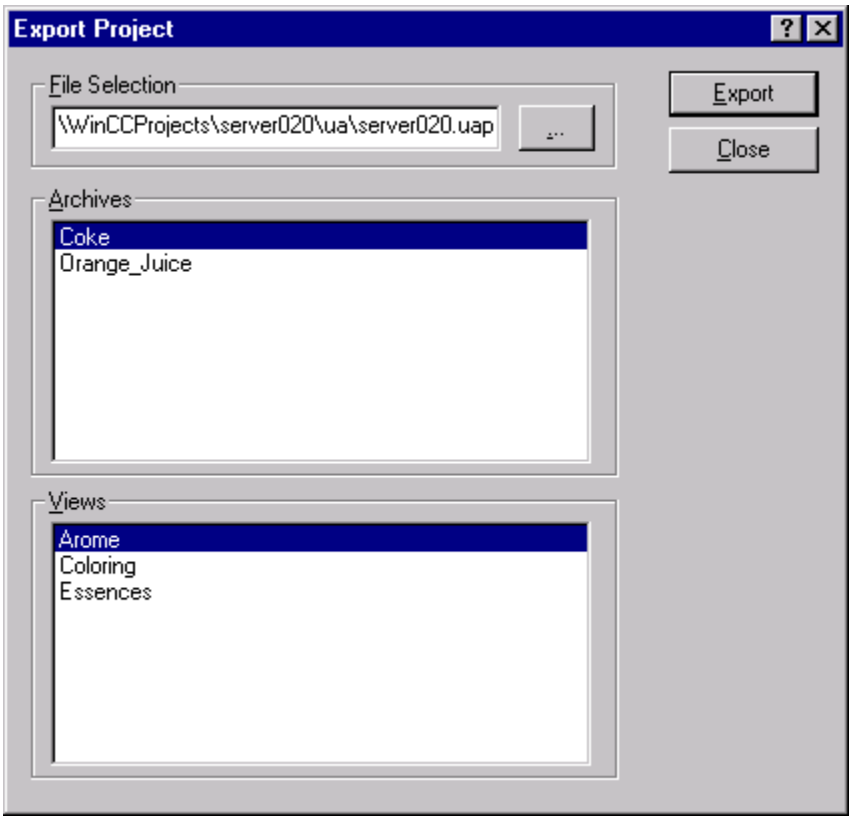
The "Cut, Copy and Paste" functions are only available for the data window. Only one archive, field or view can be cut, copied or pasted at a time. A save procedure can only be performed, if no archive is being referenced at the same time (e.g. an archive is referenced while it is displayed in a table window in CS or in runtime).

Restore

The "Restore" menu command discards the changes made and restores the last saved state, without exiting the editor. Additionally, this function allows you to apply changes that have been made and saved by scripts or external programs since opening the editor. These external changes are not provided automatically to the editor.

Export (Project Menu)

This menu command allows you to export archive and view structures (CS data) of an open WinCC project.



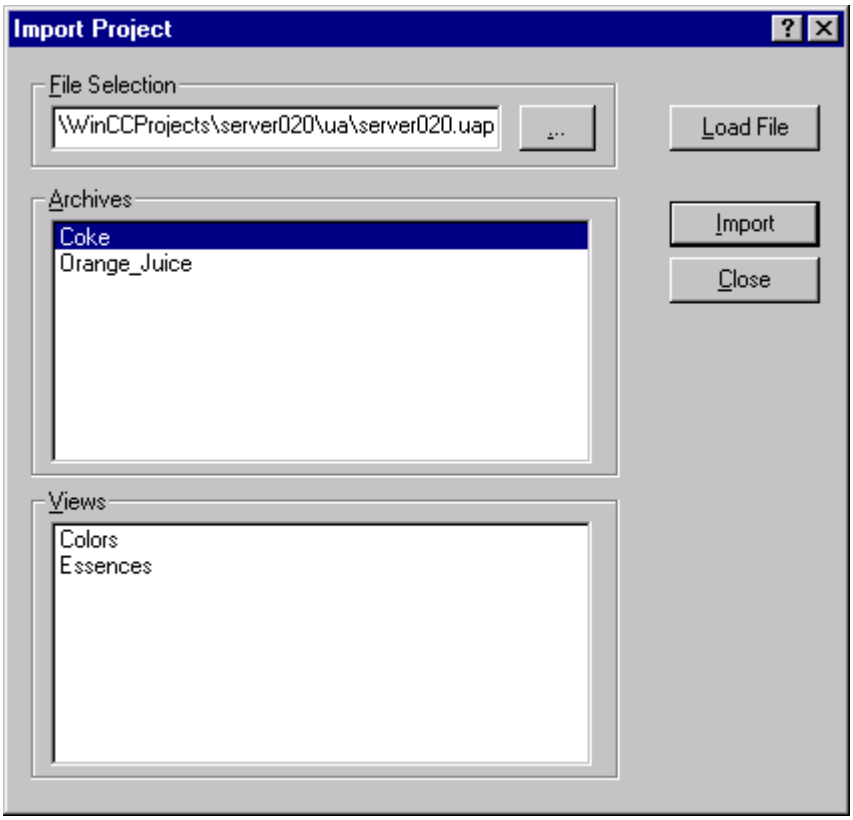
If you select the "Export" command from the "Project" menu, a dialog box opens, which lists the archives and views created in the open WinCC project. You can make single or multiple selections. In the data selection area, the project path of the open project is automatically preset, together with a file name consisting of the project name and the extension ".uap". If you click on the button for the file selection, a selection dialog box opens, in which you can specify a storage location. After you have specified a storage location, clicking on the "Export" button will initiate the export process. Close the dialog box after the selected archives and views have been exported.

Note

To export runtime data, the "Export" command of the "Runtime Data" menu must be used.

Import (Project Menu)

This menu command allows you to import archive and view structures (CS data) to an open WinCC project.



To import archives and views, the corresponding archives or views must first be exported from the project, in which the import will take place, to generate a ".uap" file. To import, click on the "Import" button from the "Project" menu. A dialog box will open, in which the archives and views to be imported can be selected. You can make single or multiple selections. In the data selection area, the project path of the open project is automatically preset, together with a file name consisting of the project name and the extension ".uap". If you click on the button for the file selection, a selection dialog box opens, in which you can browse for the file to be imported. After you have selected a file, clicking on the "Import" button will initiate the import process. Close the dialog box after the selected archives and views have been imported.

Note

To import runtime data, the "Import" command of the "Runtime Data" menu must be used.

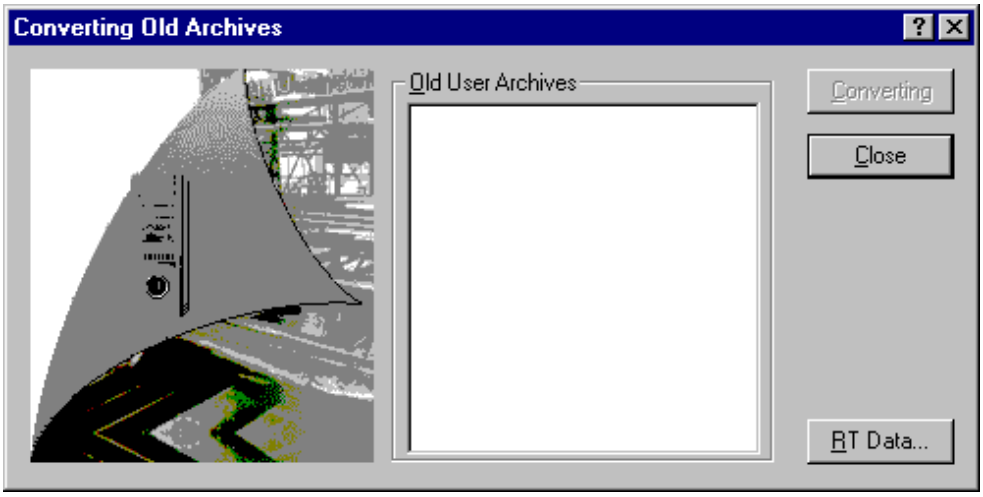
Check

This menu command allows you to check, if the tags referenced in the User Archives Editor exist in the Control Center. If no error is detected, the following message will be displayed: The check detected no errors. If an error is detected, the following error message will be displayed:

The archive, affected field and the tag missing from Tag Management will be displayed.

Convert

This menu command must be used to convert old User Archives that have been created with WinCC Tag Logging - starting with version 3.x - to the current format of the new WinCC User Archives.



The conversion of the User Archives is performed in two steps:

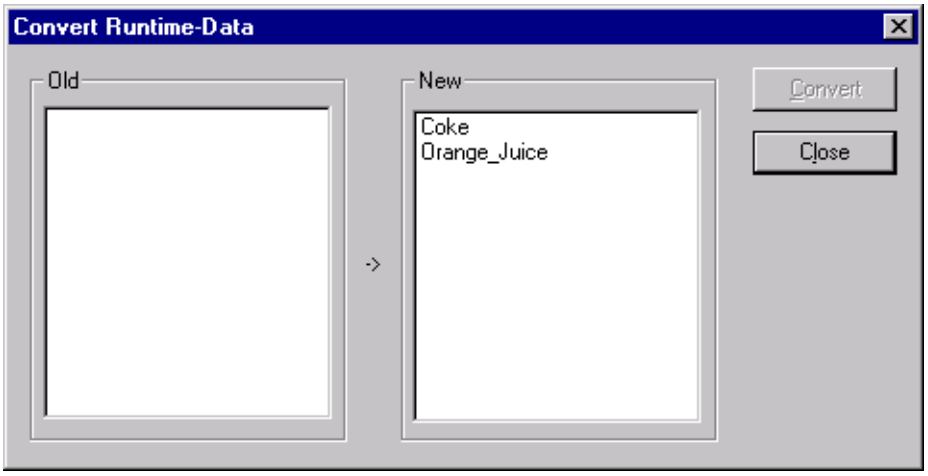
1. Conversion of the archive structure.
2. Conversion of the runtime data.

To convert the archive structure, proceed as follows:

1. Select the User Archive to be converted and start the conversion by clicking on the "Convert" button.
2. After successful conversion, exit the dialog box by clicking on the "Close" button.
3. Save the converted archive structure.

To convert the runtime data, proceed as follows:

1. Select the "Project - Convert" menu command.
2. In the "Covert Old Archives" dialog box, click on the "RT Data..." button. This will open the "Convert Runtime Data" dialog box.



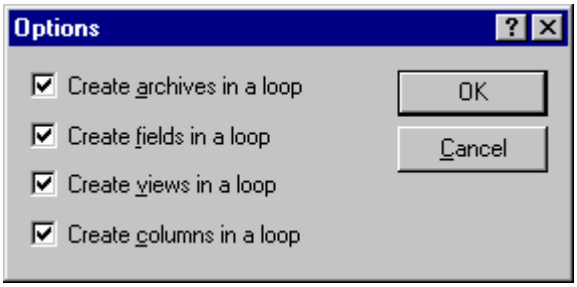
3. Select the old and newly formed archive and start the conversion by clicking on the "Convert" button.
4. Close the "Convert Runtime Data" dialog box.
5. Close the "Convert Old Archives" dialog box.

Runtime Data

This menu command allows you to edit online data in the table window. A check-mark next to this menu command indicates that the "Runtime Data" status is active.

Options

This menu command allows you to specify, how User Archives and views are entered. The following dialog box will be displayed after clicking on this menu command:



Create Archives in a Loop:
If this option is checked, the dialog box for entering additional archives will automatically be displayed after a User Archive and its fields have been entered.

Create Fields in a Loop:
If this option is checked, the dialog box for entering additional data fields will automatically be displayed after a User Archive data field has been entered.

Create Views in a Loop:

If this option is checked, the dialog box for entering additional views will automatically be displayed after a view and its columns have been entered.

Create Columns in a Loop:

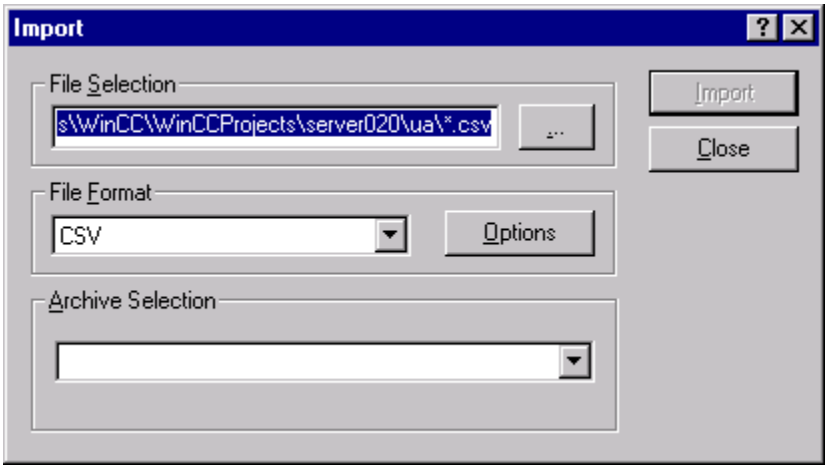
If this option is checked, the dialog box for entering additional columns will automatically be displayed after a view and its columns have been entered.

Divide

This menu command adjusts the size of the three sub-windows of the User Archives Editor.

Import (Runtime Data Menu)

This menu command imports the data records (runtime data) into the selected archive.



In the "File Selection" field, enter the path and file name of the User Archive to be imported. The "..." button helps you to select the file. The file path is automatically preset to the "ua" folder in the project path of the active archive.

In the "File Format" field, the file format of the file to be read can be selected. The "Options" button allows you to set the desired separator. The default separator is the ";" semicolon.

In the "Archive Selection" field, an archive of the current project can be selected as the target archive.

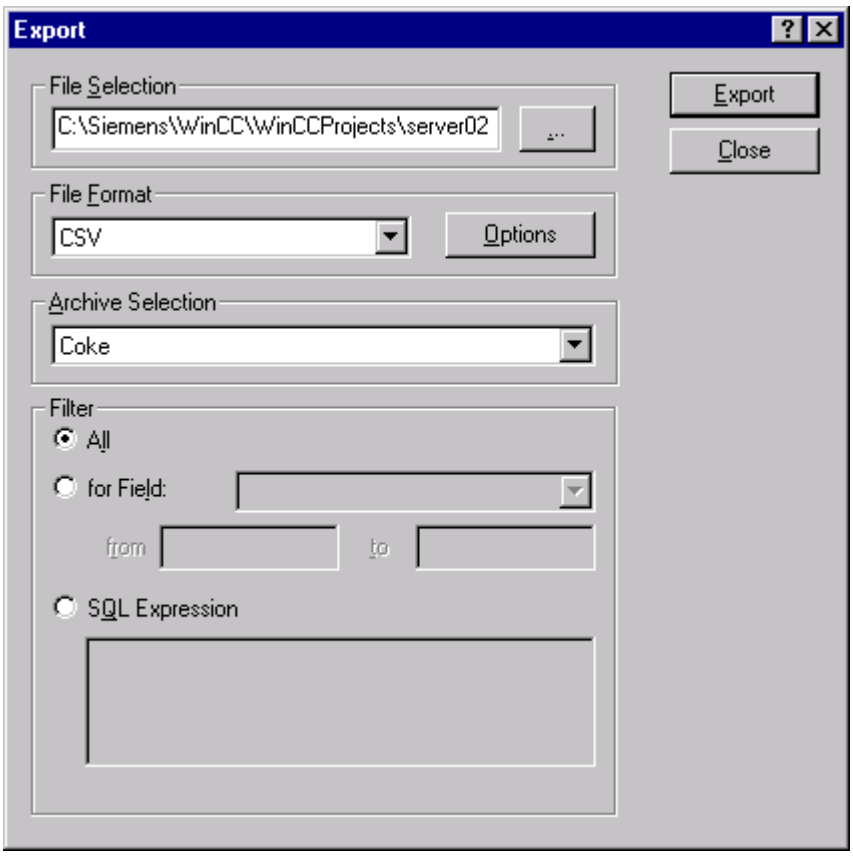
The import process is initiated by clicking on the "Import" button. The structure of the source and target archives must be identical, otherwise the import will fail.

Note

In a client-server project, note the following: If an archive exists on the server, for example at "c:\Projects\Test\UA", the archive will be enabled using this path. On the client's side, the archive will be enabled by mapping a network drive, for example "I:\Test\UA". Accordingly, the default path of this archive on the client is "I:\Test\UA". However, this folder does not exist on the server under this path. If you want to import this archive to the client, the client's default path must be changed, in our example to "C:\Projects\Test\UA".

Export (Runtime Data Menu)

This menu command exports the data records (runtime data) of the selected archive.



In the "File Selection" field, enter the path and file name of the User Archive to be exported. The "..." button helps you to select the file. The file path is automatically preset to the "ua" folder in the project path of the active archive.

In the "File Format" field, the file format in which the archive is to be exported can be selected. The "Options" button allows you to set the desired separator. The default separator is the ";" semicolon.

In the "Archive Selection" field, an archive of the current project can be selected as the target archive.

In the "Filter" area, an export filter can be specified. In the "Filter for Field" box, specify the field the filter is referring to. In the "from ... to" boxes, the value range passing the filter is entered.

Selecting the "SQL Expression" radio button allows you to enter a filter expression using the SQL language. Additional information about SQL expressions can be found in the appendix.

The export process is initiated by clicking on the "Export" button.

Note

In a client-server project, note the following: If an archive exists on the server, for example at "c:\Projects\Test\UA", the archive will be enabled using this path. On the client's side, the archive will be enabled by mapping a network drive, for example "I:\Test\UA". Accordingly, the default path of this archive on the client is "I:\Test\UA". However, this folder does not exist on the server under this path. If you want to export archive data to the server, the client's default path must be changed, in our example to "C:\Projects\Test\UA".

2.1.2 The Toolbar

The User Archives Editor can be operated from its toolbar. The following describes the individual icons of the toolbar in alphabetical order.

Icon	Description
	Paging
	Properties
	Export
	About
	Import
	Delete
	New
	Runtime Data
	Save
	Restore

Paging

The "Paging" icons allow you to page through a User Archive while in runtime.

Properties

The "Properties" button allows you to edit the properties of archives or data fields. A right mouse button click on a data field or User Archive also enables you to change its properties.
In runtime, while the "Properties" icon is activated, you can navigate through the table using the cursor keys and edit the data fields immediately. The "Properties" icon can only be activated after selecting a data field.

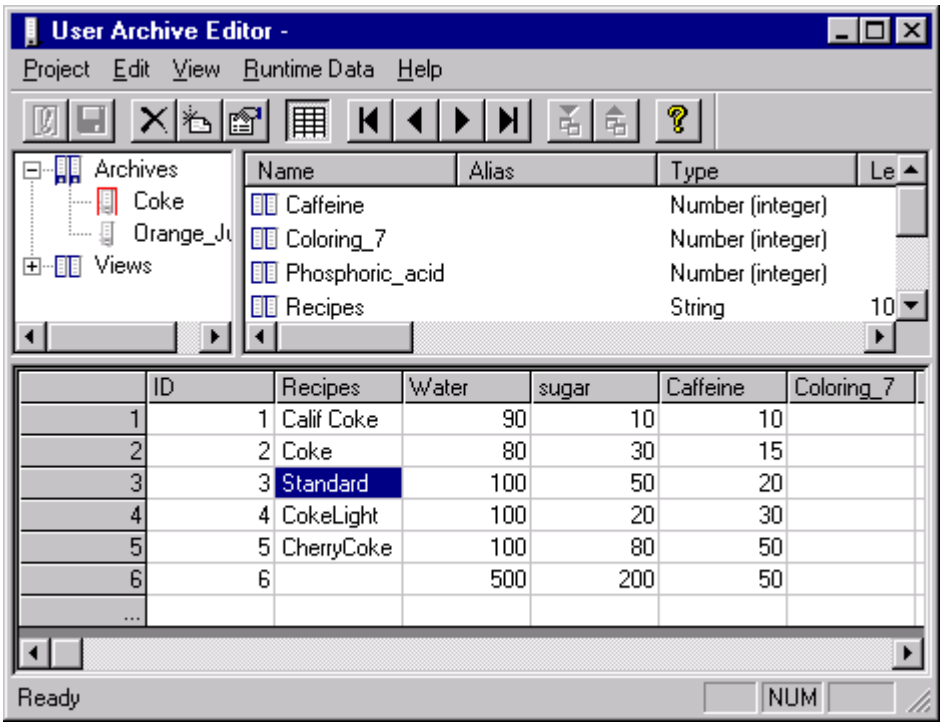
Delete

The "Delete" button allows you to delete archives or data fields. A right mouse button click on a data field or User Archive also enables you to delete it. You can also click on a data field or archive and then hit the "Delete" key (on your keyboard).

New

The "New" icon allows you to create new archives or data fields. A right mouse button click on one of the upper windows also allows the creation of a new archive.

2.1.3 The Table Window



Via the "Edit - Runtime Data" menu or the corresponding button, the table window can be turned on or off. Double-clicking on one of the table fields enables the data entry. This is marked by a text cursor. In runtime, while the "Properties" icon is activated, you can navigate through the table using the cursor keys and edit the data fields immediately. The "Properties" icon can only be activated after selecting a data field. The editing functions can also be accessed via a pop-up menu in the table field. To copy data records into an external program, highlight the desired table lines and copy them to the clipboard with the “CTRL + C” key combination. To insert the clipboard contents into the external program, use the “CTRL + V” key combination. External data cannot be inserted into the table window in this manner.

Note

If one or more values are changed in the User Archives Editor or User Archives Table Control, you must exit the data record (by clicking on another table cell or line) after making the entry in order for the value to be accepted into the database and be updated in all displays.

2.2 Configuration

The first step is the configuration of a new User Archive. Wizards that guide you through the configuration are available. The following configuration steps are required:

Configuration of User Archives

- Create User Archives
- Define Archive Fields

Configuration of Views

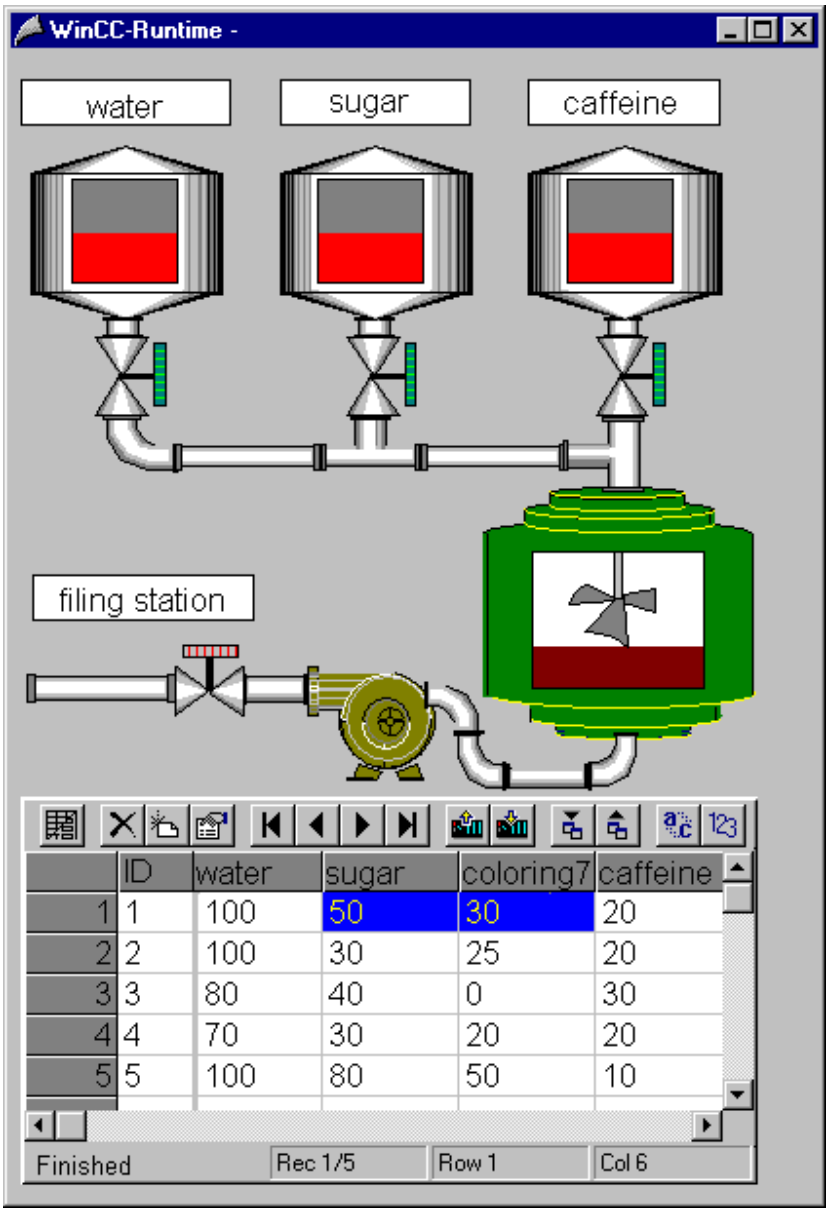
- Create View
- Define Data Fields
- Define the Relations

Configuration of the User Archives Control

- Create the User Archives Control
- Create the Form Fields

2.2.1 User Archives Example

In our example, the beverage producer "Sun Drink" produces "Calif Coke" and "Sunny Juice". To store the recipes of the beverages' ingredients, the WinCC User Archives are used. If a storage tank of the filling machine is empty, the recipe data is sent to the PLC's using WinCC communication channels. The PLC's will then refill the storage tank according to the recipe data.



The User Archives are used as follows:

- **Archives**: Contains an archive each for the Coke and orange juice.
- **Views**: Views group data fields of the two archives. In the example, this is the coloring product group.

Each archive consists of data fields with properties that can be edited. In the example, the data fields of the Coke contain its ingredients. Each data field has properties, e.g. name, alias name, type, length, value, etc. The display of the data fields and their properties in the User Archives Editor takes place in lines and columns. Therefore, we will also refer to the data fields as lines and to the properties as columns. For example, the structure of the "Coke" archive looks as follows:

Coke Archive	**Properties (Columns)**						
Data Fields (Lines)	Name	Alias	Type	Length	Min. Value	Max. Value	Start Value
Water	Water	Well 5	Int	2	1000	1500	1000
Sugar	Sugar	Zmela	Int	2	120	140	130
Coloring7	FS1007	D1007	Int	2	6	8	6
Caffeine	Caffeine	Caffeine	Int	2	2	3	2
Phosphoric Acid	Phos. A.	PhosAc	Int	2	170	190	170

2.2.2 Configuration of User Archivess

2.2.2.1 Creation of New User Archives

Creation of New User Archives

From the WinCC Control Center, open the "User Archives" editor:

- To do so, right-click on "User Archives" and select the "Open" entry from the pop-up menu. The interface of the User Archives Editor will be displayed.

Note

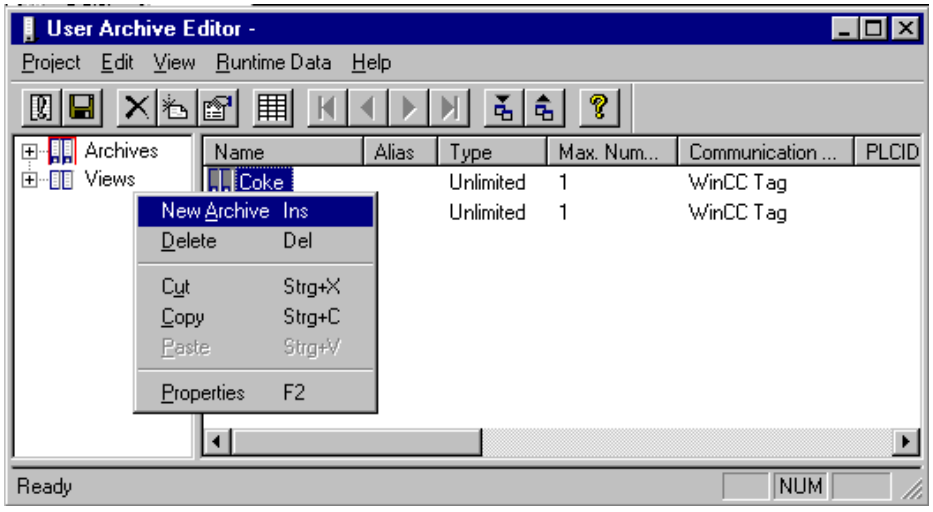
Per archive, 500 fields can be created.

If you make changes to the configuration of an archive, this archive must not be displayed by a Control or be requested by the "UAQueryArchive" script function at the same time.

The preset option "Create Archives in a Loop" allows the sequential creation of multiple archives. If you only want to create a single archive, this option can be deactivated from the "Edit - Options" menu.

To create User Archives, proceed as follows:

1. In the navigation window, click on "Archives".
2. Right-click on the navigation or data window. The following pop-up menu will be displayed:

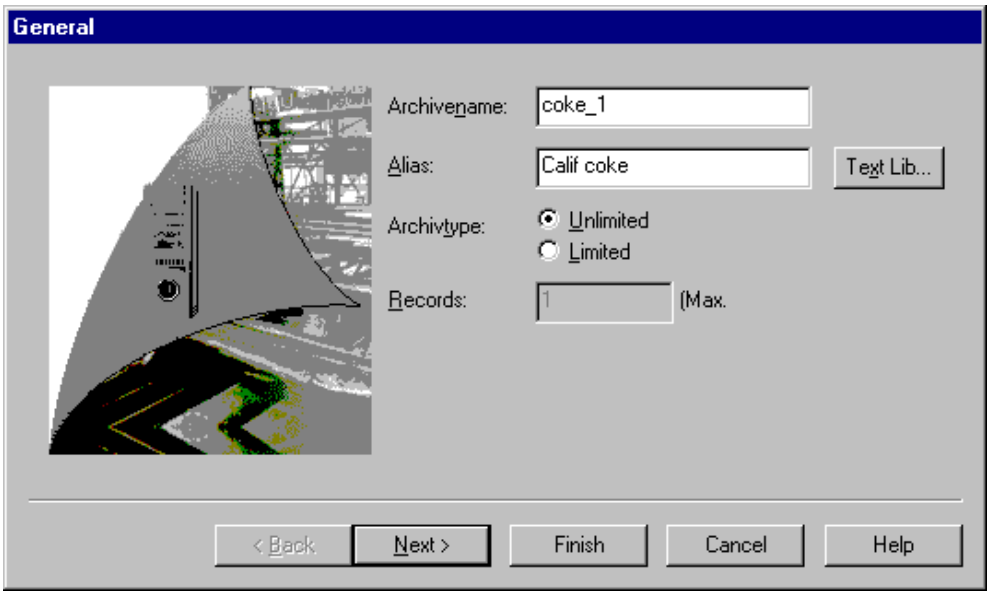


3. Click on the "New Archive" entry.

The Wizard for the configuration of archives will be displayed.

Definition of General Archive Properties

The "General" dialog box will be displayed. A new archive can be created using this dialog box.



As the archive name, for example, enter "Coke". In the "Alias" field, a second archive name can be entered, for example "Calif Coke", to annotate the archive or to implement a Language Switch in runtime via the Text Library. This entry is optional.

Additional information about a language switch can be found in the Online Help.

If the "Limited" archive type is specified, the maximum number of data records can be defined in the "Records" field. The "Unlimited" archive type creates archives with an unlimited number of data records.

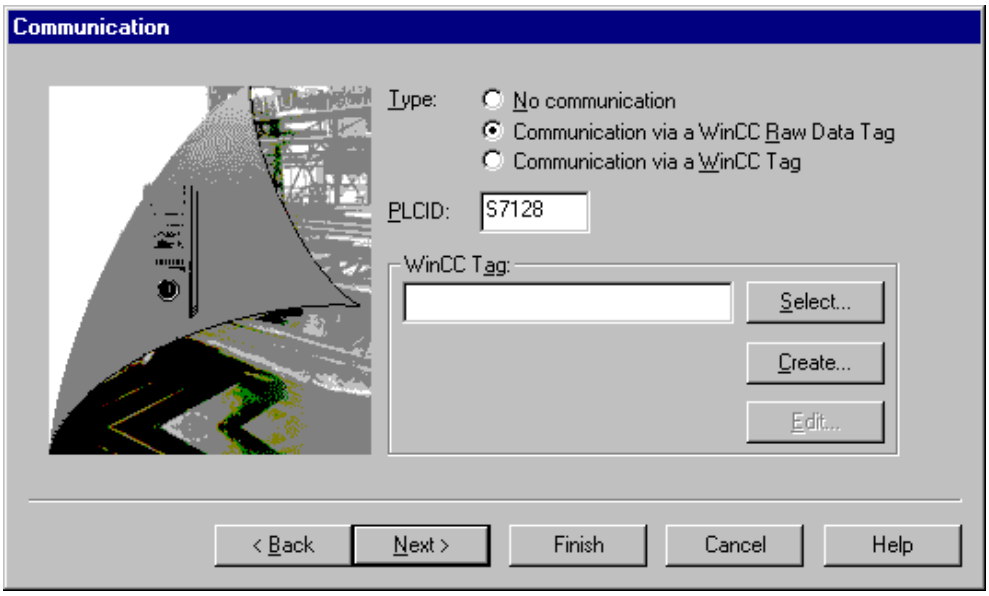
Note

Keywords (or reserved words) of the database language SQL must not be used as archive or field names. See also the "Alphabetic List of SQL Keywords" chapter.

While data records are created, they are not checked for completeness or correctness.

Communication Settings

In the "Communication" dialog box, the connection type between the PLC and the archive is set:



At the "Type" area, the communication type can be defined:

- **None:** No communication possible
- **Via Raw Data Tag:** Access to PLC via a raw data tag
- **Via WinCC Tag:** Access to PLC via a WinCC tag

To establish a connection via raw data tags, select "via Raw Data Tag". Enter the identification of the PLC in the "PLCID" field. The "PLCID" can contain a maximum of 8 ASCII characters. This identifier describes the corresponding archive and is required in order for the PLC to sent back the process screen data to the correct archive.

If you selected the communication "via a Raw Data Tag", clicking on "Select" allows you to choose a raw data tag.

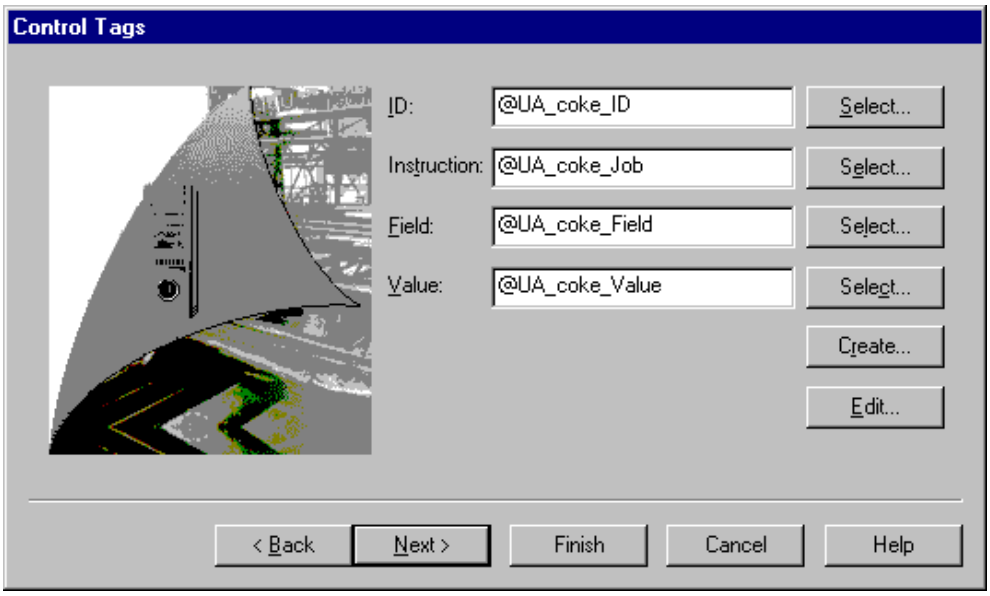
If you selected the communication "via a WinCC Tag", the assignment of the tags is carried out in the properties dialog box of the archive fields.

Note

The communication via a raw data tag connects a complete data record to a raw data tag. The communication via a WinCC tag connects one tag each to an archive field.

Definition of Control Tags

In the "Control Tags" tab, control tags in the form of WinCC tags are set up that are used to access archive fields.



The WinCC tags, used to access data record IDs, instruction codes, archive fields and archive field values, are defined in the tab's four input fields.

A "Select" button is located next to each input field, which opens the tag selection dialog box. This dialog box displays all existing WinCC tags that can be selected.
To automatically generate new tags, click on the "Create..." button. This will set up a new tag group "@UA[ArchiveName]" consisting of the generated tags in the form of @UA[ArchiveName]ID, @UA[ArchiveName]Job etc.

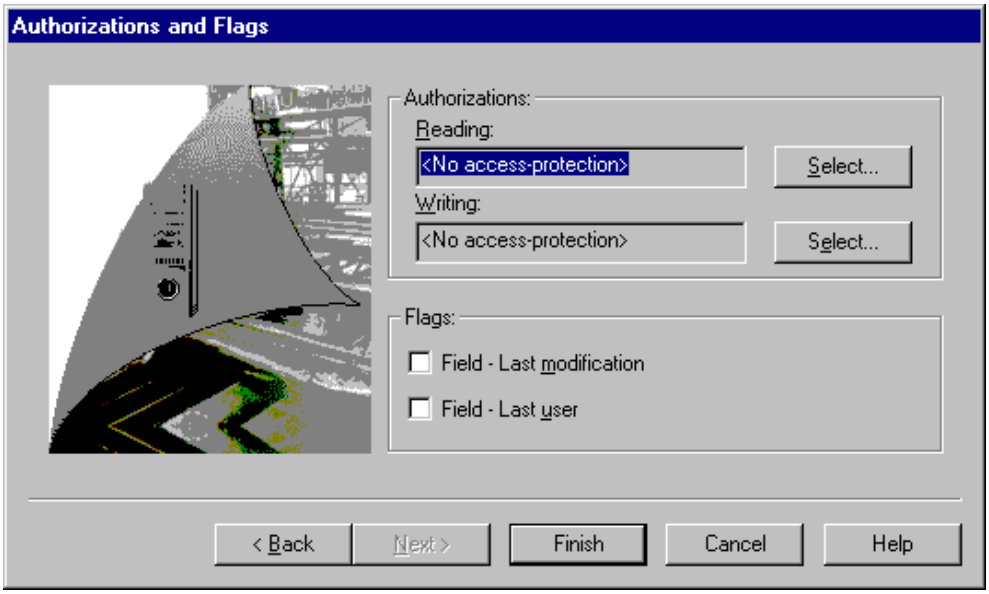
With the help of these four control tags, an archive can be controlled. For the control, either the "ID" and "Job" tags or the "Job", "Field" and "Value" tags must be provided with the corresponding values.

Function of the Control Tags	
ID	The identifier (corresponding to the data record number) of the archive
Instruction Code	Three instruction codes are possible: Read, Write and Delete: Read = 6 Write = 7 Delete = 8 After the instruction has been executed, the control tag will contain an error code: No Error = 0 Error = -1
Field	The archive field
Value	The archive field value

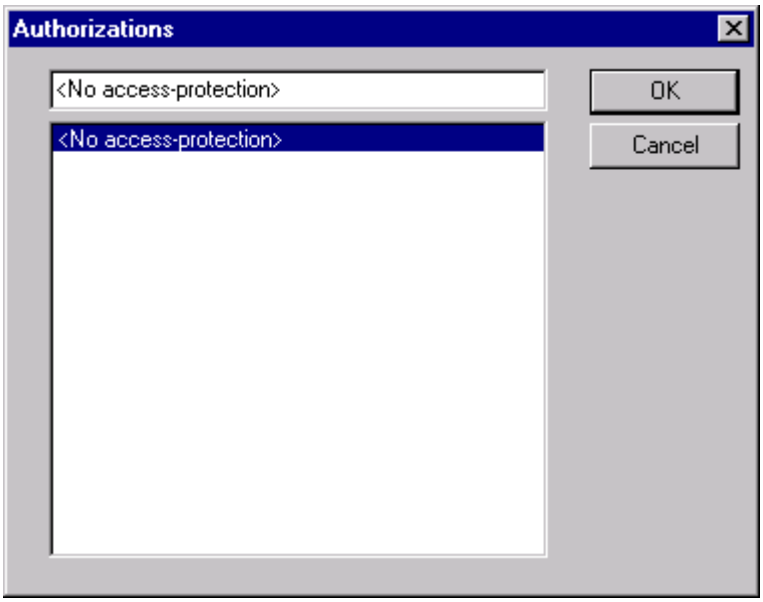
If you do not want to use control tags in the example, exit the dialog box without making entries. An example for the application of control tags can be found in the "Properties of Control Tags" chapter.

Definition of the Authorizations and Flags

In the "Authorizations and Flags" dialog box, the access rights to the User Archives and the output - in separate columns - of the last modification/user are set.



The currently set authorization levels for read and write accesses are displayed. To change these settings, click on one of the "Select" buttons. The "Authorization Levels" dialog box will then be displayed, which provides the authorization levels that have been created in the User Administrator:



Activating the "Field - Last Modification" option creates a column containing the date and time of the last access. The "Field - Last User" option creates a column containing the name of the user who last accessed the User Archive.

1. Select one of the authorization levels.
2. For example, select the "Last User" field.
3. Complete the archive creation by clicking on "Finish".

After the creation of the archive is complete, you will be asked, if you want to "Add Fields?". If you select "Yes", the "General" dialog box for creating archive fields will be displayed. How to create archive fields is explained in the "Creation of Archive Fields" chapter.

If you selected the "Create Archives in a Loop" option from the "Edit - Options" menu, the "Next Archive?" dialog box will be displayed after the creation of the fields. If you select "Yes", the initial "General" dialog box for defining the next archive will be displayed.

Save the new User Archive by clicking on the "Disk" (save) icon or go to the "Project - Save" menu.

Note

Changes made to a User Archive only become effective after saving that User Archive. If you want to synchronize an archive via the "Redundancy" option, the flag "Last Modification" must be checked.

In our example, the properties of the "Coke" archive are:

Archive	**Properties**	
Coke	Name:	Coke
	Alias:	Calif Coke
	Type:	Unlimited
	Max. Records:	1
	Com. Type:	Raw
	PLCID:	S7112
	Tag Name:	CalifVarGroup
	Right read:	0
	Right write:	0
	Flags:	U
	Pos.:	3
	Last modification:	03/05/98 12:54

2.2.2.2 Creation of Archive Fields

This section describes the creation of User Archive data fields.

The preset option "Create Fields in a Loop" allows the sequential creation of multiple fields. If you only want to create a single field, this option can be deactivated from the "Edit - Options" menu.

1. In the navigation window, expand the "Archives" entry (click on the "+" sign). The new "Coke" archive will then be displayed in the navigation window.
2. In the navigation window, right-click on the "Coke" archive name. The following pop-up menu will be displayed:

3. Click on the "New Field" menu entry.

The "General" dialog box will then be displayed.

Note

If archive fields are changed, data might be lost under the following circumstances:

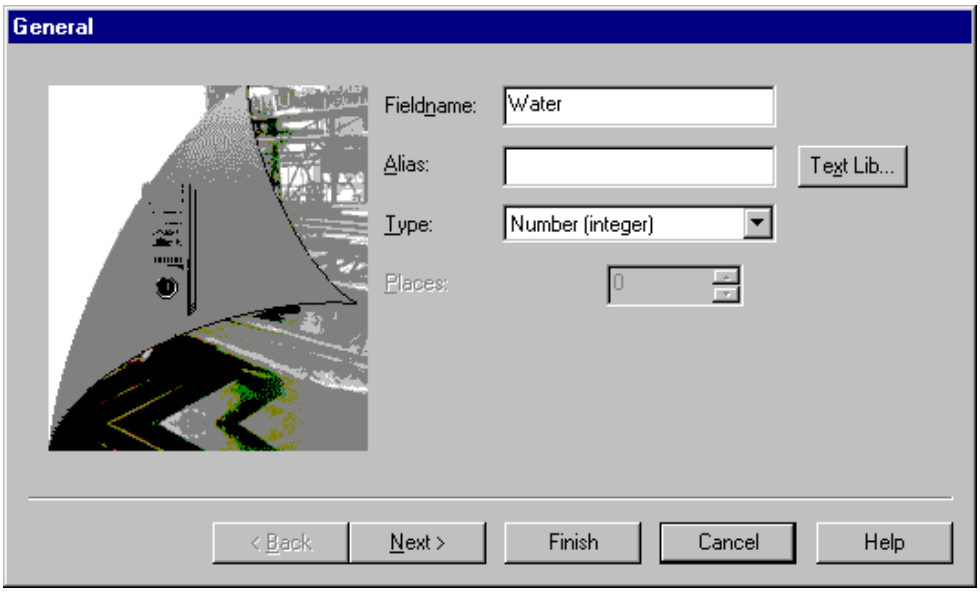
If a new consistency condition can not be met by already existing data, e.g. for "Unique", "Not Null", etc.

If a field has been renamed.

If a new data type is unable to convert the data from the source.

Definition of General Properties of Archive Fields

In the "General" dialog box, specify the archive field that you want to create as well as the field type, field length and number of decimal places.



- In the "Field Name" entry field, enter the name of the first archive field. In our example, this is the recipe ingredient "Water".
- In the "Alias" field, a second field name can be entered to annotate the field or to implement a Language Switch for the display in runtime via the Text Library. This entry is optional.

  Additional information about a language switch can be found in the Online Help.

The names entered serve for the later assignment of the fields for the tabular display.

In the "Type" entry field, one of the following tag types can be selected:

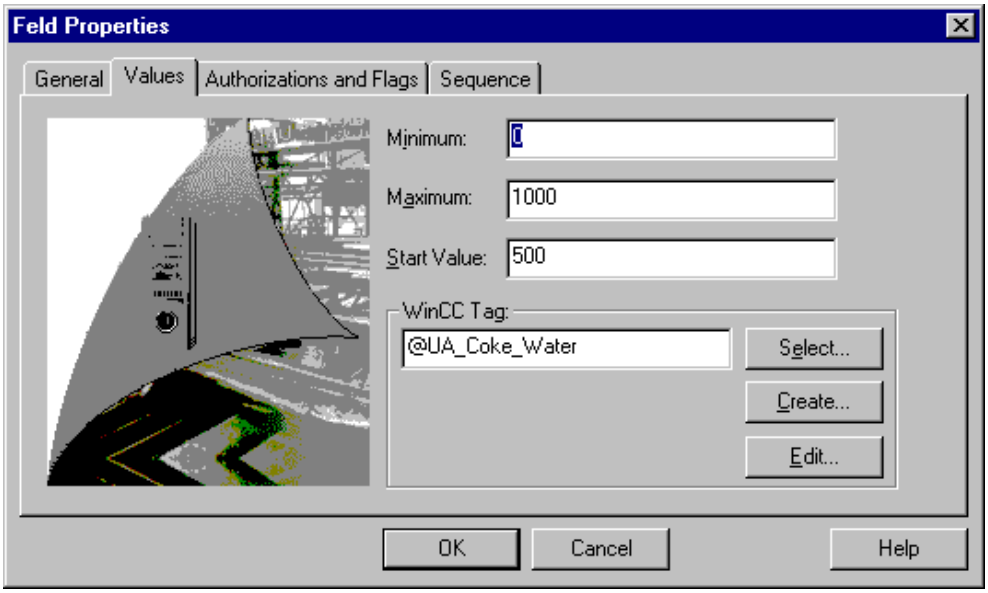
- Integer Signed 32-Bit Value
- Double Floating Point Number 64-Bit IEEE 754
- String Text Tag 8-Bit Character Set
- Date/Time No specific data type available

Note

For the "Date/Time" tag type, the input format of the date and time is dependent on the settings of the operating system.

Definition of the Values

In the "Values" dialog box, the minimum, maximum and start values are specified.



Minimum, Maximum and Start Value

A period must be used if minimum, maximum and start values of the "Double" type or decimal values are entered.

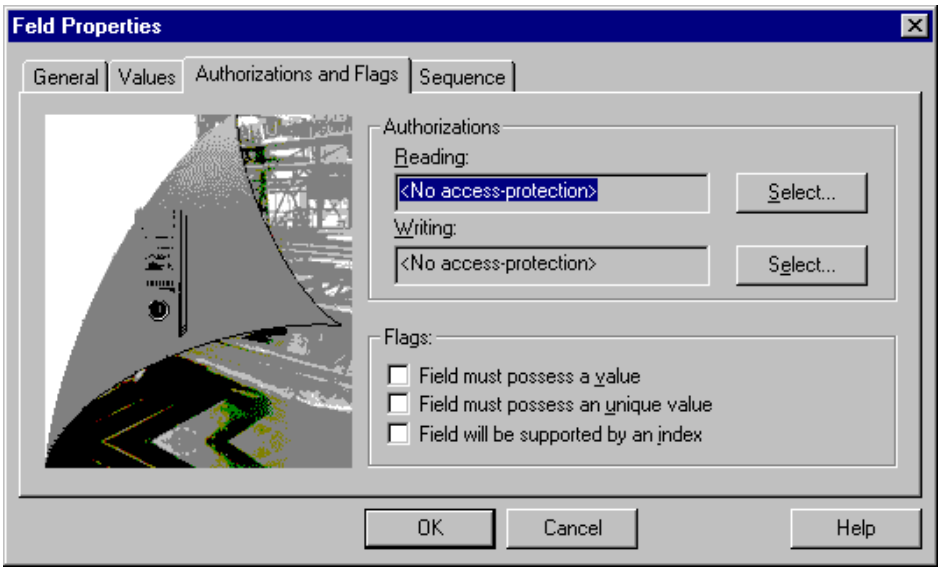
WinCC Tag

Here you can create a WinCC tag that will store the value of the archive field. Follow one of these steps:

1. Enter the tag directly in the input field.
2. Interactively choose a tag or create a new one by clicking on the "Select" button.
3. Automatically generate a new tag by clicking on the "Create" button.
4. Edit the properties of an existing tag by clicking on the "Edit" button.

Definitions of the Authorizations and Flags

In the "Authorizations and Flags" dialog box, the access rights and properties of the archive fields can be defined.



Authorizations

Using the "Select" button, the read and write access authorizations can be defined in here. The possible authorization levels are defined in the User Administrator. The setup of access rights is performed as described in the "Creation of New User Archives" chapter.

Flags

In the "Flags" area, the following properties can be defined for the selected data field:

1. "Field must contain a Value":
   - The field must contain a value other than zero.
2. "Field must contain a unique Value":
   - The field must contain a unique value, i.e. the values in this column must differ from one another.
3. "Field supported by an Index":
   - If possible, the field supports an index value. This index, for example, can increase the performance during search commands.
4. Complete the data field entry by clicking on the "Finish" button.

This will create a new data field in the "Coke" User Archive.

If you selected the "Create Fields in a Loop" option from the "Edit - Options" menu, the "Create Next Field?" dialog box will be displayed. If you select "Yes", the initial "General" dialog box for defining the next field will be displayed.

5. Save the User Archive.

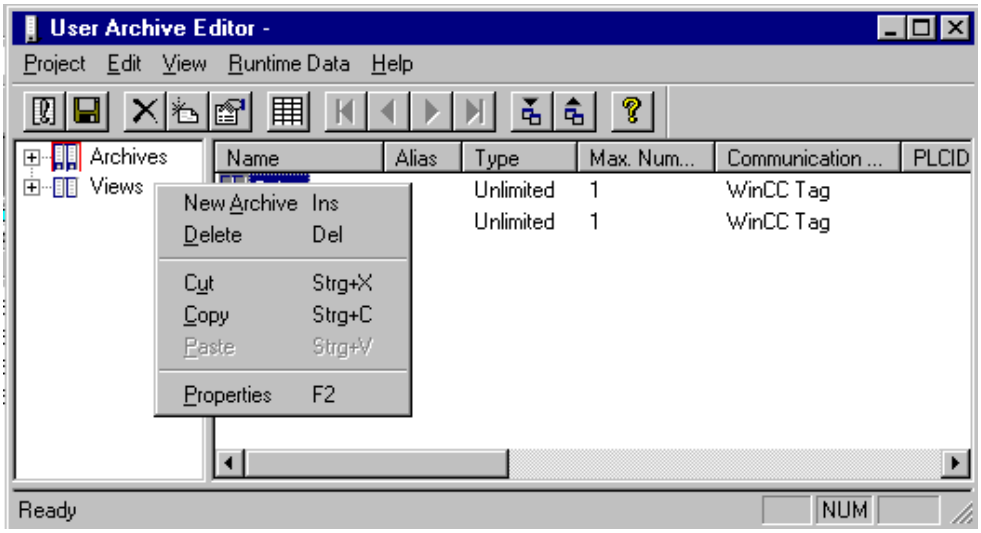
Note

Changes made to a User Archive only become effective after saving the database.

2.2.2.3 Properties of Archives

To edit the properties of the User Archives, follow these steps:

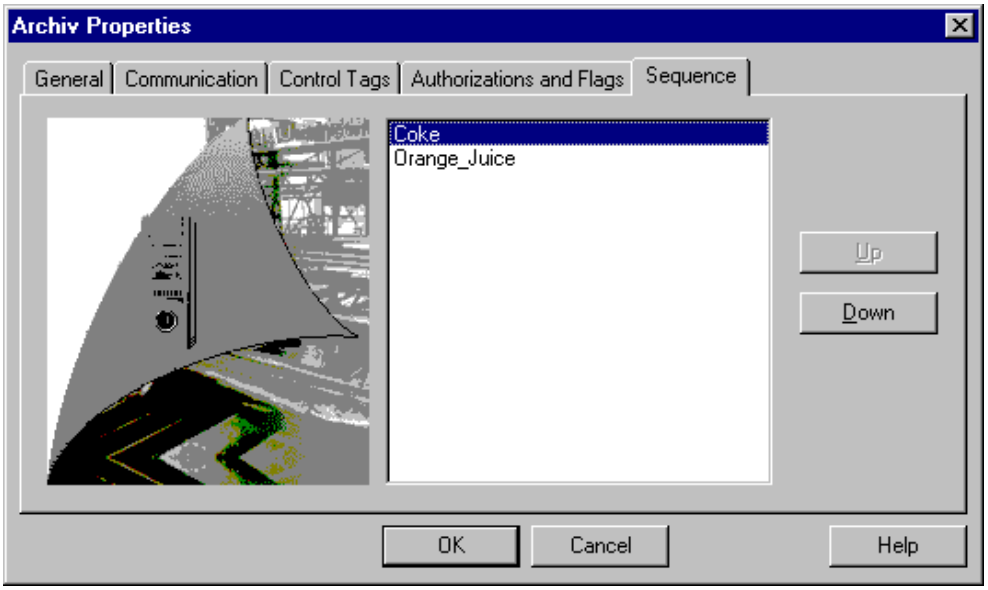
- In the navigation window, right-click on one of the archives, e.g. the "Coke" archive (expand the archives first).
- Select "Properties" from the pop-up menu.



The "Archive Properties" dialog box will then be displayed, in which you can edit the properties. The "General", "Communication", "Authorizations and Flags" tabs are described in the "Creation of New User Archives" chapter. The additional "Sequence" tab defines the sequence of the archives.

The "Sequence" Tab

The "Sequence" tab defines the sequence of the archives.



Select one or multiple archives and change their position using the "up" and "down" buttons. Confirm your entries by clicking on "OK". Save the User Archive by clicking on the "Disk" (save) icon or go to the "Project - Save" menu. The sequence of the archives will be updated in the User Archives Editor at the "Pos." column.

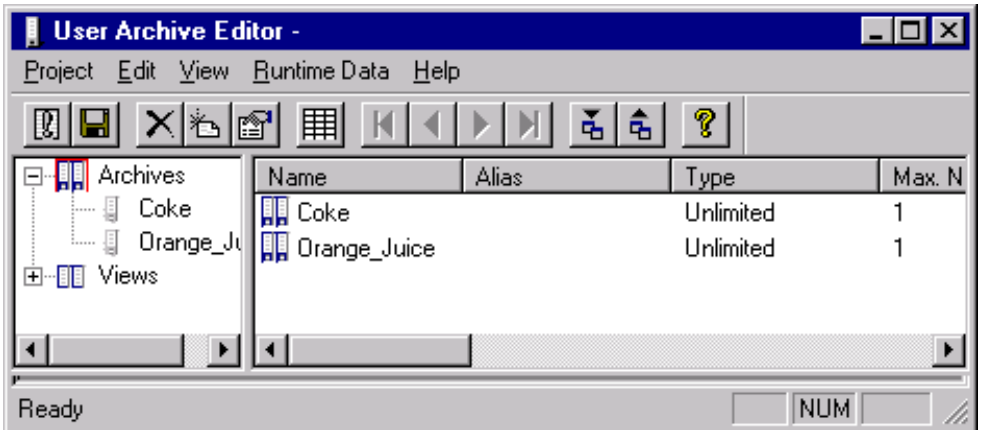
Note

Changes made to a User Archive only become effective after saving the database.

2.2.2.4 Properties of Archive Fields

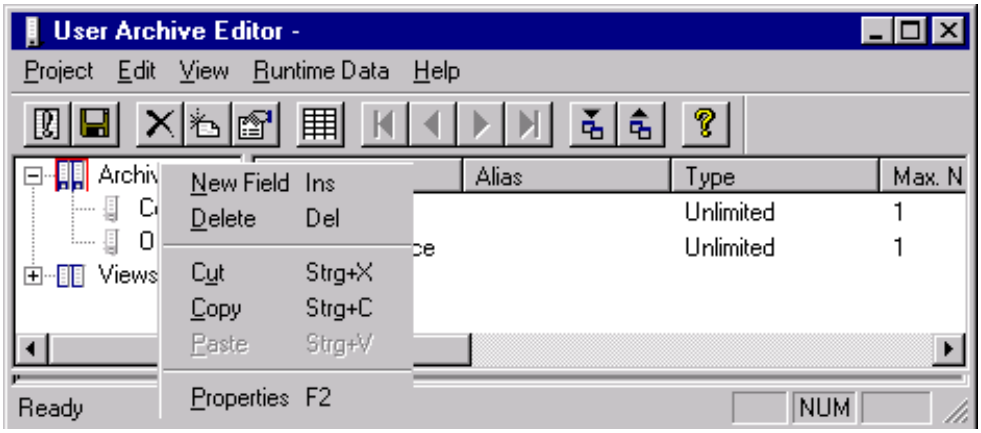
To edit the properties of data fields, follow these steps:

- In the navigation window, click on one of the archives, e.g. the "Coke" archive (expand the archive first).
- The data window of the User Archives Editor should then display the data fields of the "Coke" User Archive:



To edit the data fields of a User Archive, proceed as follows:

- In the data window of the User Archives Editor, right-click on the "Water" field name.
- In the pop-up menu, select "Properties".



The "Field Properties" dialog box will then be displayed, in which the properties of the data field can be edited.

The "General", "Values" and "Authorizations and Flags" tabs are described in the "Definition of the Archive Fields" chapter. The additional "Sequence" tab defines the sequence of the archive fields.

"Sequence" Tab

To define the sequence of the data fields, the "Sequence" tab is available. The sequence set in this tab will affect the display of the data in the table window of the User Archives Editor, the Control of the runtime screen and the assignment of indices for the access via script functions.

Select one or multiple fields and change their position using the "up" and "down" buttons. Confirm your entries by clicking on "OK".
Save the User Archive by clicking on the "Disk" (save) icon or go to the "Project - Save" menu. The sequence of the archive fields will be updated in the User Archives Editor at the "Pos." column.
In our example, the "Coke" archive contains the following properties:

Archive	Data Fields	Properties	
Coke	Water	Name:	Water
		Alias:	Water_from_Well_4
		Type:	Integer
		Length:	
		Precision:	
		Min. Value:	1000
		Max. Value:	1200
		Start Value:	1100
		Tag n... :	
		Right (read):	0
		Right (write):	0
		Flags:	NN
		P...:	3
		Last modification:	03/05/98 12:54

Archive	Data Fields	Properties
	Sugar	Name
		Alias
		....
	Coloring7	Name
		Alias
		....
	Caffeine	Name
		Alias
		....
	Phosphoric Acid	Name
		Alias
		....

Finally, save the User Archive.

Note

Changes made to a User Archive only become effective after saving the database.

2.2.2.5 Properties of Control Tags

The properties of the control tags can be edited using the properties dialog boxes of the archives and archive fields. To do so, click on the "Edit" button in the respective tab. The "Tag Properties" dialog box will be displayed, in which the properties of the tag are controlled and can, if necessary, be changed.

Data Types of the Control Tags	
Data Type for @UA_Coke_ID	Signed 32-Bit Value
Data Type for @UA_Coke_Job	Signed 32-Bit Value
Data Type for @UA_Coke_Field	Text Tag 8-Bit
Data Type for @UA_Coke_Value	Text Tag 8-Bit

With the help of these four control tags, an archive can be controlled. For the control, either the "ID" and "Job" tags or the "Job", "Field" and "Value" tags must be provided with the corresponding values.

Function of the Control Tags	
ID	The identifier (corresponding to the data record number) of the archive
Instruction Code	Three instruction codes are possible: Read, Write and Delete: Read = 6 Write = 7 Delete = 8 After the instruction has been executed, the control tag will contain an error code: No Error = 0 Error = -1
Field	The archive field
Value	The archive field value

The control tags offer to methods to access archives:

1. By specifying the "ID" and "Instruction Code" control tags, values can specifically written, read or deleted from a data recorded.
2. Instead of the "ID" control tag, the "Field" and "Value" control tags can be utilized to search for a data record. Using the "Instruction Code" control tag, the found data record can then be written, read or deleted. This type of data selection can be used, if, for example, data records must be deleted from a table and then be added at its end again. The "Value" field must be unique, otherwise the first data record matching the condition of the "Value" field will be used.

Note

How to provide values to the control tags is detailed in the control tags application example in the Online Help.

Control Tags Application Example:

To work with control tags in our example, the following steps must be carried out:

In the User Archives Editor

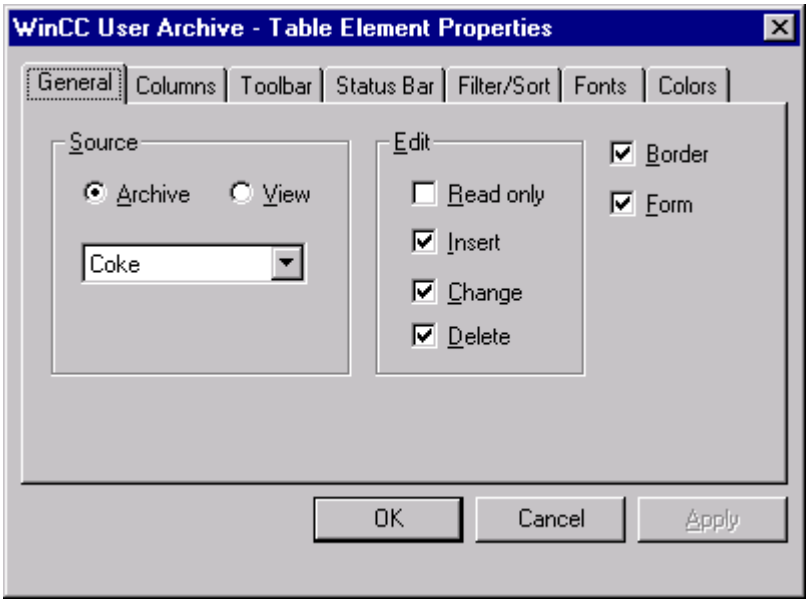
1. Create a User Archive (in our example, the "Coke" archive). During the archive creation with the Wizard, please enter the settings listed below. If the "Coke" project has already been created, then the settings can be checked, and changed if necessary, via the archive's properties dialog box.

Properties of the "Coke" Archive	
Archive Type	"Unlimited"
Communication	Via WinCC Tags
Control Tags	Generate
Tag Group	"@UA_Coke"
Data Type for @UA_Coke_ID	Signed 32-Bit Value
Data Type for @UA_Coke_Job	Signed 32-Bit Value
Data Type for @UA_Coke_Field	Text Tag 8-Bit
Data Type for @UA_Coke_Value	Text Tag 8-Bit

2. In the User Archive, create the data fields "Water", "Sugar", "Coloring7", "Caffeine" and "Phosphoric Acid" (integer type).
3. Create a "Recipes" (string type) data field.

In the Graphics Designer

1. Open a new screen and place a WinCC User Archives Table Control in it. Double-click on the Control to open the "WinCC User Archives Table Control Properties" dialog box.



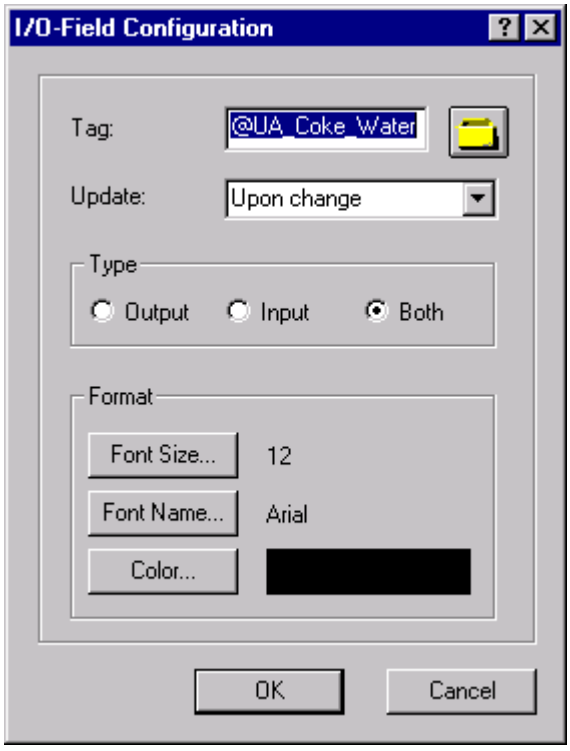
- In the "Source" area of the "General" tab, activate "Archives" and select the "Coke" archive from the list-box.
- In the "Edit" area, activate the "Read Only" check-box. Activate the "Insert", "Change" and "Delete" access types.
- The remaining settings can be applied unchanged. If a User Archives Table Control has already been created, then the settings can be checked, and changed if necessary, via the Control's properties dialog box.

2. Create an I/O field for each of the four control tags and set them as follows:

Control Tag	Data Format	Output Format
@UA_Coke_ID	Decimal	0999
@UA_Coke_Job	Decimal	s9
@UA_Coke_Field	String	*
@UA_Coke_Value	String	*

- For each tag, select the "Update upon Change" object property.

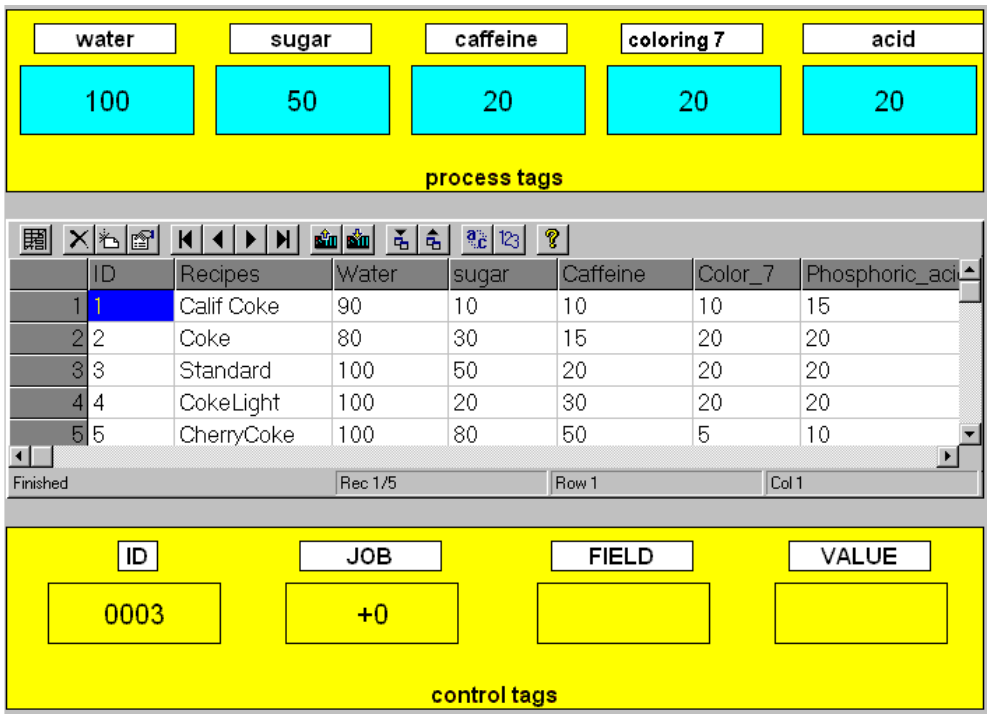
3. Create an I/O field for each configured data field (Water, Sugar, etc.) and connect it to the corresponding tag (e.g. the I/O field for "Water" to the "@UA_Coke_Water" process tag). _For each tag, select the "Update upon Change" object property.



Note

Additional information regarding the configuration of I/O fields can be found in the Graphics Designer documentation.

For each configured I/O field, create a text field for its label. These labels will allow you to identify the individual I/O fields in runtime. Save the changes made and activate runtime. Enter five data records into the table window. For the ID 2 data record, enter "Coke" in the recipes column and for the ID 4 data record "Coke Light".



Detailed Procedure for Executing the possible Actions

1. Selection of a data record using its ID and writing of the data record values:
   - Enter "3" into the "ID" I/O field and "7" (write) into the "Instruction Code" I/O field.
   - This will output the values of the data record "3" in the I/O fields of the process tags.
   - If the action was successful, the "Instruction Code" I/O field will display the error number "0". In case of an error, the error number "-1" will be output.
   - The "Field" and "Value" control tags are not used.

Note

By entering the ID "-1" and the job number "6", the current contents of the process tags will be read into the table. The new values will be added to the end of the table, with the IDs of the data records being incremented progressively. The write (7) and delete (8) jobs cannot be performed via the ID “-1”.

2. Selection of a data record using its ID and reading of the data record values:
   - Change the values in the I/O fields of the process values and enter "5" into the "ID" I/O field. Enter "6" (read) into the "Instruction Code" I/O field.
   - The changed process tag values will now be written to data record "5". The values of the previous data record will be overwritten.
   - The "Field" and "Value" control tags are not used.
3. Selection of a data record using the "Field" and "Value" control tags:
   - Enter the word "Recipes" into the "Field" I/O field and the text "Coke Light" (enclosed in apostrophes) into the "Value" I/O field. Enter "7" (write) into the "Instruction Code" I/O field.
   - The "Coke Light" data record will then be written and the values of the data record be output in the I/O fields of the process tags.
   - The "ID" control tag is not used and must be set to "0".

Note

The field referenced by the "Value" control tag must be assigned the flag "Field must contain a unique Value" from the "Authorizations and Flags" dialog box. Otherwise a unique assignment of the data record to the field value is not possible.

Decimal numbers entered in the I/O fields must be separated by a period (e.g. 34.864). Text entered in the "Value" I/O field must be enclosed in apostrophes, e.g. 'Coke Light'.

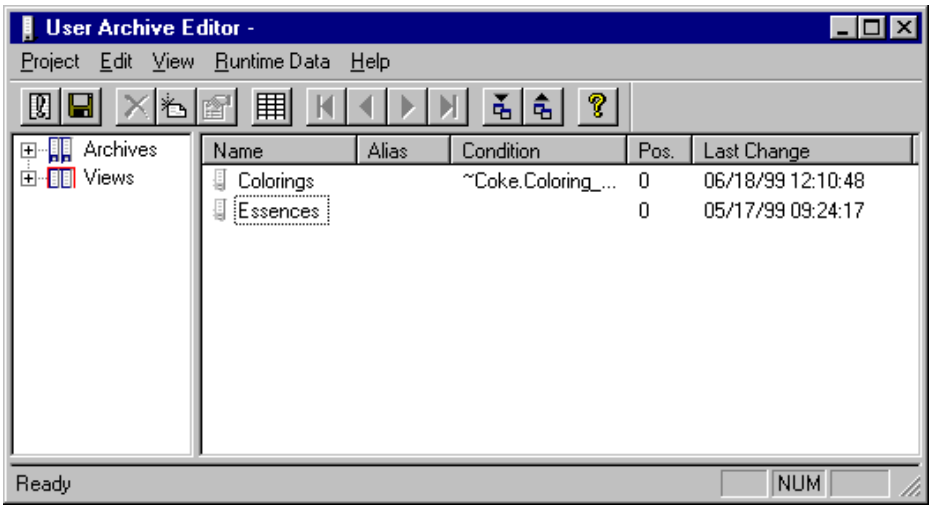
2.2.3 Configuration of Views

2.2.3.1 Creation of Views

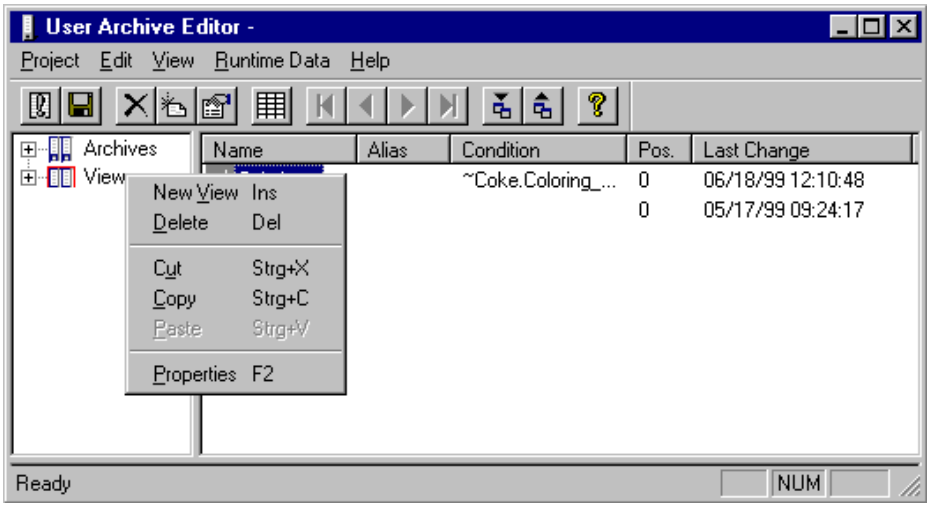
The preset option "Create Views in a Loop" allows the sequential creation of multiple views. If you only want to create a single view, this option can be deactivated from the "Edit - Options" menu.

To create a new view, proceed as follows:

1. In the navigation window, click on "Views".

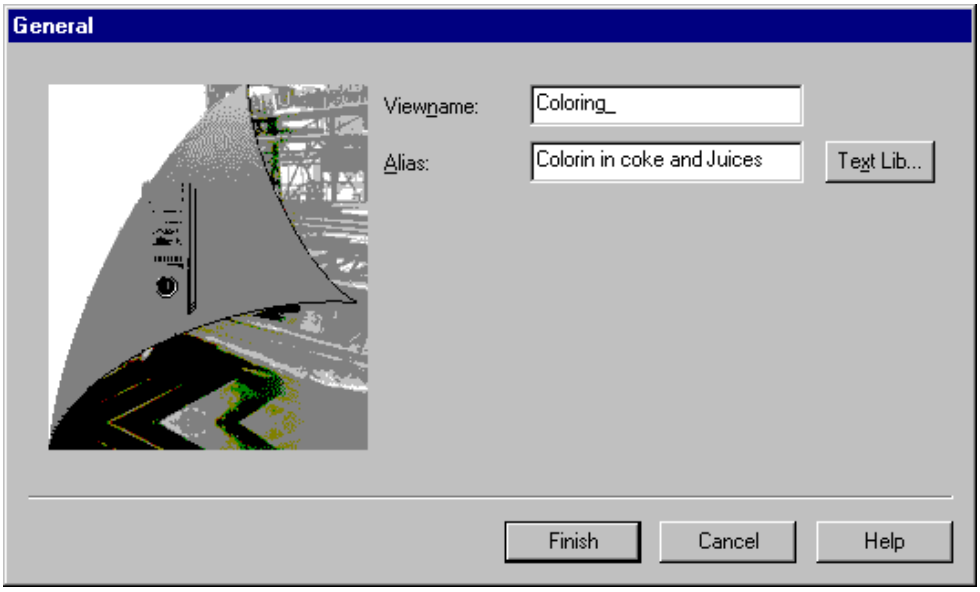


2. Right-click on the navigation or data window. The following pop-up menu will be displayed:



3. Click on the "New View" entry.

The Wizard for configuring views will be activated. The "General" dialog box will be displayed, in which a new view can be created.

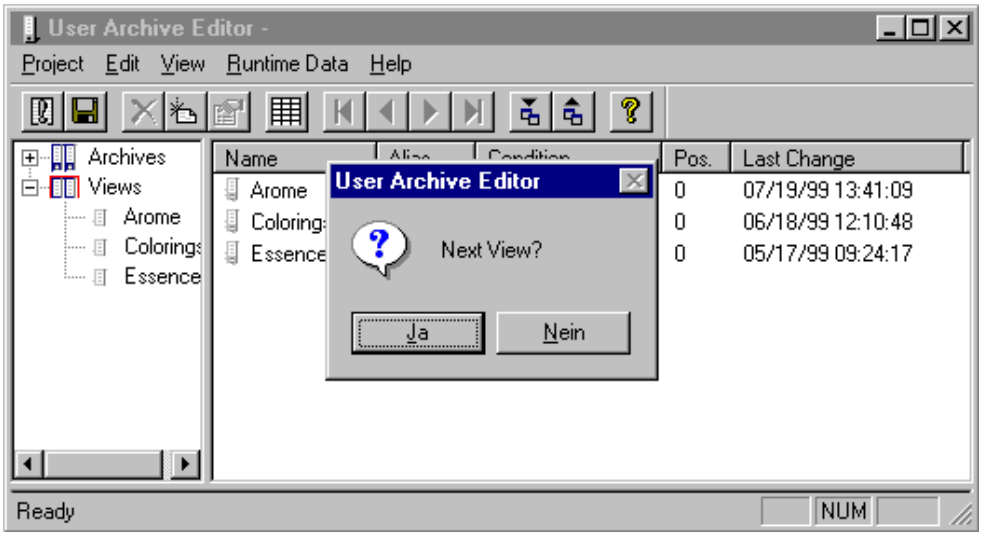


As the view name, for example, enter "Colorings". In the "Alias" field, a second view name can be entered, for example "Colorings in Coke and Juice", to annotate the view or to implement a Language Switch in runtime via the Text Library. This entry is optional. Additional information about a language switch can be found in the Online Help.

Complete the creation of the view by clicking on the "Finish" button.

After the creation of the view is complete, you will be asked, if you want to "Add Columns?". If you select "Yes", the "General" dialog box for creating view columns will be displayed. How to create the columns of a view is explained in the "Creation of Columns of a View" chapter.

If you selected the "Create Views in a Loop" option from the "Edit - Options" menu, the "Next View?" dialog box will be displayed after the creation of the columns. If you select "Yes", the initial "General" dialog box for defining the next view will be displayed.



Save the views after the creation is complete.

Note

Changes made to views only become effective after saving the database.

2.2.3.2 Creation of Columns of a View

The preset option "Create Columns in a Loop" allows the sequential creation of multiple columns of a view. If you only want to create one column of a view, this option can be deactivated from the "Edit - Options" menu.

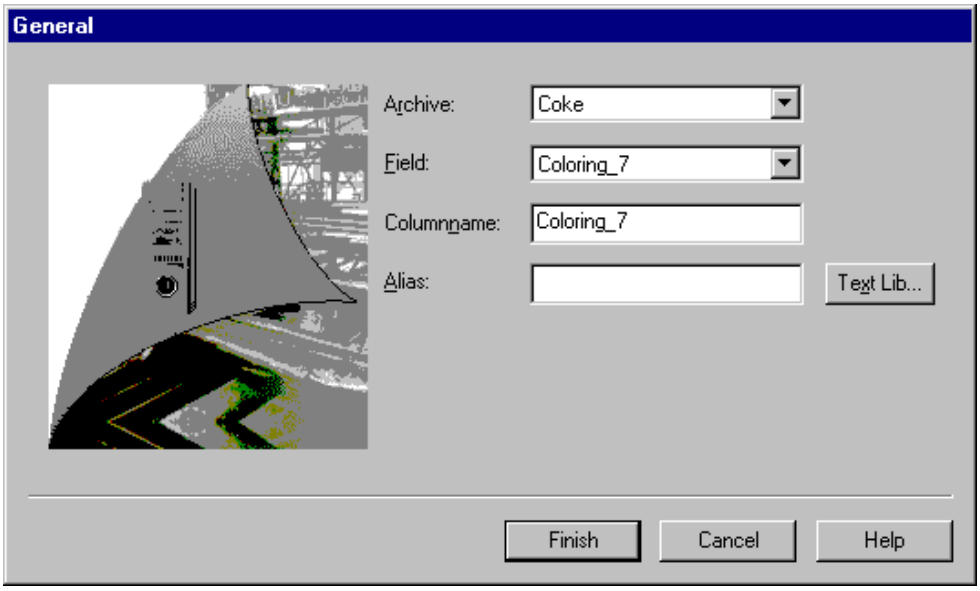
1. In the navigation window, expand the "Views". The views, for example the "Colorings" view, will then be displayed in the navigation window.
2. In the navigation window, right-click on the "Colorings" view. The following pop-up menu will be displayed:

3. Click on the "New Column" button.

The "General" dialog box will then be displayed.

General Properties of Columns of a View

In the "General" dialog box, archive fields can be selected, be declared as columns in your created view and be given a name.

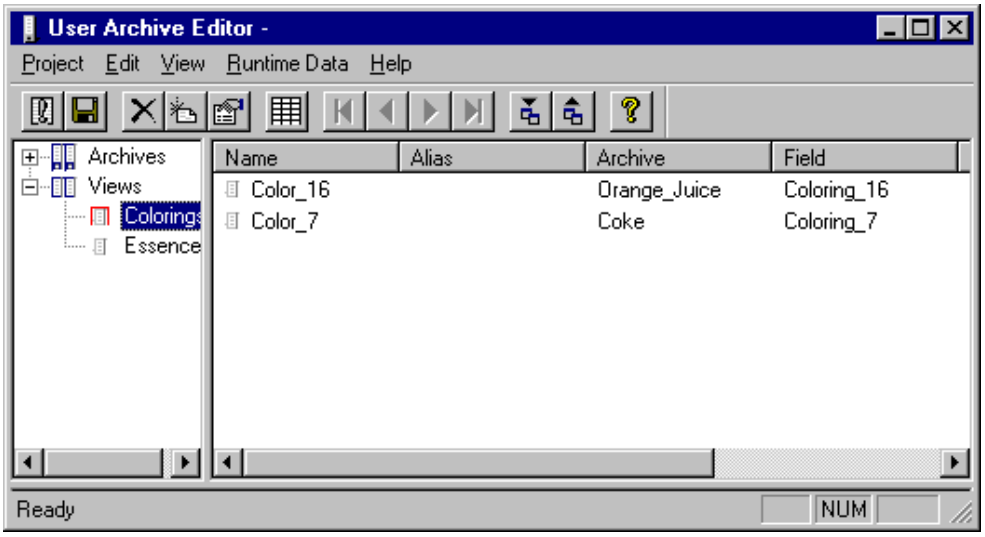


- In the "Archive" list-box, you can select one of the created User Archives. For example, keep the "Coke" archive setting.
- In the "Field" list-box, select one of the fields of the "Coke" User Archive. For example, keep the "Coloring7" setting. To move to the next field, either hit the "TAB" key or click on the desired field.
- If you click on the "Column Name" field, the entry in the "Field" list-box will be applied. Any column name can be entered, but it must be unique within the view. For our example, accept the name "Colorings".

In the "Alias" field, a second column name can be entered to annotate the column or to implement a Language Switch in runtime via the Text Library. This entry is optional.

Additional information about a language switch can be found in the Online Help.

Click on the "Finish" button to generate the configured data field:



The beverage producer in our example creates a "Colorings" view, in which he groups the "Coloring7" and "Coloring16" data fields from the "Coke" and "Juice" User Archives.

If you activated the "Create Columns in a Loop" option from the "Edit - Options" menu, the "Create Next Column?" dialog box will be displayed. If you select "Yes", the initial "General" dialog box for defining the next column will be displayed.

Save the field of the view.

Note

Changes made to views only become effective after saving the database.

2.2.3.3 Properties of Views

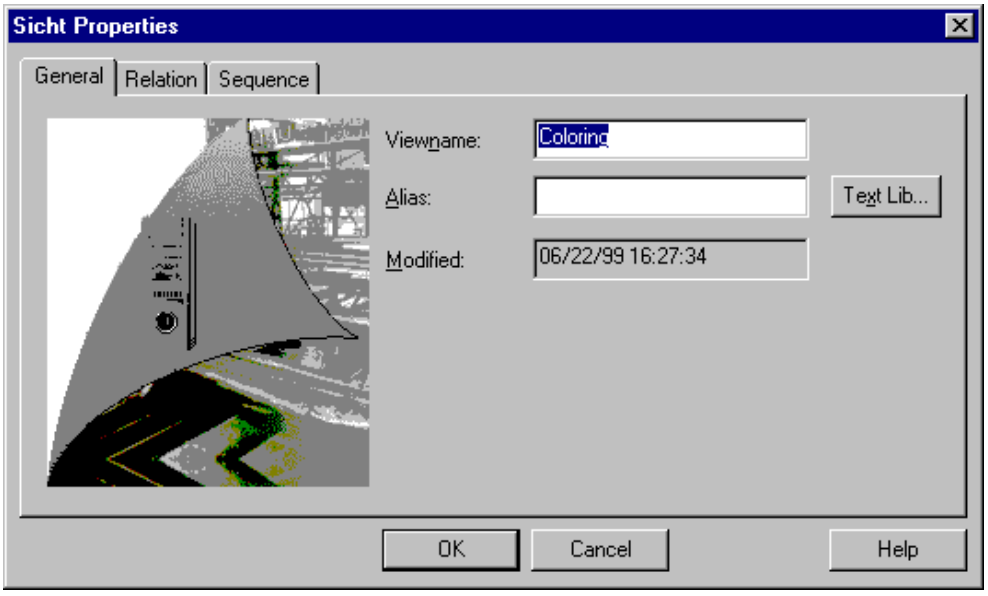
To edit the properties of a view, follow these steps:

1. In the User Archives Editor, right-click on one of the views.
2. Select "Properties" from the pop-up menu.

This will display the "View Properties" dialog box.

General Properties of Views

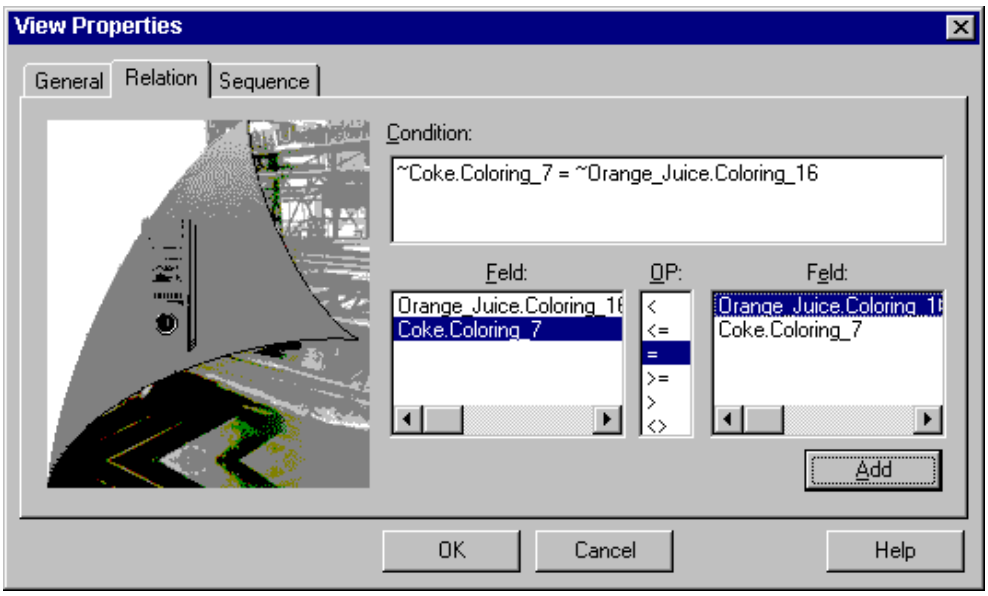
In the "General" tab, the properties of the selected view are displayed.



You can change the names in the "View Name" and "Alias" fields. This dialog box also displays the date and time of the last modification.

Definition of the Relations of Views

In the "Relation" tab, a relation between multiple archives can be established for the output of a view. Links can either be formulated directly in the SQL language or be defined interactively using the default relation operators. Ensure that the archive fields linked with each other are of the same tag type.



Relation

In the "Relation" field, SQL expressions can be entered directly. The appendix contains additional information about the SQL Language.

Conditions

In the condition fields, conditions can be defined interactively. To do so, select entries from the left and right "Field" list-boxes and set the relation by selecting an operation from the "OP" list-box. Click on the "Add" button to apply the condition. This condition will then be displayed in the "Relation" field.

Functionality

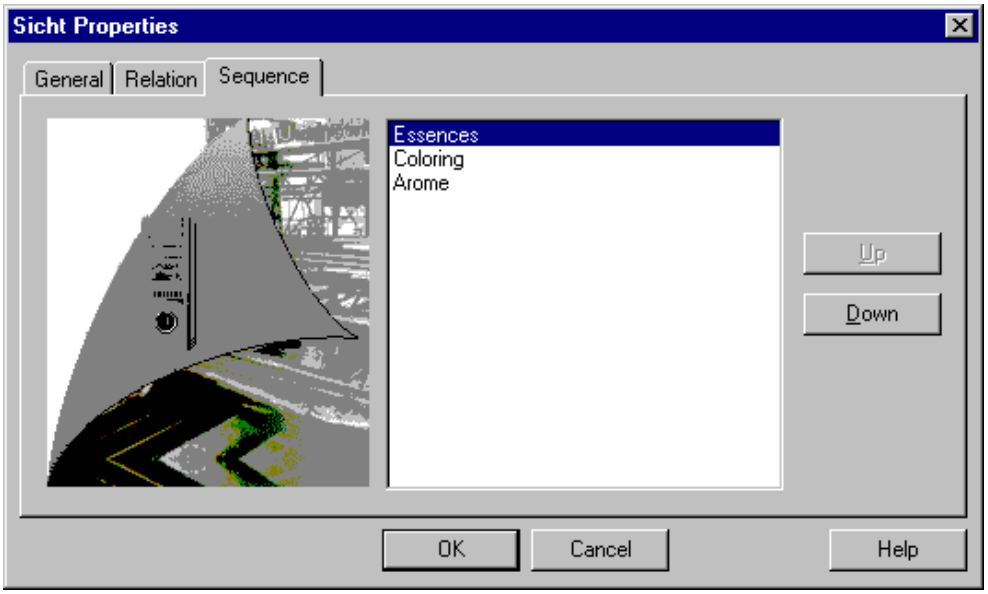
In the specified archives, all fields that show a relation will be linked together. The field contents are filtered using the defined relation and the result displayed as a view in runtime. The data of a view can also be edited during runtime - the edited data will then be applied to the originating archive.

Note

The archives linked must have at least one common characteristic or relation.

Definition of the Sequence of Views

In the "Sequence" tab, the sequence of the views is defined.

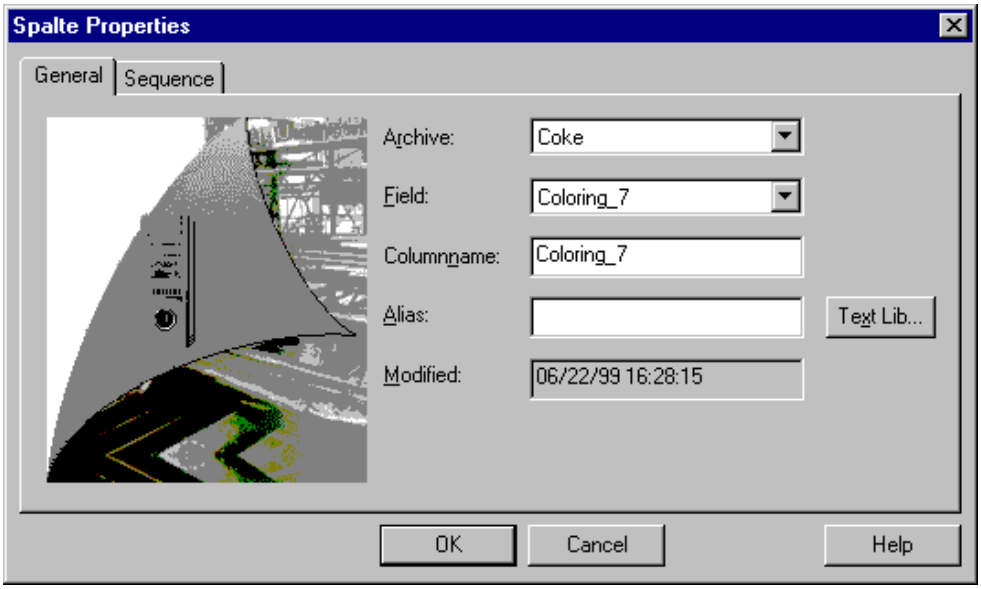


Select one or multiple views and change their position using the "up" and "down" buttons. Confirm your entries by clicking on "OK". Save the views by clicking on the "Disk" (save) icon or go to the "Project - Save" menu. The sequence of the views will be updated in the User Archives Editor at the "Pos." column.

2.2.3.4 Properties of Columns of a View

To edit the properties of the columns of a view, proceed as follows:

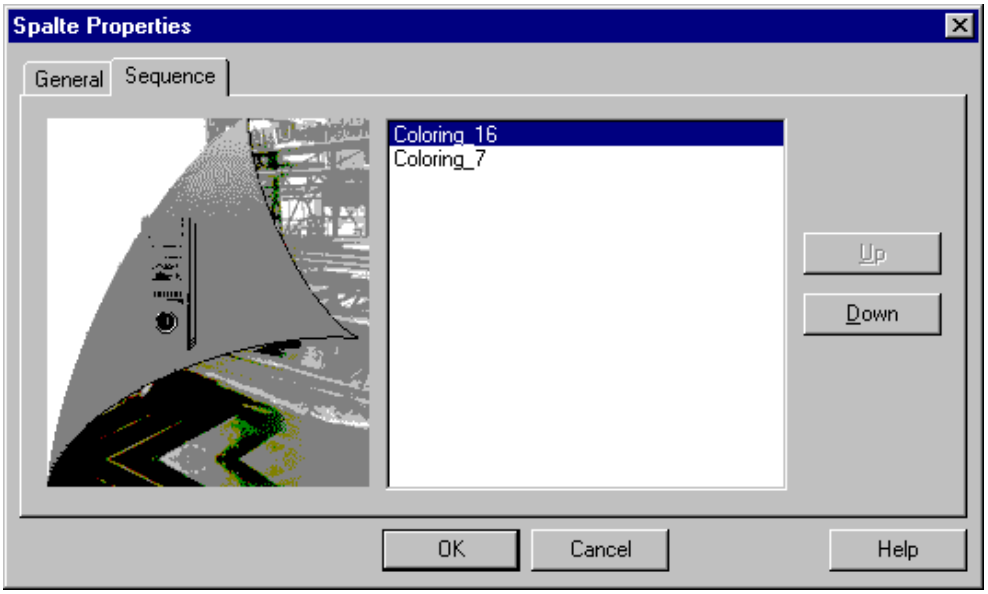
1. In the User Archives Editor, right-click on one of the view columns.
2. Select "Properties" from the pop-up menu. The "Column Properties" dialog box will then be displayed:



The "General" tab contains the same fields as the tab used for creating a new view column. The date and time of the last modification are displayed in the "Modified" field.

Definition of the Sequence of Columns of a View

In the "Sequence" tab, the sequence of the columns of a view is defined.



Select one or multiple columns and change their position using the "up" and "down" buttons. Confirm your entries by clicking on "OK". Save the views by clicking on the "Disk" (save) icon or go to the "Project - Save" menu. The sequence set here affects the display of the columns in the table window of the User Archives Editor and in the Control of the runtime screen.

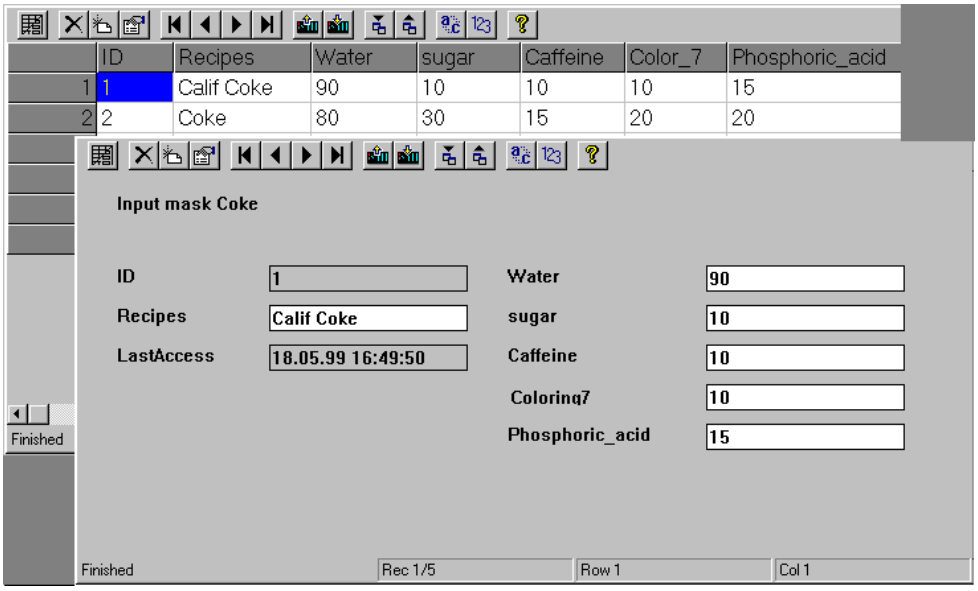
2.2.4 Configuration Tips

- The communication between the PLC's and the User Archives is limited to one connection per User Archive.
- The "PLCID" must not contain more than 8 characters while establishing the communication to the PLC.
- Terms containing special characters or reserved words must not be used as field or table names. See also the "Alphabetical List of SQL Keywords" chapter.
- In runtime, configuration changes can only be saved, if no archive is being accessed, e.g. archives must not be synchronized by redundancy (display of the Table Control in CS or runtime).
- If after the start of the User Archives Editor all icons of the tool bar are grayed out (except for "Restore"), the "UAEditor.loc" file must be deleted from the project path. This also applies to an inoperational User Archives Table Control.
- If the error message "Error while connecting the data!" is displayed while activating runtime or while switching the User Archives Table Control to the runtime view, then the Table Control has no connection to an archive or view. Check, if the connection has been entered correctly, the configuration has been changed or the selected archive/ view still exists.
- For projects of WinCC V4.02 and V4.02SP1, the "User Archives Table Control" must be converted to the WinCC V5.0 format. To do so, double-click on the Table Control in the Graphics Designer and again assign the archive or view using the Package Browser. Save and close the screen. The next time the screen is opened in the Graphics Designer, the Table Control will be connected to the archive/ view.

3 WinCC User Archives Table Control

The User Archives Control provides access to the archives and views of the User Archives. In runtime, the User Archives Control allows you to:

- Create or delete data records
- Page through User Archives
- Read and write tags via a direct tag connection
- Import and export archives
- Define filter and sort conditions



The User Archives Table Control offers two views: the table view and the form (user-defined) view.

The Table View

The table view displays the User Archives in tabular form. Each data record occupies one row, with the data fields of a data record appearing as columns.

The Form (User-Defined) View

The form view offers a user interface, which can be defined by the user. The form view of the User Archives offers three field types: static texts, input fields and buttons.

Note

During configuration, a User Archives Table Control is connected to a selected archive or view and can then only access that archive or view. To permit access, the archive or view must be enabled. Specific authorization levels can be assigned to the Control in the User Administrator.

3.1 Configuration of the User Archives Table Control

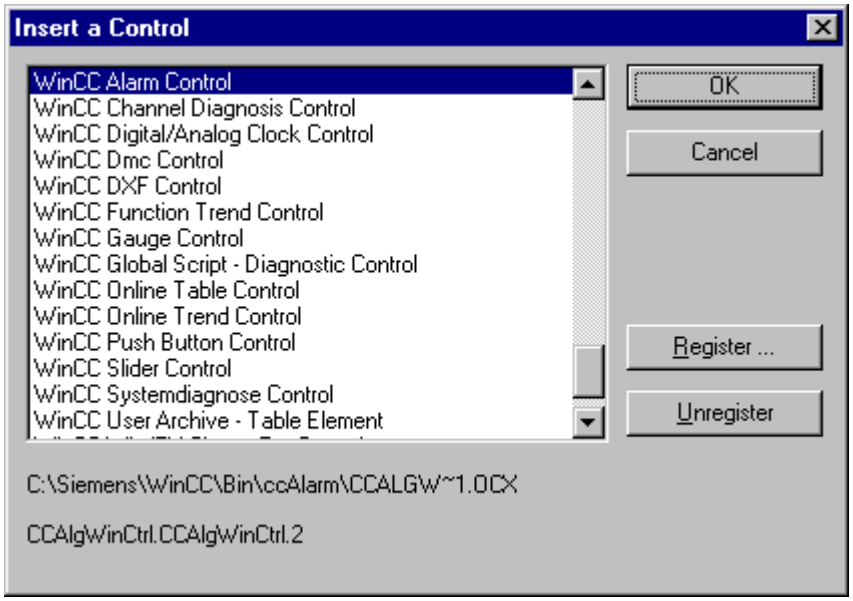
To configure a WinCC User Archives Control, proceed as follows:

1. Configure a User Archive using the User Archives Editor or the User Archives Scripts. The User Archives Editor description explained the configuration of the "Coke" archive.
2. Place a new User Archives Control in a screen of the Graphics Designer.
3. Configure the properties of the User Archives Control.
4. Configure the User Archives form view.

3.1.1 Placing a User Archives Control in a Process Screen

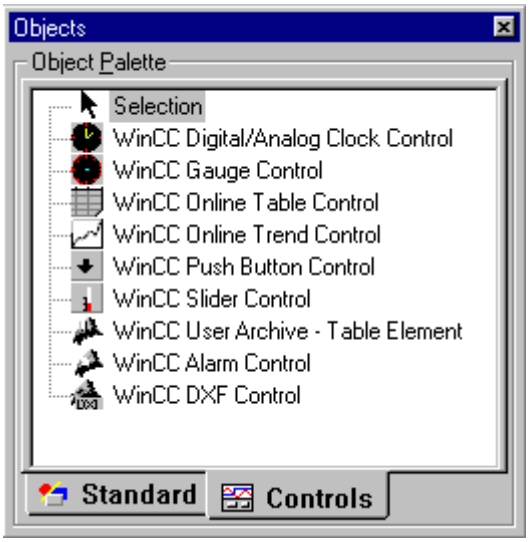
To set up a User Archives Control in a process screen, it must be configured in the Graphics Designer. To do so, follow these steps:

1. In the "Object Palette", expand the "Smart Objects" group.
2. Select the "OLE Control" object, place it on the screen and drag it to size.
3. In the following "Insert OLE Control (OCX)" selection dialog box, select the "WinCC User Archives Table Control" option and confirm the selection by clicking on "OK".



or:

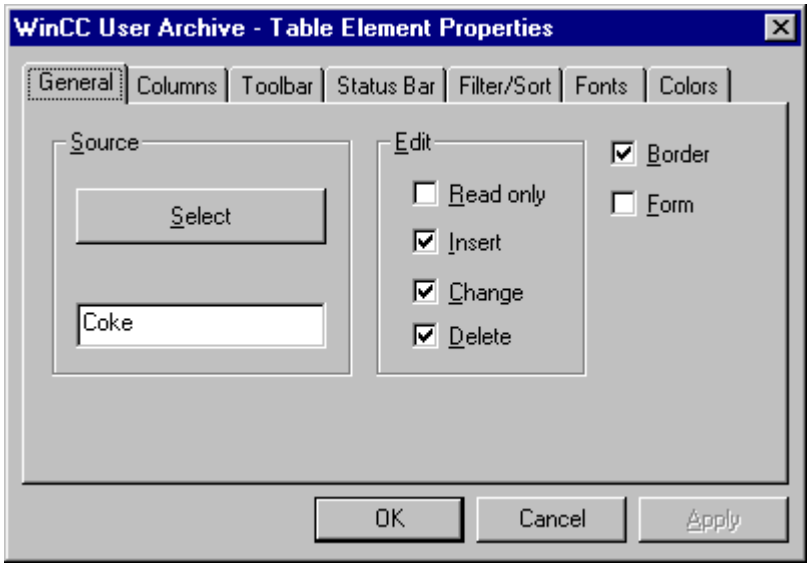
1. From the object palette, select the "Controls" entry - the object palette window will then list some standard controls for selection.
2. Select the WinCC User Archives Table Element.



3.1.2 Defining the Properties of the User Archives Control

The following guideline describes the configuration of a User Archives Control for the "Coke" archive using the "WinCC User Archives Table Control Properties" dialog box (in the Graphics Designer).

1. Double-click on the "WinCC User Archives Table Control". This will display the "WinCC User Archives Table Control Properties" dialog box containing the "General" tab.



2. In the "Source" area, the archive or view to be displayed in the Control is defined. Click on "Select" and then select "Coke"in the Dialogbox Package Browser
3. In the "Edit" area, the runtime access type can be set. The access types "Insert", "Change" and "Delete" are activated by default. Instead of them, you can also activate "Read only".
4. The "Border" check-box defines, if the Table Control window is displayed with or without a frame. Activate this option.

The presettings of the remaining tabs can be accepted unchanged.

3.1.3 Deleting the User Archives Control

The deletion of a User Archives Control is carried out in the Graphics Designer in two steps:

1. Click on the User Archives Control to be deleted.
2. Press the "Delete" key or select the "Edit - Delete" command.

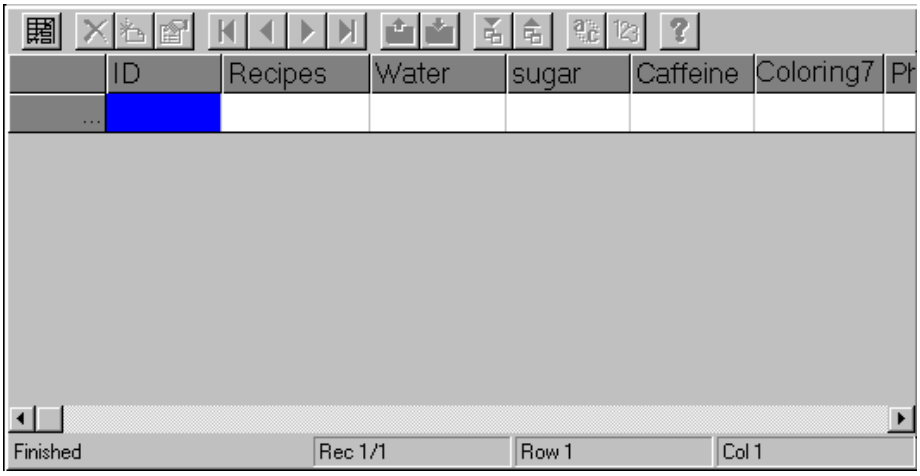
The deletion will be performed without prior warning! The deletion can be reversed via the "Edit - Undo" command or the "CTRL - Z" key combination.

3.2 Configuration of a Form View

The form of the User Archives Control can be user-defined in the Graphics Designer and is utilized for editing and displaying the User Archives data in runtime.
A configured User Archives Control is required for the creation of a form view.

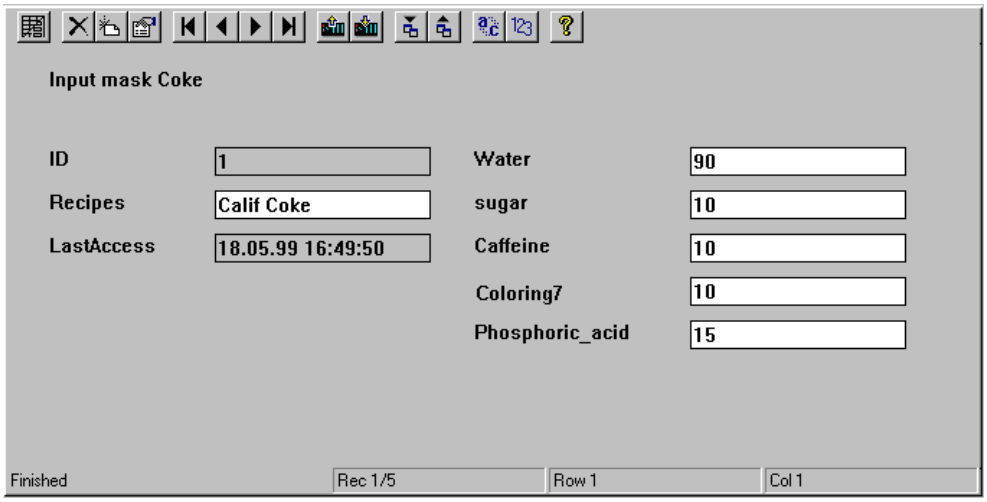
The following guideline illustrates the configuration of a new form view using the Graphics Designer.

1. While pressing the "CTRL" key, double-click on the "User Archives Control". The table view of the User Archives Control will be displayed. In the table view, the width of the individual columns for the runtime operation can be defined.



2. This icon allows you to switch between the form and table views. Click on this icon to display the form view. Now you can start with the configuration of the form.

We will create the following form:



Note

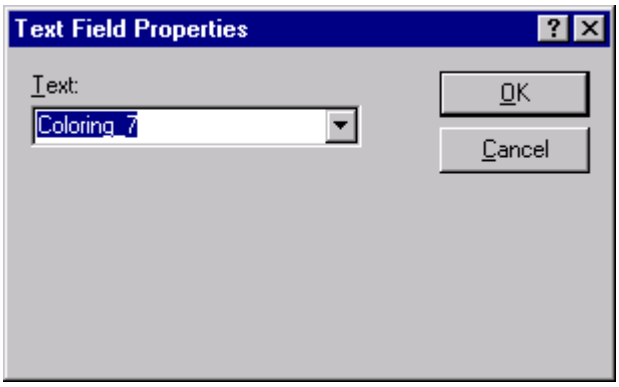
If you right-click on the blank form and select the "Create all" function from the pop-up menu, the form fields of all the archive's data fields will be generated automatically. A text field containing the alias name will also be crated for each data field. The "Create selected" function will only generate the form fields for the columns selected in the "Columns" tab.

3.2.1 Creating a "Text" Form Field

Open the form view, if it is not yet open.

To create a new "Text" form field, right-click on the User Archives Control's workspace at the location, where you want to place the text. The following pop-up will be displayed:

After selecting "Insert Text Field", the "Text Field Properties" dialog box will be displayed:



In the "Text" field, the desired text can be entered. In here, enter "Coke Input Form" as the title of the form.

Note

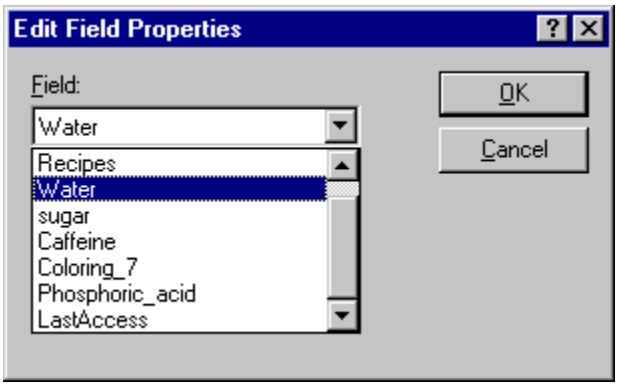
If you expand the list-box of the "Text" field, all field names of an archive will be displayed as static texts. If text references for a language switch have already been created in the Text library, they will also be listed.

3.2.2 Defining the "Edit" Form Field

Open the form view, if it is not yet open.

To create a new "Edit" form field, right-click on the User Archives Control's workspace at the location, where you want to place the edit field. The following pop-up menu will be displayed:

After selecting "Insert Edit Field", the "Edit Field Properties" dialog box will displayed:

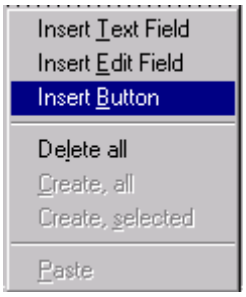


The list-box of the dialog box contains all configured archive fields.
Select the "Water" field. You can also define additional edit fields, e.g. Sugar, Coloring7, Caffeine, Phosphoric Acid, etc.

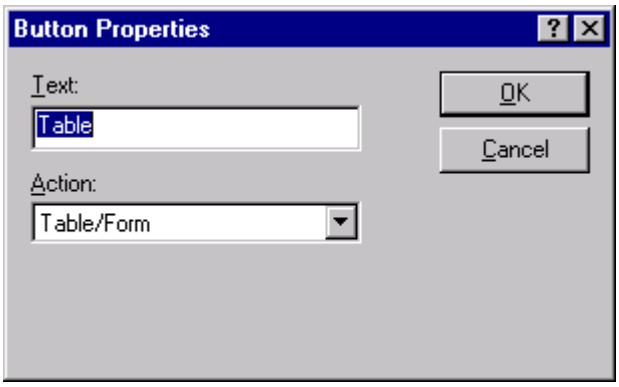
3.2.3 Defining the "Button" Form Field

Open the form view, if it is not yet open.

To create a new button, right-click on the User Archives Control's workspace at the location, where you want to place the button. The following pop-up menu will be displayed:



After selecting "Insert Button", the "Button Properties" dialog box will be displayed:



In the "Text" field, the label for the new button can be entered. Enter the text "Table View".

In the "Action" field, one of the icons for the form view can be selected. Your newly configured button will then perform the same action as the corresponding icon from the toolbar. Select "Form" to enable the switch to the table view.

Note

All functions of the form view's toolbar can be connected to a button. This allows you to define the size and appearance of the buttons to, for example, operate the toolbar from a Touch Screen.

3.2.4 Editing Form Fields at a Later Time

To edit a form field, right-click on the configured form field and select "Properties" from the pop-up menu,

or

Double-click on the configured form field.
This will display the corresponding dialog box for editing the form field (as described in the text, edit and button form field chapters).

3.2.5 Deleting Form Fields

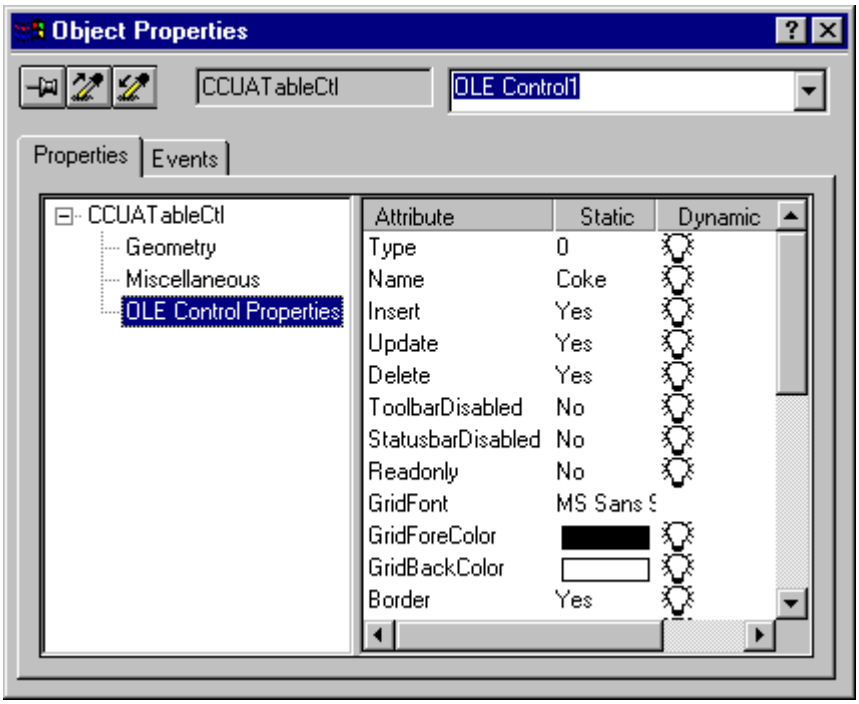
To delete a form field, right-click on the configured form field to be deleted. Select "Delete" from the pop-up menu. This will delete the form field. Do not press the "Delete" key, since it will delete the entire Control.

3.3 Properties of the WinCC User Archives Table Control

3.3.1 Object Properties of the WinCC User Archives Table Control

The properties of the User Archives Control can be changed by right-clicking on the object and selecting "Properties" from the displayed pop-up menu. The static (column) of the "Filter", "Form", "Press TB (Toolbar) Button" and "Sort" properties (attributes) can be edited here. To avoid inconsistencies in the database, changes to the remaining object properties should always be made in the "WinCC User Archives Table Control Properties" dialog box (accessed via a double-click on the Control).

In the "Properties" tab of the "Object Properties" dialog box, select the "OLE Control Properties" group.



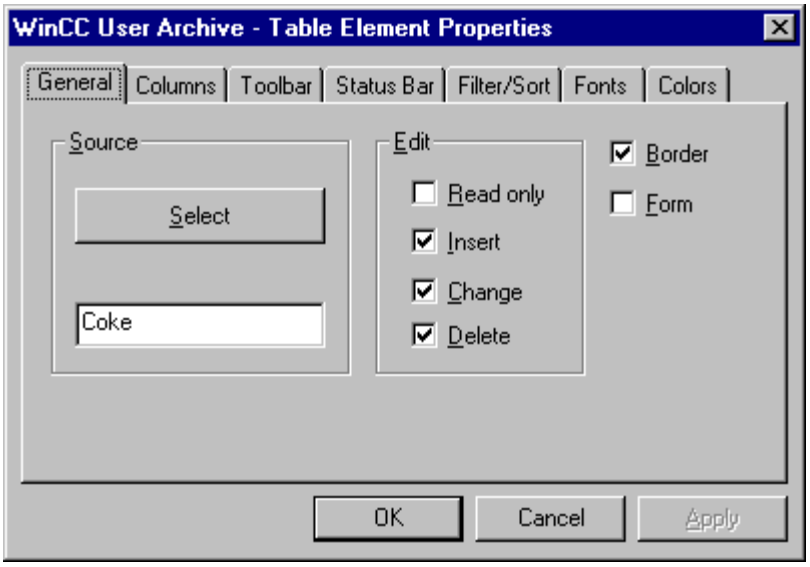
Note

A complete description of all properties of the WinCC User Archives Table Control can be found in the Online Help.

In the Graphics Designer, the configuration of the User Archives Control is usually performed by double-clicking on the Control. The desired changes can then be made in the displayed dialog box. Since existing archives, views, tags, etc. are listed in the various tabs, changes can be made safely and easily.

3.3.2 Properties Dialog Box of the "WinCC User Archives Table Control"

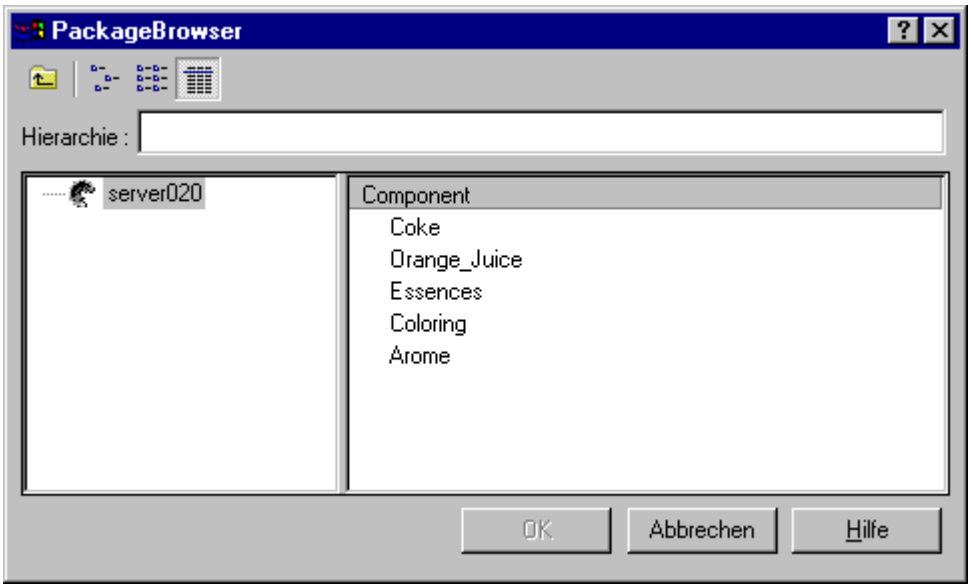
"General" Tab



Field	Description
Source	The "Select" button opens the Package Browser from which you can select a previously configured archive or view.
Edit	In the "Edit" field, the runtime access type can be defined. If you deactivate the "Read only" check-box, the access types "Insert", "Change" and "Delete" will be enabled for archives. For views, only the "Change" check-box will be enabled.
Border	The "Border" check-box defines, if the Control window is displayed with or without a frame.
Form	The "Form" check-box defines, if the form view is the initial view of the Control window.

The Package Browser

The "Select" button in the properties dialog box of the "User Archives Table Control" activates the Package Browser. This browser displays the already configured archives and views.



In a multi-client project, the navigation field of the "Package Browser" dialog box allows you to select those servers from which packages have been loaded and on which a User Archive with tags has been configured. In a multi-client project, the archives of all servers in the project can be accessed. User Archives on the multi-client itself have not been planned. The "Hierarchy" field displays the path to the selected server. This field can be edited, giving you the option to manually enter the desired server.

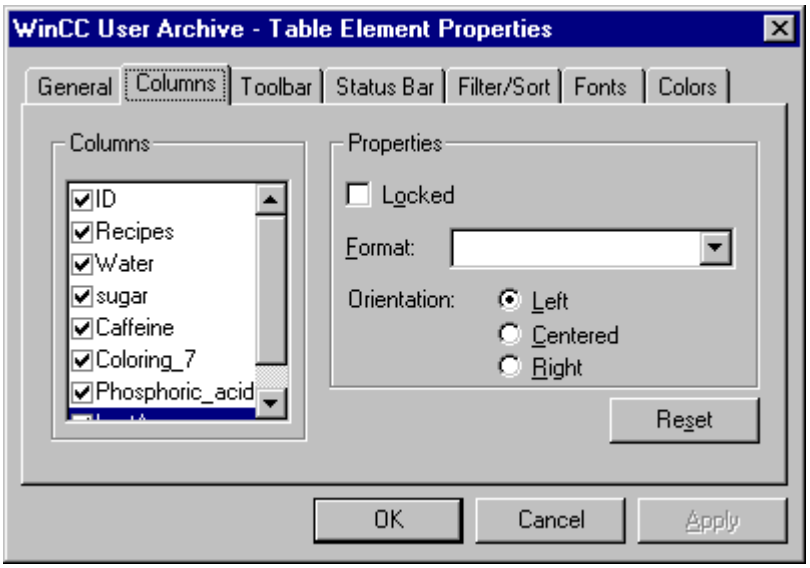
If a required server is not included in the server list, a package of this server must be loaded first using the "Load" server data function. For additional information about the Multi-Client Functionality, please refer to the help in the Control Center.

Note

If the Control is not connected to an existing archive or view, the error message "Error while connecting the data!" will be displayed if runtime is activated.

For projects of WinCC V4.02 and V4.02SP1, the "User Archives Table Control" must be converted to the WinCC V5.0 format. To do so, double-click on the Table Control in the Graphics Designer and again assign the archive or view using the Package Browser. Save and close the screen. The next time the screen is opened in the Graphics Designer, the Table Control will be connected to the archive/view.

"Columns" Tab

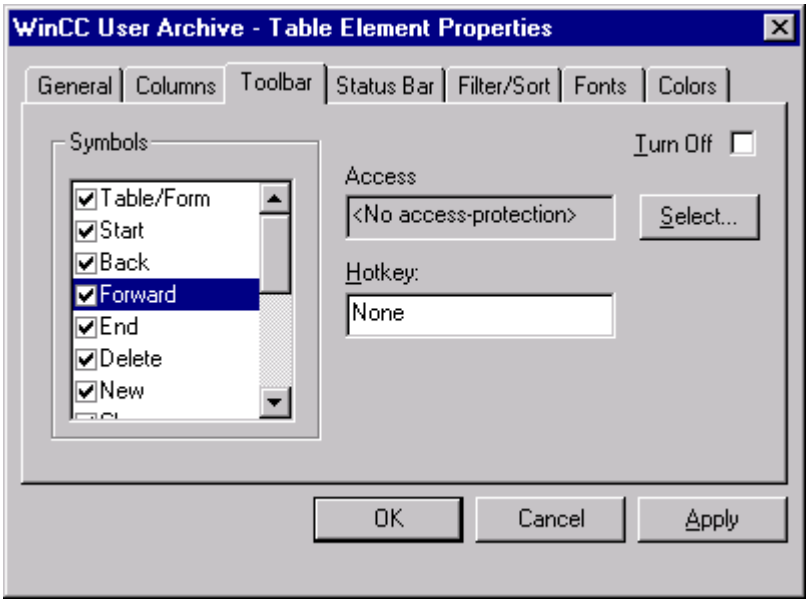


Field	Description
Columns	In the "Columns" field, the fields - created in the User Archives Editor - to be displayed in the process screen are selected.
Properties	The "Properties" field allows you to define the properties of the currently selected "Columns" field.
Locked	The "Locked" check-box allows you to write-protect the selected field.
Format	In the "Format" field, the value display is defined: Fixed (fixed-point number "%.2f") Scientific (exponential display "%e") Date (only output of date "%x") Time (only output of time "%X") TimeStamp (output of data and time "%c") The display of a date field follows the format set in the operating system.
Orientation	The "Orientation" can either be "Left", "Centered" or "Right".
Reset	The "Reset" button restores the previous settings.

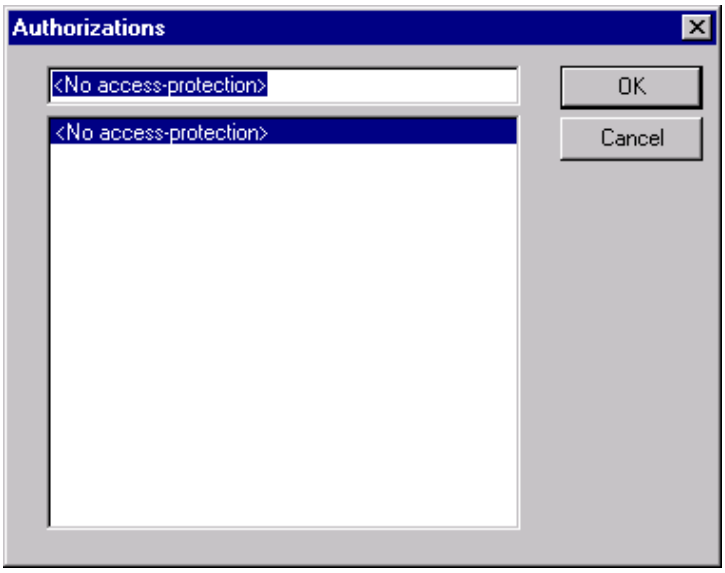
Note

In the "Format" field, the number of decimal places (e.g. "%3f" for three decimal places) or the hexadecimal format "%x" for integer values can be set.

"Toolbar" Tab

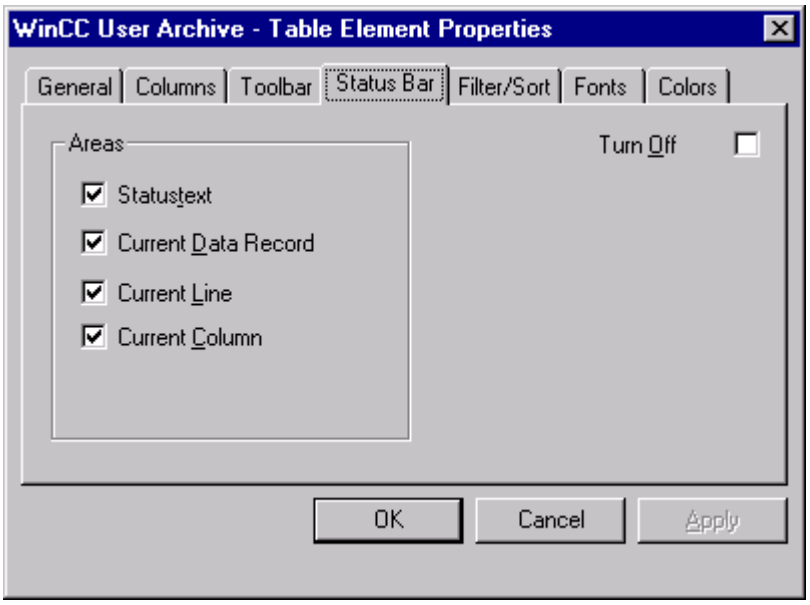


Field	Description
Icons	The "Icons" check-boxes allow you to select the icons of the Control's toolbar.
Access	The "Access" field displays the access rights of the selected icon.
Select	Clicking on the "Select" button will display the "Authorization Levels" dialog box, in which you can set the desired access.
Turn Off	The "Turn Off" check-box allows you to turn the toolbar on or off.
Hotkey	In the "Hotkey" field, hotkeys can be assigned to the individual functions.



In the "Authorization Levels" dialog box, the desired access can be defined. The entries in this dialog box were previously set in the User Administrator.

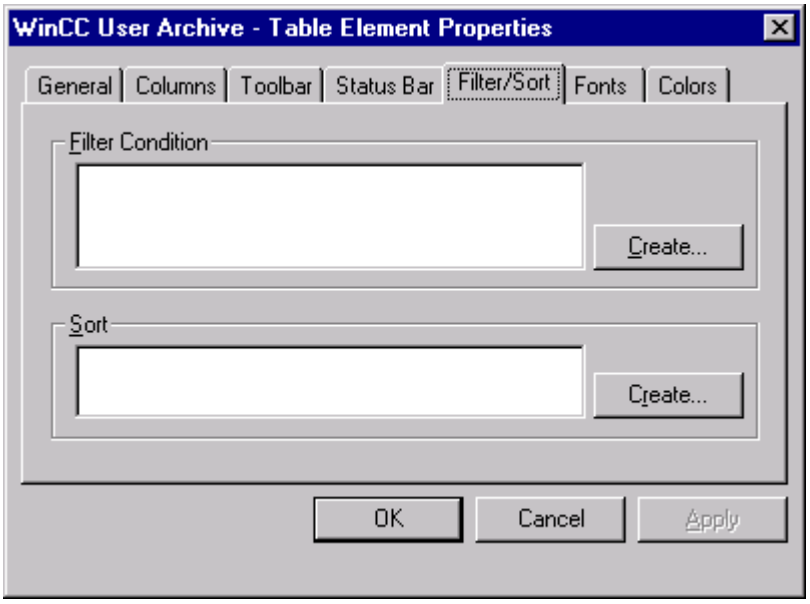
"Status Bar" Tab



Field	Description
Areas	The "*Areas*" check-boxes allow you to select the elements of the Control's status bar.
Turn Off	The "*Turn Off*" check-box allows you to turn the status bar on or off.

If all areas of the status bar have been activated, the status bar will look as follows:

"Filter/Sort" Tab

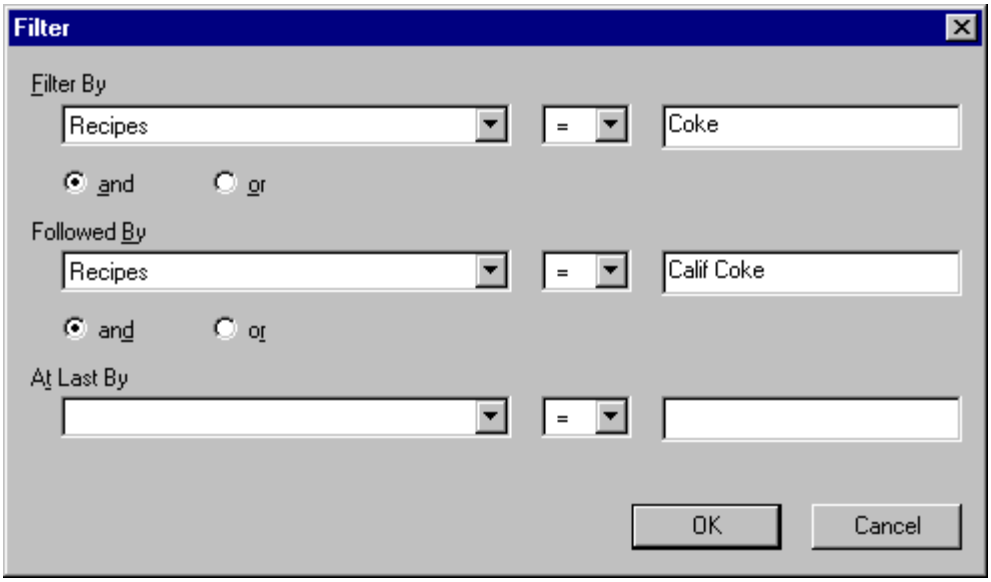


Filter Condition

In the "Filter Condition" field, the filter conditions are defined. Enter the rules for the filter conditions directly. These conditions are formulated using the database programming language SQL (Structured Query Language). The appendix contains a Description of SQL Statements, including several practical examples.

Example: FieldC > 100
All data records in the "FieldC" column containing values greater than 100 are selected.

Clicking on the "Create..." button will display a filter dialog window, in which you can define the filter conditions.



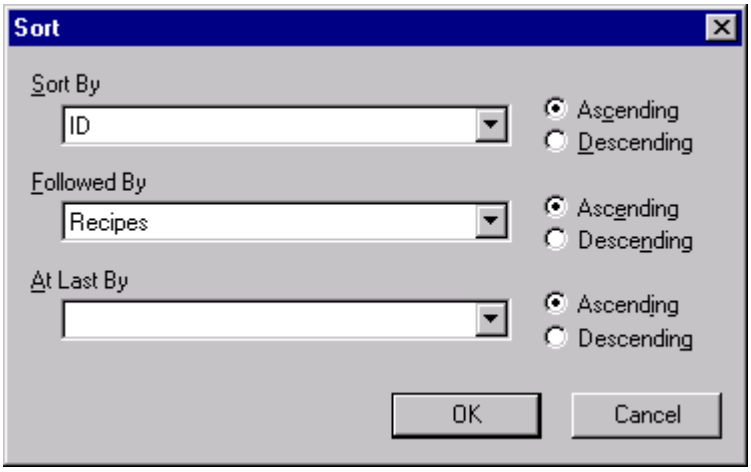
In the "Filter By" line, the filter criteria can be defined (the left list-box contains all data fields of the archive). The "Followed By" and "At Last By" lines allow you to define subsequent filter conditions. The filters will be processed in this order.

Sort

In the "Sort" field, the sort conditions are defined. Enter the sorting rules directly using the database programming language SQL.

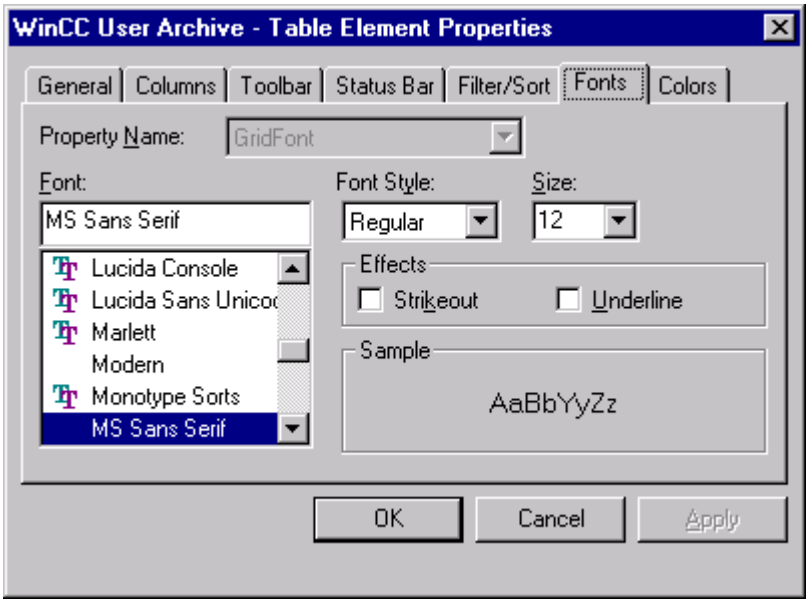
See Description of SQL Statements

Clicking on the "Create..." button will display a sort dialog window, in which you can define the sort conditions.



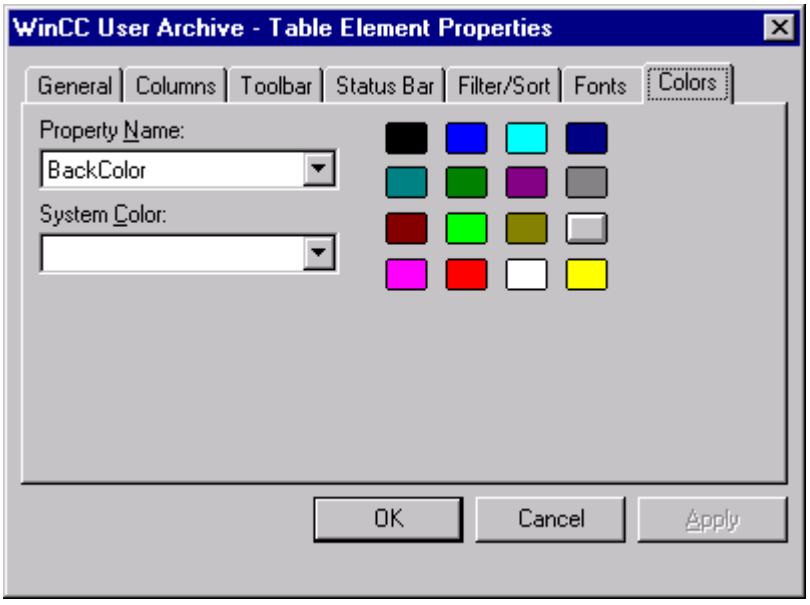
In the "Sort By" field, the sort criteria can be defined (the list-box contains all data fields of the archive). The "Followed By" and "At Last By" list-boxes allow you to define subsequent sort conditions. The sort conditions will be processed in this order. You can sort in "Ascending" and "Descending" order.

"Fonts" Tab



In the "Fonts" tab, the font used by the Control is defined.

"Colors" Tab

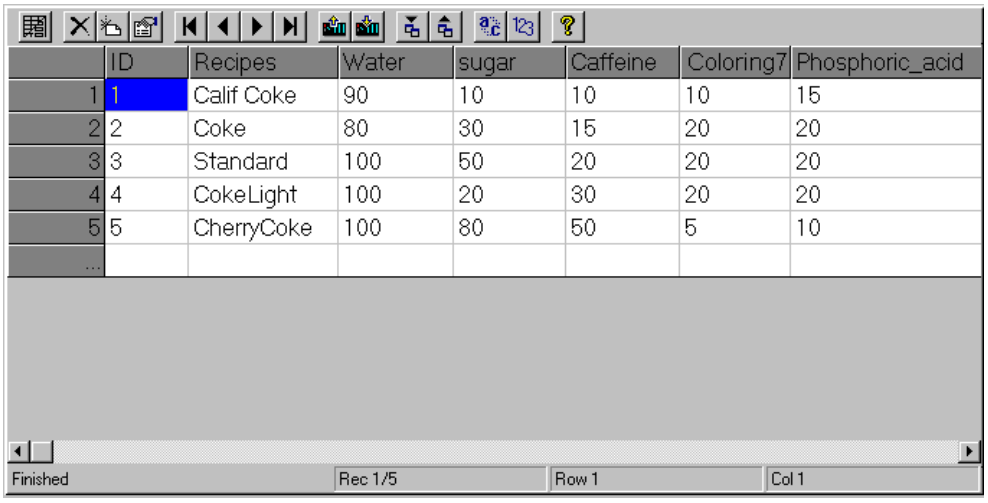


In the "Colors" tab, the colors used by the Control are defined.

3.4 User Archives Control in Runtime

3.4.1 The Table of the User Archives Control

The table of the User Archives Control displays the User Archives data in runtime (in tabular form).



	ID	Recipes	Water	sugar	Caffeine	Coloring7	Phosphoric_acid
1	1	Calif Coke	90	10	10	10	15
2	2	Coke	80	30	15	20	20
3	3	Standard	100	50	20	20	20
4	4	CokeLight	100	20	30	20	20
5	5	CherryCoke	100	80	50	5	10
...							

Finished | Rec 1/5 | Row 1 | Col 1

The table and form windows of the User Archives Table Control are operated with this toolbar:

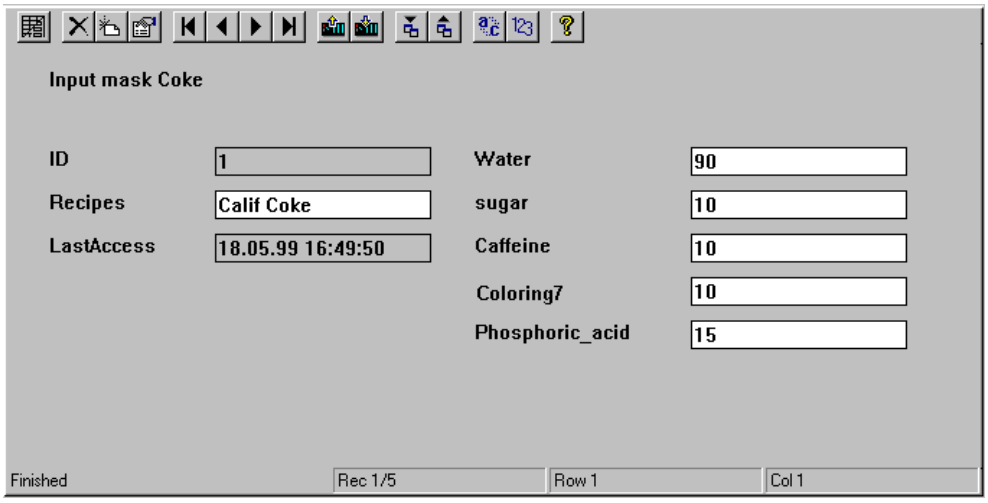
Editing within the table is performed in the same manner as the editing in the Table Window of the des User Archives Editor.

Note

If one or more values are changed in a Control table, you must exit the data record (by clicking on another table cell or row) after making the entry in order for the value to be accepted into the database and be updated in all displays.
User Archives Scripts must be able to select data records for themselves. A selection of data records through the User Archives Control is not possible.

3.4.2 The Form of the User Archives Control

The form of the User Archives Control can be user-defined in the Graphics Designer and is utilized for entering and displaying the User Archives data in runtime.



Note

If one or more values are changed in the User Archive Control form, you must click on another data record after making the entry in order for the value to be accepted into the database and be updated in all displays.

3.4.3 The Toolbar of the User Archives Control

The toolbar offers the following operating options:

Icon	Description
	Switch
	Delete a data record
	Create a new data record
	Edit an existing field
	Page through the table window
	Read or write from tags
	Import/export archives
	Define filter conditions
	Define sort conditions
	Request help

Switch

This icon allows you to switch between the form and table views.

Delete a data record

Deletes the highlighted data record.

Create a new data record

Sequentially enter values into the data fields and confirm each entry by clicking on this icon. After entering all data fields, the data record with the entered values will be created.

Edit an existing field

After clicking on this icon, click on the field you want to edit. This will display the cursor, signaling the editability of this field. As long as the "Edit an existing field" icon is active, the User Archives Control is in the "Edit" mode. This means that you can move the cursor in the table and make changes immediately. If the "Edit" mode is turned off, changes can only be made after pressing the F2 key or double-clicking on the field to be changed.

Page through the table window

These buttons allow you to page forward/backward in the table window and to jump to the beginning/end of the archive.

Read or write from tags

These buttons allow you to read and write from WinCC tags.

While configuring the archive in the "Archive Properties" dialog box of the "Communication" tab, the communication type Communication via WinCC Tag can be selected.

Import/export archives

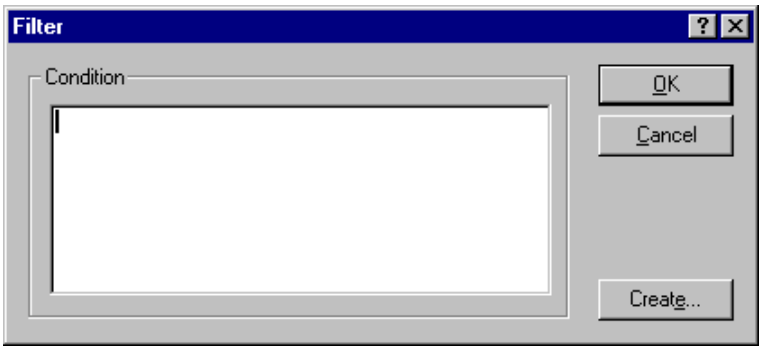
Clicking on these icons imports/exports User Archives in the CSV (Coma Separated Value) format.
Warning! Before exporting to Excel, the CSV file type must be specified in order for the exported WinCC CSV file to be read correctly.

Note

In a client-server project, note the following: If an archive exists on the server, for example at "c:\Projects\Test\UA", the archive will be enabled using this path. On the client's side, the archive will be enabled by mapping a network drive, for example "I:\Test\UA". Accordingly, the default path of this archive on the client is "I:\Test\UA". However, this folder does not exist on the server under this path. If you want to import/ export this archive, the client's default path must be changed, in our example to "C:\Projects\Test\UA".

Define filter conditions

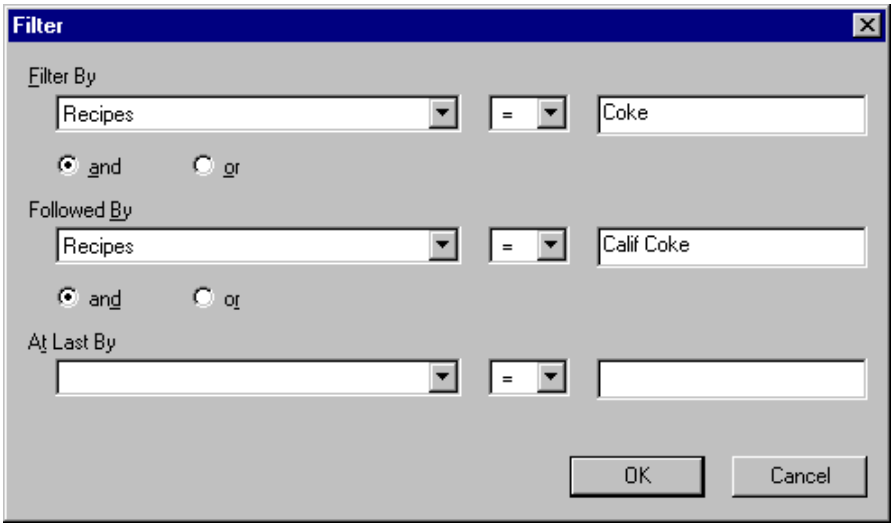
This option allows you to define of filter conditions. All displayed data will be exported - if you only want to export a partial set, you must formulate filter conditions that will only allow the display of the desired data. You can then export the filtered data.



The filter conditions are formulated using the database programming language SQL (Structured Query Language). The appendix contains a Description of SQL Statements, including several practical examples. Additional information can be obtained from appropriate literature.

Example: ID < 100
Only data fields with IDs ranging from 1 to 99 will be selected, all other data fields will not be displayed.

Clicking on the "Create..." button will display a filter dialog window, in which you can define the filter conditions.



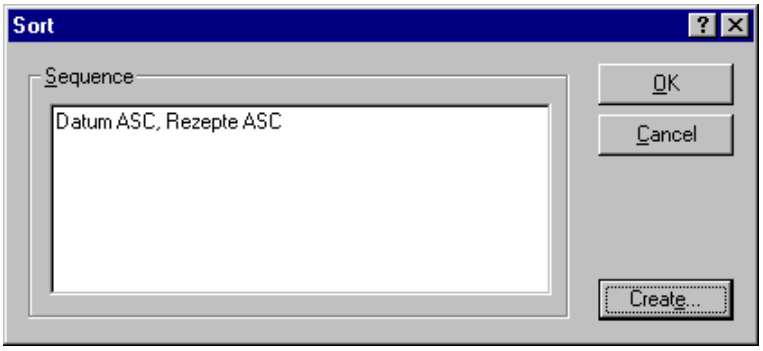
In the "Filter By" line, the filter criteria can be defined (the left list-box contains all data fields of the archive). The "Followed By" and "At Last By" lines allow you to define subsequent filter conditions. The filters will be processed in this order.

Note

The filter conditions defined in here are only temporary, i.e. after a new screen is generated, the filter criteria defined in the properties dialog box will apply again.

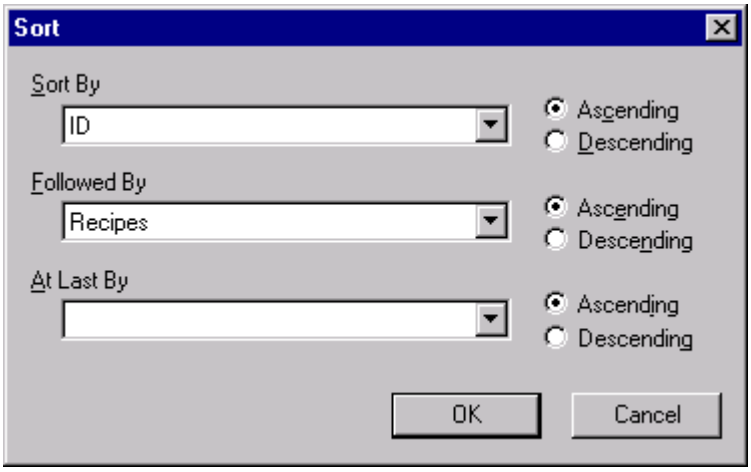
Define sort conditions

This option allows you to define sort conditions.



Enter the sorting rules directly using the database programming language SQL.
See also the Description of SQL Statements in the appendix. Additional information can be obtained from appropriate literature.

Clicking on the "Create..." button will display a sort dialog window, in which you can define the sort conditions.



In the "Sort By" field, the sort criteria can be defined (the list-box contains all data fields of the archive). The "Followed By" and "At Last By" list-boxes allow you to define subsequent sort conditions. The sort conditions will be processed in this order. You can sort in "Ascending" and "Descending" order.

Note

The sort conditions defined in here are only temporary, i.e. after a new screen is generated, the sort criteria defined in the properties dialog box will apply again.

Request help

Click on this icon to request help for the User Archives Control.

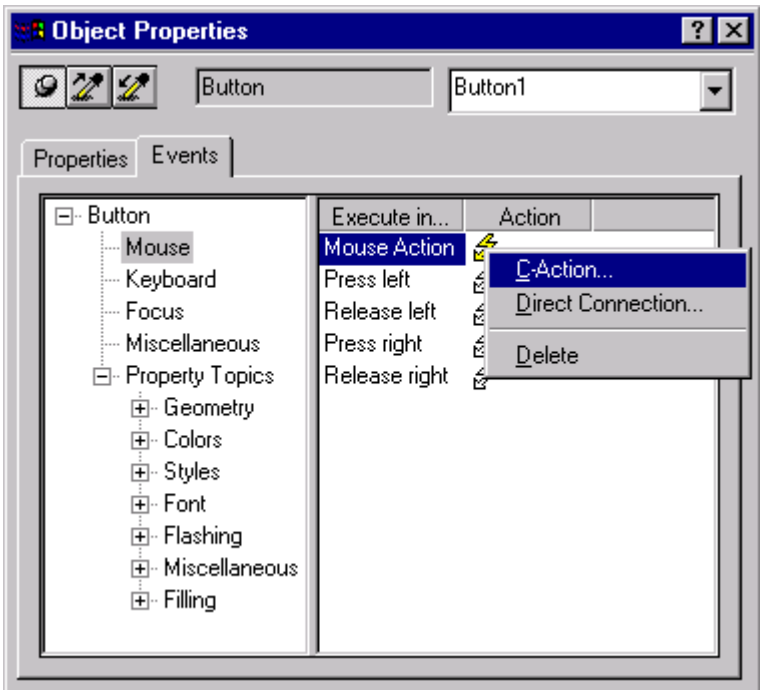
3.4.4 Operation of the Control via Dynamic Objects

The User Archives Table Control allows you to connect all buttons of the toolbar to user-defined buttons or I/O fields. This allows you to define the size and appearance of each button to, for example, operate the Table Control from a Touch Screen.

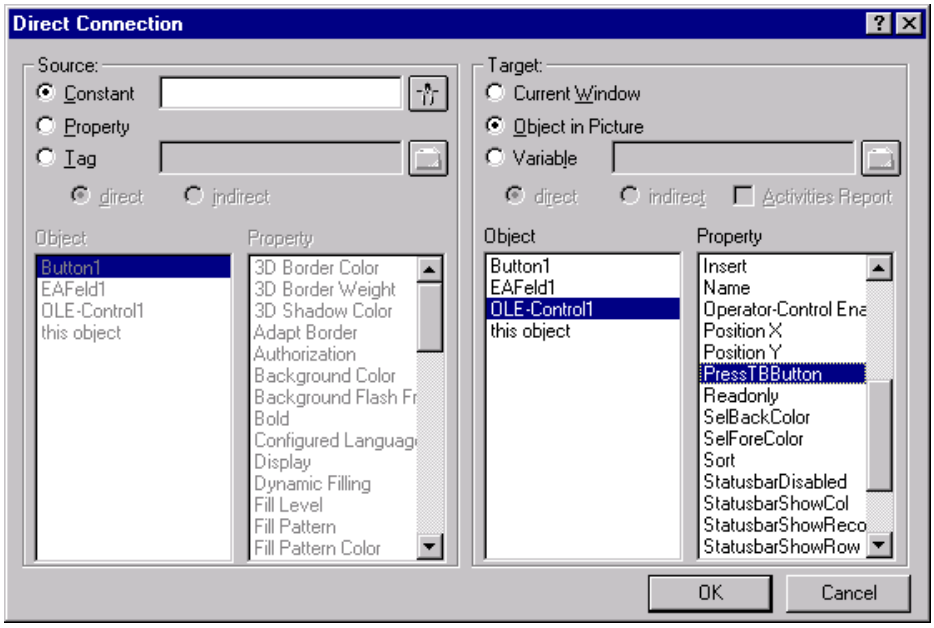
Example: Using the "Press TB Button" Property

To establish a connection of the User Archives Table Control to a button, perform these steps:

1. In the Graphics Designer, create a button and display its object properties (by right-clicking on the button and selecting "Properties" from the pop-up menu).
2. In the "Events" tab, select the "Mouse" option. In the right side of the tab, select execute in the case of a "Mouse Action". Right-click on the arrow in the "Action" column and select "Direct Connection" from the pop-up menu.



3. In the "Source" area, activate the "Constant" radio-button and enter a constant, e.g. "Form" (an overview of the constants available for the User Archives Table Control is provided below). In the "Target" area, activate the "Object in Screen" radio-button and select the Table Control to be connected from the "Object" list. Select "Press TB Button" from the "Property" list and confirm all settings made by clicking on "OK".



4. Save the Graphics Designer screen and activate runtime. If you now click on the configured "Form" button, the display of the Table Control will switch from the table view to the form view and vice versa.

The Constants for a Direct Connection to the User Archives Table Control

For the above direct connection of the User Archives Table Control, a constant is available for each button of the Control. The assignment of the individual buttons is listed in the following table:

Constant	Associated Button
Form	
Delete	
New	
Edit	
First	
Previous	
Next	
Last	
ReadTag	
WriteTag	
Import	
Export	
Filter	
Sort	
Help	

Note

If the table window is operated with a keyboard, the cell cursor in the selected data record cell will become invisible after hitting the "TAB" or "Position 1" key. To jump back to the last edited data record, create a button, following the steps outlined above, using the constant "VTB_Focus". By clicking on this button, the cell cursor will jump back to its last position.

4 Standard Script Functions

The description of the standard script functions is divided into the following sections:

- General Information about Action Scripts
- Script Functions of the User Archives
- Handles of the Script Function
- A practical Example containing Script Functions
- Reference for the Standard Functions of the User Archives
- A detailed description of the User Archives functions can be found in the WinCC User Archives online help.

WinCC offers a number of script functions to allow the user a flexible utilization of the User Archives.

The script functions of the User Archives follow uniform name conventions. All User Archives script functions start with "ua", for example "uaConnect", "uaArchiveOpen", uaArchiveGetFields", etc. User Archives Runtime functions always start with "uaArchive".

The User Archives functions are divided into configuration and runtime functions. Handles are required for the configuration and runtime functions, which are returned by the previously called functions "uaQueryConfiguration", "uaConnect" and "uaOpen".

Note

User Archives scripts must be able to select data records for themselves. A selection of data records via the User Archives Table Control is not possible.
If a program has opened a User Archive and a record is added or deleted via a Control or the User Archives Editor, that program will not be informed about the change. Only after a requery will the changes be known to the program.

4.1 Creation of Action Scripts

To configure an action script (action), follow these steps:

1. Open the Graphics Designer and create a plant screen.
2. Right-click on the object, for which an action (e.g. button) should be added.
3. Select "Properties" from the pop-up menu.
4. Select the element from the "Properties" or "Events" tab and double click on the desired action (e.g. to configure an action for the "Press Left" mouse action, select "Events/Mouse/Press left"). In the following dialog box, the C-Code can be entered directly and then be compiled.
5. Click on the "OK" button to complete the configuration of the action.

4.2 Script Functions of the User Archives

Configuration using the User Archives Editor

The first step is the configuration of the User Archives. The configuration can be carried out with the User Archives Editor or the User Archives Script Functions.

Configuration using the User Archives Script Functions

The "uaQueryConfiguration" function provides a handle (UAHCONFIG) for the configuration functions. With this handle, the "uaSetArchive", "uaAddArchive", "uaSetField", "uaAddField", etc. configuration functions can be called. The "uaReleaseConfiguration" function ends the configuration of the User Archives.

Establishing a Connection to the User Archives

For the access in runtime, the *uaConnect* standard function must be called to establish a connection to the User Archives component. "uaConnect" generates the "UAHCONNECT" handle, which allows archives and views to be opened. The "uaDisconnect" function terminates the connection to the User Archives.

Opening Runtime Functions

For the runtime operation, a configured User Archive is required. The "uaQueryArchive" and "uaQueryArchiveByName" functions provide a handle for the runtime functions. After opening the archive with the "uaArchiveOpen" function, the User Archives runtime functions can be used.

Functions for the Runtime Operation

The "uaArchiveNext", "uaArchivePrevious", "uaArchiveFirst" and "uaArchiveLast" functions move the pointer. A unique assignment to a data record of the User Archive is generated via the "hArchive" handle. This assignment also allows indirect addressing, as required by the screen dialog boxes.

The "uaArchiveUpdate" function stores the temporary data record in the archive and overwrites the data record to which the pointer is currently pointing. This data record must previously be read by the "uaArchiveNext", "uaArchivePrevious", "uaArchiveFirst" or "uaArchiveLast" functions.

Terminating the Connection to the User Archives

The "uaArchiveClose" function closes a User Archive. The "uaReleaseArchive" function terminates the connection to the to the current archive and the "uaDisconnect" function terminates the connection to the User Archives component.

Function for Establishing a Connection	Function for Terminating a Connection
UaQueryConfiguration	uaReleaseConfiguration
UaConnect	uaDisconnect
uaQueryArchive	uaReleaseArchive
uaQueryArchiveByName	uaReleaseArchive
uaArchiveOpen	uaArchiveClose

Note

The connections to the User Archives established in a script must also be terminated again in that script.

For the User Archives, there are two forms of API calls:

1. With the prefix "ua" (lower case letters) for scripts (Global Script and action programming).

2. With the prefix "UA" (upper case letters) for programs that run outside of WinCC.
If the calls for the User Archives are used in a Dynamic Wizard, they must be preceded by the prefix "UA" (upper case letters).

4.3 Handles of the Script Functions

4.3.1 Handles for the Configuration of User Archives

The "uaQueryConfiguration" User Archives script function generates the "UAHCONFIG" handle, which is required for the configuration of the User Archives. This means that the "uaQueryConfiguration" function must be called first in order to receive the "UAHCONFIG" handle. This handle then allows you to call the configuration script functions listed below. Finally, to complete the configuration, "uaReleaseConfiguration" must be called.

Handles for the Configuration of User Archives	
UaQueryConfiguration	---> Handle UAHCONFIG
	required by:
	uaAddArchive
	uaAddField
	uaGetArchive
	uaGetField
	uaGetNumArchives
	uaGetNumFields
	uaReleaseConfiguration
	uaRemoveAllArchives
	uaRemoveAllFields
	uaRemoveArchive
	uaRemoveField
	uaSetArchive
	uaSetField

4.3.2 Handles for Runtime Archive Functions

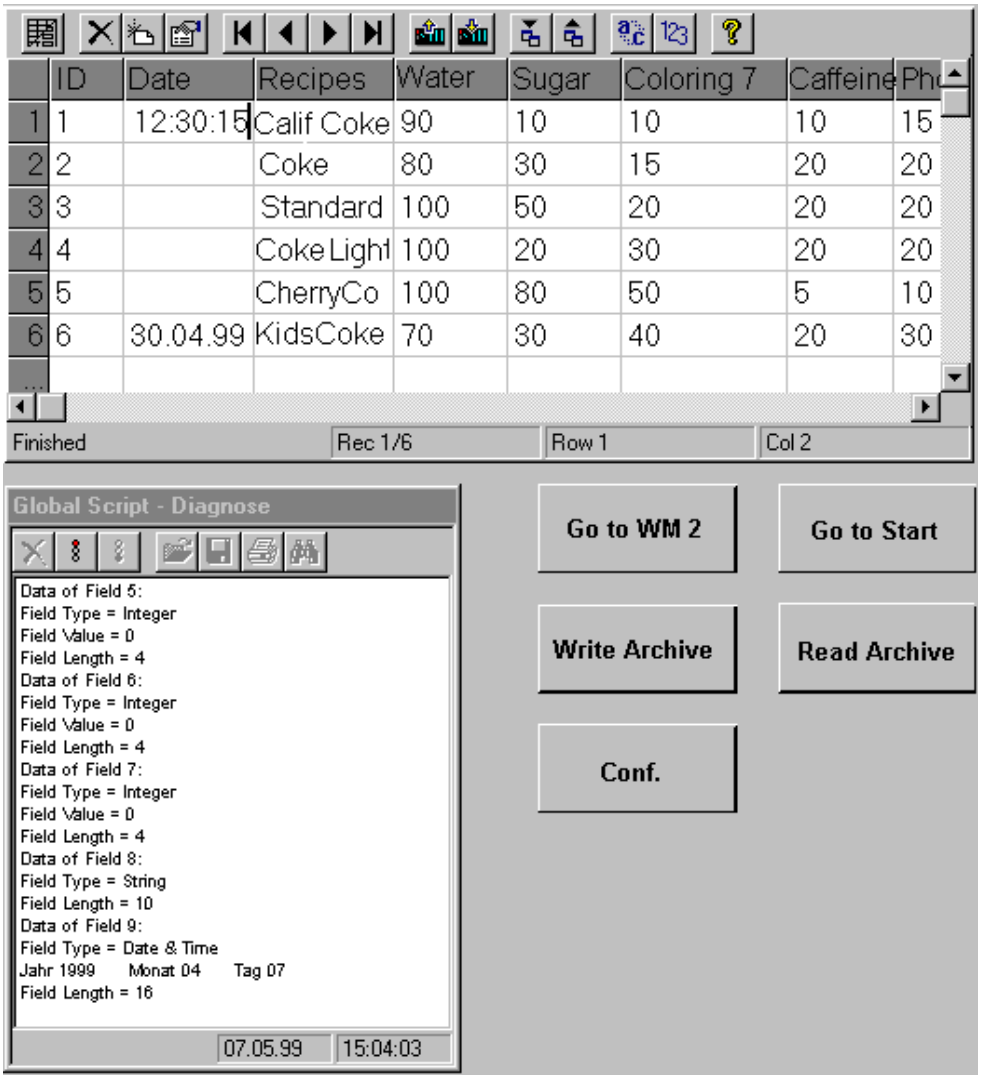
The "uaConnect" User Archives function generates the "UAHCONNECT" handle, which is required for opening and closing archives and views. This means that the "uaConnect" function must be called first in order to receive the "UAHCONNECT" handle. This handle then allows you to call the script functions listed below for opening and closing archives and views. Finally, to complete the configuration, "uaDisconnect" must be called.

The "uaQueryArchive" and "uaQueryArchiveByName" functions generate the "UAHARCHIVE" handle. This handle is required for the "uaArchiveOpen" User Archives script function, which opens the archive for the runtime operation. To terminate the connection, the "uaRelease" and "uaArchiveClose" functions must be called.

Handles for Runtime Archive Functions		
UaConnect	-> Handle UAHCONNECT	
	required by:	
	uaDisconnect	
	uaQueryArchive	--> Handle UAHARCHIVE
	uaQueryArchiveByName	--> Handle UAHARCHIVE
		required by:
		uaArchiveOpen
		Required for:
		uaArchiveClose
		uaArchiveDelete
		uaArchiveExport
		uaArchiveGetFieldLength
		uaArchiveGetFields
		uaArchiveGetFieldType
		uaArchiveGetFieldValueDate
		uaArchiveGetFieldValueDouble
		uaArchiveGetFieldValueLong
		uaArchiveGetFieldValueString
		uaArchiveGetFieldName
		uaArchiveGetFilter
		uaArchiveGetID
		uaArchiveGetName
		uaArchiveGetSort
		uaArchiveImport
		uaArchiveInsert
		uaArchiveMoveFirst

Handles for Runtime Archive Functions		
		uaArchiveMoveLast
		uaArchiveMoveNext
		uaArchiveMovePrevious
		uaArchiveReadTagValues
		uaArchiveReadTagValuesByName
		uaArchiveRequery
		uaArchiveSetFieldValueDate
		uaArchiveSetFieldValueDouble
		uaArchiveSetFieldValueLong
		uaArchiveSetFieldValueString
		uaArchiveSetFilter
		uaArchiveSetSort
		uaArchiveUpdate
		uaArchiveWriteTagValues
		uaArchiveWriteTagValuesByName
		uaReleaseArchive

4.4 Example containing Script Functions



The following is an example of two standard functions for reading and writing a User Archive in runtime. The "UAReadFromArchive" function reads the "Coke" archive and displays the data read in the "WinCC Global Script Diagnostics Control" window. The "UAWriteToArchive" function writes to the archive and displays states and messages. The diagnostics window is created by placing an OLE Control (from the Object Palette -> Smart Objects) in the Graphics Designer and then selecting the "WinCC Global Script - Diagnostics Control" from the "Insert OLE Control (OCX)" dialog box.

In the Graphics Designer, create a new screen for your project. In this screen, create the "Read Archive" and "Write Archive" buttons and add the script functions listed below. The procedure is as follows:

1. In the Graphics Designer, select "Button" from the "Object Palette" -> "Windows Objects".
2. Place the button in the Graphics Designer and drag it to size while keeping the mouse button pressed.
3. Right-click on this newly created button and select "Properties" from the pop-up menu. In the "Properties" tab, the button label (text) and color can be defined. The labels, for example, could read "Read Archive" and "Write Archive".
4. In the "Events" tab, add an action to the mouse by selecting "Mouse" and then double-clicking on "Mouse Action". This will display the script editor. Enter the "UAReadFromArchive" standard script function listed below:

```
#include "apdefap.h"

void UAReadFromArchive()
{
        UAHCONNECT      hConnect;
        UAHARCHIVE      hArchive;
        LONG            IndexArchive;
        LONG            FieldLength;
        LONG            FieldType;
        LONG            NumberOfFields;
        LONG            Index;
        long            IntValue;
        double          DoubleValue;
        char            ArchiveName[255], StringField[255];
        SYSTEMTIME      SysDate;

//*******     Connect to User Archives Component ****************************
        if   ( uaConnect( &hConnect ) == FALSE )
        {
                printf( "uaConnect error: %d\n", "uaGetLastError()" );
                return;
        }
        if   ( hConnect == NULL )
        {
                printf( "Handle UAHCONNECT equals NULL\n" );
                return;
        }

//*******     Connect to Archive via Archive Name ****************************
        if  (  uaQueryArchiveByName( hConnect, "Chili", &hArchive ) == FALSE )
        {
                printf( "uaQueryArchive Error: %d\n", "uaGetLastError()" );
                return;
        }
```

```
//*******      Open Archive
*********************************************************
        if  (  uaArchiveOpen( hArchive ) == FALSE )
        {
                printf( "uaArchive Open Error\n" );
                return;
        }
//*******      Get Number of Fields
***********************************************
        NumberOfFields = uaArchiveGetFields( hArchive );
        printf( "Number of Fields = %u\n", NumberOfFields );
//*******      Read and show Data Fields
****************************************
        for  ( Index = 1; Index < NumberOfFields; Index++ )
        {
                printf( "Data of Field %u: \n", Index  );
                FieldType = uaArchiveGetFieldType( hArchive, Index );
                switch   ( FieldType )
                {
                        case  UA_FIELDTYPE_INTEGER :
                                printf("Field Type = Integer\n");
                                if   ( uaArchiveGetFieldValueLong (
                                        hArchive, Index, &IntValue ) == TRUE )
                                        printf( "Field Value = %u\n", IntValue );
                                else
                                        printf(
                                                "Error callinguaArchiveGetFieldValueLong:
                                                        %d\n", uaGetLastError() );
                        break;
                        case  UA_FIELDTYPE_DOUBLE :
                                printf("Field Type = Double\n");
                                if     ( uaArchiveGetFieldValueDouble (
                                                hArchive, Index, &DoubleValue ) == TRUE )
                                        printf( "Field Value = %g\n", DoubleValue );
                        else
                                printf
                                        ( "Error calling uaArchiveGetFieldValueDouble:
                                                %d\n", uaGetLastError() );
                        break;
```

```
                case  UA_FIELDTYPE_STRING :
                        printf("Field Type = String\n");
                        if   ( uaArchiveGetFieldValueString (
                                hArchive, Index, StringField, 20 ) == TRUE )
                                printf( "Field Value = %s\n", StringField );
                        else
                                printf
                                        ( "Error callinguaArchiveGetFieldValueString:
                                                %d\n", uaGetLastError() );
                break;

                case  UA_FIELDTYPE_DATETIME :
                        printf("Field Type = Date & Time\n");
                                if   ( uaArchiveGetFieldValueDate ( hArchive,
                                        Index, &SysDate ) == TRUE )
                        printf( "%d.%d.%d\n ",
                                SysDate.wDay, SysDate.wMonth, SysDate.wYear,  );
                else
                        printf
                                ( "Error calling uaArchiveGetFieldValue
                                        Long: %d\n", "uaGetLastError()" );
                break;

                case  -1 :
                default   :
                        printf( "Error executing uaArchiveGetFieldType\n");
        }

//*******      Read and show Field Length ***************************************
        FieldLength = uaArchiveGetFieldLength( hArchive, Index );
        if   ( FieldLength != -1 )
                printf( "Field Length = %u\n", FieldLength );
        else
                printf( "Error executing uaArchiveGetFieldLength\n");
        }
```

```
//*******      Close Archive
*********************************************************
        if   ( uaArchiveClose ( hArchive ) == FALSE )
        {
                printf( "error on closing archive\n" );
                return;
        }

//******       Release Connection to Archive
**************************************
        if   ( uaReleaseArchive ( hArchive ) == FALSE )
        {
                printf( "error on releasing archive\n" );
                return;
        }

//*******      Disconnect User Archives Component *************************
        if   ( uaDisconnect ( hConnect ) == FALSE )
        {
                printf( "error on disconnection\n" );
                return;
        }
}
```

Create a second button for writing to the archive. Follow the procedure of the first button. This time, name the standard script function "UAWriteToArchive" and enter the following script code:

```
void UAWriteToArchive()
{
        UAHCONNECT              hConnect;
        UAHARCHIVE              hArchive;
        LONG                    IndexArchive;
        LONG                    FieldLength;
        LONG                    FieldType;
        LONG                    NumberOfFields;
        LONG                    Index;
        long                    IntValue;
        double                  DoubleValue;
        char                    StringField[255];
        SYSTEMTIME              SysDate;
```

```
//*******      Connect to User Archives Component ***************************
        if   ( uaConnect( &hConnect ) == FALSE )
        {
                printf( "uaConnect error: %d\n", "uaGetLastError()" );
                return;
        }
        if   ( hConnect == NULL )
        {
                printf( "Handle UAHCONNECT equals NULL\n" );
                return;
        }
//*******      Connect to Archive via Name ************************************
        if  (  uaQueryArchiveByName( hConnect, "Chili", &hArchive ) == FALSE )
        {
                printf( "uaQueryArchive Error: %d\n", "uaGetLastError()" );
                return;
        }
//*******      Open Archive
*********************************************************
        if  (  uaArchiveOpen( hArchive ) == FALSE )
        {
                printf( "uaArchive Open Error\n" );
                return;
        }
//*******      Get Number of Fields
***********************************************
        NumberOfFields = uaArchiveGetFields( hArchive );
        printf( "Number of Fields = %u\n", NumberOfFields );

//*******      Read Last Data Set
***********************************************
        if   ( uaArchiveMoveLast( hArchive ) == TRUE )
                printf( "Number of Fields = %u\n", NumberOfFields );
        else
        {
                printf( "uaArchiveMoveLast Error: %d\n", "uaGetLastError()" );
                return;
        }
```

```
//*******      Write into Data Fields
*********************************************
        IntValue = 32;
        DoubleValue = 64;
        strcpy( StringField, "Text12" );
        GetSystemTime( &SysDate );

        for  ( Index = 1; Index < NumberOfFields; Index++ )
        {
                printf( "Data of Field %u: \n", Index  );

                FieldType = uaArchiveGetFieldType( hArchive, Index );

                switch   ( FieldType )
                {
                        case  UA_FIELDTYPE_INTEGER :
                                printf("Field Type = Integer\n");
                                        if   ( uaArchiveSetFieldValueLong ( hArchive,
                                                Index, IntValue ) == TRUE )
                                printf( "Field Value = %u\n", IntValue );
                                else
                                        printf( "Error calling uaArchiveSetField
                                                ValueLong: %d\n", "uaGetLastError()" );
                        break;

                        case  UA_FIELDTYPE_DOUBLE :
                                printf("Field Type = Double\n");if   ( uaArchiveSetField
                                        ValueDouble ( hArchive, Index, Double
                                                Value ) == TRUE )
                                printf( "Field Value = %g\n", DoubleValue );
                        else
                                printf( "Error calling uaArchiveSetField
                                        ValueDouble: %d\n", "uaGetLastError()" );
                                                break;
```

```
                    case  UA_FIELDTYPE_STRING :
                        printf("Field Type = String\n");
                            if   ( uaArchiveSetFieldValueString (
                                hArchive, Index, StringField ) == TRUE )
                        printf( "Field Value = %s\n", StringField );
                        else
                        printf
                            ( "Error calling uaArchiveSetFieldValue
                                String: %d\n", "uaGetLastError()" );
                    break;

                    case  UA_FIELDTYPE_DATETIME :
                        printf("Field Type = Date & Time\n");
                            if   ( uaArchiveSetFieldValueDate ( hArchive,
                                Index, &SysDate ) == TRUE )
                        printf( "%d.%d.%d\n ",
                        SysDate.wDay, SysDate.wMonth, SysDate.wYear );
                        else
                        printf
                            ( "Error calling uaArchiveGetFieldValue
                                Long: %d\n", "uaGetLastError()" );
                    break;

                    case  -1 :
                    default   :
                        printf( "Error executing uaArchiveGetFieldType\n");
            }

            FieldLength = uaArchiveGetFieldLength( hArchive, Index );
            if   ( FieldLength != -1 )
                printf( "Field Length = %u\n", FieldLength );
            else
                printf( "Error executing uaArchiveGetFieldLength\n");

        }
```

```
//*******      Close Archive
*****************************************************
        if   ( uaArchiveClose ( hArchive ) == FALSE )
        {
                printf( "error on closing archive\n" );
                return;
        }

//******       Release Connection to Archive
**************************************
        if   ( uaReleaseArchive ( hArchive ) == FALSE )
        {
                printf( "error on releasing archive\n" );
                return;
        }

//*******      Disconnect User Archives Component ***************************
        if   ( uaDisconnect ( hConnect ) == FALSE )
        {
                printf( "error on disconnecting\n" );
                return;
        }
}
```

You can now close the Script Editor and the Graphics Designer and start runtime. Observe the effect of your script functions in the "Global Script Diagnostics Control" window.

4.5 Reference for the User Archives Functions

4.5.1 Reference for the User Archives API Functions

These functions display the last error read in the User Archives and the COM function.

User Archives Function	Description
uaGetLastError	Read last error
uaGetLastHResult	Read last COM error

4.5.2 Reference for the User Archives Configuration Functions

These functions serve for the configuration of the User Archives.

User Archives Function	Description
uaAddArchive	Adds a new archive
uaAddField	Adds a new field
uaGetArchive	Reads the archive configuration
uaGetField	Reads the field configuration
uaGetNumArchives	Finds the number of configured archives
uaGetNumFields	Finds the number of fields
uaSetArchive	Writes the archive configuration
uaRemoveArchive	Deletes an archive
uaRemoveAllArchives	Deletes all archives
uaSetField	Sets the field configuration
uaQueryConfiguration	Establishes a connection to the User Archives configuration
uaReleaseConfiguration	Terminates the connection to the configuration
uaRemoveAllFields	Deletes all fields
uaRemoveField	Deletes a field

4.5.3 Reference for the General Runtime Functions

These functions open and close archives and views for the runtime operation.

User Archives Function	Description
uaConnect	Establishes a Connection to the User Archives, this connection is valid for all archives during runtime
uaDisconnect	If a connection to a User Archive (runtime) exists, it will be terminated
uaGetLocalEvents	Reads local events
uaSetLocalEvents	Sets local events
uaIsActive	Determines, if runtime is active
uaUsers	Finds the number of active connections or active users
uaOpenArchives	Determines the number of open archives
uaOpenViews	Determines the number of open views
uaQueryArchive	Establishes a connection to the archive
uaQueryArchiveByName	Establishes a connection to the archive using the archive name
uaReleaseArchive	Terminates the connection to the archive

4.5.4 Reference for the Archive-Specific Runtime Functions

These functions are used for the application of archives and views in runtime.

User Archives Function	Description
uaArchiveOpen	Establishes a connection to the current archive
uaArchiveClose	Terminates the connection to the current archive
uaArchiveDelete	Deletes a data record from the current archive
uaArchiveExport	Exports the current archive
uaArchiveGetFieldLength	Reads the length of the current field
uaArchiveGetFieldName	Reads the name of the current field
uaArchiveGetFields	Reads the number of fields
uaArchiveGetFieldType	Reads the type of the current field
uaArchiveGetFieldValueDate	Reads date and time and places it in the current data field
uaArchiveGetFieldValueDouble	Reads the "Double" value of the current data field

User Archives Function	Description
uaArchiveGetFieldValueLong	Reads the "Long Int" of the current data field
uaArchiveGetFieldValueString	Reads the "String" of the current data field
uaArchiveGetFilter	Reads the filter of the current data field
uaArchiveGetID	Reads the ID of the current data field
uaArchiveGetName	Reads the name of the current data field
uaArchiveGetSort	Reads the sorting of the current data field
uaArchiveImport	Imports the archive
uaArchiveInsert	Inserts a new data record into the archive
uaArchiveMoveFirst	Goes to the first data record
uaArchiveMoveLast	Goes to the last data record
uaArchiveMoveNext	Goes to the next data record
uaArchiveMovePrevious	Goes to the previous data record
uaArchiveReadTagValues	Reads tag values
uaArchiveReadTagValuesByNam e	Reads tag values based on name
uaArchiveRequery	New Query
uaArchiveSetFieldValueDate	Writes the current data field
uaArchiveSetFieldValueDouble	Writes the "Double" value of the current data field
uaArchiveSetFieldValueLong	Writes the "Long Int" of the current data field
uaArchiveSetFieldValueString	Writes the "Sting" of the current data field
uaArchiveSetFilter	Sets the filter
uaArchiveSetSort	Sets the sort criteria
uaArchiveUpdate	Updates the data record
uaArchiveWriteTagValues	Writes the values of the current data record into a tag
uaArchiveWriteTagValuesByNa me	Writes the values of the current data record into a tag based on name

5 Data Exchange with SIMATIC S5/S7

A data exchange between User Archives and S5 or S7 PLCs can be performed using raw data tags or WinCC tags. All SIMATIC interfaces can be used with the exception of the AS511 programming interface.

The following PLCs can perform data exchanges with WinCC:

- S7-400
- S5 PLC 115U or higher

The following topics will be discussed:

- Data Exchange with S5 and S7 via WinCC Tags
- Data Exchange with S5 and S7 via Raw Data Tags
- Differences in Data Format between WinCC and S5/S7

5.1 Data Exchange via WinCC Tags

The data exchange with S5 and S7 via WinCC tags is very easy to configure. However, it must be ensured that the User Archives only use certain Tag Management data types.

If the "Integer", "Double" or "String" data types are used in the User Archives Editor, the following corresponding data types in the Tag Management of the data manager must be used. For the date/time User Archives data type, no corresponding data type exists in Tag Management.

Selection in the User Archives Editor	Tag Management/WinCC Tag
Number (Integer)	Signed 32-Bit Value
Number (Double)	Floating-Point Number 64-Bit IEEE 754
String	Text Tag 8-Bit Character Set
Date/Time	No corresponding data type

5.2 Data Exchange via Raw Data Tags

The following describes the data exchange via WinCC raw data tags. The raw data tags can be sent by the PLC via an active transmitter. The messages contain one or more requests to the WinCC archive system. These can be write or read request. WinCC will return the requested data and a processing acknowledgment.

This section contains information about the following topics:

- Sending Requests/Data to WinCC
- Sending Processing Acknowledgment/Data to SIMATIC S5 and S7
- Structure of the Message Headers

5.2.1 Sending Requests/Data to WinCC

Structure of the raw data tag for sending requests and data from SIMATIC S5 and S7 PLCs to WinCC:

Message to S5/S7
Message Header
Request Header 1
Data of Request 1
possibly Request Header 2
possibly Data of Request 2
Request n

5.2.2 Sending Processing Acknowledgment/Data to SIMATIC S5 and S7

Structure of the raw data tag for sending processing acknowledgments and data from WinCC to the SIMATIC S5 and S7 PLCs:

Raw Data Tag for Sending to S5 and S7
Processing Acknowledgment
Acknowledgment Header
Acknowledgment Data

5.2.3 Structure of the Message Headers

Structure of the message blocks in detail (breakdown by Bytes):

Function of the Field	Comment
Message Length in Bytes LSB *)	Length of the field is 4 Bytes
.	max. length 4091 Bytes
.	.(because of S5/S7 Transport)
Message Length in Bytes MSB **)	.
Transfer Type	1 from WinCC, 2 from the PLC
Reserved	
Number of Requests in the Message LSB *)	Length of the field is 2 Bytes
Number of Requests in the Message MSB *)	.
Name of the Archive 1st Character	The indication of the name
.	is done in ASCII
.	Length of the field is 8
.	Bytes.
.	.
.	.
Name of the Archive 8th Character	.

*) LSB = Least Significant Byte
**) MSB = Most Significant Byte

5.2.4 The Request Header

Structure of the request header in detail (breakdown by Bytes):

Function of the Field	Comment
Request Length in Byte LSB	Length of the field is 2 Bytes
Request Length in Byte MSB	.
Request Type	see description
Reserved	
Field Number LSB	Length of the field is 2 Bytes
Field Number MSB	.
Data Record Number LSB	Length of the field is 4 Bytes
.	.
Data Record Number MSB	.
Selection Criterion LSB	Field number, according to which the selection is made
Selection Criterion MSB	(not for 0) Length of the field is 2 Bytes

Data of the Request

The data of the request corresponds to the content of a data record (or addressed field).

Important Note

- Text fields are not \0-terminated !!!
- Numbers must be transmitted in the Intel format (first LSB, last MSB).
- An "Integer" field has a length of 4 Bytes, a "Double" field 8 Bytes.
- The data is moved by the length of the field that has been selected as the selection criterion, if the selection criterion has a value unequal to 0.
- If the selection criterion is used, the beginning of the data area will be used as the selection value in the field size of the selection criterion.

Acknowledgment Header

Structure of the acknowledgment header in detail (breakdown by Bytes):

Function of the Field	Comment
Message Length in Bytes LSB	Length of the field is 4 Bytes
.	.
.	.
Message Length in Bytes MSB	.
Transfer Type	1 from WinCC, 2 from the PLC
Reserved	
Request Type	see description
Reserved	
Reserved	
Field Number LSB	Length of the field is 2 Bytes
Field Number MSB	.
Data Record Number LSB	Length of the field is 4 Bytes
.	.
.	.
Data Record Number MSB	.
Name of the Archive 1st Character	The indication of the name
.	is done in ASCII
.	Length of the field is 8 Bytes
.	.
.	.
.	.
.	.
Name of the Archive 8th Character	.

Data of the Acknowledgment

The acknowledgment either contains the data record, the addressed field (for a read request) or is empty (write request, archive request).

Description of the Request Types

Type	Description
4	Test archive for presence
5	Delete all data records from the archive
6	Read data record
7	Write data record
8	Delete a data record
9	Read data record field
10	Write data record field

Description of the Error Codes

Group	Number	Description
General	0	Function has been executed
Archive	1	Invalid data
Archive	2	Data not available
Data Record	101	Invalid data
Data Record	102	Data not available
Field	201	Invalid data
Field	202	Data not available
General	254	Function not available
General	255	Undefined error

5.3 Data Format Differences between WinCC and S5/S7

The WinCC data formats generally differ from the data formats of the SIMATIC S5/S7 PLCs. This must be taken into consideration to avoid errors.

In WinCC, the data formats of Intel and Microsoft are adhered to, where the "Least Significant Byte" is generally stored first and the "Most Significant Byte" last. This data format is widely used and generally known as the "Intel Format". The following example illustrates the "Intel Format":

Intel Format

In the "Intel Format", the decimal number 300 is stored as follows:

Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Binary	0	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0
Hex	0				1				2				C			

The decimal number 300 in the Intel format corresponds to the hex number 12C (1*256 2*16 12).

SIMATIC Format

In the SIMATIC format, the "Least Significant Byte" is stored at the more significant place (moved by 1). In the "SIMATIC Format", the decimal number 300 is stored as follows:

Bit	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Binary	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1
Hex	2				C				0				1			

The decimal number 300 in the SIMATIC format corresponds to the hex number 2C01. If 2C01 is erroneously interpreted following the Intel format, the resulting decimal number would be 11265, a considerable deviation.

For the SIMATIC PLCs, function blocks are available which can perform data conversions. These function blocks should always be called before and after a data transfer between the S5/S7 and WinCC. The function blocks can be downloaded from the Siemens Customer Support Internet site (http://www.ad.siemens.de/support/html_00/download/s5-ag135.htm#.._download_s5-ag135_angps5_3.htm). Download the compressed "ANSI_S5.EXE" file. "ANSI_S5.EXE" contains the "IEEE:GP" function block.

Active sending is described in the reference manuals of the PLCs and CPs (Communication Processors).

6 Appendix

The appendix covers the following topics:

- SQL statements for specifying sort and filter criteria of User Archives
- Alphabetical list of SQL keywords; they must not be used as archive or field names in User Archives
- Specifications, especially the write and read performance of tags and the performance of the screen opening times
- Note the Following

6.1 The SQL Language

SQL (Structured Query Language) is a powerful and widely used database language. In the WinCC script functions, the SQL language is used for database tasks. For additional information, please consult the appropriate references.

For some User Archives Editor and script functions, conditions specifying the data records to be processed must be given in the SQL database language. The following provides you with examples on the usage of SQL statements:

- FieldA > '1992-12-31 23:45:12.12'
  This statement selects all data records in the "FieldA" column whose values are greater than specified. "FieldA" is of the "DB_TYPE_TIME" data type.
- FieldB like 'Tank%'
  Selects the data records in the "FieldB" column containing the "Tank1", "Tank4" and "Tank12" values. "FieldB" is of the "DB_TYPE_CHAR" data type.
- FieldC > 100
  This condition selects all data records in the "FieldC" column containing values greater than 100. "FieldC " is of the "DB_TYPE_INTEGER" data type.
- BETWEEN FieldC = 20 AND Field C = 200
  This statement selects all data records in the "FieldC" column whose values are between 20 and 200. "FieldC " is of the "DB_TYPE_INTEGER" data type.
- FieldD
  Sorts by column "FieldD".
- FieldE desc
  Sorts by column "FieldE" in reverse alphabetical order (descending order).

6.2 Alphabetical List of SQL Keywords

Archive, view and field names must only consist of letters, numbers and underscores ("_") and must not be longer than 25 characters. The first character must always be a letter.

The following terms must not be used as archive, view or field names:

- "Archive"
- "View"
- "Field"
- "ViewCol"
- All SQL keywords

Keywords (or reserved words) of the database language SQL must not be used as archive, view or field names in the User Archives. The following is an alphabetical listing of the SQL keywords:

Keywords used in the SQL Language			
add	all	alter	and
any	as	asc	begin
between	binary	break	by
call	cascade	cast	char
char_convert	character	check	checkpoint
close	comment	commit	connect
constraint	continue	convert	create
cross	current	cursor	date
dba	dbspace	deallocate	dec
decimal	declare	default	Delete
desc	distinct	do	double
drop	else	elseif	encrypted
end	endif	escape	exception
exec	execute	exists	fetch
first	float	for	foreign
from	full	goto	grant
group	having	holdlock	identified
if	in	index	inner
inout	insert	instead	int
integer	into	is	isolation
join	key	left	like
lock	long	match	membership
message	mode	modify	named
natural	noholdlock	not	null

Keywords used in the SQL Language			
numeric	of	off	on
open	option	options	or
order	others	out	outer
passthrough	precision	prepare	primary
print	privileges	proc	procedure
raiserror	readtext	real	reference
references	release	remote	rename
resource	restrict	return	revoke
right	rollback	save	savepoint
schedule	select	set	share
smallint	some	sqlcode	sqlstate
start	stop	subtrans	subtransaction
synchronize	syntax_error	table	temporary
then	time	tinyint	to
tran	trigger	truncate	tsequal
union	unique	unknown	update
user	using	validate	values
varbinary	varchar	variable	varying
view	when	where	while
with	work	writetext	

6.3 Specifications

Test Environment

The tests desribed below have been performed in the following test environment:

- Hardware Setup: Pentium II 266 with 64 MB RAM
- Connection: S7 Protocol Suite, Channel Unit MPI
- Project Environment:
  - Specifications: Three Archives, Archive 1 with 100 Fields 3000 Data Records, Archive 2 with 200 Fields 1500 Data Records and Archive 3 with 500 Fields 500 Data Records.
  - Measurements during Runtime, first and last line of the table will be read or wrote, Start of the Read-/ or Writecommand in the Table Control with the Toolbar Button.
  - Editor closed, no C- Function in use, no Screenchange.

WinCC Tags and Raw Data Tags

In these tests, WinCC tags were used. The measurements show that access times increase with archive size.

For larger archives, the application of raw data tags is recommended. Raw data tags transfer data in packets and therefore provide faster access times in large archives.

Note

Per archive, a maximum of 500 fields can be created.

6.3.1 Performance while Writing and Reading Tags

The following performance test measured the behavior of User Archives while writing and reading tags.
Please note, that the performance depend on the employed specifications.

Number of Columns	Number of Data Records	Time for writing to tags in sec	Time for reading from tags in sec
100	1	1	2
100	10	1	2-3
100	50	1	3-4
100	100	1	3-9
100	1000	1-2	>3 (abhängig von Kopplung)
200	1	2	3
200	10	2	4
200	50	1-2	>4
200	100	1-2	>4
200	1000	2-3	>4
500	1	3	4
500	10	3	7
500	50	3-4	ca. 15
500	100	4	>15
500	500	4	>15

The determined times depend on the size of the used table.

6.3.2 Performance of the Screen Opening Times

The following table contains data from the performance test of the screen opening times. It is assumed that the table window of the Users Archive Editor is inactive.
Please note, that the Screen Opening Times depend on the employed specifications.

Number of Columns	Number of Data Records	Screen Opening Time in sec
100	1	1
100	10	2
100	100	3
100	500	3
100	1000	3
100	2000	3
100	3000	3
200	1	1
200	10	2
200	100	4
200	500	4
200	1000	4
200	1500	>4
500	1	3
500	10	4
500	100	>4
500	500	>4

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6AV6392-1DA05-0AB0

Edition August 1999

C79000-G8276-C163-01

C79000-G8276-C163
Printed in the Federal Republic of Germany

Siemens Aktiengesellschaft

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1 General Information

The implementation of WinCC in the heavy machine construction and plant engineering sectors necessitates the combination of several coordinated operator stations in one common system with networked automation systems. The individual operator stations (PCs) are linked to one another by means of a Windows network. That is, all the PCs connected to the client-server system must have a network connection.

The following aspects are of interest for coordinated, networked operator control and process monitoring:

- the system configurations
- coordination in the creation phase (Configuration System)
- coordination of operator-process monitoring and control during the runtime phase (Runtime)
- coordination of online configuration

WinCC (as of Version 3), with its client-server architecture, offers a system that solves the above tasks.

Practical and Theoretical Limits in the Implementation of Client-server:

- Theoretically, due to software-related limitations, WinCC can accommodate a maximum of 64 nodes (63 WinCC clients, 1 WinCC server) in one project.
- Actually, however, the type and implementation of the process communication selected for the WinCC server is of great significance for a realistic number of WinCC clients.
  The system can be implemented with up to 16 WinCC clients.

Basic Requirements:

- The WinCC server operates solely on the basis of Windows NT, with a hardware configuration that consists of at least a PENTIUM 133MHz CPU and 64MB RAM.
- All WinCC clients are available under WindowsNT and require a minimum hardware configuration of a PENTIUM 133MHz CPU with 32MB RAM.
- Process communication with the WinCC server (process data server) in the client-server system doesn't differ from that with a single-user WinCC system under WindowsNT.
- The necessary communication drivers must be installed on the WinCC server and clients. The WinCC multi-user license must be installed on each server. A runtime license is all that's needed on the clients.

Note

If the number of configured tags is higher than the number of licensed tags, an error message indicates that demo mode will be activated. If you then start a project with fewer tags than licensed ones, without having exited the WinCC Explorer, the same error message will be displayed too and demo mode will be activated. Demo mode cannot be deactivated. One it has been activated, you have to exit and restart the WinCC Explorer.

Time Synchronization:

There is no synchronization of time between the server and clients. Archiving is performed centralized on one computer, which of course means that all the time stamps in a project are generated by the same clock.
The optional packages can be synchronized with the AS level.
It is also possible to install a DCF77 radio-controlled clock in all WinCC stations.

1.1 Definition of Terms

The introduction of the client-server concept has also introduced new terms that have so far not been used in conjunction with WinCC.
The table below contains a list of these new terms with a brief definition of each one.

Term	Definition
Server Network server	WindowsNT server, workstation. The PC on which the Windows network is administrated.
WinCC server	A PC, WindowsNT workstation as the operating system. In a WinCC project, only this PC is connected to the process (process data server). This is the PC on which the Sybase SQL server (database management system) runs.
WinCC client	A PC, WindowsNT workstation as the operating system. This PC does not have a process driver connection.
File server	This is the PC with all the project-specific data (pictures, database files, scripts, report layouts etc.). The data is stored in project folder [project_dir]. Under normal circumstances, the project folder can be found on the WinCC server. The WinCC server can, however, also be a PC on which no WinCC applications have been installed.
Alarm server	The alarm server always runs on the WinCC server. This is the PC in a WinCC project, on which the acquisition and saving of alarms is coordinated.
Alarm client	Alarm clients are all those PCs in a WinCC project, on which alarms can be displayed and acknowledged. Alarm Logging runtime must be running. Acquisition and saving of the alarms is coordinated by the alarm server.
Archive server	The archive server always runs on the WinCC server. This is the PC in a WinCC project, on which the acquisition and archiving of the process data is coordinated.
Archive client	Archive clients are all those PCs in a WinCC project, on which the process data can be output. The data is output from archives and displayed in trends and tables. Alarm Logging runtime must be running.
Script server	The script server always runs on the WinCC server. Script runtime must be running.
Script client	Script clients are all those PCs in a WinCC project, on which scripts and functions are executed. Script runtime must be running.

Term	Definition
Text server	The text server always runs on the WinCC server. Text Library runtime must be running.
Text client	Text clients are all those PCs in a WinCC project, on which text output is performed. Text Library runtime must be running.
Operator station	A WinCC server or client with the appropriate applications.

1.2 Remote Client

A WinCC client is not necessarily assigned to just one project. It can, if needs be, be logged on alternately as a remote client with a number of WinCC servers.

Prerequisite for this is that the WinCC client is entered in the computer list of the respective WinCC server.

Each WinCC server will actively integrate this WinCC client into the project with the operating configuration preset for it. The connection medium used between the client and the server can take the form of either a local network or a remote connection via ISDN.

Default settings for the client stations can be applied for non-activated WinCC clients in the project of the WinCC server, in order to prevent unauthorized access to data or unauthorized operation.
On the remote client, only the drive settings for locating the project data have to be kept local, so that the remote client is able to set up the appropriate connections via remote access services of the operating system. This means that with the exception of the settings for the operating configuration, there is no need to carry out any configuration within WinCC for a remote client.

In this way, a remote client not known to the project is not permitted for security and safety reasons to access the operational plant.

Note

In the configuration system, any computer is able to open any project and change the data contained in it. It is only the ability to activate a project which is blocked.

1.3 Network Requirements

1.3.1 TCP/IP

A TCP/IP address is made up of the TCP/IP network address and the host address, and consists of 4 tetrads. The number of tetrads that describe the TCP/IP network address depends on the network class used (A, B or C).

E.g. 142.016.000.012 (network class = B, TCP/IP network address = 142.016, host address = 000.012)

The TCP/IP network addresses of the client and server can be identical, but they do have to differ by each having a unique host address.

If the TCP/IP network addresses of the client and server are identical, no more settings have to be made for network operation.

Network Addresses With TCP/IP:

We distinguish between three different classes of network address:

Class	Available networks	Available hosts	Range	Subnet Mask
A	126	16777214	1 - 126	255.0.0.0
B	16384	65534	128 - 191	255.255.0.0
C	2097151	254	192 - 223	255.255.255.0

The range of 127.X.Y.Z is reserved for loop tests and interprocess communication, and therefore isn't a permissible network address.

Example of a network address:

Network address	Host no.
142.103.	x.y

This example shows a class B address, the range for class B addresses being from 128 to 191. The first two tetrads in this case correspond to the TCP/IP network address.

If the TCP/IP network address differs, e.g. 142.16.x.y and 142.11.x.y, one of the three preparatory actions described below must be taken for client-server operation, since a router (gateway) is required when the network addresses differ.

1. Entry in the LMHOSTS file under
   WinNT: Located in the WindowsNT\system32\drivers\etc folder is a file named LMHOSTS.SAM which must be saved as a new file in the same folder under the file name LMHOSTS. You then have to make the necessary entry in this file (see example). In addition, you also have to activate the address of the LMHOSTS lookup under Control Panel/Network/Protocols/TCP/IP/Properties/WINS and enter a default gateway.

Example of an LMHOSTS entry.

142.16.0.98		Testcomputer
TCP/IP addr.		Windows computer name

2. WINS
   The WINS server must be entered in the network setup for WINS (Windows Internet Name Service). All clients will from then on log on with the WINS server automatically. The server will then take care of assigning names. With WINS, it isn't possible to communicate with UNIX computers or other TCP/IP nodes. If the WINS server has a different TCP/IP address from the WinCC client or WinCC server, you will also have to specify a default gateway (router) in this case too, since the WINS server will otherwise not be able to be found.

3. DNS
   Use of the DNS (Domain Name Service) must be configured in the network setup. Through using the DNS, it is possible to communicate with UNIX workstations or the rest of the TCP/IP world. Here too, you will have to specify a default gateway (router) if the network addresses of the DNS server and WinCC client-server are different.

1.3.2 Netbeui

Communication with Netbeui runs on Layer 2 of the OSI reference model (7-layer model). No more administrative settings have to be made. Netbeui can, however, only be operated in a physical network. A number of Yellow Cables connected to one another by means of repeaters or bridges can also be construed to form such a physical unit.

1.3.3 IPX

IPX is a Novell product that cannot be run without a Novell server (with the exception of a peer-to-peer solution from Novell). A WinCC client-server test with a protocol solely for Novell has therefore not been carried out.

1.3.4 Assigning Rights Under WinNT

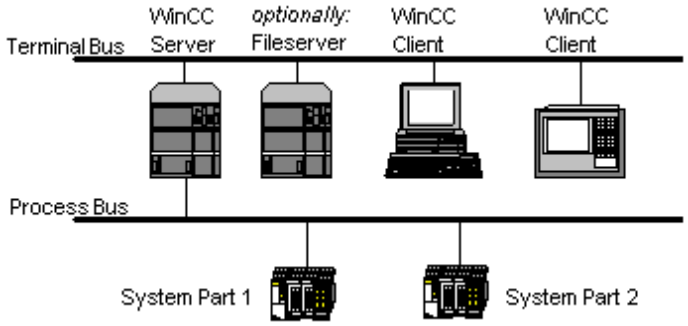
When running WinCC under WindowsNT, write access to HKEY_LOCAL-MACHINE must be granted.
You can achieve this for example by creating a group named WinCC. You then grant this group write access rights to the Registry. Due to the fact that the aplib folder has to be enabled for client-server operation, it is absolutely essential that the user has the right to enable folders. This means the user must be at least a power user.

2 System Configurations

The operating system platforms on which WinCC will run are the 32-bit operating systems from Microsoft. WindowsNT Server or Workstation is the platform for the WinCC server, while WindowsNT Workstation is the platform for the WinCC clients.

A WinCC client-server configuration comprises:

- a WinCC server with a connection to the process (automation systems) and to a Windows network
- one or more WinCC clients with a connection to a Windows network
- or optionally**,** the project data can be stored on a separate file server.



A WinCC server always has a physical connection to the automation systems (point-to-point or process network). What's more, the server also has a network connection to the WinCC clients assigned to it.

The WinCC clients have a network connection only to the server assigned.

Note

The WinCC server should not be used for the purpose of process visualization, since processing of graphics requires more than 50 % of the computing power of a Windows system and this would reduce the speed of online data processing.

WinCC clients are not able to communicate directly with one another.

Process communication with the WinCC server in the client-server system doesn't differ from that with a single-user WinCC system.

File Server (Optional):

Optionally, WinCC's architecture allows the tasks of the WinCC server to be divided up flexibly. One computer in the network is run as a separate file server and stores the project data in the [project_dir] project folder in the [projekt_name].db database.
A second computer in the network is the WinCC server, which takes care of process communication with the automation equipment.

As or when required, the optional file server can be specifically adapted to meet the requirements with the aid of hardware components. For example, failsafe operation can be achieved by integrating RAID or mirror disks, great computing speed by means of multiprocessor systems with extremely fast hard disk controllers, etc.

3 Configuration:

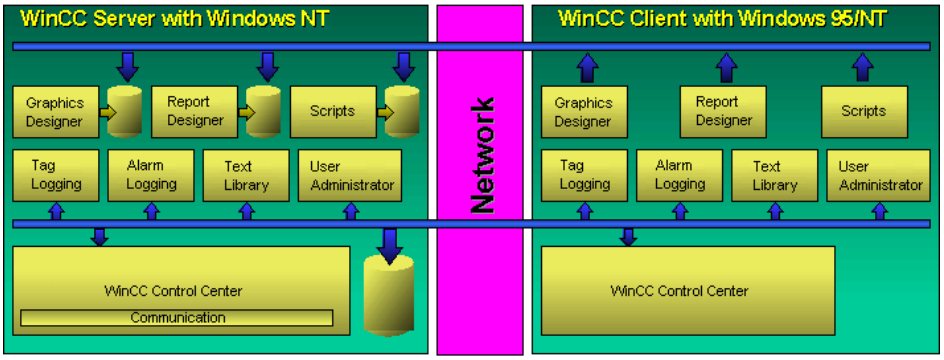
Every WinCC operator station starts the [project_name].mcp file in the [project_dir] project folder from within the Control Center.

The project folder [project_dir] can be located on any drive connected via the Windows network. In a typical configuration, this is a local drive on the server station, but it can also be a local drive on one of the clients or on another computer that, with the exception of being used to store the project data, has nothing to do with WinCC (file server).

Stored on the computer with the [project_dir] is all the data, to some extent in the form of files in subcatalogs but also as data in the database named [project_name].db.

If the local computer name of an operator station is not included in the configured computer list of the project, the computer is only capable of configuring within the project, but is not able to activate the project; that is, it can't switch to runtime mode.
You can, however, change the computer name (in Windows Explorer) to a name known in the project.
This computer will then be able to switch to runtime mode after you have restarted WinCC.

3.1 Configuration - Coordination and Data Organization



The WinCC server takes on the task of project management.

One important task of the WinCC server is that of coordination during creation of a project, so as to ensure that the data acquired during a project is consistent.
In principle, configuration work can be conducted at every operator station. With a number of specific restrictions, configuration can also be conducted simultaneously.

This means that new process pictures can be created and process tags added at one and the same time for one and the same project on different computers.
This said, it is not possible to supplement message texts or configure archives.

The WinCC server monitors and coordinates data access and in this way ensures the consistency of the configuration data.

Storage of the WinCC project data is divided up into two areas:

- Data in the central database
  - project-global setting for station data, communication data, tag data, etc.
  - configuration data for alarms
  - configuration data for process data archives
  - configuration data for user archives
  - print job data
- Files on the PC or network
  - process pictures and embedded graphics files (bmp, wmf, etc.)
  - print layouts
  - all data involved with WinCC scripts (e.g. includes, configuration wizard scripts, etc.)

Note

WinCC Explorer provides transparent access to the configuration data. The user therefore has no additional administrative and configuration work to perform.

If, however, files are moved or renamed manually (in Windows Explorer), the user is responsible for guaranteeing the consistency of this data.
This is just as valid here as in a single-user system.

3.2 Pictures - Graphics Designer

The pictures of a multi-user project are located centrally on the file server. This is the PC on which the project folder [project_dir] is located. Under normal circumstances, this will be the WinCC server.

A picture created using the Graphics Designer on a WinCC client is saved in the project folder of the server.
While being edited, this file is locked to prevent other operator stations from accessing it in order to write to it. Once the file has been closed, any other operator station is able to open it and continue making changes to the configuration.

Different pictures can of course be edited at the same time on different operator stations.

Pictures can be copied locally on the computer to the installation folder of WinCC [WinCC\bin\PDLCache].

In runtime mode, preference is given to calling up these pictures from this local folder (quicker picture setup). If the picture selected is not present in this folder, it is loaded from the central file store, i.e. the file server. Consistency between the pictures in the central project file server and the local folder must be maintained manually. This task isn't supported automatically by WinCC.

Online Configuration:

The picture data can be changed in runtime. Different pictures can be edited at the same time on different operator stations.
These pictures are available to all operator stations involved in the project immediately after being saved. All you have to do is deselect the current picture and load the new or modified one.

Note

If pictures exist in more than one place, on the file server and locally on the operator station, these changes apply only to the modified file. There is no automatic updating!

3.2.1 Peculiarities During Picture Configuration

Due to the networking of several computers, it is possible for a number of problems to arise with respect to the display of graphics pictures, that cannot be solved automatically and arise due to differing configuration of the computers involved:

Possible Errors On Opening a Picture:

- If a picture is displayed on a computer with an OCX that is not installed on this computer, the message "Unknown Object" will appear.
- The description above also applies to the display of OLL objects.

With OLE Links

- The OLE server is not installed.
- There is no referenced file on the local computer.

In both cases, the data is displayed in runtime, but is not able to be changed (per double-click).

3.3 Scripts - Global Script

WinCC default and project functions exist just once within the project and are stored centrally in the [project_dir] project folder.
Project-specific actions can be defined independently on the local computer.

The project or default functions (*.fct) and actions (*.pas) created using Global Script are stored in files. Actions in pictures are stored in the respective picture files.
While being edited, this file (function or action) is locked to prevent other operator stations from accessing it in order to read from or write to it. Once the file has been closed, any other operator station is able to open it and continue making changes to the configuration.

If configuration is conducted on a client without the server being accessed, this configuration is local; that is, the default functions are stored locally and used for compilation. Procedures at this point are identical to those in a single-user system.
The user him- or herself is now responsible for copying the default function to the file server when it accessible again and for "making it known" to the system by means of "Regenerate Header".

The script data of a project contains:

- project functions
- properties of the project functions
- project-specific description files of the function libraries (header files)
- etc.

Note

In the case of the API calls apcompile and apcompileex, you can use a flag to specify whether the include path is to be set locally or globally.

Online Configuration:

Both functions and actions can be changed in runtime.
Such changes can be made on any operator station logged on in the WinCC project.

WinCC makes sure that the change is distributed to all the operator stations connected. The operator stations informed unload the old version of the changed function and load the new one (corresponds to deleting a function or creating a new one). Prerequisite for this is that Script runtime is running on the operator station.

3.4 Alarms - Alarm Logging

The configuration data exist just once within the project and are located centrally in the [project_dir] project folder in the [projekt_name].db database.
Only one operator station is able to configure the Alarm Logging system at any one time. Prerequisite for this is of course that the WinCC server and the file server can be accessed. No provision has been made for local configuration with transfer of the data at a later time.

Note

Always pay attention to the configuration instructions of the respective editor when configuring reports (Report Designer) or integrating alarm windows (Graphics Designer).

When reading the data from the database, the default texts for the report system are loaded from the resource DLL.

Text Library CS, Alarm Logging CS and Password CS are no longer locked against each other on the same computer.

Locking takes place across computers, that is, Text Library CS, Alarm Logging CS and Password CS can only be started in parallel on one computer.

Online Configuration:

Alarm Logging data can be changed in runtime.
Such changes can be made on any operator station logged on in the WinCC project.
In contrast to offline configuration, however, the scope of the data that can be changed online is restricted.

Possible Changes

- Change attributes of the message blocks
- New/change message window
- Add message blocks
- Add single messages

Not possible

- Changing message archive structures
- Message reports
- Group messages
- Removing a message class
- Deleting single messages

WinCC makes sure that the change is distributed to all the operator stations connected.

3.5 Archive - Tag Logging

The configuration data exist just once within the project and are located centrally in the [project_dir] project folder in the [projekt_name].db database.
Only one operator station is able to configure the Tag Logging system at any one time. Prerequisite for this configuration is of course that the WinCC server and the file server can be accessed. No provision has been made for local configuration with transfer of the data at a later time.

Online Configuration:

Tag Logging data can be changed in runtime.
Such changes can be made on any operator station logged on in the WinCC project.

WinCC makes sure that the change is distributed to all the operator stations connected.

3.6 User Administrator

The list of all the users and corresponding operator authorizations exist just once within the project and are located centrally in the [project_dir] project folder in the [projekt_name].db database.

Only one operator station is able to configure the User Administrator at any one time. Prerequisite for this configuration is of course that the WinCC server and the file server can be accessed. No provision has been made for local configuration with transfer of the data at a later time.

Online Configuration:

The operator authorizations can be changed in runtime.
The changes can be made on the WinCC server or on a WinCC client.

The other operator stations are not informed of the changes, since the valid authorization list is loaded from the database anyway each time a station is logged on in runtime.

Note

If a change made to an authorization is to take effect immediately, the user must log on afresh.

All configured authorizations are user-specific and not computer-specific. This means that an assigned authorization is valid for all operator stations with the same login.

3.7 Text Library

The configuration data exist just once within the project and are located centrally in the [project_dir] project folder in the [projekt_name].db database.

Only one operator station is able to configure the Text Library at any one time.

The Alarm Logging CS and the User Adminstrator CS use the same database table as the Text Library CS and are able to read and write consistently from/to the same database table simultaneously on one operator station.

This ability to configure simultaneously is, however, not possible from different operator stations.

Online Configuration:

The Text Library can be changed in runtime.
Such changes can be made on any operator station logged on in the WinCC project.

WinCC makes sure that the change is distributed to all the operator stations connected, this update being integrated in the data language set at the respective local level.

3.8 Reports - Report Designer

The configuration data consists of the layouts (files) and the print jobs (entries in the database). Both pieces of data exist just once within the project and are stored centrally in the [project_dir] project folder.

Only one operator station is able to configure a layout file at any one time. The same applies to the print jobs.
Prerequisite for this configuration is of course that the WinCC server and the file server can be accessed.

Local configuration of the layouts is possible, but the user must then subsequently apply the data manually (in Windows Explorer).

Online Configuration:

No provision has been made for configuring the report system during runtime.
You configure reports, i.e. print jobs with corresponding layouts, and can then execute them.

4 Coordination In Runtime

In the case of a multi-user system, special measures must be taken for startup, failure and restart after a failure. This applies both to the server and the clients.

Startup

All operator stations in a multi-user system are capable of starting up independent of one another.
The WinCC server runs up and offers its services to the clients connected. The WinCC clients run up and log on with the WinCC server. If the server can't yet be accessed, the clients wait in a standby state and start a logging-on cycle that runs until they can access the WinCC server.

Server Failure

If the WinCC server fails during operation, the WinCC clients are no longer updated and they report this failure of the WinCC server by means of a box. The WinCC clients automatically attempt to access the WinCC server again.

Configuration of Tag Properties

If while a client-server project is activated, a client is deactivated in order to change the properties of a tag, these changes will only take effect after a complete restart of all the computers (clients and server) on which the project is active at the time the change is made.

4.1 WinCC Server

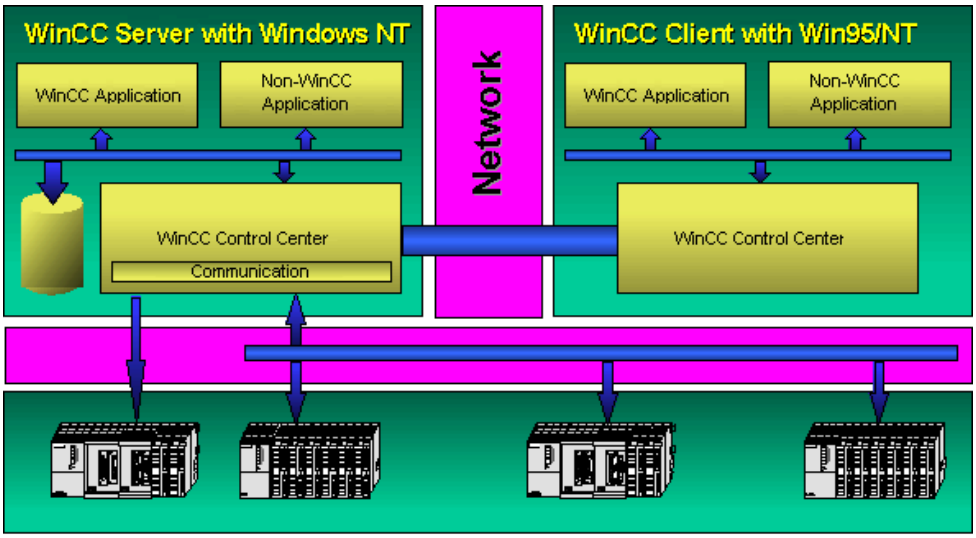
During runtime, the WinCC server plays the main role in process communication with the automation equipment. The exchange of process data is performed by the WinCC server, with the aid of the communication drivers.

The server distributes the process data for storage in the archives and the alarm logging system or forwards it to the WinCC clients for visualization. The clients then present the process data in the process pictures or process it further in action scripts.

In order to update the process data required, the WinCC clients access the WinCC server.

The WinCC server sends the requested data to the operator stations cyclically with the timing configured.
However, the data is only exchanged if the new value is different from the previous value. The decision as to whether a value has changed or not depends on the respective data type: i.e. in the case of an integer value, the smallest deviation is 1; with a float value 1e-[n], where n is the number of places after the decimal point.

When the same data is requested, all operator stations basically operate synchronously. In the case of graphical objects, however, this can't be guaranteed if the same picture is opened on two clients at the very same time.



Note

Optionally, the data can be stored on a separate file server. This has no effect on requests made for the data by the operator stations.

4.2 Graphics Editing

When you open a picture on an operator station during runtime, the operator station first looks to see if the picture is stored in the permanently set, local path \bin\PdlCache\[PictureName].PDL. If it isn't, the station then looks in the project folder [project_dir]\GraCS\[PictureName].PDL.
If the picture can't be found, a message to this effect is displayed.

If opening a picture necessitates an exchange of data with other WinCC applications (e.g. Alarm Logging, Tag Logging or Global Script), this exchange always takes place locally, i.e. on the operator station involved.

Note

In contrast with configuration, a picture can be opened and edited by several operator stations simultaneously during runtime.

Graphics actions that have a cyclic trigger are transferred and edited when a picture is opened.

Graphics actions that have an event trigger (typically a button action) are likewise loaded, with the trigger being transferred only when the event occurs.

If the configured PDL files (they are located in the project path of the server) are copied to the \bin\PdlCache path on the operator station, picture buildup during runtime is quicker. This speed advantage is due to the fact that no data is exchanged over the network. If a PDL file is changed on the server, this change has no effect at all on the copied PDL file. The changed PDL file once again has to be copied manually to the \bin\PdlCache path.

4.3 Script Editing

Script control is available on every operator station and is started automatically by WinCC during runtime. Its job is to execute functions (*.fct), actions (*.pas) or graphics actions. On the basis of the entries in the computer list, each operator station knows whether it is a script client or a script server.

When an operator station activates a project (i.e. starts runtime at local level), the following data is loaded locally:

- the project functions *.fct from the project folder [project_dir]\Library\[Function_name].fct on the file server and
- the default functions *.fct from the installation folder [WinCC_dir]\aplib\[Function_name].fct on the WinCC server.

Note

When the project is activated, the WinCC server must of course be up and running in order to enable the default functions stored on it to be accessed. If the server then fails later on, the functions remain available locally on the operator station. This is the case, however, only as long as the operator station is running.

4.4 Alarm Editing

If the alarm system is activated on an operator station, the Alarm Logging runtime system operates on the WinCC server as an alarm server and on the other operator stations as an alarm client.
The system retrieves the information it requires for this purpose from the computer list of the WinCC Explorer.

The alarm server retrieves the configured data from the database during activation. The alarm clients log on with the alarm server.
The alarm list or alarm archives are displayed and controlled on all operator stations in exactly the same way as on a single-user system.

New Alarms:

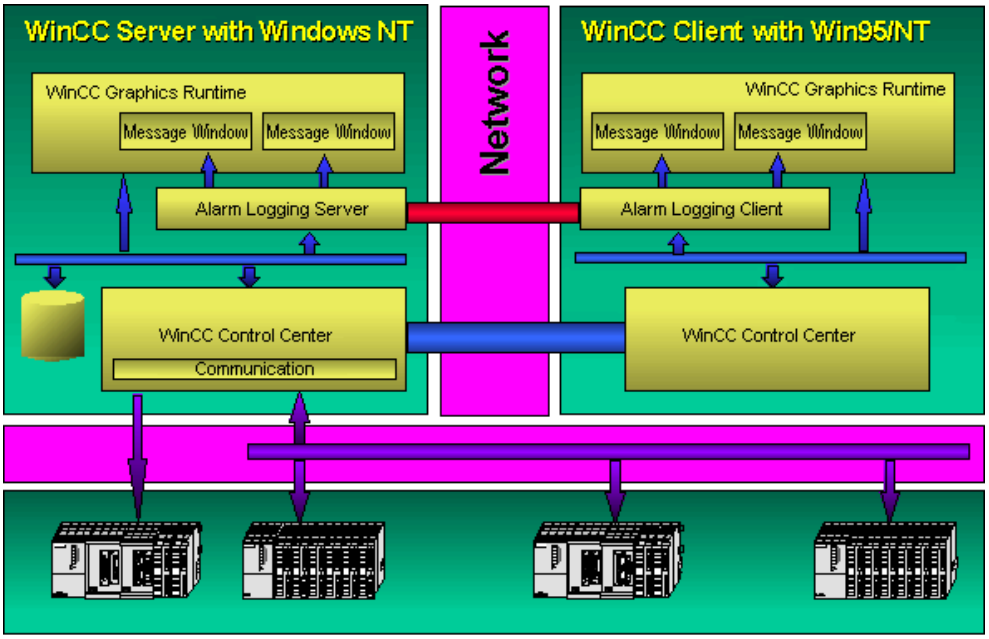
When new alarms are received, the alarm server takes care of archiving them. If alarm clients require data to enable them to display these alarms, they address the alarm server which then supplies them with the necessary data.

Acknowledgement:

When an alarm is acknowledged on an operator station, the acknowledgement is sent to the alarm server which enters it in the archive and is then distributed to all alarm clients logged on. If an acknowledgement bit has been configured for a tag, the alarm server sees to it that the relevant information is written to the data manager tag.

Disable:

The alarm server coordinates disabling of alarms. If an alarm is disabled on one operator station, the disable also applies to all other operator stations.



4.5 Archive Editing

If the archive system is activated on an operator station, the Tag Logging runtime system operates on the WinCC server as a tag server and on the other operator stations as a tag client.
The system retrieves the information it requires for this purpose from the computer list of the WinCC Explorer.

Only the archive server accesses the database. The archive clients address the archive server whenever they want to access archive data.
Only the archive server acquires and archives (stores) the process data. The archive clients always have to request this data from the archive server.

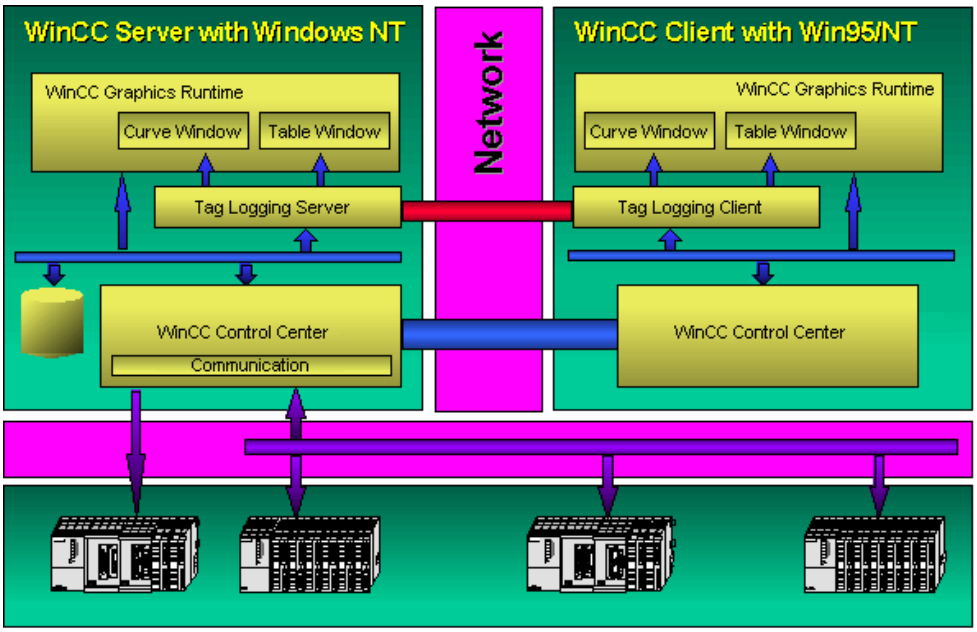
Online Trends / Tables:

Online trends and tables can be displayed on any operator station on which Tag Logging runtime is running. The data for such displays always comes from the archive server.

All actions executed during runtime, from the user interface or via the Tag Logging API, are forwarded to the archive client, which in turn informs the archive server. The job is then processed by the archive server and the result sent back to the archive client. The archive client then assigns the result to the respective consumer.

User Archives:

User archive accesses by the AS to the PC or read/write accesses by the PC to the AS are always processed by means of the archive server, which always runs on the WinCC server.



4.6 User Administration

User authorizations are checked by the runtime of the User Administrator.
Runtime is started automatically on every operator station when WinCC is started.

Login:

If the login is changed (for a different user), the current user authorization list is loaded directly from the database of the file server and stored locally on the operator station.

Check Operation:

This check is conducted on the basis of the local user authorization list.

If operation is locked (i.e. the current user doesn't have authorization), the user can log on afresh.
Once the user has successfully logged on, the user authorization list is requested from the file server and loaded to the local operator station. The check is then carried out again.

The authorization list that then exists at local level is retained until a further login leads to a new copy being requested from the database.

4.7 Text Service

Once the project has been activated, the Text Library runtime system runs on the WinCC server as a text server and on the other operator stations as a text client.
The system retrieves the information it requires for this purpose from the computer list of the WinCC Explorer.

WinCC ensures that the data is always read from the database of the file server.
Prerequisite for this is of course that the file server is running and logged on in the network.

4.8 Report Printing

General Information About the Reporting System:

The reporting system doesn't have a runtime in the same way as other WinCC applications (e.g. Tag Logging, Alarm Logging etc.).
Configuration includes defining the page or line printer layout and print jobs.
The reports are printed out in the executive segment, which can effectively be seen as the "runtime mode of reporting". This, however, is not directly coupled with activation of a WinCC project (runtime), but can also be started independent of such activation.

This means that print jobs of the reporting system can also be started during offline configuration of WinCC.
These print jobs serve to document configured data (in the Control Center e.g.: tags, connections from CS applications).
If, however, you start during offline configuration a print job that is also to contain process or archive data, it is essential that the WinCC project be activated (i.e. in runtime mode).

Client-server:

The reporting system is started automatically on every operator station when WinCC is started.
The report server is started on the WinCC server, while the report clients are started on the other operator stations. The report clients log on with the report server or try to do so cyclically as long as the server cannot be accessed. When the report server can be accessed, all the report clients are supplied with the latest information about the available print jobs, their status and the printers available.

Printing-Out of the Print Jobs:

When a print job is started on an operator station, this station retrieves the relevant and current print job data from the database on the file server.
This job data is then used to start a printing process locally. This printing process for its part requests the application-specific data from the local applications, links this data with the layout defined in the print job and prints out the report on the printer configured.

The report server receives the status information about the instantaneous status of the print job and distributes this to all the other report clients logged on.

5 Startup Failure Behavior During Runtime

In the case of a multi-user system, special measures must be taken for startup, failure and restart after a failure. This applies to all PCs in a WinCC project.

Startup

All stations in a multi-user system are capable of starting up independent of one another. The WinCC server runs up and offers its services to the clients connected. WinCC clients run up and log on with the WinCC server. If the server can't yet be accessed, the clients wait in a standby state and start a logging-on cycle that runs until they can access the server.
In the case of a scaled system (WinCC server, file server), the system is only ready for operation once both servers are available in the network.

Server Failure

If the WinCC server fails during operation, the clients are no longer updated and they report this failure of the WinCC server.

5.1 WinCC Explorer

Startup of the Clients and Server

Installed on client and server stations is the WinCC system software, which after the respective start, runs up alone to the stage where the WinCC Explorer is "empty", that is, without a project.

The last project to be edited is opened from the WinCC Explorer. This project is located centrally on the file server. This means that a WinCC client must access the project server remotely over the previously installed Windows network.
The WinCC client is only able to activate a WinCC project if its own Windows computer name is configured in the project to be opened. Otherwise, it can only configure offline.

If the WinCC server (or file server) cannot be accessed, this fact is reported by means of a system box. You now have the following options open to you:

- You give the command for abort, on which the WinCC client returns to the "empty" WinCC Explorer (with no project).
- You don't acknowledge the system box. This leads to the WinCC client trying cyclically to open the project again until the WinCC server can be accessed.
- You give the command to start WinCC locally. This makes sense if the WinCC server can't be accessed, but the network connection to the file server is still "online"; that is, the project folder can still be accessed.
  In this case, this WinCC client assumes the function of the WinCC server (but without a process driver connection) in the project. The database management system now runs on this WinCC client. This operator station now answers all requests made by the other WinCC clients.
- If the file server defined in the project is physically down (e.g. due to a power failure, hardware defect), there is no way the project can be edited unless a new project is opened.

If a project is activated, the WinCC server sets up the communication connections. The WinCC clients address the WinCC server and report if they are unable to access it.

Server Down

If the server (WinCC server, file server) fails while a project is being worked on, the next unanswered request made by a WinCC client leads to an appropriate alarm being displayed on its screen.

If available, the WinCC clients can display and use the configuration data during runtime, e.g. for changing picture etc. Missing process data is identified by special characters.

Server Coming

Until the server comes, the client tries on a cyclic basis to interconnect with it.

5.2 Graphics Designer

Startup of the Clients and Server

Server Down

If the WinCC server fails during runtime, no process data can be read in. Special characters (e.g. Specified value: " ***** ") are displayed in the pictures instead of the process values.

Server Coming

Once the server is available again, the pending pictures are automatically supplied with the latest data.

5.3 Global Script

Startup of the Clients and Server

WinCC servers and WinCC clients can run up in any order.
During startup, WinCC installs the script server and the standard function catalog is released.
When a WinCC client runs up, the script client is started and the connection to the script server is set up.

If the WinCC server is only run up later or isn't available at all, a connection to the script server is not set up for the script client.
Attempts are now made cyclically to set up a connection to the server.

Server Down

If the script server fails, all the script clients notice the fact and can respond to it.
A notification is sent to all connected client applications of the operator station, e.g. Script.
The script control now automatically and cyclically attempts to set up the connection again.

If the data manager (database management system) fails, the script server continues running normally.
Read and write jobs to the data manager are, however, not accepted by it.

Server Coming

Once the WinCC server is available again, all operator stations connected are notified of the fact. Script is now able e.g. to access the central standard functions again.

5.4 Alarm Logging

Prequisite for operation of the Alarm Logging runtime system is that the WinCC server and the file server are both running and available.

Startup of the Clients and Server

The Alarm Logging runtime system runs on the WinCC server (precisely there and only there due to the process driver connection) as an alarm server and on all the other computers in the project as an alarm client.
The alarm server then logs on with the WinCC server to supply it with data, the alarm server logging on with the alarm events defined in the configured data and opening the alarm archive. The alarm clients log on with the alarm server.

Both are then ready for the requests of clients of the Alarm Logging runtime system, typically of the graphics system. Requests are first sent to the local Alarm Logging runtime system.
If the request is sent to an alarm client, this client forwards the request to the alarm server which then sends back the data requested.

Server Down

If the alarm server can no longer be reached, the alarm clients realize this and all clients of the Alarm Logging runtime system on all operator stations indicate this fact by displaying the message "Alarm Logging runtime server not initialized” instead of the message window, which is masked out.

The alarm clients continue attempting cyclically to access the alarm server.

Server Coming

Once the alarm server can be reached again, the alarm clients automatically access it again and the alarm windows in the Alarm Logging runtime system client applications are displayed and updated again.

5.5 Tag Logging

Prequisite for operation of the Tag Logging runtime system is that the WinCC server and the file server are both running and available.

Startup of the Clients and Server

The Tag Logging runtime system runs on the WinCC server (precisely there and only there due to the process driver connection) as an archive server and on all the other computers in the project as an archive client.
When the Tag Logging runtime system is started on an operator station, this runtime system knows from the computer list whether it will act as an archive server or archive client. In both cases, the operator station the operator station retrieves the Tag Logging configuration data from the file server.

The archive server then logs on with the WinCC server to supply it with data, the archive server logging on with the process data supplies defined in the configured data and opening the measured-data or user archives. The tag archive clients log on with the archive server.

Both are then ready for the requests of clients of the Tag Logging runtime system, typically of the graphics system. Requests are first sent to the local Tag Logging runtime system.
If the request is sent to an archive client, this client forwards the request to the archive server which then sends back the data requested.

Server Down

If the WinCC server fails, the archive server fails too. Requests made by the archive clients remain unanswered.

If the file server fails, tag loggings in runtime are able to request neither the current configuration data nor the archived data in the archives.

Archive clients then attempt cyclically to access the archive server.

Server Coming

Once the archive server can be accessed again, the attempts by the archive clients to log on are answered and the system continues running.

Note

If the client in a client-server project crashes while working in Tag Logging, the remaining stations in the client-server project will not be able to open Tag Logging without deleting the "TLGCS.log" or "TLGRT.log" log file from the server. The log file will be stored in the specified project path.

5.6 User Administrator

Startup of the Clients and Server

User Administrator is started automatically on every operator station when WinCC is started.
It waits during runtime for a logon event to occur and then loads the latest authorization lists from the file server.

The User Administration CS runs on any operator station and writes purely directly to the project database.
There is no logging-on of the client stations with the server, neither for configuration nor for runtime services.

Server Down

If the file server fails, the User Administration CS can no longer access the database for purpose of configuring authorization lists.

After a failure of the file server duing a login, runtime clients are likewise unable to access the project database and retrieve the up-to-date user authorization list stored there.
In so far a clients are still capable of working sensibly, they are no longer able to enable protected actions while the file server is missing.

Server Coming

Once the file server can be accessed again, not only configuration but also the runtime applications are able to access the project database again. There is, however, no automatic mechanism that informs User Adminstration CS or RT on the operator stations of the fact that the file server is available again. If it far more the case that user actions implicitly trigger server access.

5.7 Text Library

Startup of the Clients and Server

When WinCC runs up, the Text Library is started on those operator stations on which Text Library Runtime is entered in the startup list.
This runtime system is set up as either a text server or text client in line with the respective computer setting. The text server holds the connection to the project database, while text clients wait for requests from their client application.

Server Down

If the WinCC server fails, the text service is also no longer available. The Text Library can, however, be configured offline, as long as the connection to the file server is still up and running.

Server Coming

Since the text service is request-driven and not logon-oriented, the text clients are able to answer all requests received from the text clients after the text server has become available again.

5.8 Report Designer

Startup of the Clients and Server

The reporting system is started automatically on every operator station when WinCC is started.

The report server is started on the WinCC server, while the report clients are started on the other operator stations. The report clients log on with the report server or try to do so cyclically as long as the server cannot be accessed. When the report server can be accessed, all the report clients are supplied with the latest information about the available print jobs, their status and the printers available.

Server Down

If the report server fails, all the report clients notice the fact and can respond to it. The report clients then attempt cyclically to set up the connection to the report server.

Server Coming

If the connection to the report server can be set up again, coordinated configuration of changes becomes possible once again and the report server once again supplies the latest status information to the print jobs from this point on.

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Manual

6AV6392-1DA05-0AB0

Edition August 1999

C79000-G8276-C163-01

C79000-G8276-C163
Printed in the Federal Republic of Germany

Siemens Aktiengesellschaft

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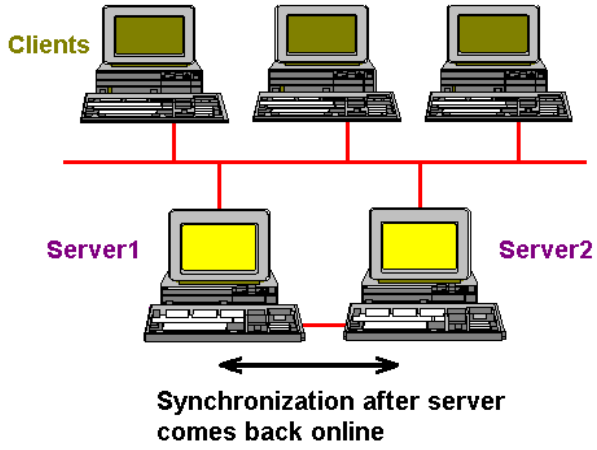
1 WinCC Redundancy

The WinCC Redundancy significantly increases the availability of WinCC and the plant by running to connected server PCs in parallel.



The servers monitor each other in runtime to allow for an early recognition of a failing partner server.

If one server fails, the clients will automatically be switched from the failed server to the still active server. This ensures that all clients will always be available for monitoring and operating the process.

During the failure, the active server will continue to archive all messages and process data of the WinCC project. After the failed server comes back online, the contents of all message, process value and user archives will automatically be copied to the returned server. This will fill the archive data gaps of the failed server. This action is also called synchronization after return.

The WinCC Redundancy Option offers:

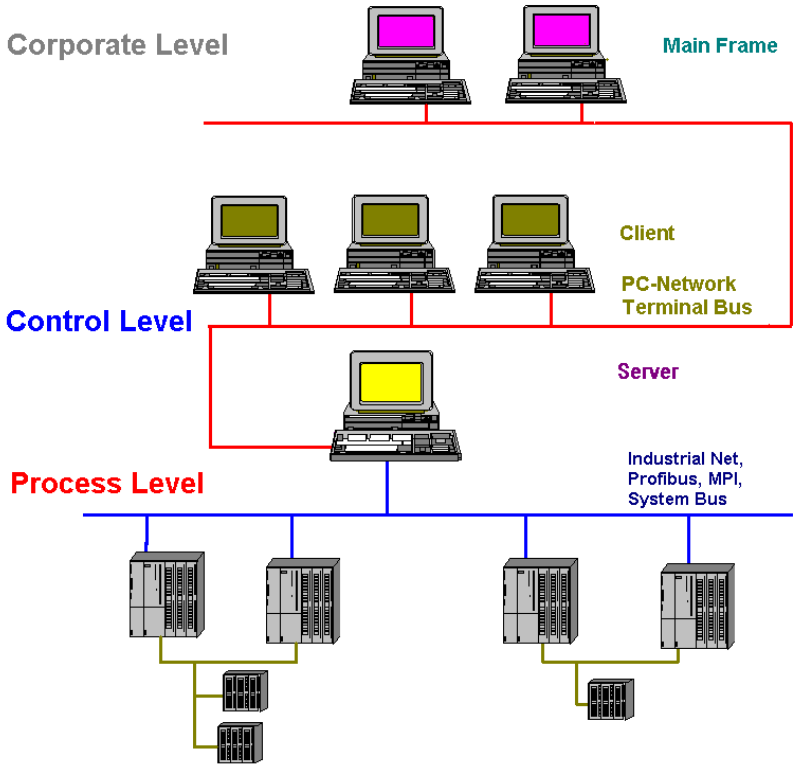
- The automatic synchronization of message, process value and user archives after the failed server returns.
- The automatic synchronization of message and process value archives after a process connection error.
- The online synchronization of message archives in a certain number range (server-local messages).
- The online synchronization of User Archives.
- A "Project Switcher" for the automatic or manual switch of the clients between the redundant servers.
- A "Project Duplicator" for copying a project to a redundant server.

Note

The redundant servers and clients must run Windows NT.

1.1 Structure of a redundant WinCC System

1.1.1 Structure of a WinCC System without Redundancy



The above chart illustrates the structure of the WinCC Control Level with the Corporate Level above and the Process Level below.

As you can see, the tasks of the control level are distributed among multiple PCs. The tasks are distributed following to a client server structure.

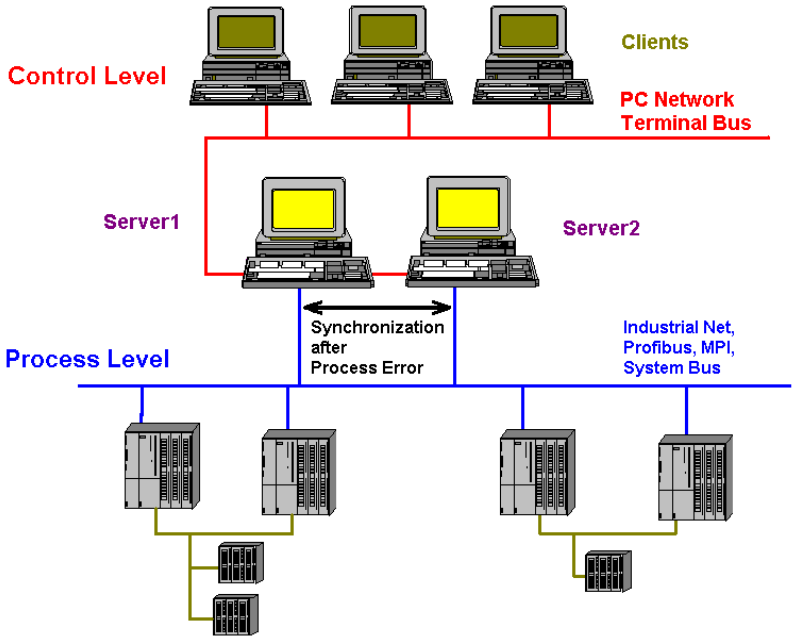
Tasks of the Servers:

- The servers acquire the process images and messages of the PLCs.
- To acquire data, the servers are connected to the PLCs via industrial networks.
- The servers provide the process data to the clients and control the processing states.

Tasks of the Clients:

- The client stations operate and monitor the entire plant.
- Clients retrieve the currently needed states from the corresponding server via PC networks.
- In general, all clients are equal and have the same rights.

1.1.2 Structure of a WinCC System with Redundancy



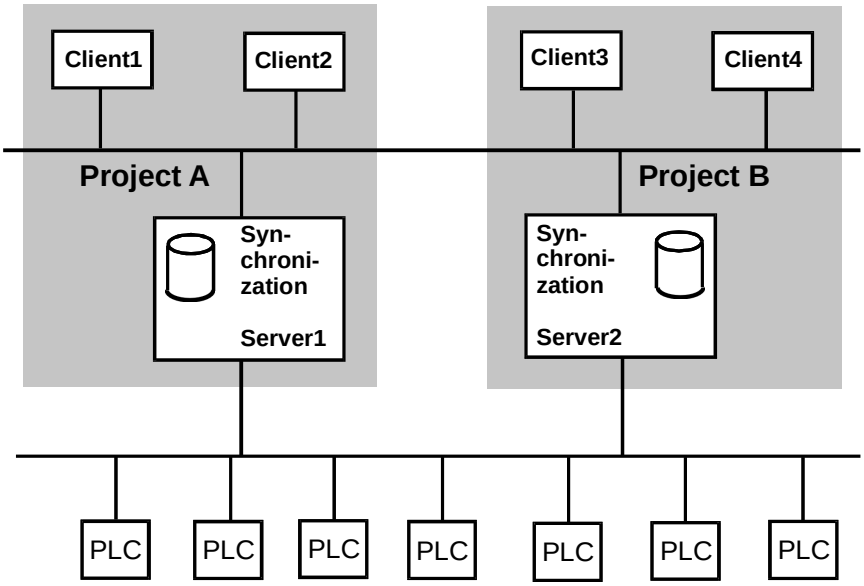
WinCC Project

Assign a group of PLCs, a server and one or multiple clients to a WinCC project. The project also includes all data (e.g. programs), configuration data and miscellaneous settings.

Redundant WinCC Project

A redundantly structured project is implemented by running an additional, functionally identical server in parallel. The two servers are connected to the to each other, the PLCs and the clients. See also Functionally Identical Configuration.

1.2 Functionality of Redundancy



Archiving and Archive Synchronization of the redundant Parallel-Running Servers

WinCC Archiving during Normal Operation

During normal operation, the process data servers are running completely in parallel in runtime. Each server has its own process connection and available data archives. The process data and messages are sent by the PLCs to both redundant servers, which process them accordingly.

The servers monitor each other during runtime operation, to allow for the early recognition of a failing partner server, which is then indicated by a process control message.
User Archives and messages in certain number ranges can continuously be synchronized online (online synchronization).

Both servers have equal rights and work independently of each other. Both are available to the user. Should one server fail, an equal redundant server will always be available.

The communication between the redundant servers, for lifebeat monitoring and archive synchronization purposes, is carried out via the terminal bus. As network, a PC LAN using the TCP/IP or NetBEUI protocols is utilized.

Failure of a Server

If one server fails, the remaining one will continue to receive and archive process values and messages from the PLCs. This guarantees complete data integrity.

The clients will automatically be switched from the failed server to the redundant partner server. After a brief switching period, all operator stations will be available again.

Factors triggering the Client Switch

The switch of the clients from the default (master) server to the partner server during a server failure is performed automatically by the system. The following factors cause a switch of servers:

- Interrupted network connection to the server
- Server Failure

Factors triggering the Archive Synchronization after the Server returns

The synchronization of the archives between the servers will be initiated after the following errors have been corrected:

- Process connection error. The process connection monitoring can be turned off, see "Configuration" chapter.
- Interrupted network connection to the partner server
- Server Failure
- Project is not active
- Project has not been opened

Synchronization after the Server returns

After the failed server comes back online, the Redundancy will perform an archive synchronization for the down time. The archive gap caused by the failure will be filled by transferring the missing data to the failed server. This action equalizes and makes both servers available again.

A synchronization of the message archives, process value archives and User Archives will be performed. The failed server receives its data after a slight time delay (caused by the failure).

The different archive types are synchronized in the following order:

1. the message archives
2. the process value archives
3. the User Archives

The archive synchronization is realized as a background function and runs parallel to the process and archiving of WinCC. This ensures the operation and monitoring of the plant at any time.

Note

If the "Storage" option is used in conjunction with Redundancy, the following problems may occur:
1. If one of the servers has failed and "Storage" is exporting and deleting data to and from the second server, this data cannot be synchronized anymore.
2. If "Storage" is exporting data from a failure period not yet synchronized, the gap in the exported data will not be filled by the synchronization of the archives.
3. To avoid data losses, the "Storage" option is deactivated during the archive synchronization. After the archiving is complete, "Storage" will automatically be activated again.

Synchronization after a Process Error

If a network error occurs beween a server and one or multiple PLCs during an operation, a synchronization will automatically be started - if configured - after the error has been resolved.

Online Synchronization

A direct server-to-server synchronization (online synchronization) is performed for the User Archives and for Alarm Logging messages in certain number ranges.

Note

To perform an online synchronization of Alarm Logging, the short-term archive must be configured in the Alarm Logging Editor.

2 Configuration of the Redundancy Servers

2.1 Functionally Identical Configuration

Process Data and Message Archives

Tag Logging and Alarm Logging must be configured functionally identical for both redundant servers. Functionally identical means:

- Identical archives, where additions can be made in the form of additional measurement points or archives. These additions will not be synchronized and must therefore be updated manually on the partner server.

The following archives are synchronized by WinCC:

- Archives that are located on hard drives, i.e. process value archives, compressed archives and message archives. These can be short-term (cyclic) as well as sequential archives.
- On the other hand, no synchronization of main memory archives is performed.

To perform an online synchronization of message archives, the short-term archive must be configured in the Alarm Logging Editor.

User Archives

The User Archives require the same structure on both servers:

- The configuration of the User Archives to be synchronized must be identical in terms of their properties and field/record structure.

2.2 Requirements

The following requirements must be met for the WinCC Redundancy:

- The redundant servers and clients must run Windows NT. If the Project Switcher is being used, the client/s must run Windows NT. Note: A Windows NT Workstation can manage a maximum of two clients. For more clients, Windows NT Server must be used.
- Synchronized servers are required for the WinCC Redundancy. A time synchronization of the plant (WinCC computer, PLCs, etc.) is recommended. This can be realized using the Lifebeat Monitoring from the option package or the DCF77.exe application from the SmartTools.
- Messages and acknowledgments of the PLCs and clients must always contain a time stamp (in the message) to avoid double entries (sequential reporting).
- Process values and messages from the subordinate PLCs are sent to both servers in parallel.
- The Redundancy option must be installed on both servers.
- The Redundancy servers must be configured functionally identical.
- Each User Archive must contain a field for the unique assignment and a field for the date of the last change. For additional information, please refer to "Redundant User Archives".

Note

Only data of "new" User Archives (starting with V4.02) will be synchronized.
User Archives of later versions - but configured with the old structure - will not be synchronized. However, these "old" User Archives can be converted to the new structure. For additional information, see the User Archives manual.

To safely exit WinCC in case of a power failure, the application of an uninterrupted power supply - UPS - is recommended.

If STORAGE is used in conjunction with REDUNDANCY and the archives are exported to a shared, third computer, the archiving drive of the redundant servers must not be the same.

2.3 Redundant User Archives

User Archives can be edited by operations, stand-alone programs, PLCs or other functions.

Editing User Archives in Parallel

Note the following, while adding records to redundant User Archives in parallel:

- Because of runtime reasons, the sequence in which the records are inserted can be different.
- Even before the synchronization of a returned server is complete, records can be added to the server being synchronized.
- Even during the online synchronization, some time will pass before the record has been synchronized in the redundant archive.

2.3.1 Requirements:

The configuration of the archives must be identical on both computers. The "Project Duplicator" should therefore be used.

In case the archives are not identical, the system message "Synchronization not ready for all User Archives" will be displayed.

Configuration of the Archives

To be able to activate the synchronization for a User Archive, these two fields must be configured:

Unique Key

A unique key is required for assigning the records of one archive to the records of the redundant archive.
Records with the same content in this field are synchronized. This field must contain a "unique value" property - this will ensure that there are never 2 records with the same content in an archive.
This can be implemented via:

- The record number - this number is always part of a record and must not be configured separately (the record number is always unique). If the record number is used, no other field must contain this "unique value" property.
- An archive field that has been assigned the "unique value" property. If a field other than the record number is used, then this field must be the only one containing the "unique value" property.

  For example: Recipe Name ("Text" Type)

  Recipe Number ("Integer" Type)

  Insertion Date/Creation Date ("Date" Type)

"Last Access" Field

This field must be selected while configuring the archive properties, since the time stamp is used as the synchronization criterion.
During synchronization, a data record with a newer time stamp overwrites the older record - this ensures that the most current data record remains. This must be noted for working or editing in parallel during a synchronization.

The latest modification date is automatically entered by the system. During the import of records, the modification date of the "csv" file will be accepted unchanged.

2.3.2 Functionality of the User Archives Synchronization

	Synchronization via Record Number	**Synchronization via Unique Value**
Deleting a record during a server failure	Does not take place	Does not take place
Editing/adding a record during a server failure	During the offline synchronization all data records edited or added during the down time will be synchronized.	During the offline synchronization all data records edited or added during the down time will be synchronized.
Changing a record during online synchronization	OK	OK The "unique key" field content must not be changed (if it is changed, the new record content will still be added to the redundant archive, the old record, however, will also remain because it cannot be identified).
Adding a record during online synchronization	OK If a record is added separately to both redundant archives before the synchronization of a returned server is complete, the automatically assigned record number might already be present in the redundant archive. In this case, the older of the two records will be overwritten.	OK

	Synchronization via Record Number	Synchronization via Unique Value
Deleting a record during online synchronization	OK An online synchronization of deleted records will only be performed if the synchronization is carried out via the record number and the changes are made within an "OLE Control Element (OCX)" or via the User Archives API functions. Only records are deleted that contain no earlier time in the "Last Access" field than the time of deletion.	Not available

Note
A record containing a value greater than the current system time in the "Last Access" field must not be added. A synchronization is only performed up to the current system time.

If the server providing the data is shut down or has a failure before completing the synchronization of all records, only the last 50 records of each archive will be synchronized if runtime is activated again.

If WinCC runtime is stopped and started again within 10 seconds (which is generally only possible for smaller projects), this will not be recognized as a failure and no synchronization will take place.

The online synchronization stores up to 10 records. If there is a connection error to the redundant server, these records will be synchronized immediately after the connection has been reestablished.

2.4 Messages Synchronized Online

Certain message are synchronized online. This includes the system operator messages of Alarm Logging and the messages of Batch-Flexible.

Additionally, there is a given range of message numbers (number range), in which user-specific server-local and to be synchronized messages can be stored. This means that comments for messages in this number range will also be synchronized. The numbers range from 1015000 to 1015999.

Locally generated process control messages are not being synchronized, since they are not unique, i.e. they are not specific to one computer and cannot be traced to the server on which they were generated.

3 Working with Redundancy

3.1 Guideline for Setting Up a Redundant System

The following guideline illustrates the setup of a redundant WinCC system consisting of Server 1 and its Partner Server 2.

Setting up the Servers and Clients on the Network

Install the network on each computer and give each computer a unique name by which it can easily be identified on the network.

Setting up the Users

After installing the network, user accounts must be set up on each computer.

Installation of the Authorization

If you did not install the Redundancy authorization during the installation of WinCC, you can do so by running the "authorsw.exe" program from the authorization disk. Install an authorization on each server.

Configuration of the Project

During the configuration of the WinCC Redundancy, the partner server and the User Archives to be synchronized are defined.

Note

Only configure the User Archives for the synchronization that you really need. The greater the number of User Archives to be synchronized, the longer the synchronization process will take and the greater the system loads will be.

Configuration of the Clients

The "Project Switcher" allows you to configure clients so that they automatically switch to the still available server in the case of a server failure. This ensures continuous availability of your plant even during failures.

Note

If you configure your clients before the duplication process, it is recommended to check the path statement of the project switcher (CCProjectSwitcherRt.exe) in the startup tab of the clients.

Ensure that all clients that are to be switched are known to both servers.

Duplicating the Project

To avoid having to configure the partner server for a second time, the "Project Duplicator" gives you the ability to duplicate the project from one server to the other.

Note

Before executing the duplication process, ensure that the recipient server (to which the project is being duplicated) has enough space and has not been specified as a client.

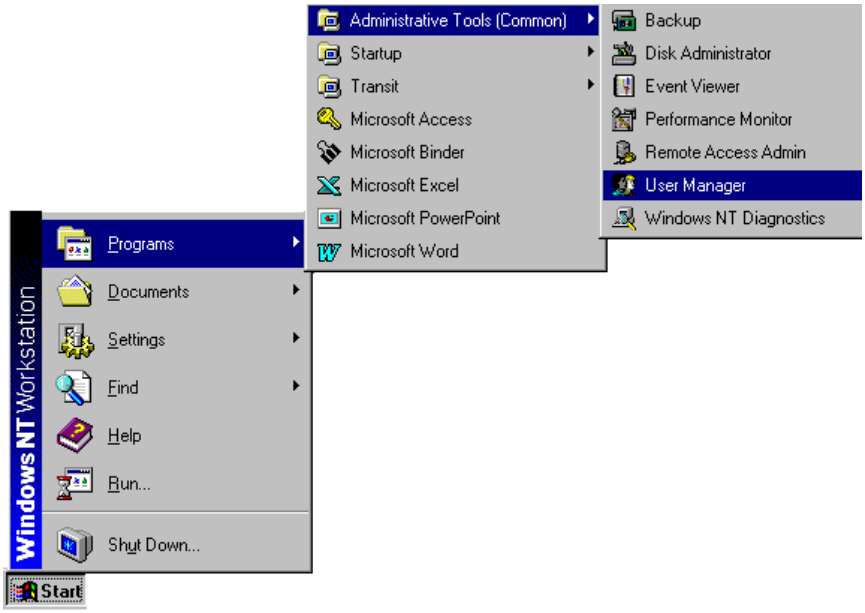
Activating Redundancy

After completing the configuration, the WinCC Redundancy can be activated as follows:

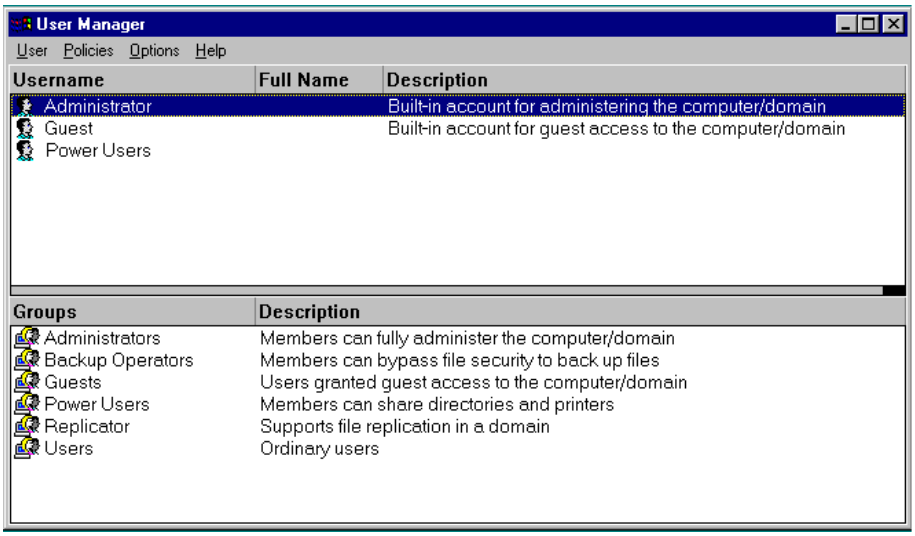
Activate the first server. Next, start its existing clients. Once they are active, activate the second server and its existing clients. The first synchronization will then be performed. The down time synchronized is the interval between starting the first and second server.

3.2 Entering the Servers in Windows NT

To enter the users in Windows NT, run the User Manager. The User Manager is accessed via the Windows Start menu:



In the following "User Manager" dialog box, set up the users as "Power Users":



Both redundant servers must be known to each other on the network. For this, enter the same user names in the Windows NT User Manager of both servers.

Note

The user must have administrator rights or be a power user.
The redundant servers and clients must run Windows NT.
If more than two clients are used, the server must run Windows NT "Server".

3.3 Configuration

The WinCC "Project Duplicator" allows the duplication of an entire configuration from one server to the other. Existing plants can therefore be upgraded to the WinCC Redundancy functionality quickly and easily. Additional configurations only have to be made on one server, since the redundant server can be supplied with the functionally identical project by the "Project Duplicator".

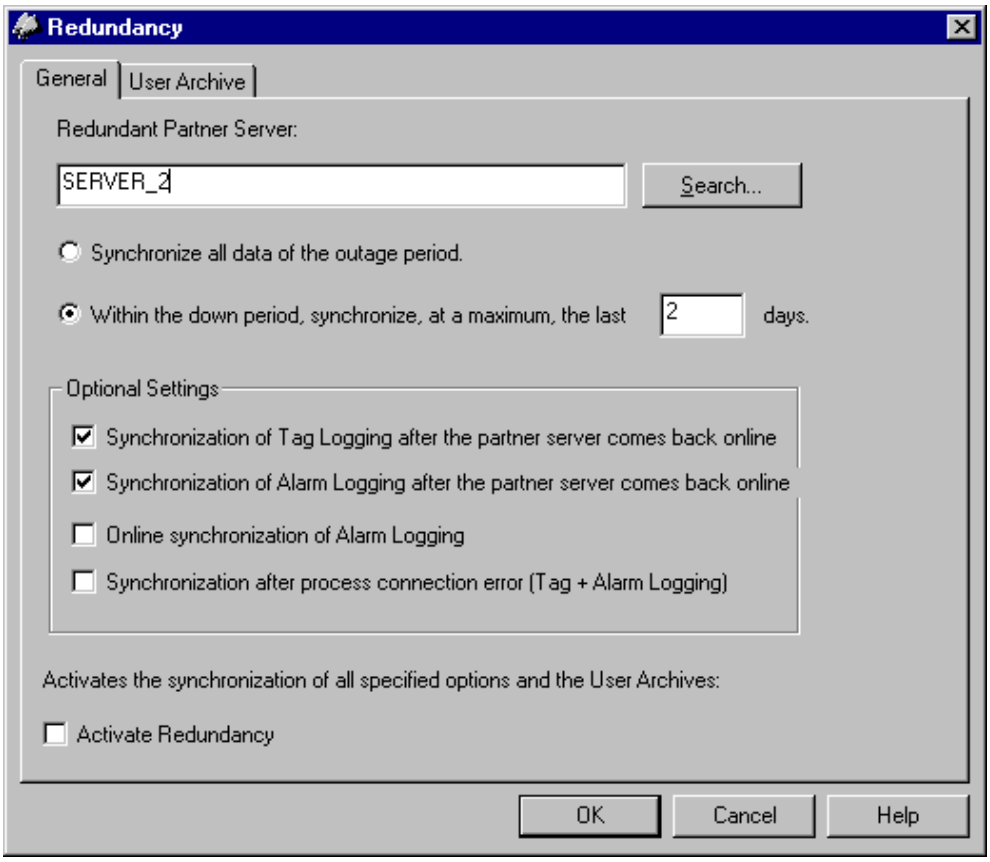
Note

The WinCC Redundancy system always consists of 2 servers. No additional Redundancy PCs should be configured as Redundancy servers.
To perform an online synchronization of Alarm Logging, the short-term archive must be configured in the message system. Computer-specific settings must be changed manually afterward.

Procedure

To call the Redundancy system, display all Editors and then right mouse click on the "Redundancy" Editor. In the following pop-up menu, click on "Open".

"General" Tab



The "General" Tab	
Redundant Partner Server	In the ""Redundant Partner Server" field, enter the computer name of the partner server, in our example this is "RedServ_2". The "Search" button supports you with the selection of the partner server.
Synchronize all data of the down time	The "Synchronize all data of the down time" radio-button defines that all data of the entire down time are to be synchronized.
Within the down time, synchronize at a maximum the last ... days	The "Within the down time, synchronize at a maximum the last ... days" radio-button defines that, for example, only the last 10 days of the down time are to be synchronized.
Synchronization of Tag Logging after the partner server comes back online	The "Synchronization of Tag Logging after the partner server comes back online" check-box defines, if a synchronization of Tag Logging is to be performed after the partner server returns.
Synchronization of Alarm Logging after the partner server comes back online	The "Synchronization of Alarm Logging after the partner server comes back online" check-box defines, if a synchronization of Alarm Logging is to be performed after the partner server returns.

The "General" Tab	
Online synchronization of Alarm Logging	The "Online synchronization for Alarm Logging" check-box defines, if a synchronization of the Alarm Logging operator messages and the messages of the reserved number range is to be performed in runtime.
Synchronization after process connection error (Tag + Alarm Logging)	The "Synchronization after process connection error (Tag + Alarm Logging)" check-box defines, if the network connection between the servers and the PLCs of a project should be monitored. If the process connection monitoring is active, the corresponding server will perform a "Lifebeat Monitoring" of all connected PLCs. The server determines that a process connection to a PLC is faulty, if the addressed PLC does not send back a reply to the server. If a network error to one or multiple PLCs is detected in this way, a synchronization of all message archives, process data archives and User Archives will be performed for all PLCs belonging to the project. This means that the archives of PLCs that have not failed will also be synchronized. If this option is deactivated, the runtime loads on the servers are reduced. Since an error occurring in the network of the PLCs cannot be recognized if the monitoring of the network connections is turned off, no archive synchronization will take place.
Activate Redundancy	The "Activate Redundancy" check-box indicates if the Redundancy system is active. The Redundancy can be activated/deactivated by clicking on this field. This check-box is primarily used to temporarily deactivate the Redundancy system while configuring. If you click on the "Activate Redundancy" check-box while the Redundancy is active (indicated by the check-mark), a dialog box asking you "Do you really want to deactivate the Redundancy?" will be displayed as a safety precaution. This gives you the option to stop the deactivation of Redundancy.

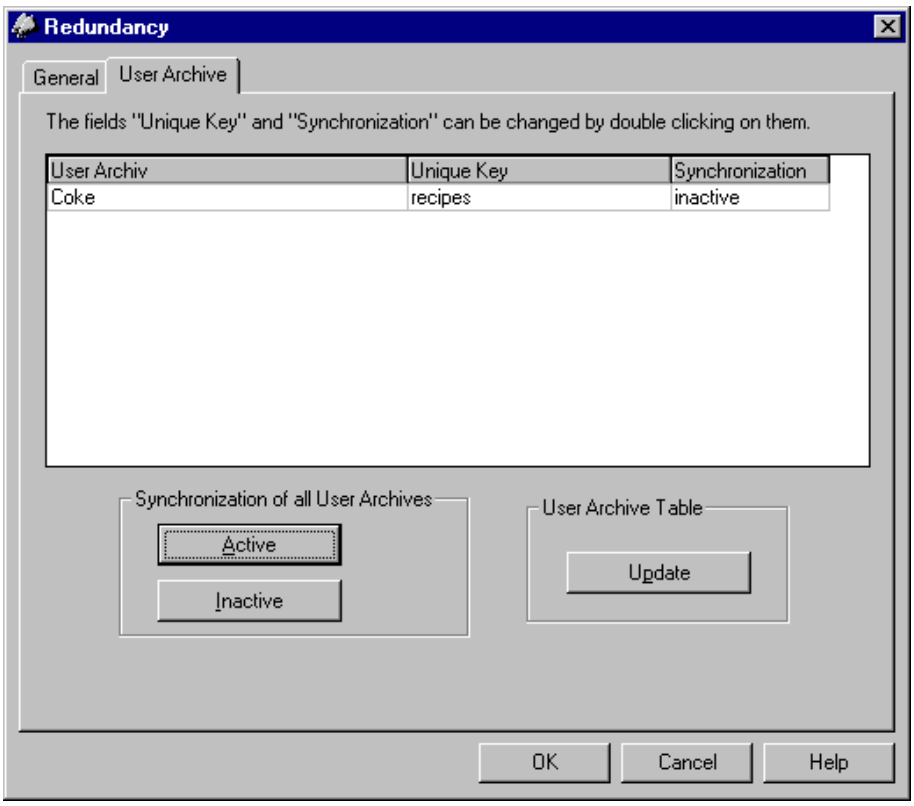
Note

During commissioning, WinCC Runtime is often activated and deactivated on the server PCs. Every time this happens, the archive synchronization will be initiated if the Redundancy option has been activated, which can cause a noticeable degradation of WinCC's runtime performance. To avoid this, it is recommended to deactivate Redundancy during commissioning.

The Redundancy can also be configured and activated while in runtime.

"User Archives" Tab

Click on the "User Archives" tab. The following dialog box is displayed:



In this tab, the automatic User Archives synchronization for the Redundancy system is configured.

The "User Archives" Tab	
User Archive	In the "User Archive" column, all configured User Archives are displayed by row.
Unique Key	In the "Unique Key" column, the unique key for the assignment of the data records to both redundant archives is displayed. Double-clicking on this field will display a selection of all suitable archive fields. These are all fields with the configured "Unique Key" property and the record number itself. If something other than the record number is selected, the archive to be synchronized must not contain additional fields with the "Unique Key" property (other than the selected field). Otherwise, these fields must be removed again from the User Archives Editor.
Synchronization	In the "Synchronization" column, the synchronization of the individual User Archives can be activated or deactivated. Double-clicking on this field switches its current status. If the "Last Access" field has not yet been configured for the archive, it can be added in here. This can take some time, especially if the archive contains a lot of data records.

The "User Archives" Tab	
Synchronization of all User Archives	The two buttons at "Synchronization of all User Archives" field allow you to activate or deactivate the synchronization of all displayed User Archives.
Update	The "Update" button applies the current configuration, if the configuration has been changed in the User Archives Editor after calling the Redundancy Editor.

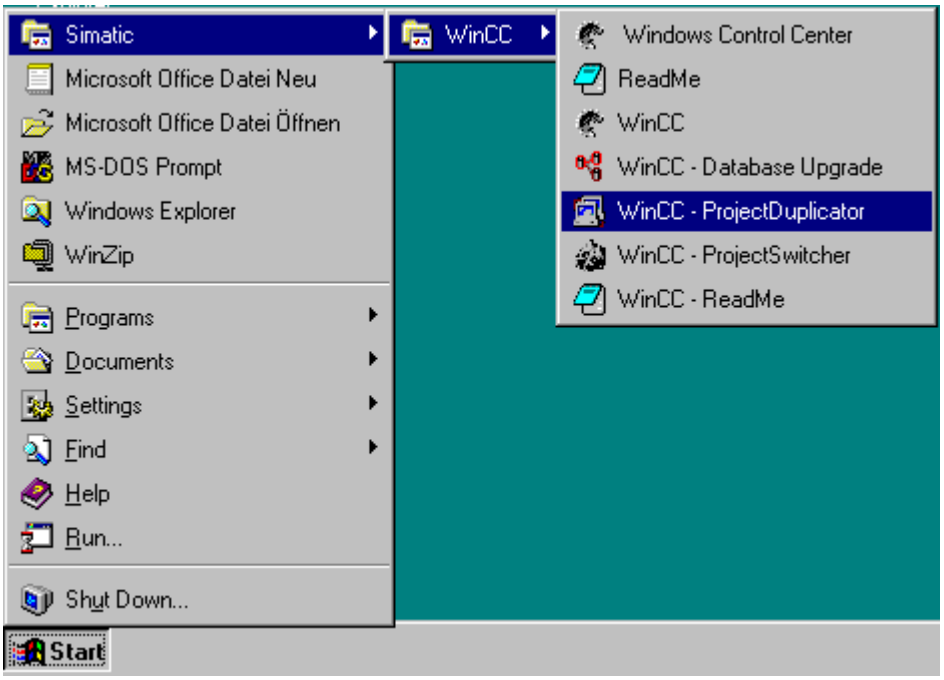
3.4 WinCC Project Duplicator

Both servers must contain functionally identical projects. Once the configuration has been completed, the project duplicator enables you to copy all data belonging to the Project to the redundant partner server.

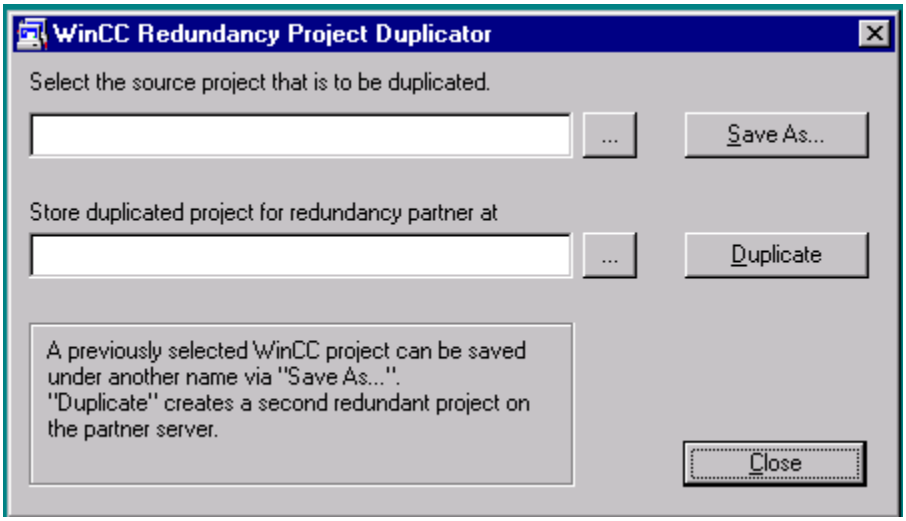
The WinCC project duplicator automatically generates the redundant partner project. The project duplicator not only copies all the project data (screens, scripts, archives, etc.), but also makes all the necessary settings on the target computer, which is then ready for the Redundancy.

Procedure

Open the WinCC Project Duplicator from the Windows "Start" menu as follows:



This will display the "WinCC Project Duplicator" dialog box:



The "WinCC Project Duplicator" Dialog Box	
Select the Source Project	In the "Select the source project that is to be duplicated" field, the source project is specified. The "..." button helps you in finding the path name of the source project.
Duplicated Project	In the "Store duplicated project for Redundancy partner at" field, the target computer including the folder of the target project is specified. The "..." button helps you in finding the folder of the target project.
Save As	The "Save As" button allows you to create a back-up copy of the source project or you can save the project under a new name. "Save As" only saves the configuration data. The current runtime database will not be saved. However, a new, empty runtime database will be generated to prevent a project from being accidentally started without a runtime database.
Duplicate	After specifying the source project and the target computer of the project to be duplicated, click on the "Duplicate" button to start the duplication process. A completely configured partner project will then be created on the target computer.

Note

Computer-specific settings must be changed manually afterward.

3.5 WinCC Project Switcher

The Project Switcher enables the switch of one or multiple clients from a down server to a running server.

The switch of the clients is performed either manually or automatically, depending on the configuration.

Note

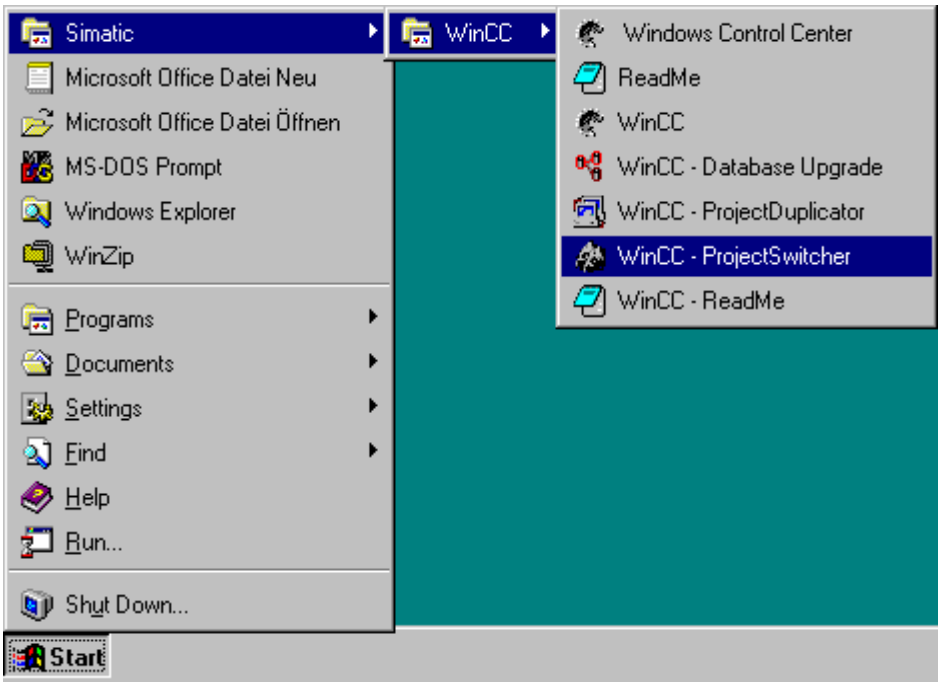
The automatic switch of the clients is triggered by network errors between the clients and the current server. If a PLC fails, no automatic client switch is performed.

The switch process of the clients can take several minutes if the project is very large. Because no project is active while the clients are switched, they are inoperational for the duration of the switch.

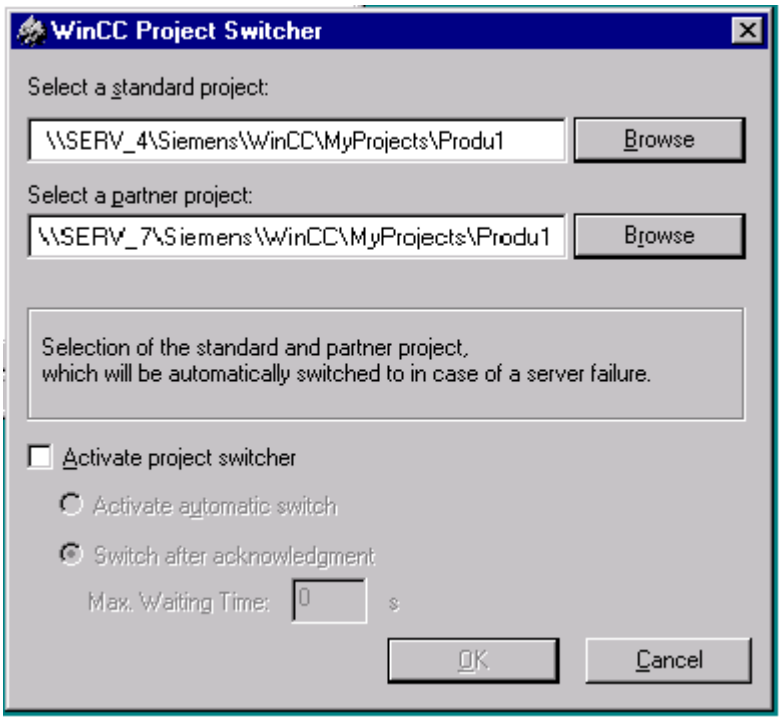
If runtime is ended or WinCC exited, the Project Switcher task at the clients will also terminate. Clients can then only be switched manually to the other server from the Control Center.

Setting the Project Switcher Parameters

To set the parameters of the Project Switcher, start WinCC on the client and open your standard project. The project must not be in runtime. To switch projects, start the "WinCC Project Switcher" from the Windows "Start" menu:



This will display the "WinCC Project Switcher" dialog box:

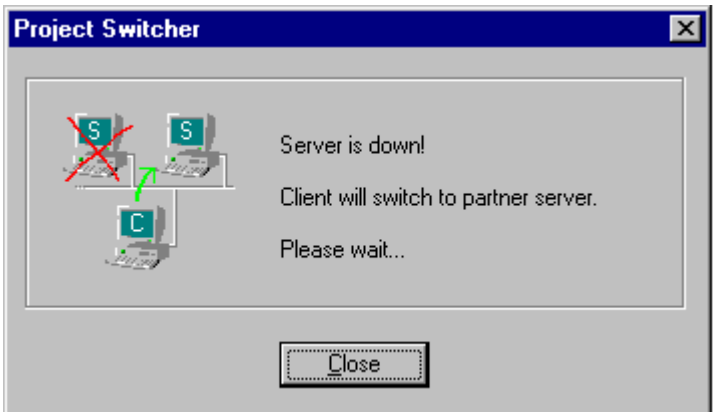


In this dialog box, the server switch during runtime is configured. Enter the following:

The "WinCC Project Switcher" Dialog Box	
Select a standard project:	In the "Select a standard project" field, enter the standard Project of the (master) server to which the client is connected by default.
Select a partner project:	In the "Select a partner project" field, enter the Project of the partner server to which the client will switch in the case of a failure.
Browse	The "Browse" buttons help you to find the desired project.
Activate project switcher	The "Activate project switcher" check-box enables or locks the Project Switcher.
Activate automatic switch	To enable an automatic switch of the clients in case of a server failure, the "Activate automatic switch" radio-button must be activated.
Switch after acknowledgment	Instead of the automatic project switch, a project switch can also be performed "after acknowledgment". For this, the "Switch after acknowledgment" radio-button must be activated.
Max. Waiting Time	If you activated the "Switch after acknowledgment" radio-button, you can specify define a waiting time in the "Max. Waiting Time" field. Within this waiting time, the switch can either be confirmed or aborted. If the waiting time = 0, no action will be taken until you either confirm or abort the switch.

Switching Clients Automatically

To inform you about a server failure while servers are automatically switched, the following dialog box will be displayed:



Switching after Acknowledgment

If you configured a manual switch, the following dialog box will be displayed:

Switching with a Waiting Time

If a waiting time > 0 has been specified, the time remaining will be counted down in the "Timeout:" field. While the waiting time is counted down, you can initiate the switch at any time by clicking on the "Switch" button or abort the switch by clicking on the "Abort" button. After the waiting time has elapsed, the switch will be triggered without any additional input.

Switching without a Waiting Time

If you configured no waiting time (waiting time = zero), the dialog box displayed above will remain on screen until you either click on the "Switch" or "Abort" button.

Once the switch is complete, the Project Switcher dialog box will display the text "Switch Completed".

Switching via a WinCC Tag

To switch one or multiple clients to the other server during runtime, the internal WinCC tag "@RM_SWITCH" can be used. For this, the tag must contain the name of the client to be switched.

For example, if you want to switch the client with the name "CLIENT_1" to the redundant partner project, write its name into the internal WinCC tag "@RM_SWITCH". If multiple clients are to be switched, their names must be written into this tag one after the other.

3.6 Failure Scenarios

By means of commonly occurring failures, the functionality of the WinCC Redundancy will be illustrated. The following failures will be discussed:

1. Project of the redundant server not in runtime
2. Connection error to the redundant server
3. Connection error to the client
4. Process connection error

The WinCC Redundancy will recognize the current error itself or react to error messages by:

- Saving times and events
- Synchronizing archives
- Changing master/slave identifications
- Switching clients
- Displaying messages

Startup of the Server PCs

During startup of the server PCs, Redundancy determines if the partner server is already active. If this is the case, the server computer (1) will be set as the slave. If the partner server (2) has not been activated, the server computer (1) will be set as the master during startup. If there is a network connection error between the servers or the partner server is turned off, the master identification is reset. To identify the server computer (1) as the master, the WinCC internal tag "@RM_MASTER" will be set. To identify the server computer (1) as the slave, the tag "@RM_MASTER" will be reset. The tag "@RM_MASTER_NAME" contains the name of the server computer, for example "SERV_1". These tags can be evaluated and changed by other applications and scripts.

Redundancy only sets the above tags. Both servers are always completely equal.

Normal and Error-Free Operation

The servers independently store the process images and messages of the PLCs in their respective archives.

The servers perform a mutual Lifebeat Monitoring in short intervals to recognize a server failure as early as possible. By default, the interval is 10 seconds.

If configured, an online synchronization of Alarm Logging and of User Archives will be performed.

3.6.1 Scenario 1: Server not in Runtime

This scenario discusses the behavior of Redundancy, if the project has been deactivated on server 2.

The following actions will be triggered:

- Server 1 stores the failure time (date and time) of server 2.
- Server 1 will report the failure of server 2 through a system message.
- If server 1 was the "slave", it will become the "master" by setting the tag "@RM_MASTER". The tag "@RM_MASTER_NAME" is changed accordingly.
- If server 2 returns, it will become the slave and the tag "@RM_MASTER" will be reset.
- The tags "@RM_MASTER_NAME" are changed accordingly.

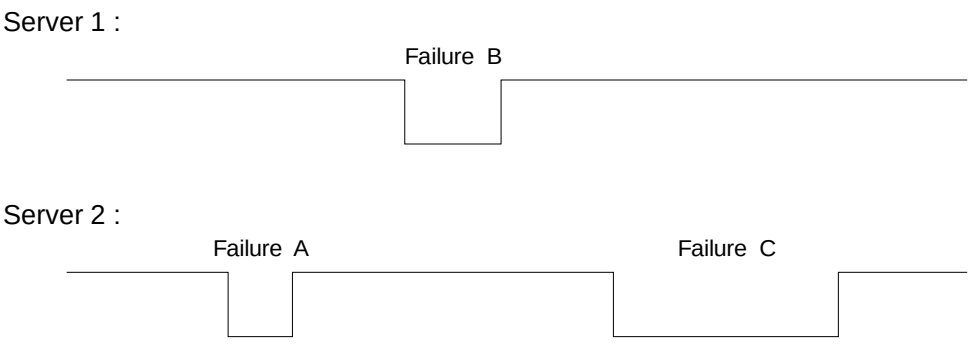
Server 2 comes back online

During the down time, a gap formed in the Archives of server 2. This gap will be filled by the following measures:

- Server 1 stores the return time (date and time) of server 2.
- Server 1 will report the return of server 2 through a system message.
- The gap in the message archive, process data archive and User Archives of server 2 will be filled with the data of server 1's archives.
- In both servers, the tags "@RM_MASTER" remain unchanged, i.e. the tag "@RM_MASTER" in server 1 remains set and the tag "@RM_MASTER" in server 2 remains reset.

Compared to the online synchronization, the archive synchronization after a server failure can take noticeably longer depending on the number of data records to be synchronized and the computer/network loads.

If failures alternate between the two servers (see diagram), they will be synchronized one after the other. After the synchronization, all data will be available in both archives.



In the scenario above, server 1 provides all values to server 2 for failure A – following that, server 1 will be synchronized by server 2 for failure B.

All these processes run automatically and in the background, independent of the process value archiving and message archiving from the subordinate PLCs running in parallel.

3.6.2 Scenario 2: Connection Error to the Partner Server

This scenario discusses the behavior of Redundancy, if there is a connection error to partner server 2. In this case, both servers run without errors in runtime.

The following actions will be triggered:

- Both servers record the failure time (date and time).
- Both servers will report the failure through a system message.

The Connection has been Reestablished

While the connection was down, no online-synchronization of Alarm Logging and the User Archives could be performed. This will be corrected by the following measures:

- Both servers record the return time (date and time).
- Both servers will report the return through a system message.
- The changes that were made in Alarm Logging and the User Archives while the connection was down will be transferred from each server to the other.
- The Tag Logging process data archive will not be synchronized, because all data continues to be archived on both computers during the failure period.

3.6.3 Scenario 3: Network Connection Error to the Client

In this scenario, a network connection error occurs between server 2 and its client "CL5".

The following actions will be triggered:

- If configured, client "CL5" will automatically be switched from the down server 2 to the running server 1.

Correction of the network error to the client

The following actions will be triggered after the network error has been corrected:

- Redundancy will not automatically switch the client "CL5" back to server 2. If the user wants to switch client "CL5" back to server 2, it can be initiated by writing "CL5" into the system tag "@RM_SWITCH".
- In both servers, the tags "@RM_MASTER" and "@RM_MASTER_NAME" remain unchanged.

3.6.4 Scenario 4: Process Connection Error

In this scenario, a process connection error occurs at server 2, caused by an interrupted network connection to the PLCs.

A PLC connection error is only recognized by Redundancy as a failure, if the connection is interrupted to only one server. If there is a connection error from one PLC is to both servers (e.g. caused by a PLC failure), this will not be recognized as failure by Redundancy.

If WinCC recognizes a failure, the following actions will be triggered:

- The process connection error is reported to server 2.
- Server 1 receives a message that partner server 2 has failed.
- Server 1 stores the failure time (date and time) of server 2.

Note

In both servers, the tags "@RM_MASTER" and "@RM_MASTER_NAME" remain unchanged. No automatic client switch is performed.

Correction of the process connection error at Server 2

Provided the process connection monitoring has been activated, the gap in the archive of server 2 will be filled by the following measures:

- Server 1 stores the return time (date and time) of server 2.
- The gap in the archive of server 2 will be filled with the data of server 1's archive. The data of all PLCs will be synchronized. This means that the data of PLCs that have not failed will also be synchronized.
- In both servers, the tags "@RM_MASTER" and "@RM_MASTER_NAME" remain unchanged.
- No automatic client switch is performed.
- The correction of the process connection error at server 2 will be reported by a system message.

4 Appendix

4.1 System Messages of WinCC Redundancy

The Redundancy option provides a number of system messages, which can be configured in the Alarm Logging Editor (at "Options" – "WinCC System Messages").

The following system messages can be output by the WinCC Redundancy:

Message No.	WinCC Message Text
1012200	REDRT:Partner Server has failed WinCC has been ended on the Partner Server.
1012201	REDRT:Partner Server has come back online WinCC has been started again on the Partner Server.
1012202	REDRT:Projects are not functionally identical
1012203	REDRT:Archive Synchronization Error
1012204	REDRT:Internal Redundancy Error
1012205	REDRT:Connection Error to the Partner Server There is a connection error to the Partner Server.
1012206	REDRT:Connection to the Partner Server has been reestablished The connection to the partner server has been reestablished.
1012207	REDRT:Partner Server - is not active. During startup it has been detected that WinCC has not been started.
1012208	REDRT:Archive Synchronization started This message is displayed at the start of the archive synchronization.
1012209	REDRT:Archive Synchronization ended This message is displayed at the end of the archive synchronization.
1012210	REDRT:Tag Logging Synchronization started Start of the process data archive synchronization.
1012211	REDRT:Tag Logging Synchronization ended End of the process data archive synchronization.
1012212	REDRT:Alarm Logging Synchronization started Start of the message archive synchronization.
1012213	REDRT:Alarm Logging Synchronization ended End of the message archive synchronization.
1012216	REDRT:Synchronization has been interrupted Synchronization has been interrupted by another failure.
1012217	REDRT:Partner Server Project is not active During startup it has been detected that WinCC has not been started or is not in runtime on the Partner Server.
1012218	SWITCH:Client has been switched automatically Client has been switched automatically to the Partner Server.
1012219	SWITCH:Client has been switched manually Client has been switched manually to the Partner Server.

Message No.	WinCC Message Text
1012220	REDRT:Synchronization is not ready for all User Archives The synchronization is not ready for all locally configured User Archives, since the archive structure on the partner server differs for at least one archive or the synchronization has not been activated on the partner server.
1012221	REDRT:Synchronization is ready for all User Archives The synchronization is ready for the locally configured User Archives and the archive structure corresponds to that of the partner server.
1012222	REDRT:Partner Server Project Active It has been determined during startup that WinCC is active on the partner server.
1012223	REDRT:Error - Partner Computer is not a Server It has been determined during startup that the configured partner server is not a server.

4.2 System Tags of WinCC Redundancy

The system tags "@RM_MASTER", "@RM_MASTER_NAME" and "@RM_SWITCH" are used by the WinCC Redundancy for the master/slave control of both redundant servers and for the switch process of the clients. These system tags can also be read and changed by other applications and scripts.

System Tags of WinCC Redundancy	
@RM_MASTER	To identify the server computer as the master, the internal WinCC tag "@RM_MASTER" is set. If the server computer is the slave, the "@RM_MASTER" tag will be reset.
@RM_MASTER_NAME	The tag "@RM_MASTER_NAME" contains the name of the master server, for example "SERV_1".
@RM_SWITCH	To switch one or more clients to the partner server during runtime, the names of the clients to be switched are written into the internal WinCC tag "@RM_SWITCH" of the connected server. Redundancy will then perform the switch.
@RM_UA_ONL_"Archivename"	Serves only diagnostic purposes. For each User Archive, a tag with the corresponding archive name is created. The tag will be set to 1, if the User Archive has been changed. After the online synchronization, the tag will be reset to 0.
@RM_OFFLINE_UA_NAME	Serves only diagnostic purposes. After a server comes back online, the synchronization of a User Archive is performed in blocks. During the synchronization of a block, this tag is set with the corresponding archive name.

4.3 Abbreviations

Abbreviation	Explanation
PLC	Programmable Logic Controller
CS	Configuration System, WinCC Configuration
CT	Control System
CTM	Control System Message, message pertaining to the control level
OS	Operator Station
TLG	Tag Logging Archiving (process data archiving)
RT	WinCC Runtime
RTO	Runtime Object

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