

Series XC50/XC55

Appendix to the operating instructions software version 3.1 and higher

PLC connection S7-1x00 with web server

PLC connection S7-3xx with web server

1 Contact

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2 Legal note

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3 Introduction

With the PLC Connector expansion, the displays of the XC50/XC55 series offer you an easy way to automatically retrieve and display the application data of a Siemens PLC. For this purpose, the PLC must have a web server that provides the desired data in the form of an XML file. This XML file is called up cyclically by the XC50/XC55 display and its content is displayed on the display.

Scope and necessary knowledge

This instruction applies to Siebert displays of the XC50/XC55 series from software version 3.1. For newer versions of the XC50/XC55 software the screenshots may differ from this instruction, but the described procedures are valid analogously.

The general properties of the XC50 and XC55 displays, in particular the underlying data model and the safety instructions, are documented in detail in the operating instructions. Their knowledge is presupposed.

Furthermore, knowledge of PLC programming is required.

Supported PLC

Basically your PLC must have a web server and be able to provide the file required by the display.

E.g.: the following controls are suitable:

- Siemens S7 1x family
- Siemens S7 3 xx family with web server version V3.2 or higher

Supported engineering tools

The engineering tool depends on the PLC used.

- TIA Portal 15 for PLCs of the S7 1x00 family
- STEP 7 for PLCs of the S7 3xx family

In this manual, the procedure is described using examples for both options.

If you use a different engineering tool, you must carry out the necessary steps analogously. However, Siebert cannot provide specific support in these cases.

Transmission protocol

The data transport always takes place via the http or https protocol. You have to enter the access data to the PLC on the web side of the display.

Query interval

The query interval is defined by the displays of the XC50/XC55 series and can be set between one second and 30 seconds. You can set the interval with a slider on the web page 'Data – PLC settings'.

4 Typical applications

In each case, you define a layout on the display. First, the properties are selected that are to be commanded later by the PLC and the necessary data is exported. In the exported XML template file, the link between the layout elements of the display and the variable names of the PLC is defined. In addition, a corresponding data block is exported which you can use in the TIA Portal.

Using pre-defined variable names in the PLC

If a S7 1x00 CPU is used, the data block exported from the display can be imported into the Engineering Tool. In this case, the variable names in the PLC are specified by the display.

If a S7 3xx CPU is used the data block must be created manually in the STEP 7 software. In this case, the variable names must correspond to the specifications in the XML template file.

In the PLC you use the variable names exported from the display.

Using user-defined variable names in the PLC

You can easily use your own variable names in the PLC. In this case, you must open the XML template file exported from the display in a text editor and manually adjust the corresponding placeholders before you import the XML file into your controller.

Multiple displays with identical layout

Create your application for a display. If the application works, the existing layout can be uploaded to other displays and then be activated. After that the access data to your PLC will be entered on these displays.

Multiple displays with different layouts and same variable names

A major advantage of object-oriented data model of the display is the separation of layout and data. If different layouts are used on different displays and the names of the layout elements are left the same for all displays, then there is no need to make any changes on the PLC.

All displays request the same data from the PLC and display it according to their respective layout.

Multiple displays with different layouts and different variables

To do this, you can export the required data for each display in the PLC settings and load it into the controller as an individual DB. Thus in the control there is an individual DB for each display.

Additional operation via the web site

It is possible to command elements of the display by the PLC and to set the same elements or other elements via the web site.

If an element is commanded by both, the PLC as well as the web site then the last access is always valid.

5 Quick Start and general procedure

Quick Start

The following Quick Start is divided into four parts:

Quick Start part 1:

Configuration of the display and creation of the files for the controller. This part is independent from the specific PLC or the engineering tool.

Quick Start part 2a:

Configuration of the control and the web server in the TIA portal.

Here you find all information needed for the PLCs 1x00 and the TIA portal.

Quick Start part 2b:

Configuration of the control and the web server with STEP 7

Here you find all information needed for the PLCs 3xx and STEP 7.

Quick Start part 3:

Troubleshooting hints

General procedure

First, a layout is defined on the display. Each element of this layout has a unique name and a type. The name can be used later to address each element individually. The type defines how the sent data is to be interpreted. The possible elements and their properties are described in the operating instructions for the XC0/XC55 displays.

In this manual the layout 'PLC-Example' is used. This layout can be downloaded from the web site www.siebert-group.com. All following screenshots refer to this example.

The 'Data – PLC web page' of the display contains the settings for the PLC connector. In the first step check the connection data to the PLC and saved them. This information is then permanently stored on the display.

In the second step the element properties are defined which are used by the PLC. The 'Export tool' is called up to select the elements. Thereafter a new web page opens where all elements of the layout are arranged in a tree structure. Select the desired elements in this tree structure and save your selection.

The display then generates a Zip file containing a PLC data block and an XML file.

Import the DB (data block) and the XML file into your control. In the DB, the corresponding variables are defined for all values that are to be displayed on the display. The XML file defines the template for the XML file generated by the PLC with the values to be displayed.

Activate the PLS's own web server of the control.

Create a new user on the PLC for communication with the display. Later, this user is used to access the PLC from the display. The user name and password must match the information you previously set on the display under 'Display-IP-Addr – Data – PLC settings'.

Then the web server of the PLC takes over the desired data cyclically from the controller and makes them available on its website.

The displays of the XC50/XC55 series log on automatically as users to the PLC web server. After successful authentication, the displays cyclically request the desired data from the PLC web server and display it on the display.

6 Quick Start Part 1: Configuration of the display and creating the files for the controller

Download of the PLC-Example files from the Siebert web page

All files required for this quick start are available on the Siebert website www.siebert-group.com in the download area of the XC50/55 displays.

The file 'PLC-Connector-Example.Zip' contains the following files:

- the Zip file PLS-Example.Zip with the example layout. This file must be loaded into the display.
- this manual
- a sample project for the TIA portal, see Quick Start part 2a.
- a sample project for STEP 7, see Quick Start part 2b.

Save the file 'PLC-Connector-Example.Zip' in an appropriate place on your PC and extract the contents into the directory PLC-Connector-Example.

The example layout has the size 32x16 pixel. You can use it for all Siebert displays of the XC50/XC55 series.

Upload of the example layout to the display

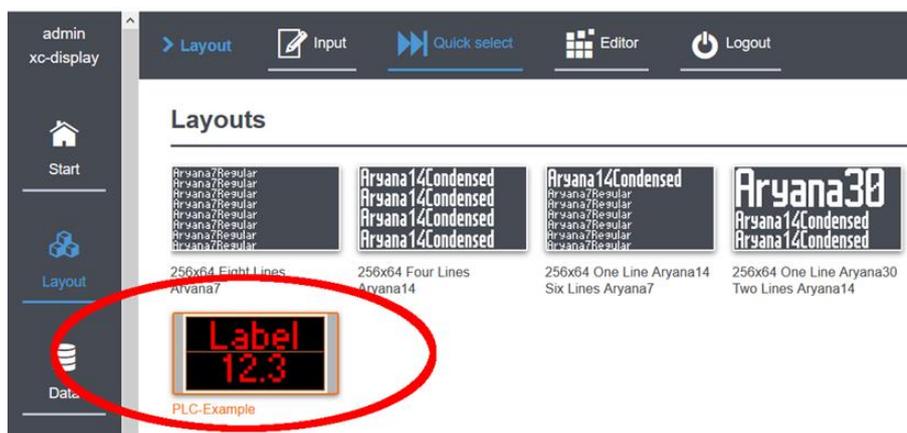
Call the website of the display.

Go to 'Utilities – File manager' and click the Upload button to upload the Zip-file 'PLC-Example.Zip' to the display.

This file contains all data necessary for this quick start.

Selection of the layout on the display

After uploading the Zip file you will find the 'Layout – Quick Select' the Layout 'PLC- Example' on the website. Activate this layout by clicking on it and confirm the security prompt. The active layout is marked in color:



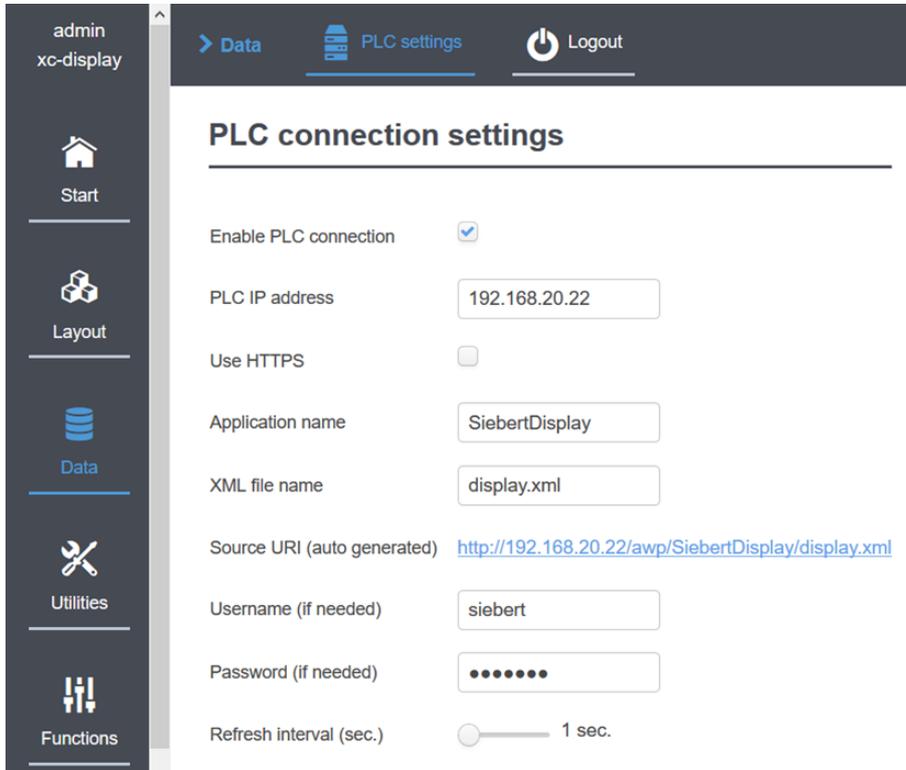
This example layout consists of a text field named 'txt1' and a numeric field named 'num1'. From the PLC, the text content and the color are to be commanded in the text field. With the numeric field the numeric value and also the Color are to be commanded.

The assignment between the elements on the display and the variables in the controller is done via a DB and a XML file. In both cases, these are human-readable ASCII files that can be opened and edited in any text editor.

Both files must match with the active layout on the display.

Entering the connection data on the website of the display

On the 'Data – PLC settings' web page enter the IP address of the controller, the access data and the transfer modes to the web server. The same access data must be entered into the web server of the controller.



The screenshot shows the 'PLC connection settings' page in a web browser. The page has a dark sidebar on the left with navigation options: 'admin xc-display', 'Start', 'Layout', 'Data' (highlighted), 'Utilities', and 'Functions'. The main content area has a top navigation bar with 'Data', 'PLC settings' (active), and 'Logout'. Below this is the title 'PLC connection settings'. The settings are as follows:

Enable PLC connection	<input checked="" type="checkbox"/>
PLC IP address	<input type="text" value="192.168.20.22"/>
Use HTTPS	<input type="checkbox"/>
Application name	<input type="text" value="SiebertDisplay"/>
XML file name	<input type="text" value="display.xml"/>
Source URI (auto generated)	http://192.168.20.22/awp/SiebertDisplay/display.xml
Username (if needed)	<input type="text" value="siebert"/>
Password (if needed)	<input type="password" value="••••••"/>
Refresh interval (sec.)	<input type="range" value="1"/> 1 sec.

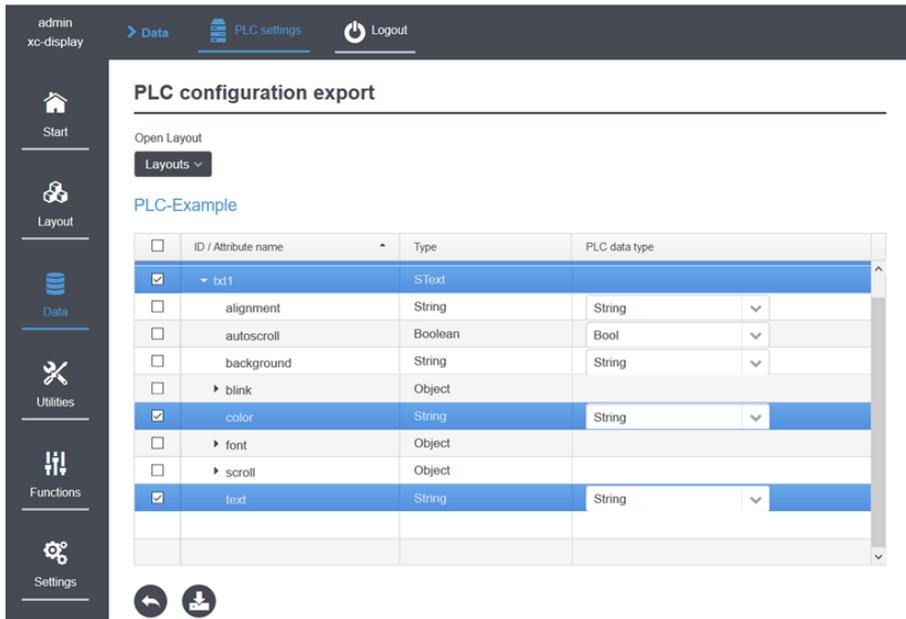
Note: The name you assign in the <XML file name> field is later used in the PLC as the name of the data block via which the data is provided for the display.

Selection of the elements for PLC configuration export

Call up also on the website 'Data – PLC settings', the 'Export tool'. On the following page you can select the elements to be filled in by the PLC.

In this example these are the content and the color of the text field 'txt1' and the numeric value and the color of the numeric field 'num1'.

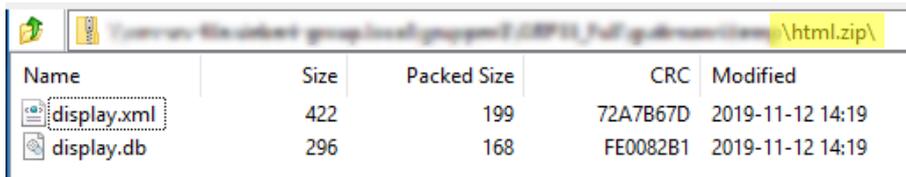
Recommendation: here only select the elements and properties that are really to be controlled by the PLC. This avoids unnecessarily large files and unnecessary variables on the PLC.



The screenshot shows the 'PLC configuration export' interface. A table lists various attributes and their types. The following table represents the data visible in the screenshot:

ID / Attribute name	Type	PLC data type
<input checked="" type="checkbox"/> txt1	SText	
<input type="checkbox"/> alignment	String	String
<input type="checkbox"/> autoscroll	Boolean	Bool
<input type="checkbox"/> background	String	String
<input type="checkbox"/> blink	Object	
<input checked="" type="checkbox"/> color	String	String
<input type="checkbox"/> font	Object	
<input type="checkbox"/> scroll	Object	
<input checked="" type="checkbox"/> text	String	String

By clicking on the Export Button the required files are created and saved under the name 'html.zip' on the PC. The two human readable files display.db and display.xml are stored in this zip file. The file name is taken from the field 'XML file name' of the web page 'Data – PLC settings'.



Name	Size	Packed Size	CRC	Modified
display.xml	422	199	72A7B67D	2019-11-12 14:19
display.db	296	168	FE0082B1	2019-11-12 14:19

Content of the XML file

The XML file is required by the web server of the controller as a template into which the contents of the variables are transferred during operation. The keywords in this file are specified by the display and are described in the XC50/XC55 operating instructions.

In this example the XML file has the following structure:

```
<?xml version="1.0" encoding="UTF-8"?><siebert-display>
  <meta>
    <request>setData</request>
    <version>1</version>
  </meta>
  <data>
    <SText id="txt1">
      <text>:="display".txt1.text:</text>
      <color>:="display".txt1.color:</color>
    </SText>
    <SNumeric id="num1">
      <value>:="display".num1.value:</value>
      <color>:="display".num1.color:</color>
    </SNumeric>
  </data>
</siebert-display>
```

The parts between the colons, p.e.: :="display".txt1.text: , are placeholders for the variables which are later filled by the PLC with the current values.

Content of the DB-file

With the DB the controller can transmit the contents of certain variables to the web server. Together with the XML file that serves as a template, the Web server generates a new XML file with data for the display. As soon as the data in the controller changes, the XML file is automatically updated with the data for the display.

In this example the DB has the following structure and defines the variables in the controller:

```
DATA_BLOCK "display"
{ S7_Optimized_Access := 'TRUE' }
VERSION : 0.1
NON_RETAIN
VAR
  "txt1" : Struct
    "text" : String;
    "color" : String;
  END_STRUCT;
  "num1" : Struct
    "value" : Int;
    "color" : String;
  END_STRUCT;
END_VAR
```

7 Quick Start part 2a: Configuration of the controller and the web server in TIA portal

You can download the TIA Portal project, which was used for the following screenshots, from our website.

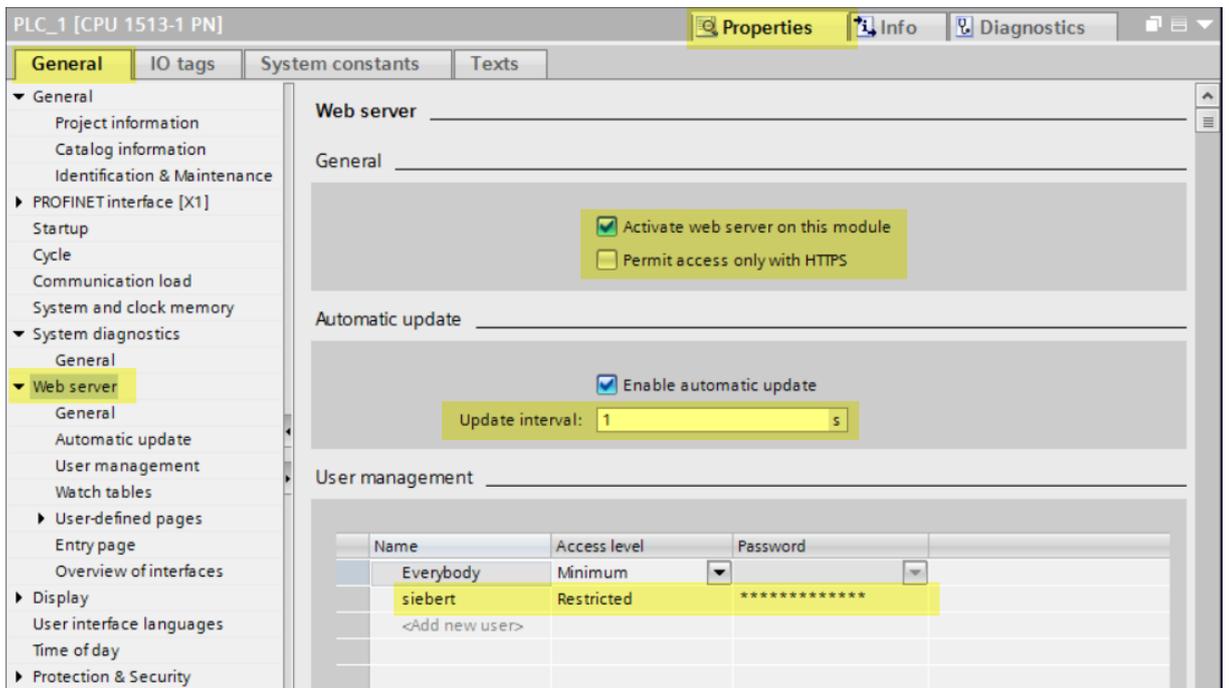
With the PLC, the following steps must be carried out:

Switching on the web server and creating users

Activate the web server of the PLC.

Then enter the user name, the password and transmission modes in the web server of the PLC.

This information must match the settings entered on the website of the display.



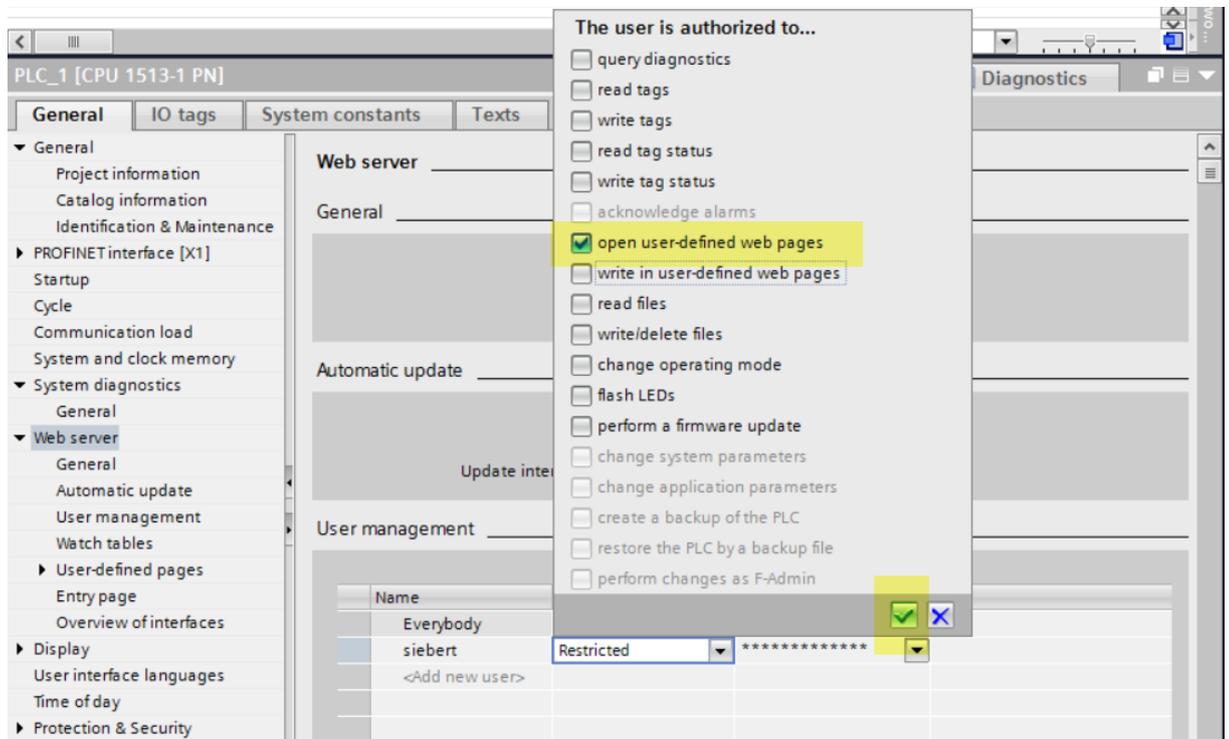
The screenshot shows the TIA Portal configuration window for a PLC_1 [CPU 1513-1 PN]. The 'Web server' section is selected in the left-hand navigation tree. The 'Web server' configuration area is divided into three sections: 'General', 'Automatic update', and 'User management'.

- General:** The checkbox 'Activate web server on this module' is checked. The checkbox 'Permit access only with HTTPS' is unchecked.
- Automatic update:** The checkbox 'Enable automatic update' is checked. The 'Update interval' is set to 1 second.
- User management:** A table lists the configured users. The 'siebert' user is highlighted.

Name	Access level	Password
Everybody	Minimum	
siebert	Restricted	*****
<Add new user>		

Define user rights

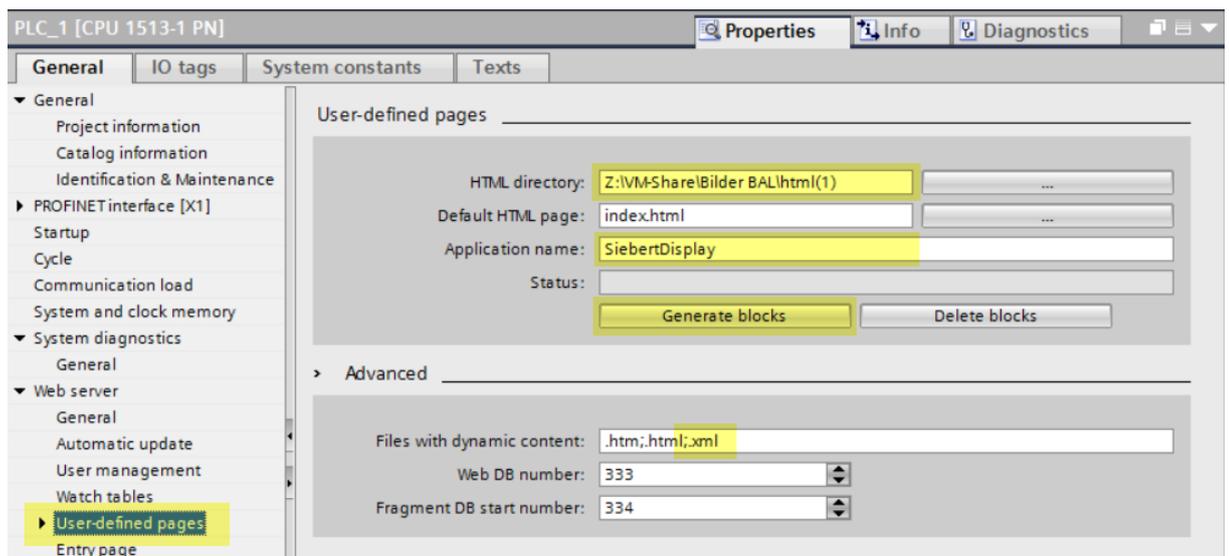
Select the marked checkbox to allow the user, in this case the XC50/XC55 display, to request data from the web server of the controller.



Load DB and XML files into the controller

Load the DB and XML file, created by the display into the controller.

Important: Ensure that you enter .xml in the <Advanced / Field with dynamic content> field.



Copy the contents of the html.zip file that you exported from the display in the first step into the directory that you specified in the <User-defined pages / HTML directory> field in the dialog above.

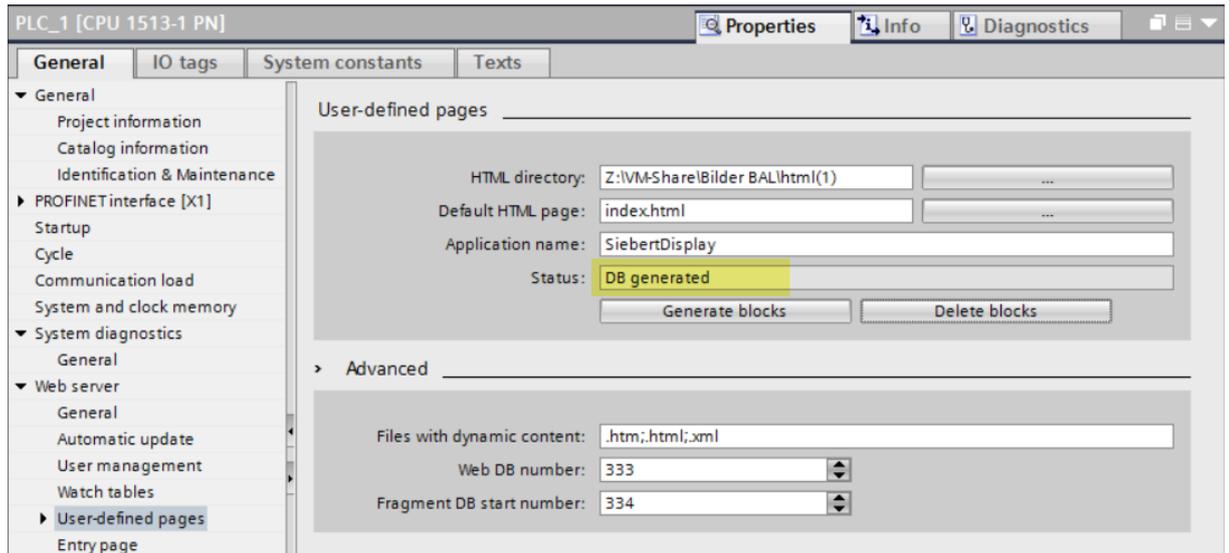
This directory must then contain the two files display.xml and display.db if you followed the Quick Start example.

Now import the display.db file into the engineering tool and create the data block.

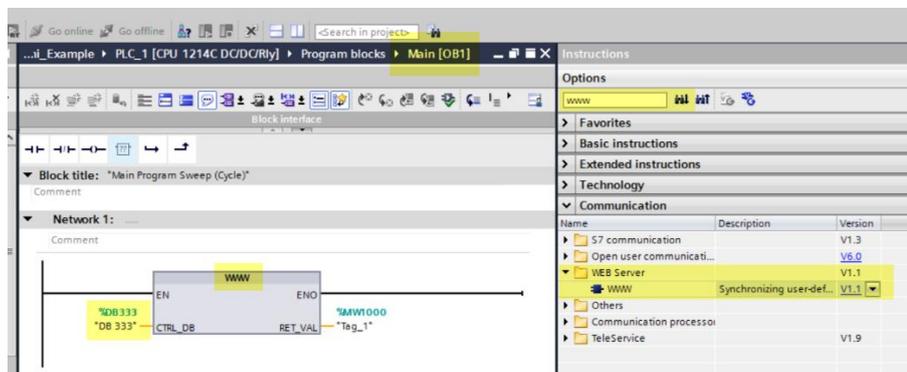
This applies analogously if you have assigned a different name for the XML file on the display web page in the PLC settings.

Generate Web server modules

By clicking on the button 'Create blocks' the files are analyzed by the controller. If successful, the status DB generated is shown.



Cyclical call of the website

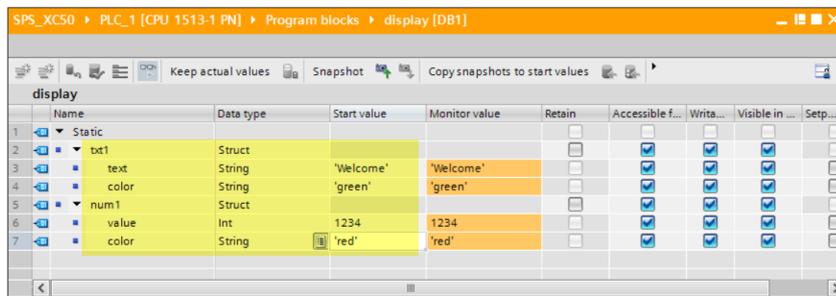


Providing data for the display

Open the generated DB.

All defined variables are displayed there and can be sent from the DB to the controller. The web server on the controller then updates its output file. With the next cyclical request of the control data by the display the new data is read and shown on the display.

Important: The display checks the received data. The illustration on the display is only updated if the data is error-free. Pay particular attention that valid values are entered for the colors: 'red', 'green', 'blue', 'orange', 'yellow', 'black', 'white', 'cyan'.



Name	Data type	Start value	Monitor value	Retain	Accessible f...	Writa...	Visible in ...	Setp...
Static								
txt1	Struct							
text	String	'Welcome'	'Welcome'		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
color	String	'green'	'green'		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
num1	Struct							
value	Int	1234	1234		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
color	String	'red'	'red'		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Function control

As the data provided by the web server are available as a XML file, simple control is possible. Therefore you have to login with a browser directly on the web server of the PLC.

With the URL <IP Adresse>/awp/SiebertDisplay/display.xml you can check the content of the xml file. This file should have exactly the same structure as the XML template file. But instead of the references to the variables in the controller the current values are entered in this file.



```

<-siebert-display>
  <-meta>
    <request>setData</request>
    <version>1</version>
  </meta>
  <-data>
    <-SText id="txt1">
      <text>'Welcome'</text>
      <color>'green'</color>
    </SText>
    <-SNumeric id="num1">
      <value>1234</value>
      <color>'red'</color>
    </SNumeric>
  </data>
</siebert-display>

```

8 Quick Start part 2b: Configuration of the controller and web server with STEP 7

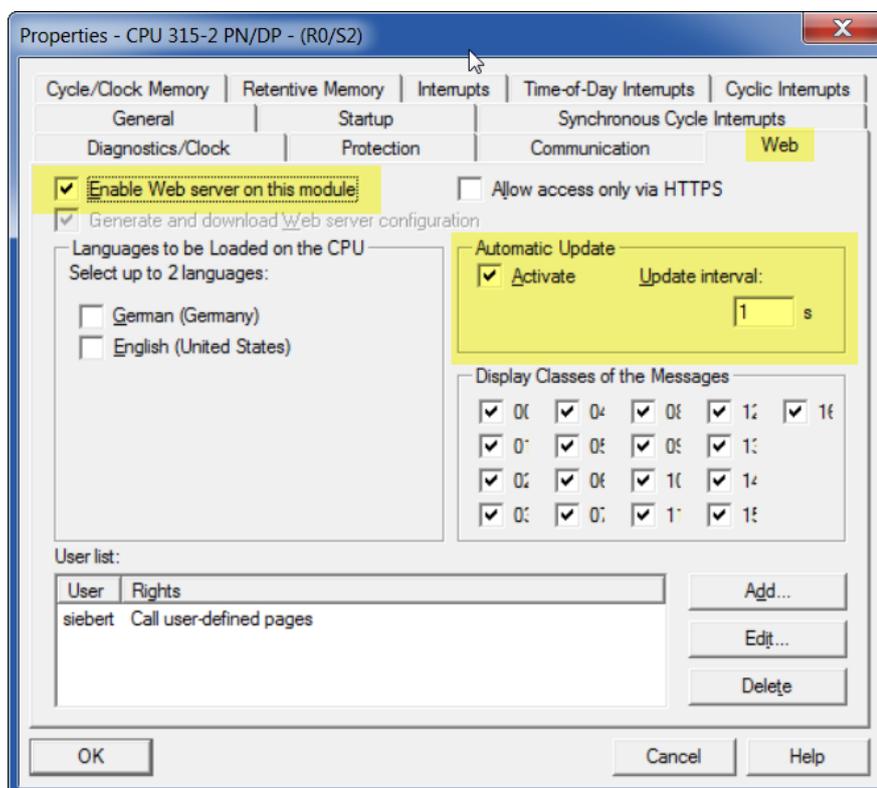
If you use a PLC S3xx, the programming is done with the STEP 7 software. Please follow the following steps:

Creating the layout is described in part 1 of the Quick Start and is prerequisite here.

Check the web server of the CPU

In order to use the PLC connector with a S7-3xx or S7-4xx, it must be ensured, that the controllers on one hand have a web server and on the other hand also can process user-defined HTML pages.

First check this prerequisite in the configuration of the hardware of the PLC. Therefore double-click on the control's icon in the hardware configuration. In the dialogue 'Properties' a tab 'Web' must appear and in the area 'Automatic Update' the check box 'Activate' must be selectable.



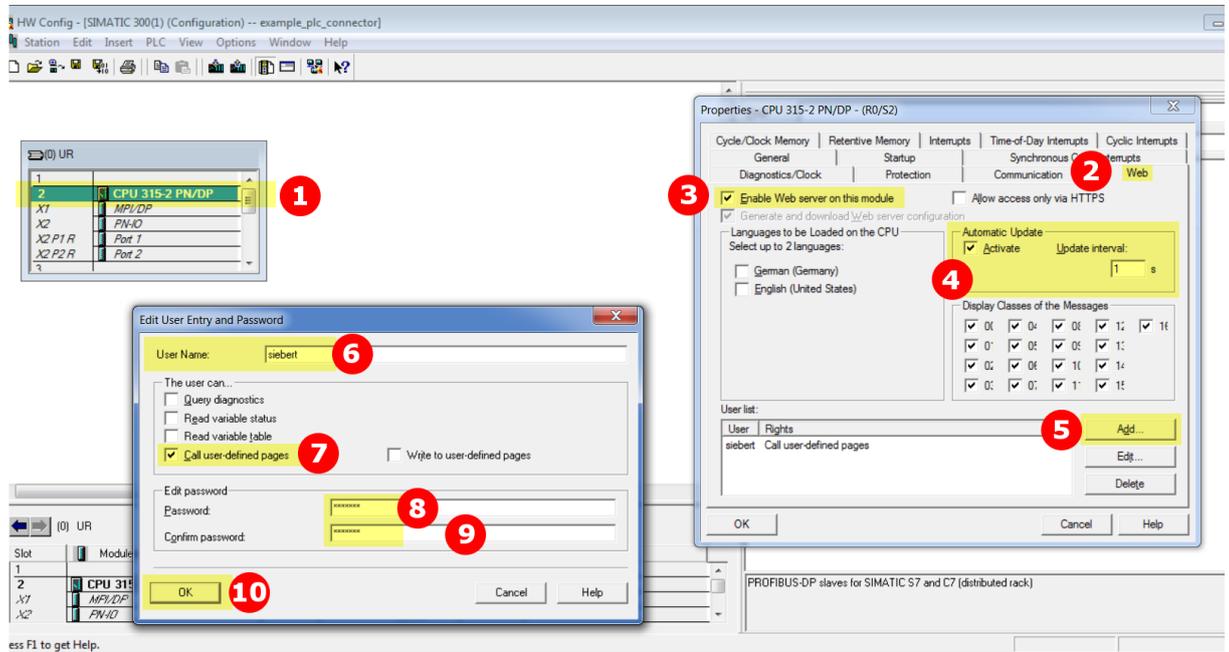
Using files exported from the display

Copy the XML file exported by the display in a directory named 'html'. The also exported ".db" file is not required with STEP 7.

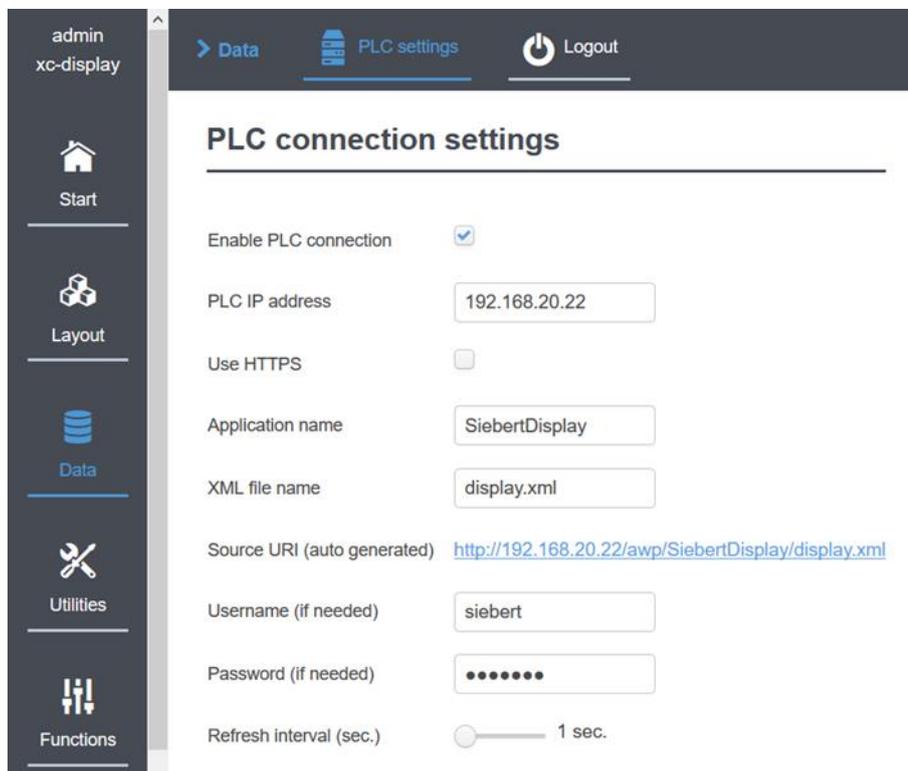


Create a new STEP 7 project

Start the STEP7 manager V5.6, create a new project and configure the controller in the hardware configuration according to the following figure:

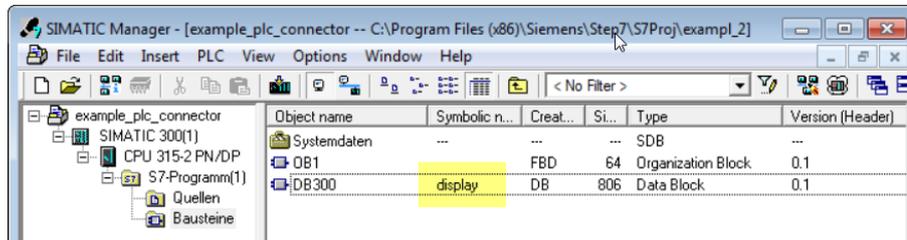


Enter the user name and the defined password on the website of the 'Data – PLC settings' of the display and save the information with the save ok Button.

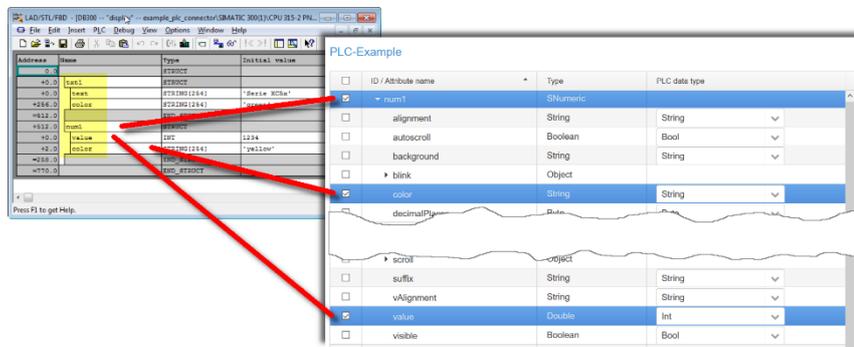


Create data block

Create a data block. The name of the data block must be identical with the name of the XML file name.

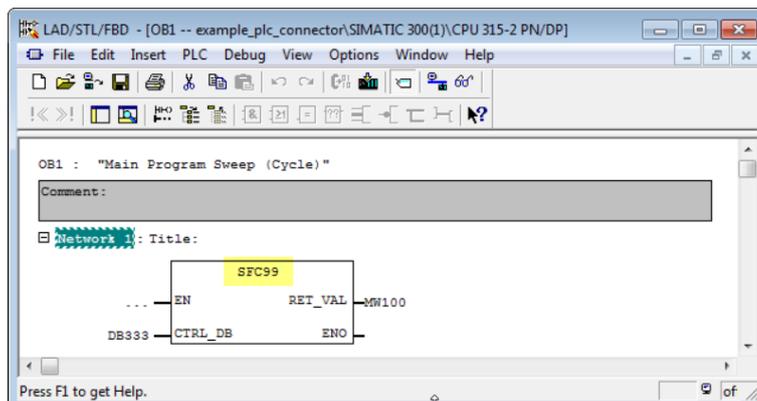


Now enter the variable names in the data block. The names and types must correspond exactly with the place holders in the XML file.

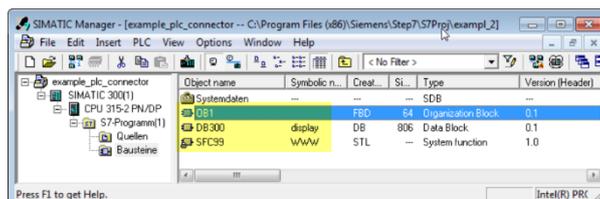


Create the SFC99

Activate the web server via the SFC99.

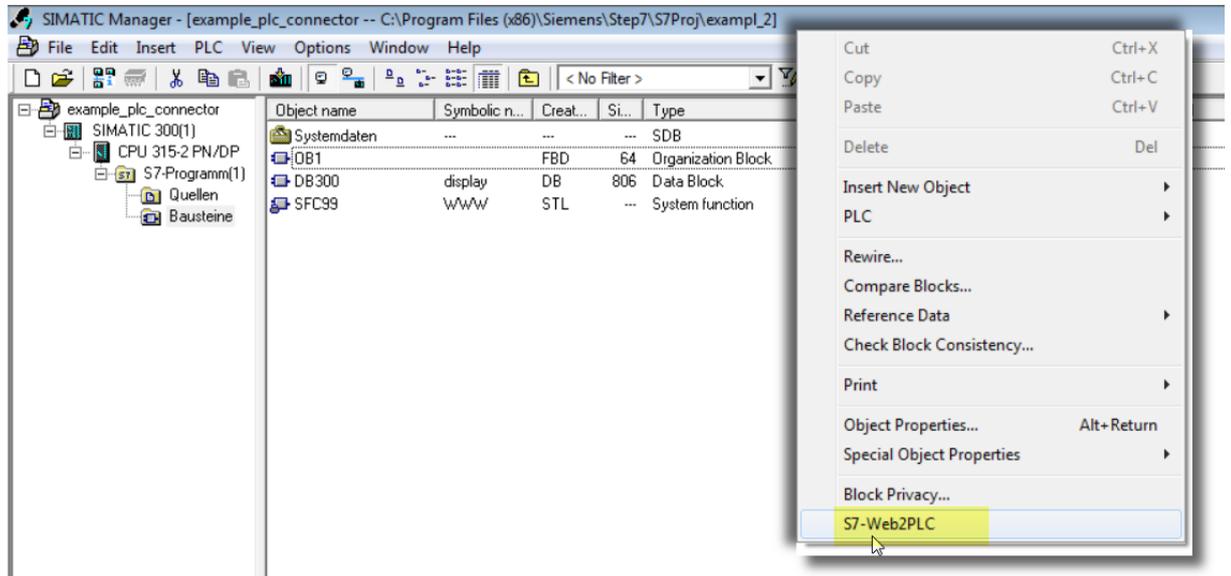


After that, the following blocks should be present in your project:

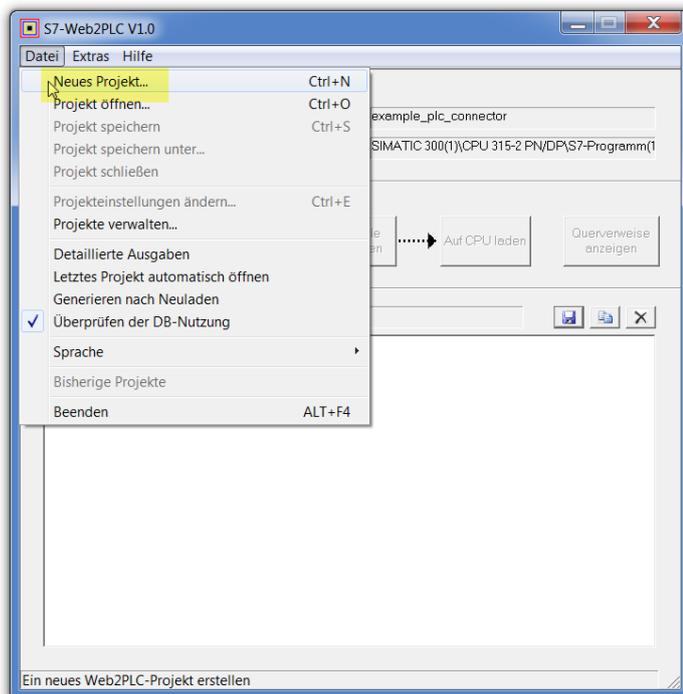


Start Web2PLC

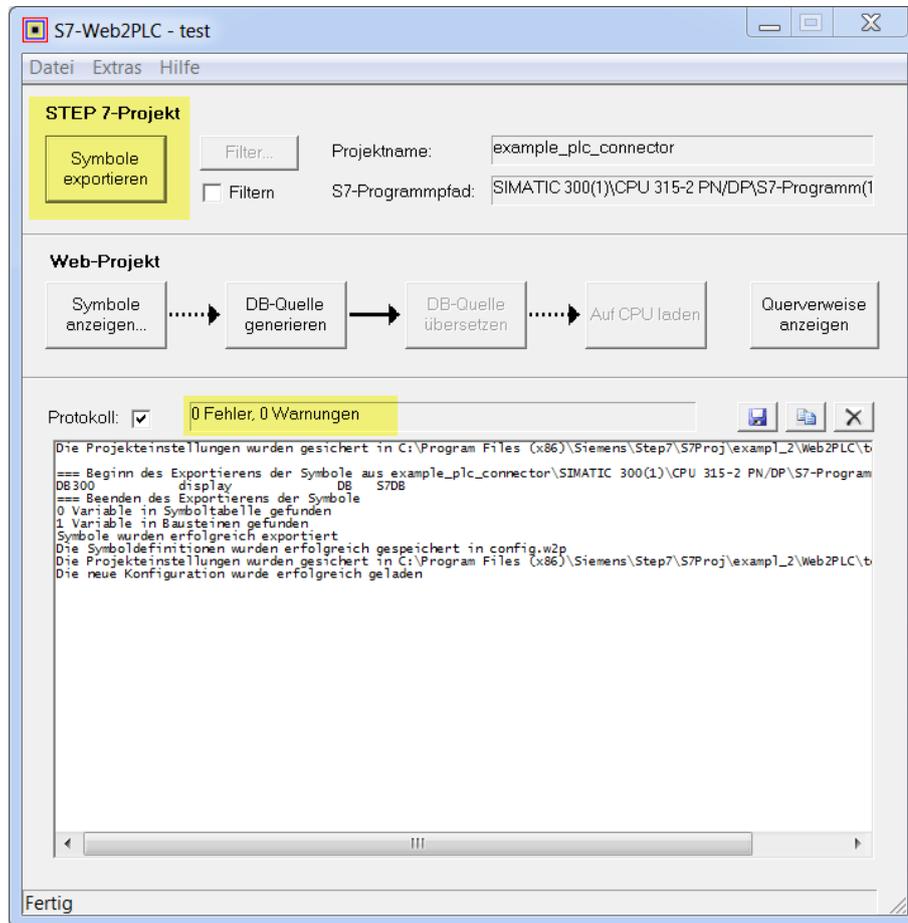
Call up the context menu by a right mouse click in the object field and start the program S7-Web2PLC.

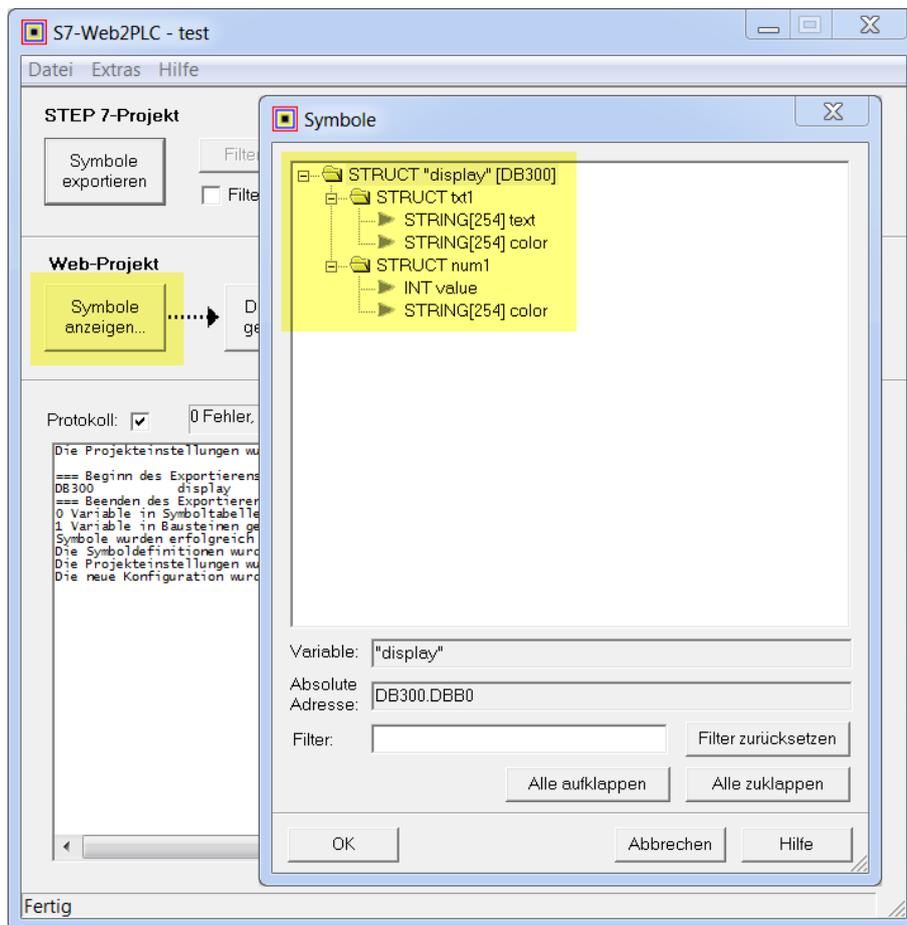


Create a new Web2PLC project



Export the DB data from the S7 project

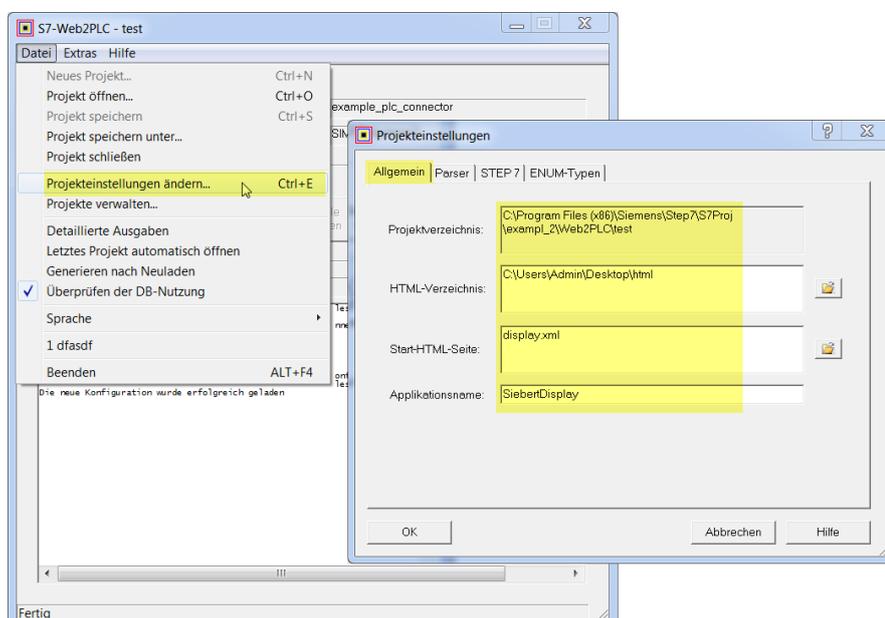




Adjust project settings

In the following dialogue 'Project settings' enter the data matching the layout:

- HTML directory location
- The file to be displayed on the start HTML page: select the XML file that you exported from the display. Note: change the data filter to '*.*'.
- Under application name, enter the same name as you defined on the display's web page.

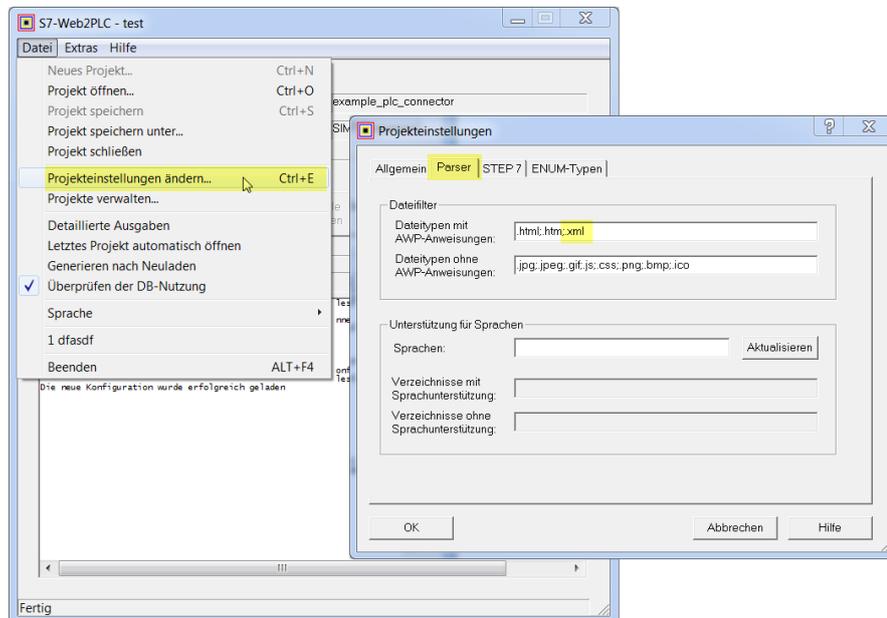


Now switch to the 'Parser tab'.

Important:

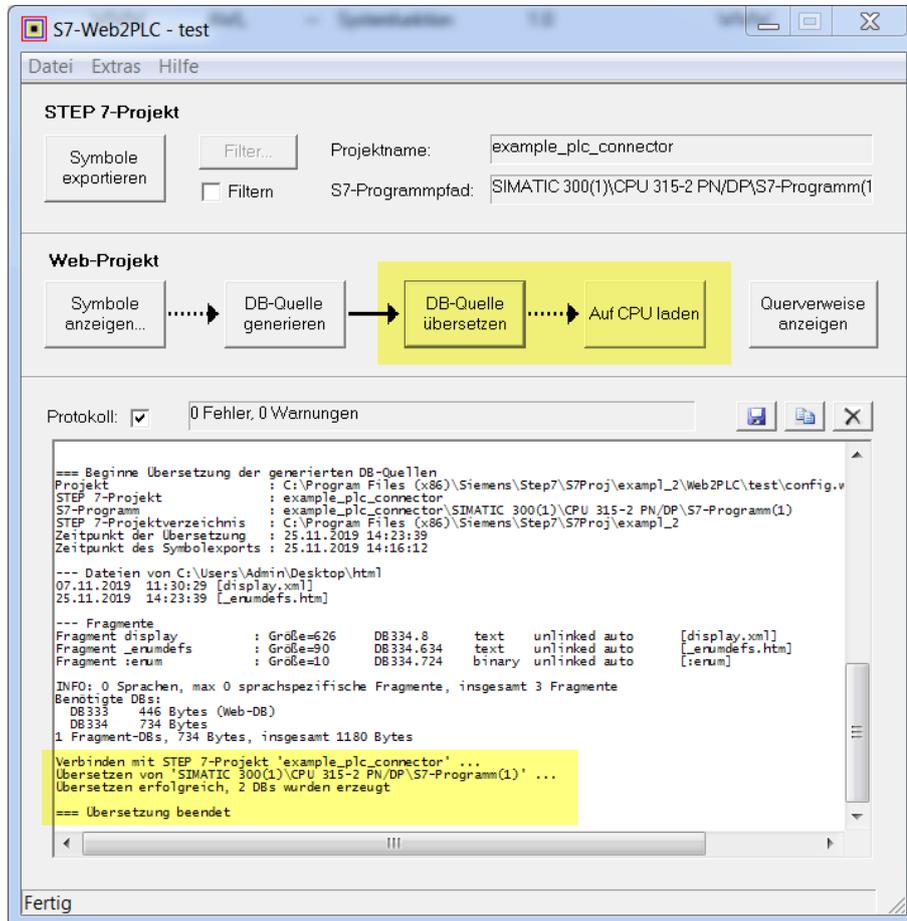
In line 'Data types with AWP instructions:' add type ".xml".

Remove type ".xml" in line 'Data types without AWP instructions'.

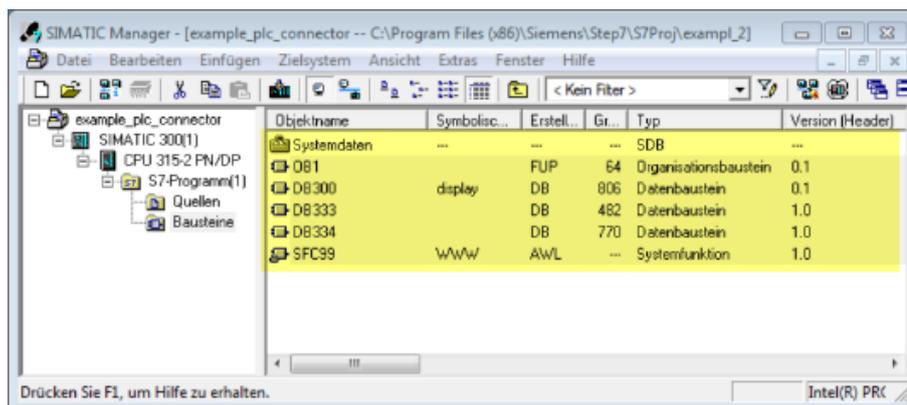


Translating the DB source and loading of the Web project on the CPU

The web project may now be loaded to the CPU if no errors were found in the translation.

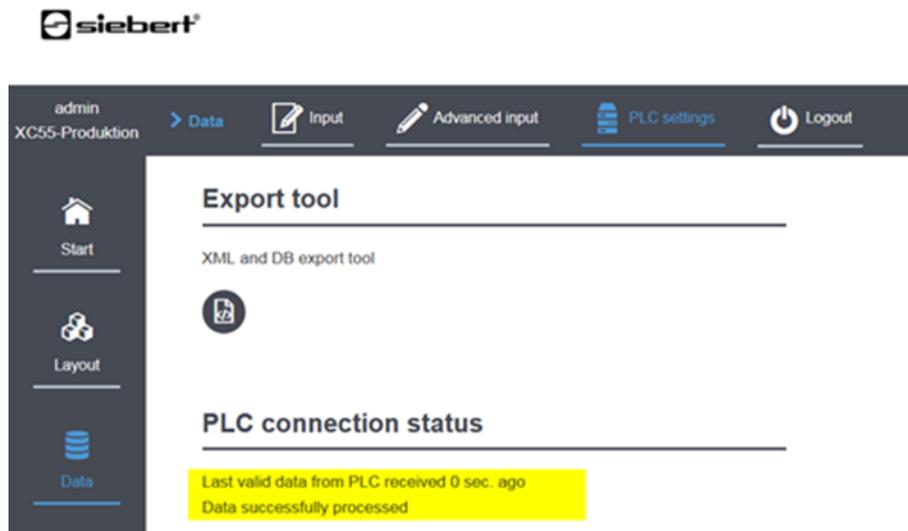


Load complete project into the CPU

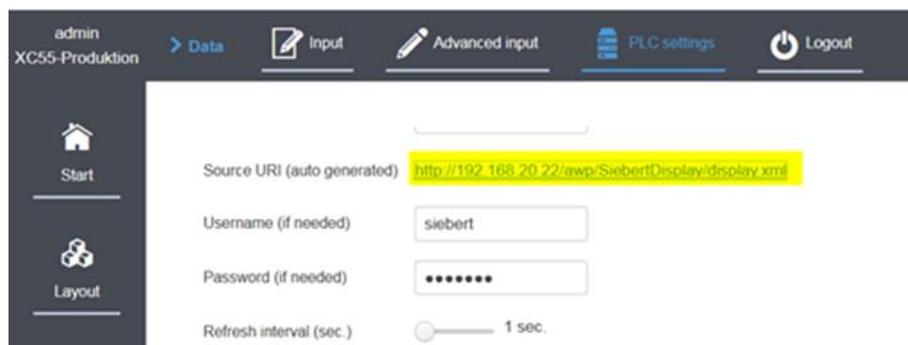


Control over the web site of the display

On the web site check 'Data – PLC Settings' in the area 'PLC connection status' the messages from the display.



By clicking on the link in the line 'Source URI (auto generated)' the XML file provided by the PLC opens.



On the now displayed web site the variable contents of PLC can be seen. The IDs contain the names of the layout elements of the display.



```

<-siebert-display>
  <-meta>
    <request>setData</request>
    <version>1</version>
  </meta>
  <-data>
    <-SText id="txt1">
      <text>'Welcome'</text>
      <color>'green'</color>
    </SText>
    <-SNumeric id="num1">
      <value>1234</value>
      <color>'red'</color>
    </SNumeric>
  </data>
</siebert-display>

```

9 Quick Start part 3: Hints and troubleshooting

The XC50/XC55 displays show the result of the last access to the PLC data in the lower section of the 'Data – PLC Settings'. The error messages can be grouped together in several groups.

- HTTP status messages of the web server.
These messages are standardized by HTTP. Their meaning can be looked up in the Internet.
- Messages for the evaluation of transmitted data
These messages are generated by the XC50/XC55 display. In these cases the connection to the PLC was successful and the messages refer to the evaluation of received data.

General notes

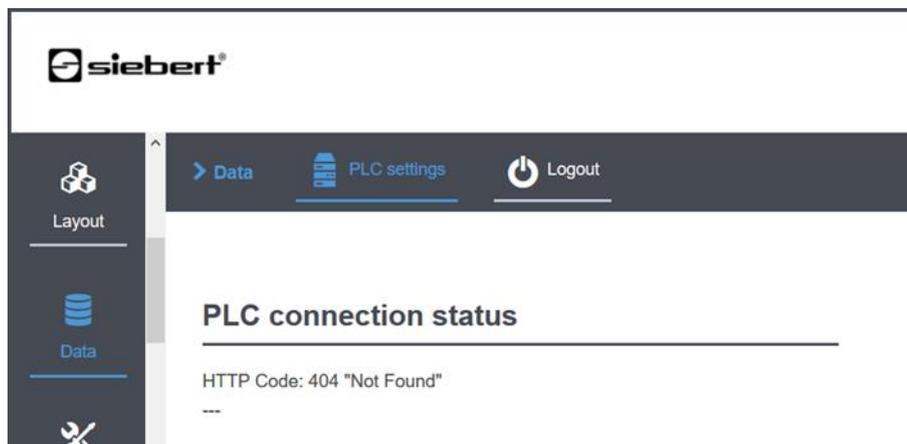
To each attribute that you export, you must also assign a variable in the PLC.

For this reason, only select those attributes with the 'PLC configuration export' that you really want to command from the PLC. By doing so, you reduce your programming effort to the absolutely necessary.

When importing the data into the PLC, no standard values can be imported. Therefore assign meaningful values to each variable used.

Http Code messages

In case of error messages that can be tracked back to the web server, the reported HTTP code is displayed. A typical example of an error code for a typing error of the IP address is for example:



Protocol messages

<pre>Last valid data from PLC received x sec. ago Data successfully processed</pre>	<p>The connection was successful, the XML was evaluated without errors.</p>
<pre>timeout('time out',) ---</pre>	<p>The connection of the web server of the PLC fails.</p> <p>Possible error causes:</p> <p>The PLC is not switched on The IP addresses do not match Username or password is incorrect</p>
<pre>BadStatusLine('',) ---</pre>	<p>The XML file was read. An error occurred during evaluation of the file.</p> <p>P.e.: Unknown names if the names of the layout elements of the display do not match the variable names of the PLC.</p>
<pre>Could not set shortcut value.: Neither color name nor hex value #rrggbb given</pre>	<p>An element with the property color was passed a wrong value, e.g. an empty string because no color was defined yet.</p>

Control of the XML file

Check if the xml file is read by the PLC by clicking on the link on the display web page <Data / PLC settings>.

Check also if the xml file has the correct form. Especially the placeholders <:="name"....:> must be replaced by meaningful values. If this is not the case, then possibly the entry .xml was forgotten in the settings of the web server.

Special characters in the XML file

The coding of the special characters of the XML file follows the rules of the W3C.

If you want to display the following characters, they must be encoded in the XML file as follows:

Character	Description	symbolic	Hex number	Decimal number
"	Quotes up	"	"	"
&	Ampersand characters & (commercial and)	&	&	&
<	Opening angle brackets	<	<	<
>	Closing angle brackets	>	>	>
'	Apostrophe, single quotation mark up	'	'	'

In these cases use the data type 'WString' in the PLC.

Please note that the illustration of the XML file depends on the web browser used. If in doubt, you can save the XML file from the web browser locally on your system and check the content with a text editor.

For example, if you want to display the text „<Hello>“ in blue color in the filed 'txt1' of the example layout, the corresponding entry in the XML file must look like this:

```
<SText id="txt1">  
  <text>&#x27;&#x3c;Hello&#x3e;&#x27;</text>  
  <color>&#x27;blue&#x27;</color>  
</SText>
```

Display preview



Date and time

Give the date or time as simple strings since the special data types for date and time in the PLC do not always work.

Character sets

When commanding character sets, use only the font names defined on the display. You can find these names on the 'Data – Advanced Input – Properties':

Font	Aryana7Regular 
Alignment	<ul style="list-style-type: none"> Aryana14Bold Aryana14Condensed <li style="background-color: #4a86e8; color: white;">Aryana14Regular Aryana30Regular Aryana7Bold Aryana7Regular
Blink	
Blinkspeed	Metric14Regular
Scrollable	Metric7Regular

The properties 'font.size' and 'font.spacingFactor' that can be selected during 'PLC configuration export' are currently without function.

10 Operate several displays on one PLC

The operation of several displays on one PLC is possible without any problems.

All displays have the same layout and should show the same data

In this case it is enough to perform the steps described in the Quick Start for a display.

If the communication with one display works, export the layout of this display, import it on the remaining displays and select it there as the current layout.

In the last step, the communication data to the PLC must be entered on the remaining displays. Since all displays query the same PLC, the data can be taken over from the first display.

The displays are to show different data

In this case, perform the steps from the Quick Start for each display in turn.

Important: The XML file must have a different name on each display. Only then can you assign a separate data block to each display on the PLC.

Since the exported data are always summarized in the file html.zip it is useful to rename this file after the export.

All data exported in this way must be copied to the directory that you specify in the PLC when configuring the web server.

After importing the various DBs into the PLC and compiling the project, the PLC can generate a separate XML file for each display with the data you defined and the displays can read and display it.

11 Technical data

All technical data such as order numbers, dimensions, power consumption, drawings of housings, temperature range, etc. can be found in the document PSP XC50_XC55.pdf entitled "Series XC50/XC55 LED Matrix Displays" in the download area of the Siebert homepage: www.siebert-group.com