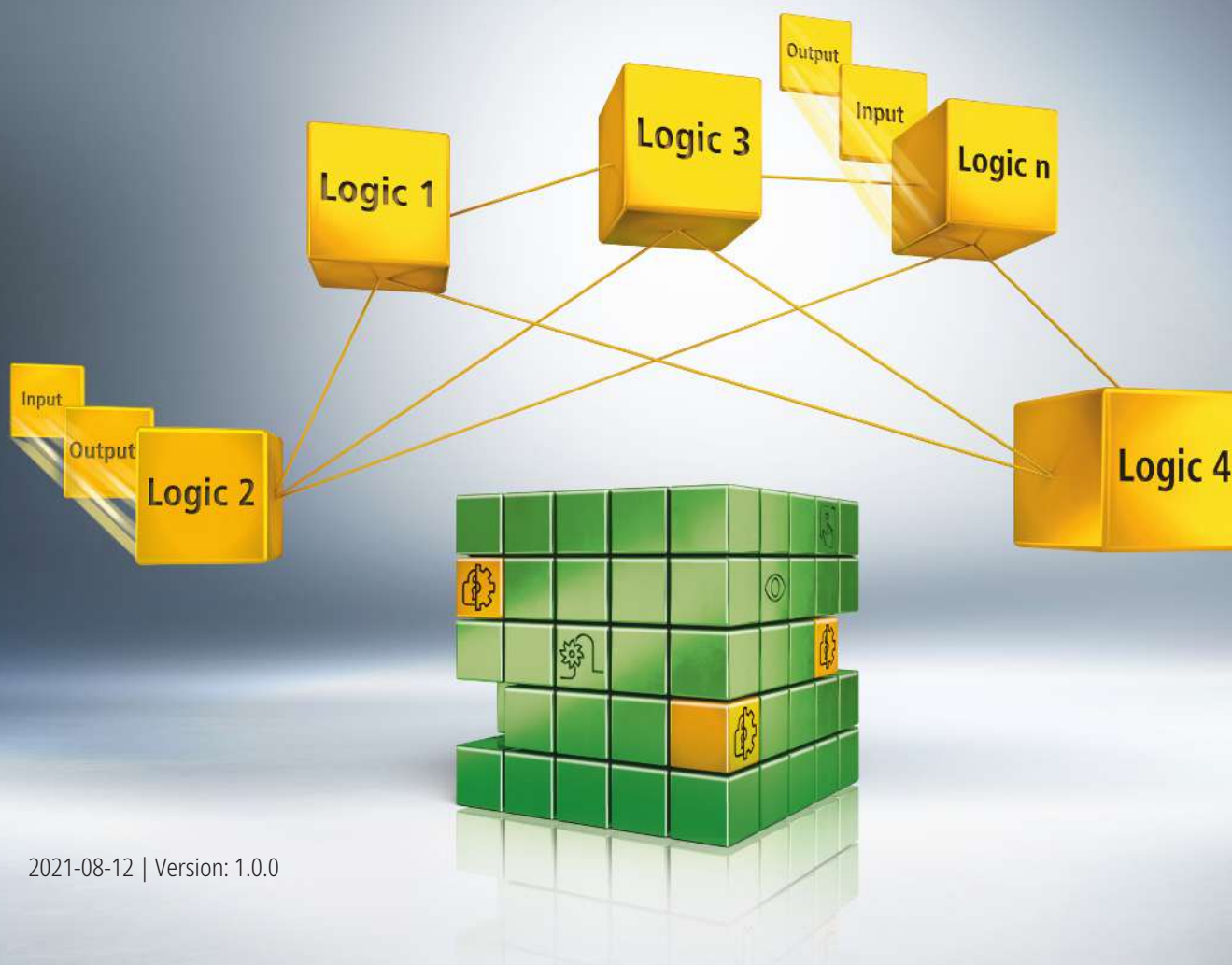


TwinSAFE tutorial 6 | EN

# Backup/Restore for AX8000

Configuration and usage





# 1 Introduction

TwinSAFE includes several innovations that bring more functionality and performance to your safety controller. A major innovation is that the functionality of the safety controller is integrated in each TwinSAFE component. This means that you can, for example, use a TwinSAFE input component both as an input component and the safety control integrated on it to use application-specific pre-processing.

This is tutorial 6 of a tutorial series.

The aim of this tutorial series is to familiarize you with the TwinSAFE innovations using individual examples.

This tutorial is about the configuration and usage of the Backup/Restore function with an AX8000.

## 1.1 Issue statuses

Version	Comment
1.0.0	• First released version
0.0.1	• First draft

## 1.2 Requirements

Meet the following requirements for this tutorial:

- TwinCAT 3 version  $\geq$  3.1.4024.11
- TwinCAT Safety Editor TE9000  $\geq$  1.2.1.1
- TwinSAFE firmware  $\geq$  03
- AX8000 firmware  $\geq$  0104; with default module ID active
- TC3 EL6910 Backup Restore Lib version  $\geq$  3.3.0.2

## 1.3 Starting point

At the starting point of the tutorial

- a standard PLC solution with an EL6910 project exists.
- a AX8000 SLP project exists.

## **1.4 Demo system**

### **1.4.1 Hardware**

The demo system of this tutorial consists of the following hardware:

- CX for EtherCAT communication and the standard PLC controller
- EL6910 as master TwinSAFE Logic
- EL1918 with safe inputs for reading light barrier signals
- Light barrier
- AX8000-x2xx

### **1.4.2 Desired safety functionality**

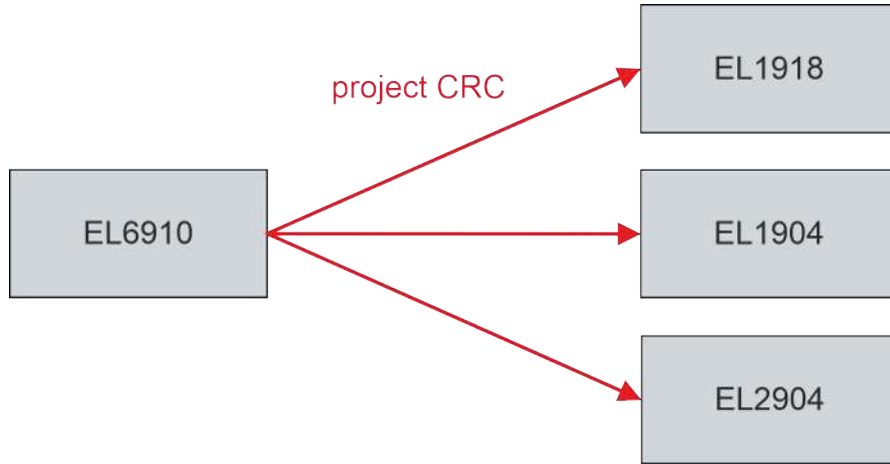
This tutorial describes the realization of the following safety functionalities:

- Backup/Restore for EL6910 and AX8000 are configured.
- Backup/Restore functionality is activated via PLC.
- Projects and user administration are restored.

## 1.5 Approach

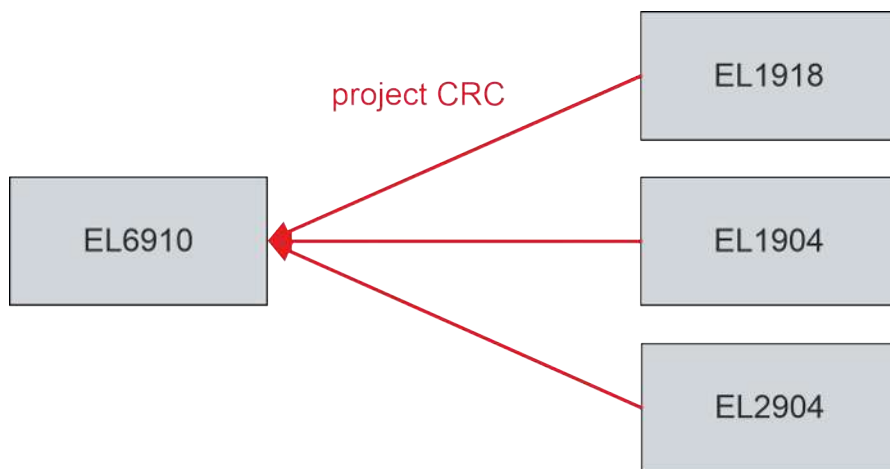
### 1.5.1 Classic solution

#### Startup communication

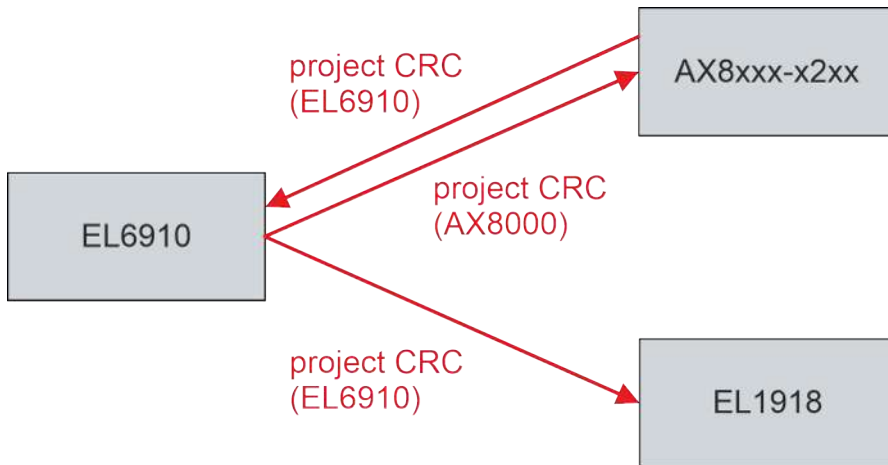


- Centralized safety project
- Project CRC distributed to slaves

#### Restore mode



## 1.5.2 Tutorial solution



- Centralized safety project + AX8000 project
- Logic to logic connection
- EL6910 and AX8000 must distribute project CRC
- Dependence of projects

## 2 Demonstration

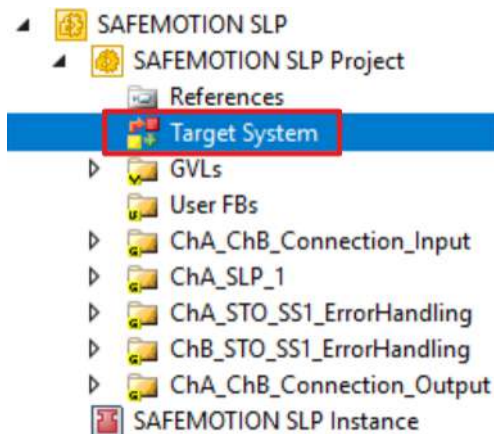
### 2.1 Configuration

To the starting point of the tutorial you see a standard PLC with the Backup/Restore program.

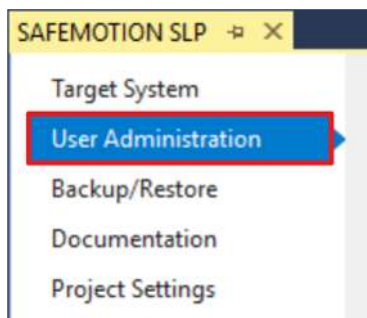
You also see the added library "TC3\_EL6910\_Backup\_Restore" in version 3.3.0.2.

#### 2.1.1 Create test user

To configure the backup/restore, first create a test user as follows:



1. Open the file "Target System" in the SLP project



2. Open the tab "User Administration"

The user administration opens.



3. Click on "Get User List" to read out the existing users

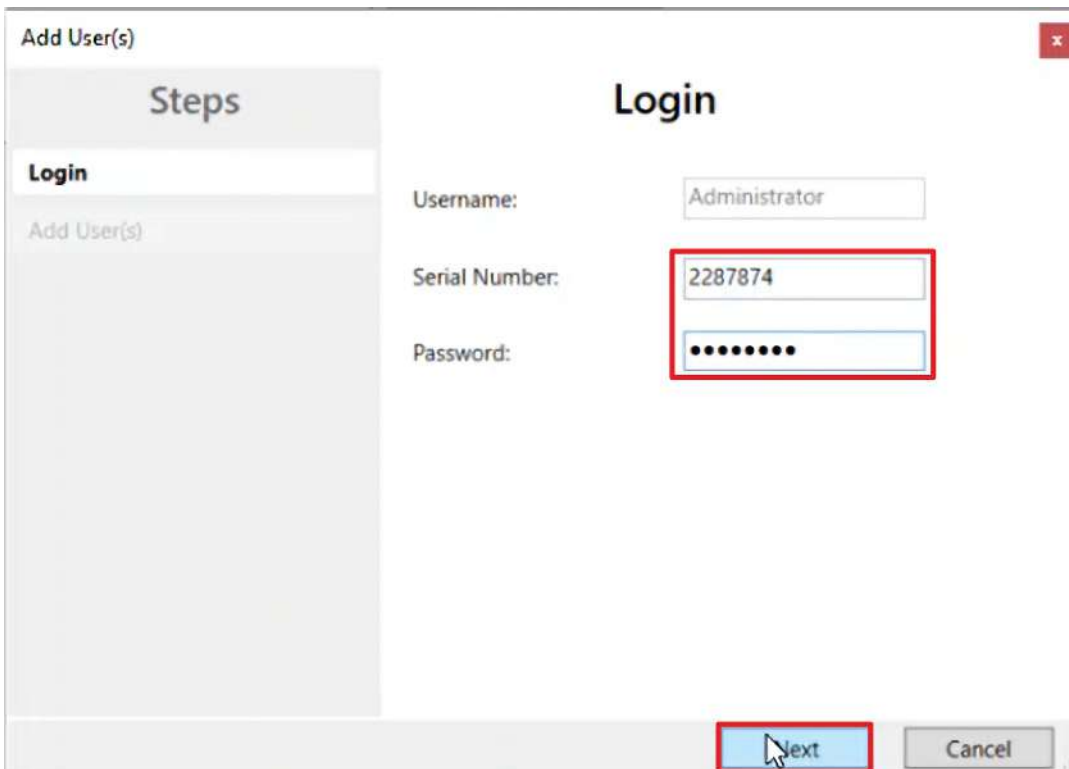


4. Click on "Add User(s)" to add a new user



A warning window appears informing you that in Run mode the secure communication will be interrupted.

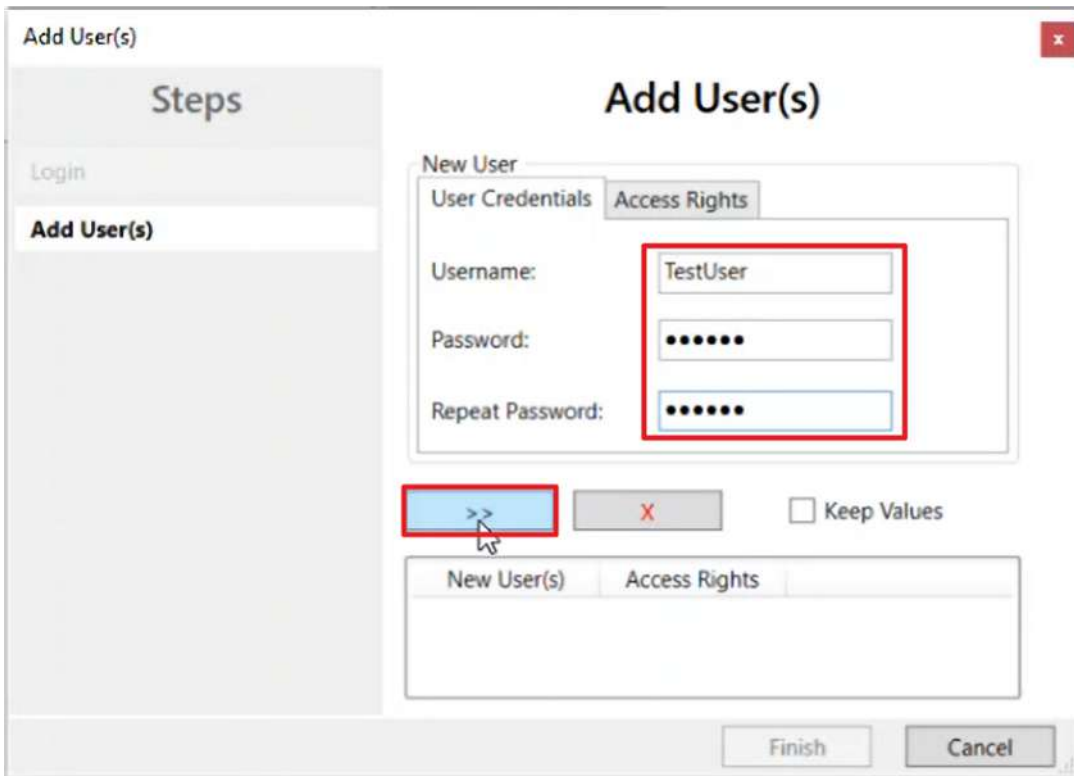
5. Close window with "OK"



The "Login" window opens. Here you log in to the target system.

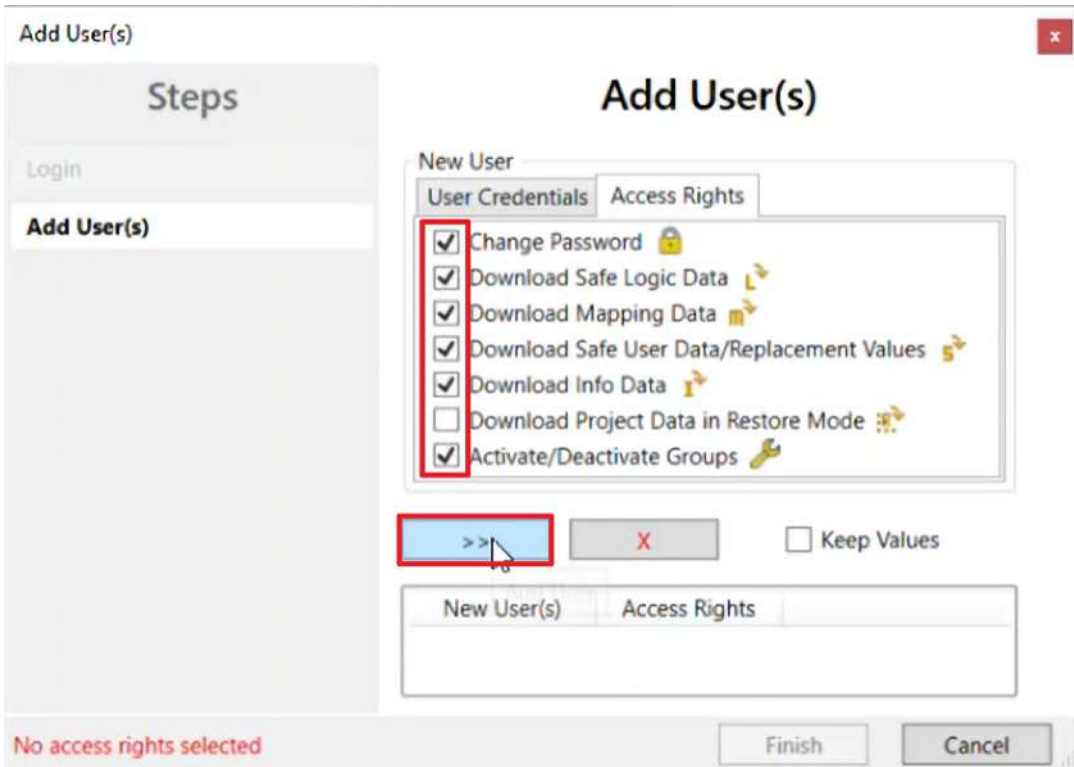
- 6. Enter serial number
- 7. Enter password
- 8. Confirm window with "Next"





In the "Add User(s)" window, enter your user data.

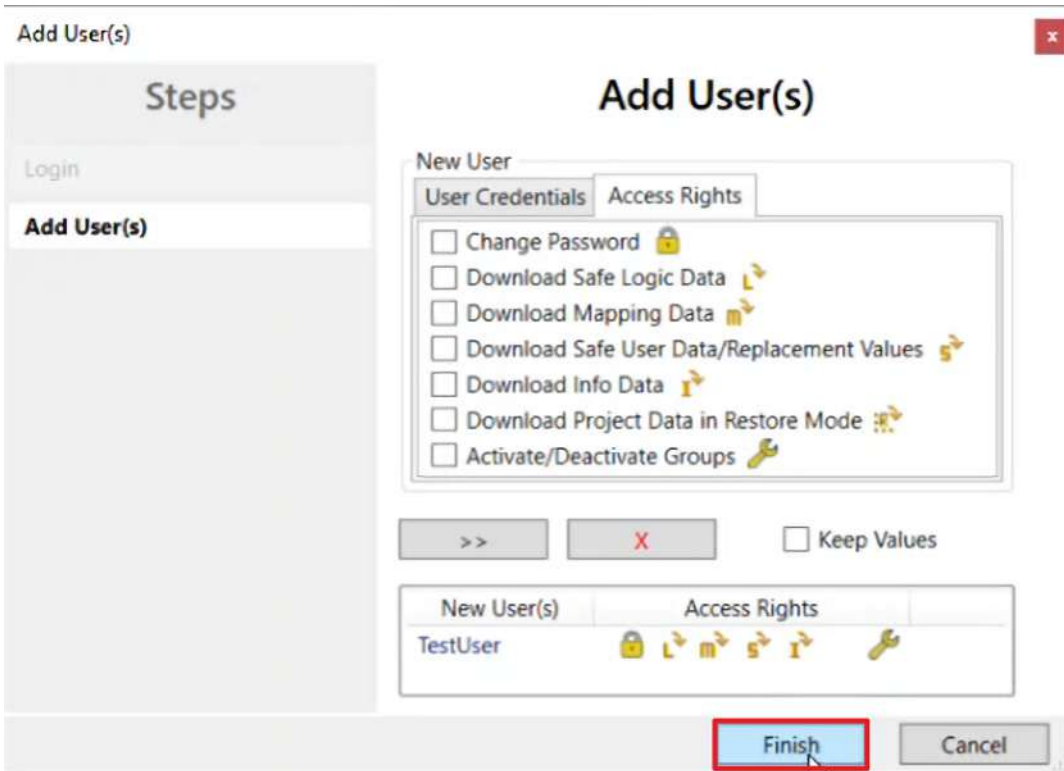
9. Enter the desired user name
10. Enter the desired password for the user name
11. Enter the password again
12. Click on the ">>" field



You will get to the "Access Rights" tab. Here you set the user rights. In the use case of this tutorial the new user gets all rights except the right to download data in restore mode.

13. Click on the box for the desired rights to select them. Do not select the right "Download Project Data in Restore Mode".

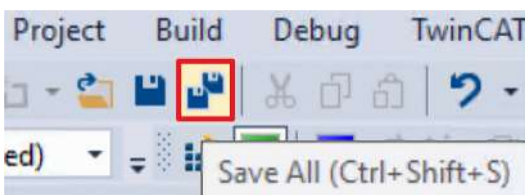
14. Click on the box ">>"



15. Close the window with "Finish"



You will now see the newly created user.



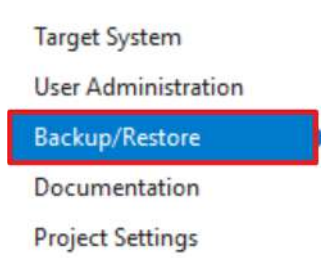
16. Click "Save all" in the menu bar to save the settings

## 2.1.2 Configure Backup/Restore

To configure the Backup/Restore function, follow the steps below for the AX8000-Safety project and for the EL6910-Safety project.

The screenshots show the procedure for the AX8000-Safety project as an example.

1. Open target system



2. Open the "Backup/Restore" tab



3. Click on the box "Activate Backup/Restore" to activate the Backup/Restore
4. click on the boxes to activate the settings according to the following illustrations

### AX8000 Safety project

Alias Device	Store Project CRC in Slave	Store Slave Project CRC in Master	Store Master Project CRC in Slave	Read Project CRC from Master
SAFEMOTION FSoE Connection (ChA_ChB_Connection_Input)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

By activating the Backup/Restore settings you define the dependency of the AX8000 with the EL6910. With these settings you define that the master project CRC is stored in the slave and that the master can read the project CRC of the slave.

### EL6910 Safety project

Alias Device	Store Project CRC in Slave	Store Slave Project CRC in Master	Store Master Project CRC in Slave	Read Project CRC from Master
Term 2 (EL 1918) - Module 1 (FSoE) (Safety_Demo_Group)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Connection to Drive 13 (AX8206-0210-0104) (Safety_Demo_Group)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

By activating the Backup/Restore settings you define the dependency of the EL6910 with the AX8000 and the EL1918. With these settings you define that the project CRC is stored in the slave and the master stores the slave project CRC.

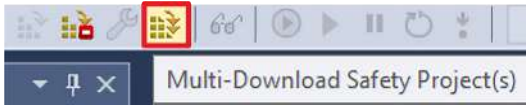


5. Click the box at "Restore User Administration"

This activates the restoring of the user administration.

## 2.2 Download safety project

After configuration, download the safety projects. To do this, proceed as follows:



1. Click on "Multi-Download Safety Project(s)"

The multi-download resolves the dependencies of the projects.

### Select Valid Project(s)

Download	Project Name	Physical Device	CRCs	Target System	Backup/Restore masters	Backup/Restore slaves
<input checked="" type="checkbox"/>	SAFEMOTION CONTROL	Term 10 (EL6910)	0x4F75   0x4F75   0x7289   0x7289	EL6910	0 Dependencies	1 Dependency SAFEMOTION SLP
<input checked="" type="checkbox"/>	SAFEMOTION SLP	Drive 13 (AX8206-0210-0104)	0xEC79   0xEC79   0x8AB3   0x98D6	AX891x	1 Dependency SAFEMOTION CONTROL	0 Dependencies

The "Select Valid Project(s)" window opens. Here you can see which safety projects you can download. In addition, the window shows the dependencies of the displayed projects among each other in the columns of the Backup/Restore mode.

If two or more projects have dependencies among themselves, you are obliged to download all dependent projects together.

You also have the possibility to ignore these dependencies by activating the "Ignore Backup/Restore settings dependent projects" field, but then the projects will not be consistent after downloading.

2. Select the safety projects that you want to download
3. Confirm the selection with "Next"

### General Download Settings

Complete Download

Download complete project data with default group customization settings (customization is possible after the download) and use these login credentials for each project:

Username: Administrator

Password: .....

Please verify the Serial Number of each project:

Verified	Project Name	Physical Device	Serial Number	Target System	Backup/Restore masters	Backup/Restore slaves
<input checked="" type="checkbox"/>	SAFEMOTION CONTROL	Term 10 (EL6910)	99999	EL6910	0 Dependencies	1 Dependency
<input checked="" type="checkbox"/>	SAFEMOTION SLP	Drive 13 (AX8206-0210-0104)	2287874	AX891x	1 Dependency	0 Dependencies

4. Enter the username and password in the "General Download Settings" window

Default username: Administrator

Default password: TwinSAFE

5. Select the safety projects that you want to download
6. Confirm the selection with "Next"

### Final Verification

Project Name	Physical Device	Download Result				Target Sy	Backup/Restore masters	Backup/Restore slaves
SAFEMOTION CONTROL	Term 10 (EL6910)	Configured Datasets	Online CRC	Offline CRC	Verification Result	EL6910	0 Dependencies	1 Dependency SAFEMOTION SLP
		Safe Logic Data	0x86FC	0x86FC	✓			
		Mapping Data	0xE36D	0xE36D	✓			
		Parameter Data	0x9F47	0x9F47	✓			
SAFEMOTION SLP	Drive 13 (AX8206-0210-0104)	Configured Datasets	Online CRC	Offline CRC	Verification Result	AX891x	1 Dependency SAFEMOTION CONTROL	0 Dependencies
		Safe Logic Data	0x74A9	0x74A9	✓			
		Mapping Data	0x81DA	0x81DA	✓			
		Parameter Data	0xFF37	0xFF37	✓			

have manually verified the data shown here and I am aware, that the correct functionality must be tested manually

7. Check the CRCs in the "Final Verification" window

This window again shows you the project dependencies.

8. If the CRCs match, click on the box to confirm the verification

9. Confirm the window with "Next"

### Activation

Login Credentials

Username: Administrator

Password:

Activate	Project Name	Physical Device	Target System	Backup/Restore masters	Backup/Restore slaves
<input checked="" type="checkbox"/>	SAFEMOTION CONTROL	Term 10 (EL6910)	EL6910	0 Dependencies	1 Dependency
<input checked="" type="checkbox"/>	SAFEMOTION SLP	Drive 13 (AX8206-0210-0104)	AX891x	1 Dependency	0 Dependencies

The "Activation" window opens, in which you activate the safety projects.

10. Enter the default password

11. Check if the safety projects are selected

12. Confirm the selection with "Next"

### Multi-Download Result

Activated	Downloaded	Project Name	Physical Device	Target System	Backup/Restore Settings	Backup/Restore masters	Backup/Restore slaves
✓	✓	SAFEMOTION CONTROL	Term 10 (EL6910)	EL6910	✓	0 Dependencies	1 Dependency
✓	✓	SAFEMOTION SLP	Drive 13 (AX8206-0210-0104)	AX891x	✓	1 Dependency	0 Dependencies

13. Close the window "Multi-Download Result" with "Finish"

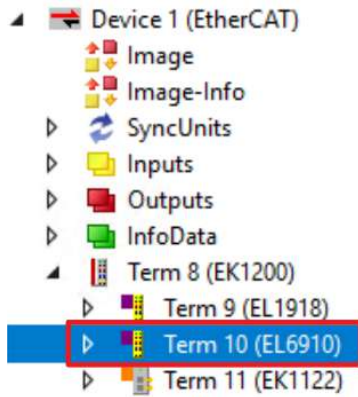
The column "Backup/Restore Settings" shows you the successful download of the Backup/Restore settings.

Your safety projects are now downloaded and active.

14. Click on "Save all" in the menu bar to save the settings

## 2.3 Check communication

Before using the Backup/Restore, check if the projects are up again.



1. Open the process image of the EL6910 for this purpose

Name	Online	Type	Size	>Addr...	In/Out	User ID	Linked to
Message_4 TxPDO X	36 00 67 F2 04 00	Safety.FSOE...	6.0	1571.0	Input	0	FSOE . FSoE Outputs . Mo...
Message_68 TxP...	X 36 03 10 CA 84 03 00 97 C7 01 00	FSOE_11	11.0	1577.0	Input	0	Message_1 . FSoE Slave ...
Safe Logic State	1	USINT	1.0	1588.0	Input	0	
Cycle Counter	195	USINT	1.0	1589.0	Input	0	
WcState	0	BIT	0.1	3058.0	Input	0	
InputToggle	0	BIT	0.1	3060.0	Input	0	
State	8	UINT	2.0	3094.0	Input	0	
AdsAddr	5.53.213.218.2.1:1002	AMSADDR	8.0	3096.0	Input	0	
Message_4 RxPDO X	36 50 14 22 0A 04 00	FSOE_7	7.0	1571.0	Output	0	FSOE . FSoE Inputs . Mod...
Message_68 RxP...	X 36 81 00 6E F0 81 00 D3 21 01 00	FSOE_11	11.0	1578.0	Output	0	Message_1 . FSoE Slave ...
Standard In Var 1 X	1	BIT	0.1	1589.0	Output	0	MAIN.TS_Run . PlcTask O...
Standard In Var 2 X	1	BIT	0.1	1589.1	Output	0	MAIN.TS_ErrAck . PlcTask ...
Standard In Var 15 X	0	BIT	0.1	1589.2	Output	0	MAIN.AX_SS1_1_CMD_Ch...
Standard In Var 16 X	0	BIT	0.1	1589.3	Output	0	MAIN.AX_Err_ACK_ChA . ...
Standard In Var 17 X	0	BIT	0.1	1589.4	Output	0	MAIN.AX_SS1_1_CMD_Ch...

Here you can see that the communication to the AX8000 as well as to the EL1918 is running up successfully.



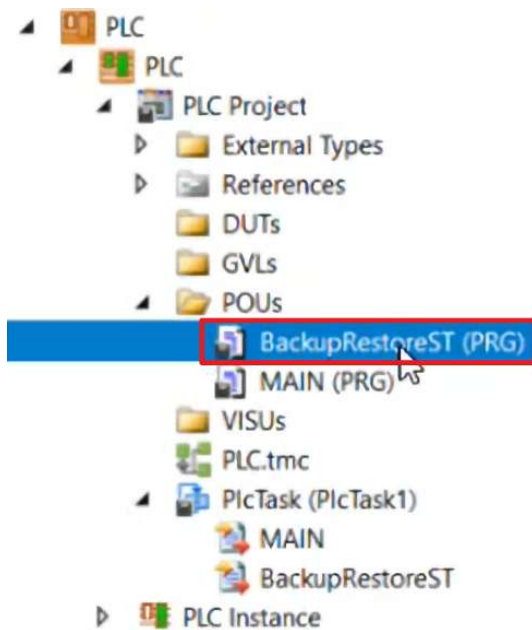
## 2.4 Use Backup/Restore

In this tutorial, the procedure is shown as an example with a test user and the Backup/Restore with the same components.

The procedure is identical for an exchange of the components.

### 2.4.1 Perform backup

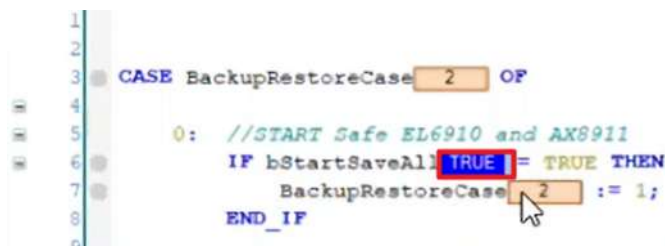
The backup/restore is controlled by the standard PLC.



1. Open PLC project
2. Create and open a program part for Backup/Restore

In this tutorial the creation of this program part is done in advance.

The program part contains triggers, for example to trigger the saving of the project.



3. Set the value "bStartSaveAll" to TRUE to execute a backup

The backup will be saved to disk or to your desired location.

4. Wait until the backup is finished

Next is how the restore mode works.

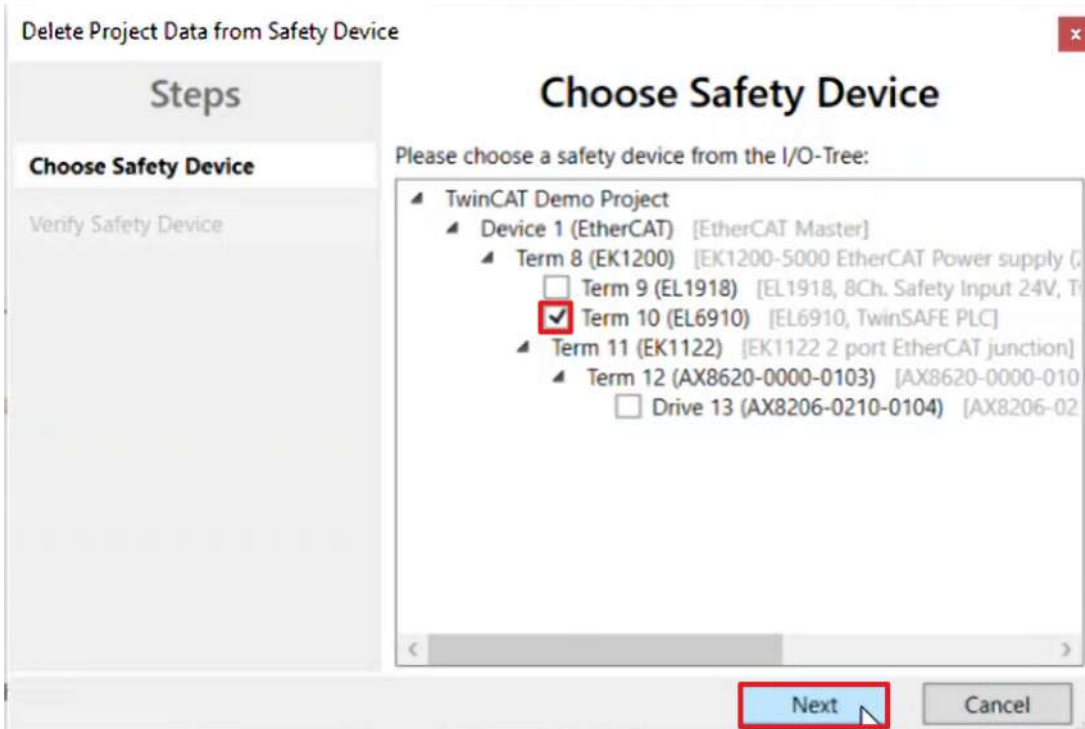
## 2.4.2 Restore EL6910

In the process image of the EL6910 you can see that the EL6910 is communicating as desired.

Now proceed as follows to delete the EL6910 project from the EL6910.



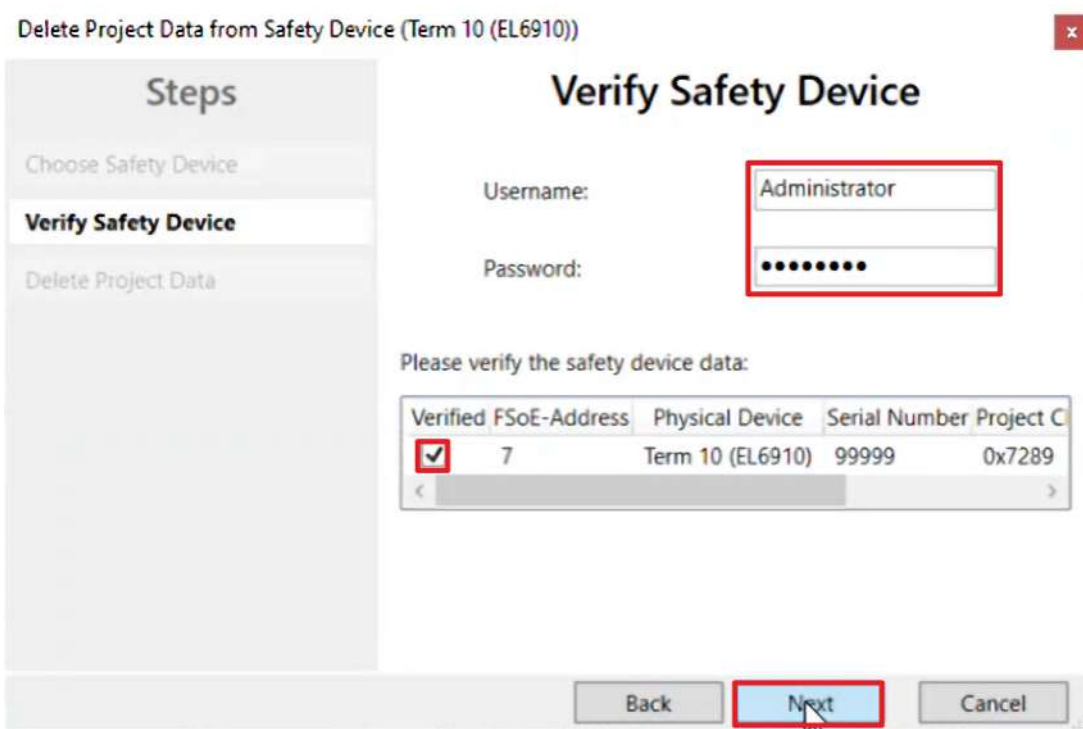
1. Click on "Delete Safety Project" in the menu bar



The "Choose Safety Device" window shows you all devices from which you can delete project data.

2. Select EL6910
3. Confirm selection with "Next"





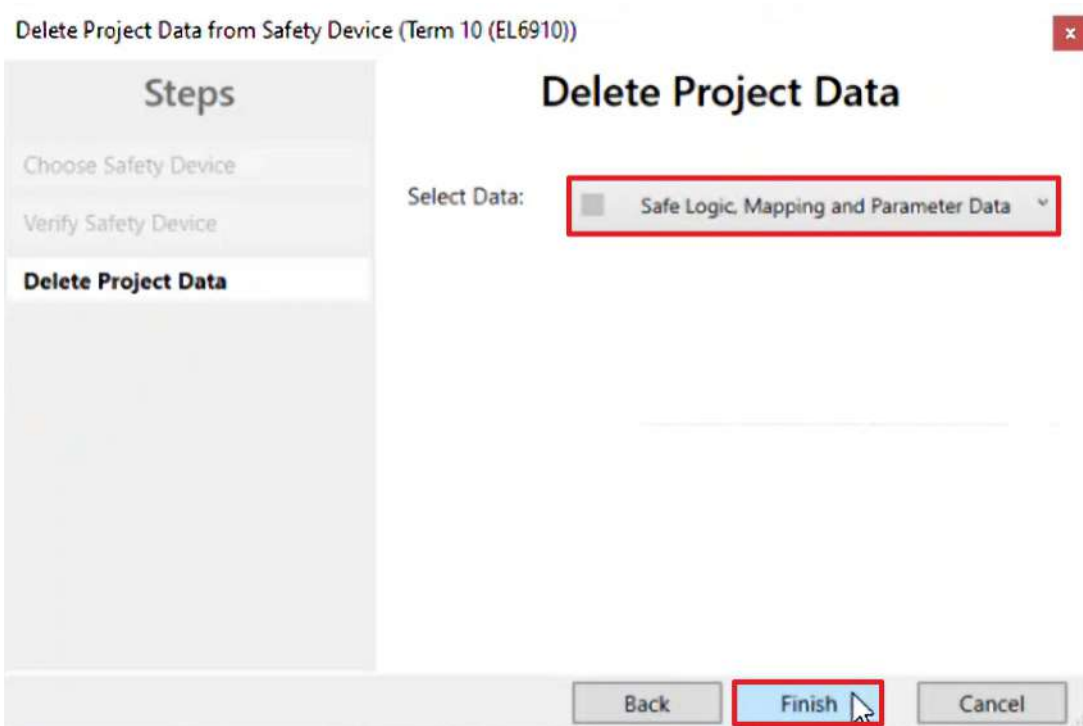
In the "Verify Safety Data" window, verify your selection.

- 4. Enter username and password

Default username: Administrator

Default password: TwinSAFE

- 5. Select EL6910
- 6. Confirm selection with "Next"



In the window "Delete Project Data" you can select via the drop-down menu what you want to delete.

- 7. Select "Safe Logic, Mapping and Parameter Data"
- 8. Confirm selection with "Finish"

On the process image of the EL6910 you can now see that communication has been stopped, since the EL6910 no longer contains a project.

- Open the program section in the PLC project

```

30      11:
31      //START Restore EL6910
32      IF bStartRestoreEL6910 = TRUE THEN
33          BackupRestoreCase := 13;
34      END_IF
  
```

- Set the value "bStartRestoreEL6910" to TRUE to start the restore

You will receive a message about the successful restore.

- Open the process image of the EL6910

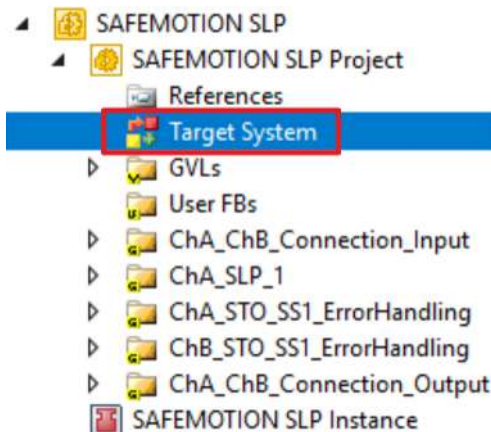
You see that the EL6910 has restarted and the project is working as expected.

### 2.4.3 Restore AX8000 and user administration

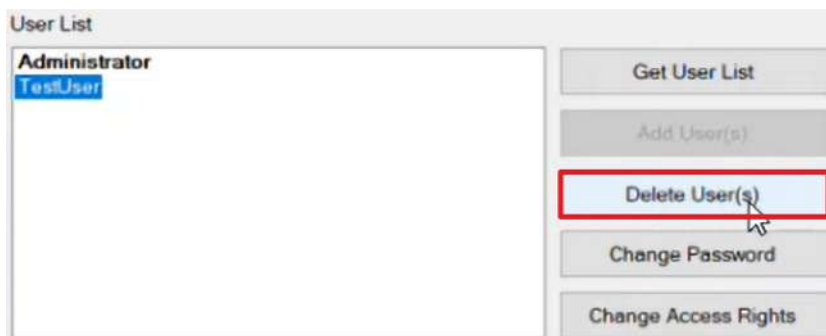
- Repeat steps 2 to 10 from chapter [Restore EL6910 \[P. 16\]](#) for the AX8000 to delete the AX8000 project

You can now see from the EL6910 process image that the connection to the AX8000 no longer exists, since the AX8000 no longer has a safety project.

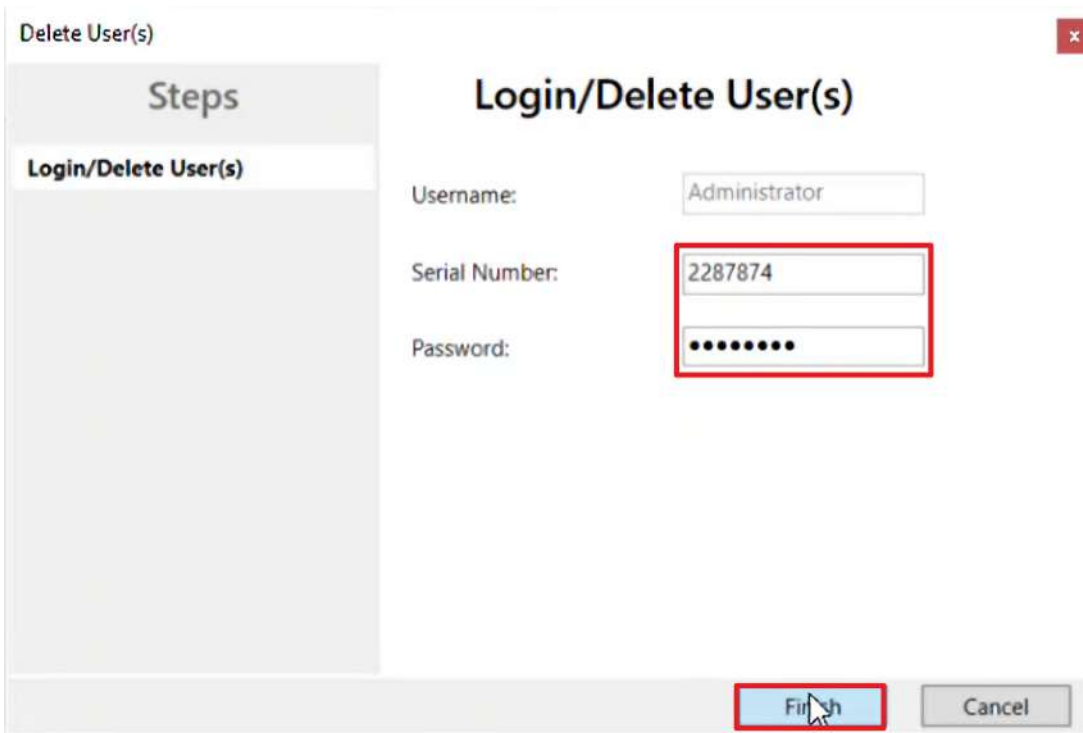
To restore the user administration, first delete the test user. To do this, proceed as follows:



- Open target system
- Open tab "User Administration"
- Click on "Get User List"



- Select test user
- Click "Delete User(s)"
- Close warning message with "OK"



- 8. In the window "Login/Delete User(s)" enter the serial number and the previously selected password
- 9. Close window with "Finish"
- 10. Click on "Get User List"

You will see only the administrator in the user list. The user list is now on the level of a newly installed AX8000.

- 11. Open Backup/Restore subroutine

```

52      100:
53          //START Restore AX8911
54          IF bStartRestoreAX8911 = TRUE THEN
55              BackupRestoreCase := 101;
56          END_IF

```

- 12. Set the value "bStartRestoreAX8000" to TRUE to start the restore of the AX8000 and the user management
- 13. Wait until the restore is finished
- 14. Open process image of the EL6910

Here you can now see how the connection to the AX8000 also starts up again successfully.

- 15. Open AX8000 project
- 16. Open tab "User Administration"
- 17. Click on "Get User List"

Here you can see that the test user has been successfully restored and is again available in the safety project.

## 2.5 TC3 EL6910 Backup/Restore Lib

The TC3 EL6910 Backup/Restore Lib consists of 3 function blocks:

- FB save backup
- FB delete project
- FB restore project.

In the function blocks you have the possibility to make Backup/Restore settings. The blocks are identical for all logic-integrated components.

The TC3 EL6910 Backup/Restore Lib can be found via <https://www.beckhoff.com/de-de/produkte/automation/twinsafe/twinsafe-hardware/el6910.html> in the Documentation & Downloads > Software & Tools tab.



More Information:  
[www.beckhoff.com/twinsafe/](http://www.beckhoff.com/twinsafe/)

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