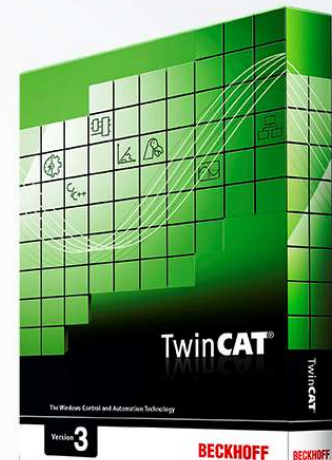
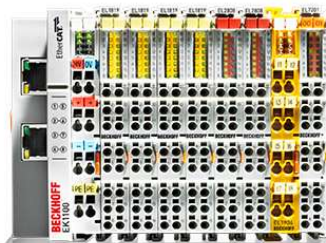


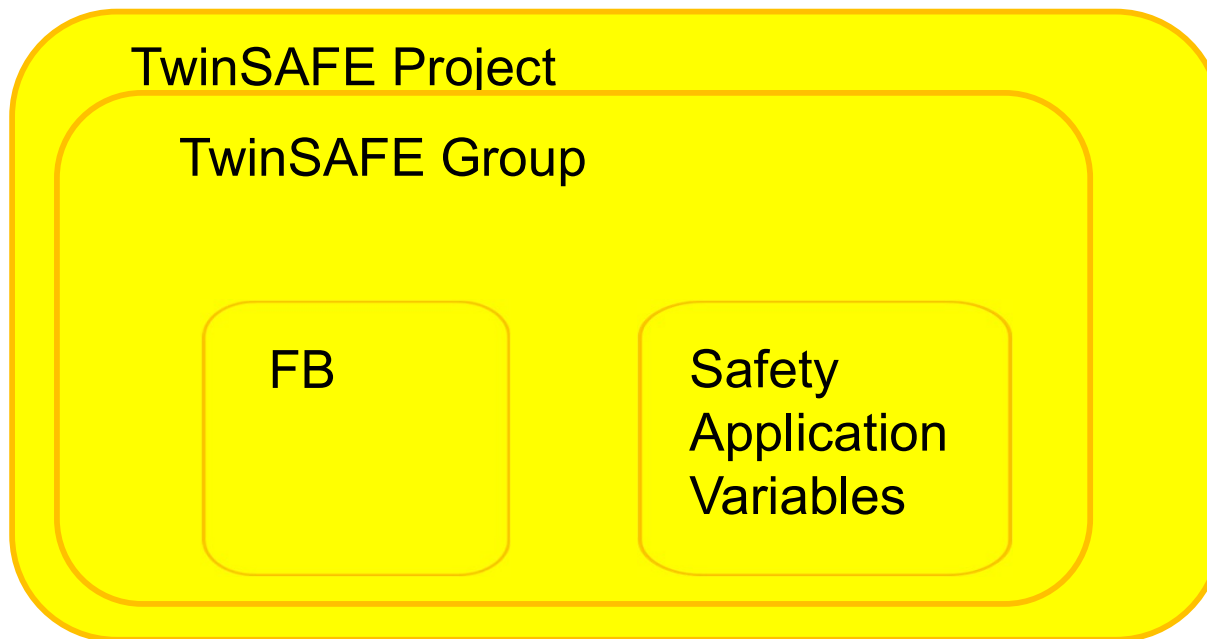
TwinSAFE

BECKHOFF



TwinSAFE – Getting Started

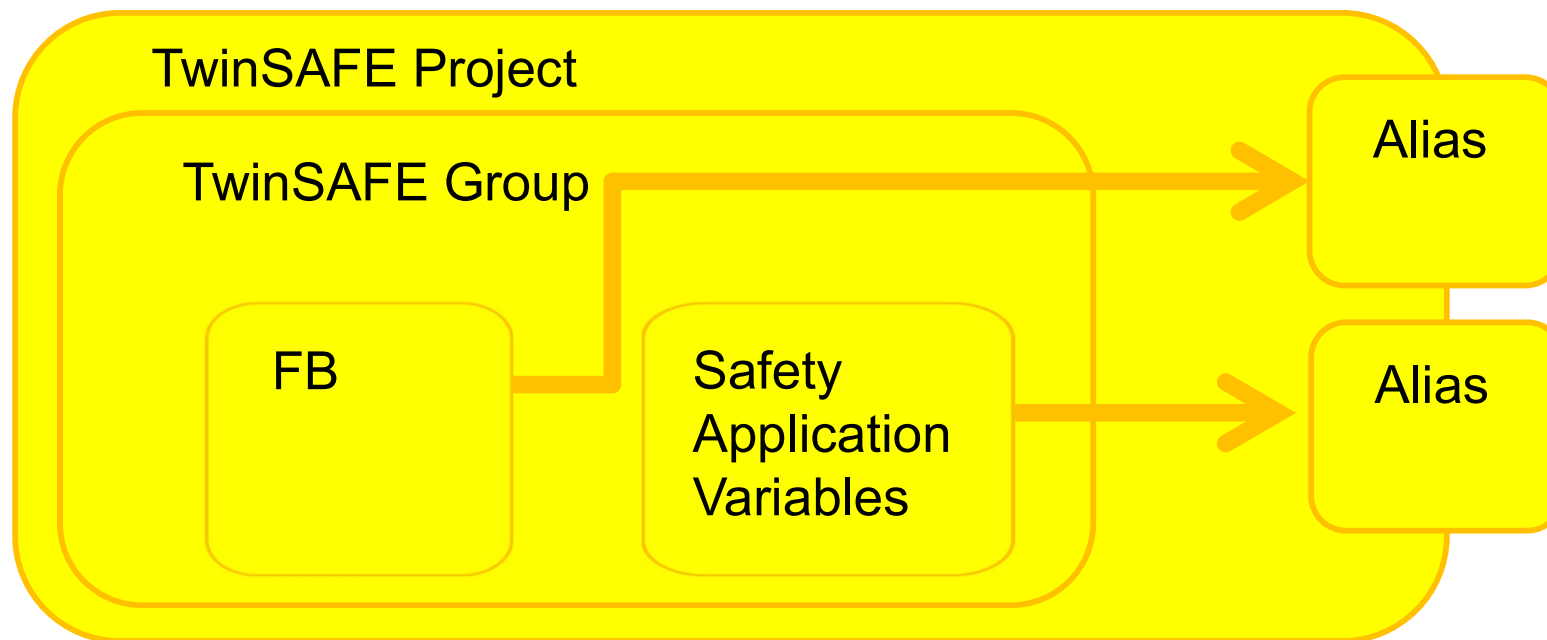
- A TwinSAFE Project will consist of one or more TwinSAFE Groups.
- Each group will have its own set of Safety Application Variables and Function Blocks



- Each TwinSAFE Project is associated with a TwinSAFE Logic Processor
- Typically EL6910

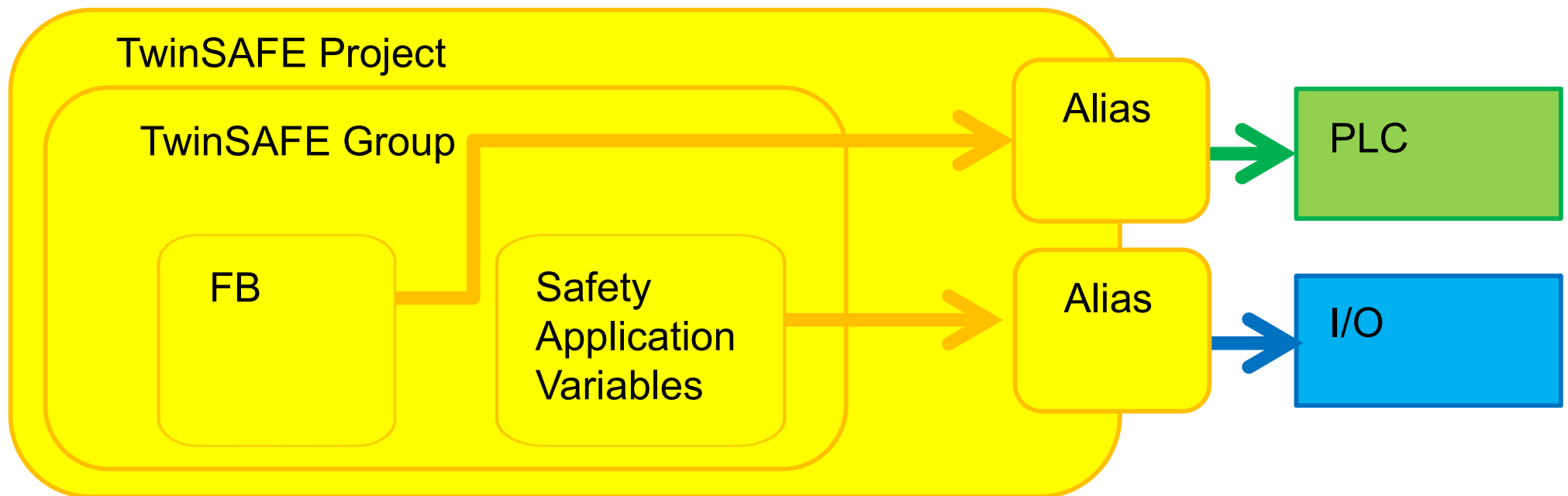


- Each Variable going into or out of the Group must pass through an Alias



- The Alias is then connected to a PLC variable or to the I/O

Note: The I/O may be Safety I/O or Standard I/O depending on the application

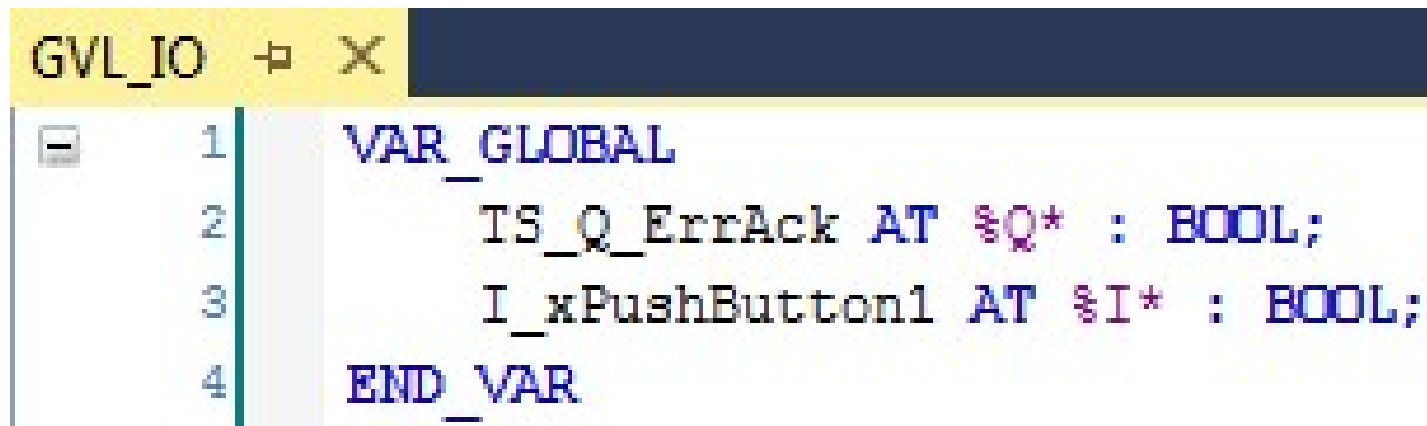


TwinSAFE – Estop and Relay

Estop and Relay

BECKHOFF

- Scan in the Hardware
- Add a PLC Project and create the following Global Variables



The screenshot shows the 'GVL_IO' window in the Beckhoff GX Developer. The window title bar includes the text 'GVL_IO' and standard window controls. The main area displays the following Ladder Logic (LAD) code for global variables:

```
1  VAR_GLOBAL  
2      TS_Q_ErrAck AT %Q* : BOOL;  
3      I_xPushButton1 AT %I* : BOOL;  
4  END_VAR
```

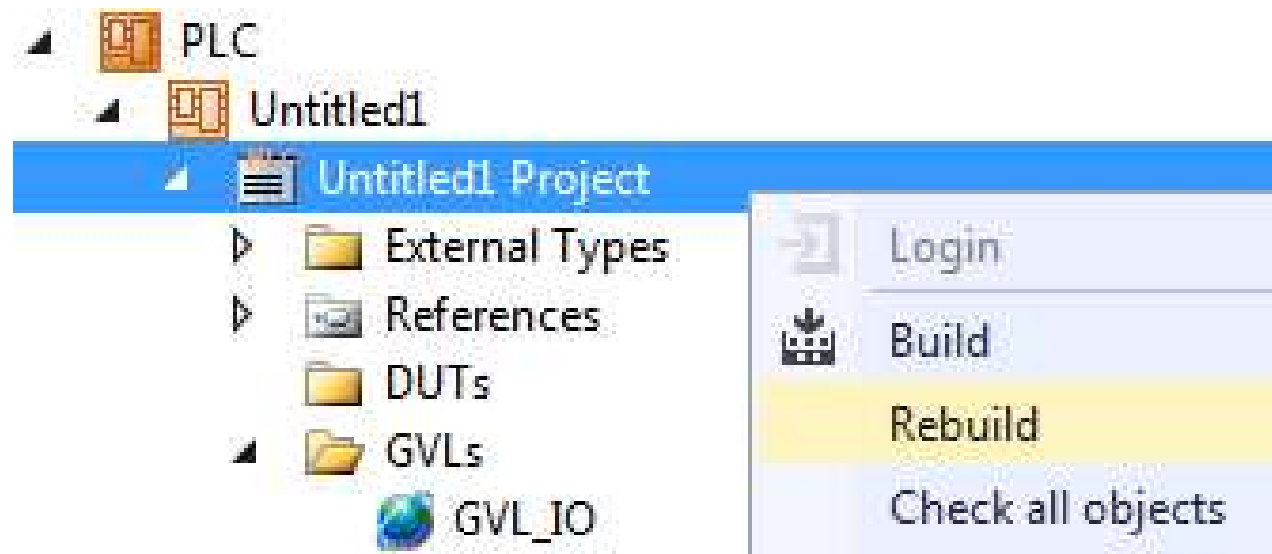
- In the body of MAIN add the following line of code

```
1 | TS_Q_ErrAck := I_xPushButton1;
```

Estop and Relay

BECKHOFF

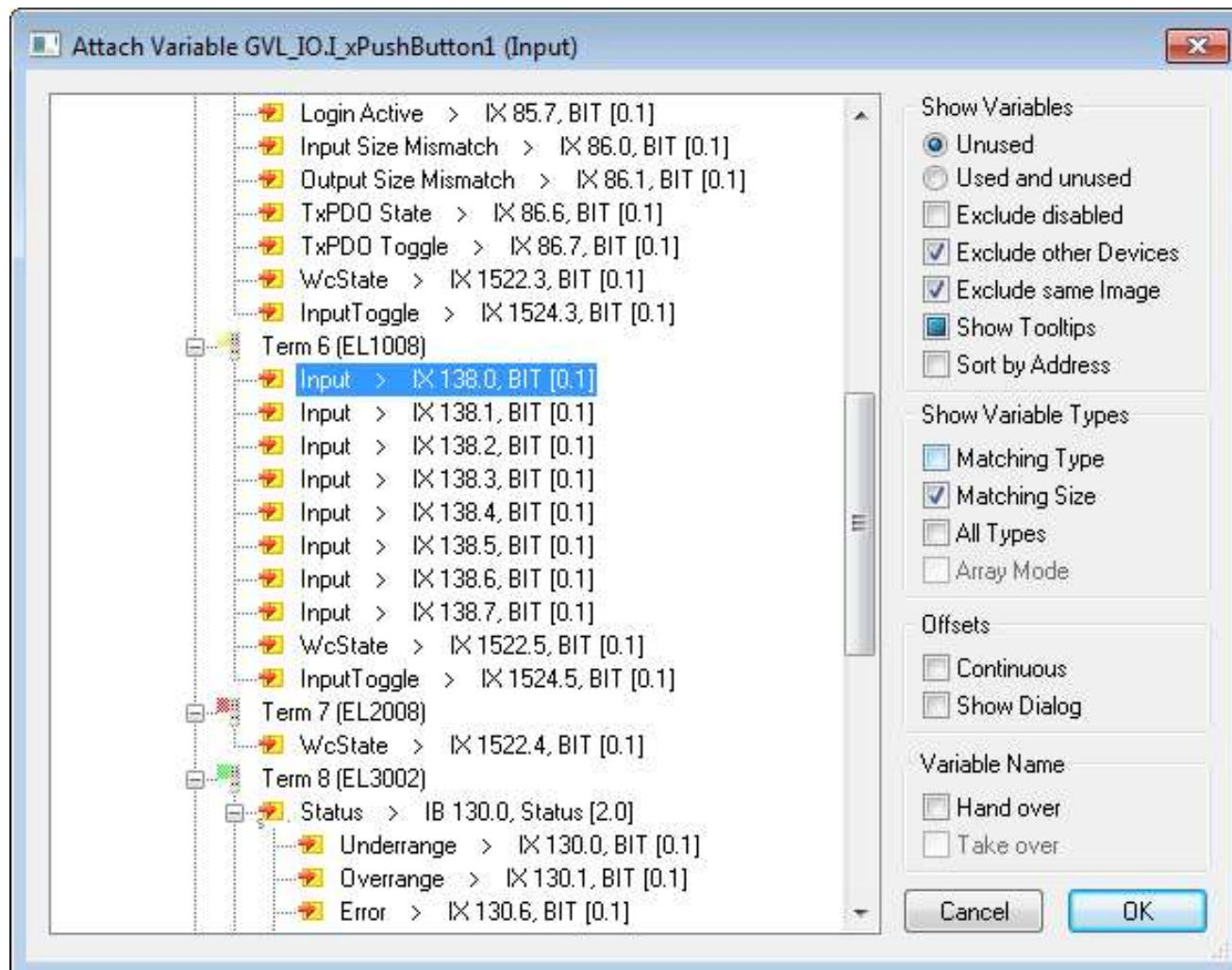
- Right-Click on the Project and select 'Rebuild'



Estop and Relay

BECKHOFF

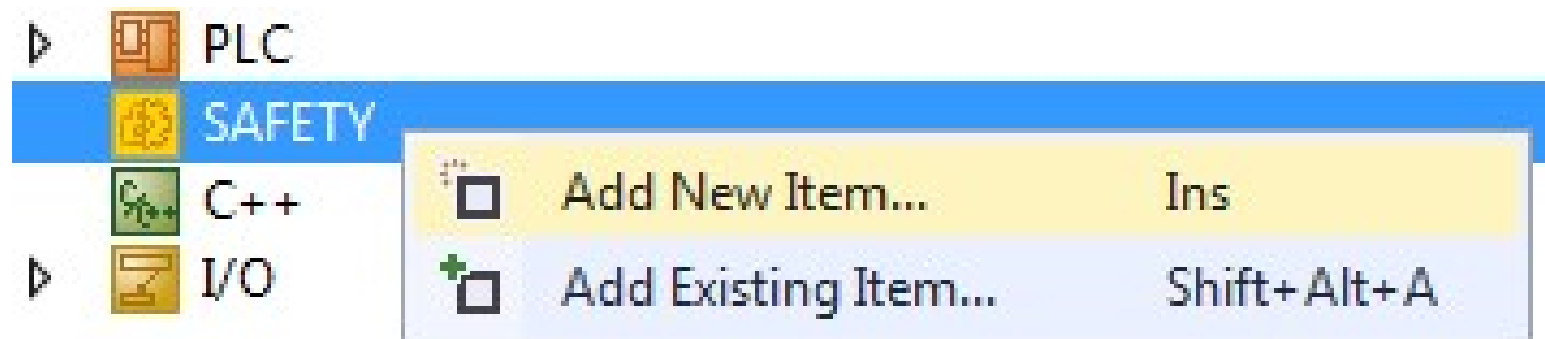
- Link the PLC Input variable to the first push button



Estop and Relay

BECKHOFF

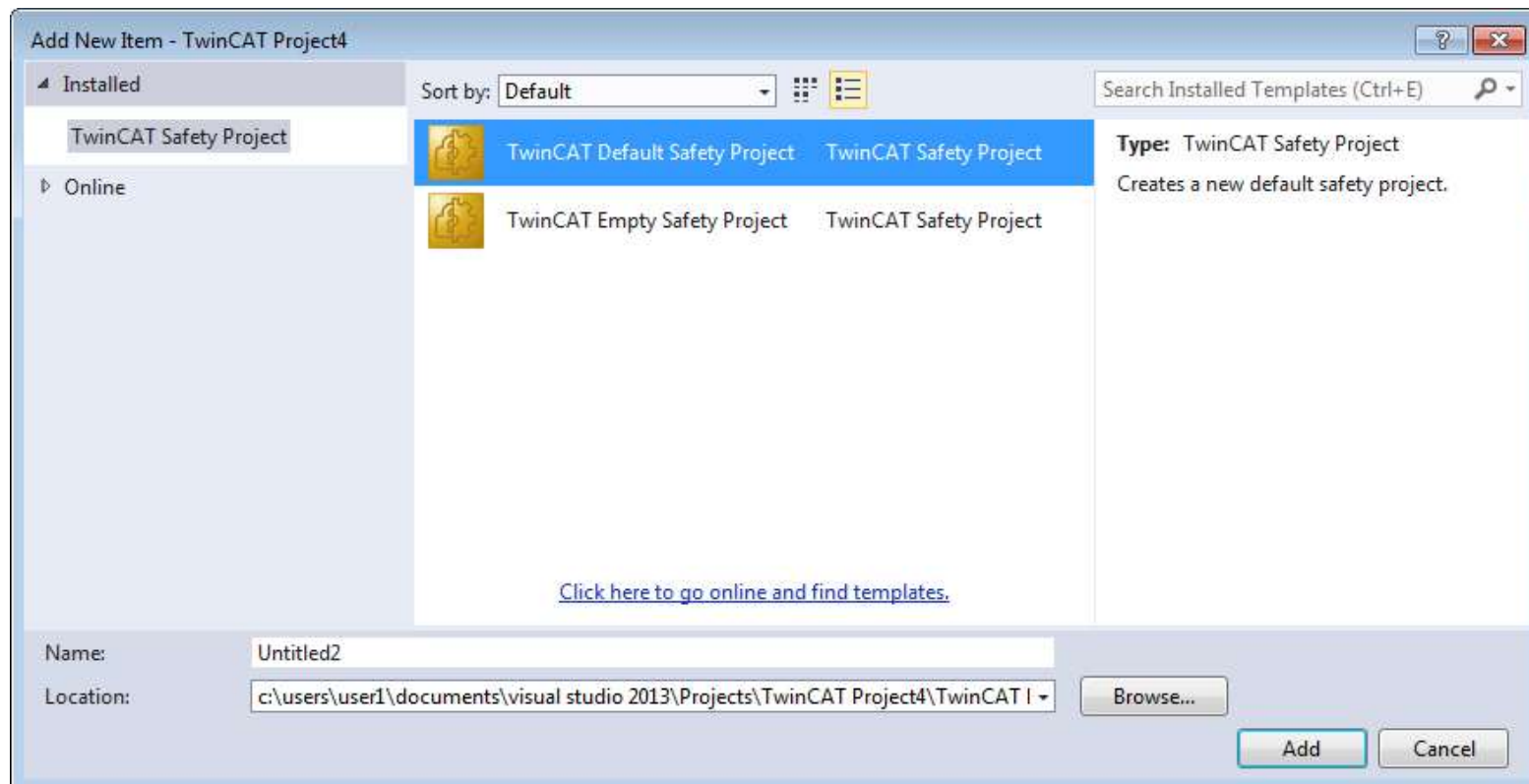
- Right-Click on 'Safety' and select 'Add New Item'



Estop and Relay

BECKHOFF

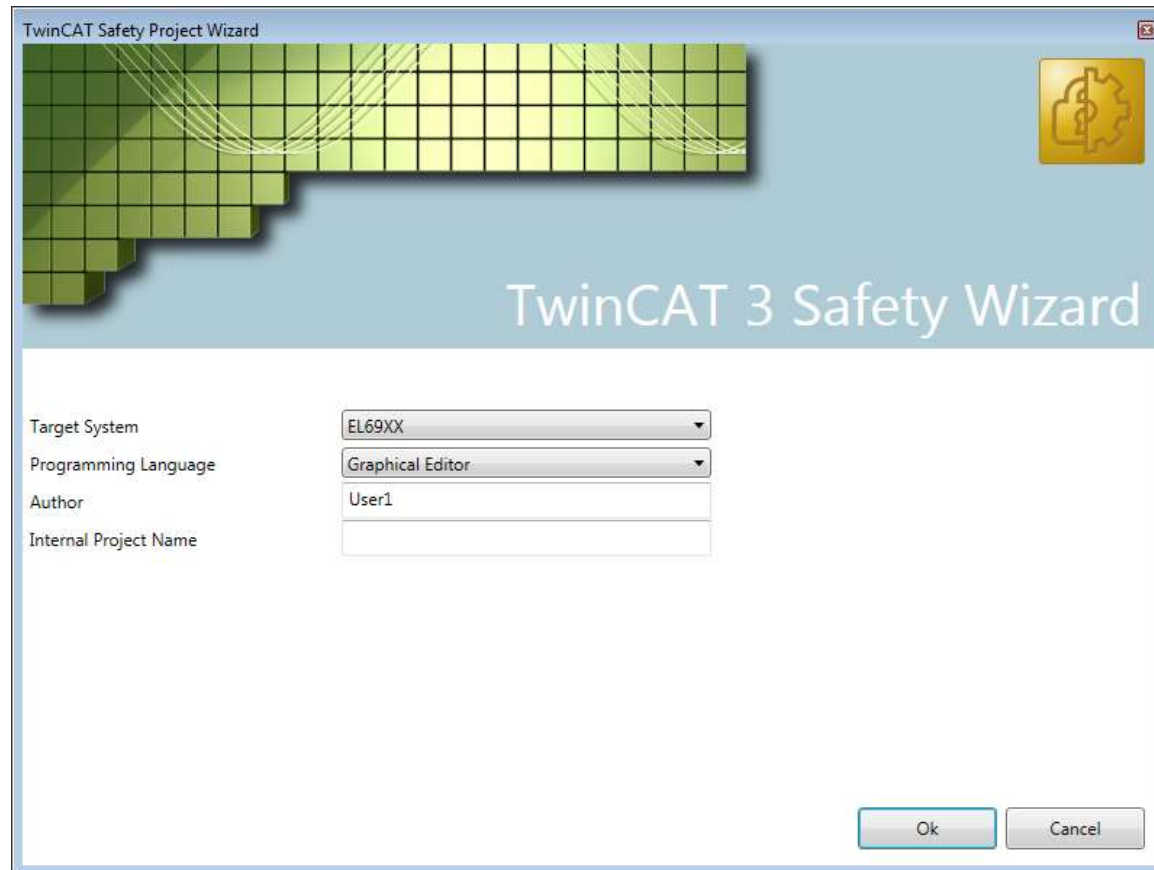
- Select 'TwinCAT Default Safety Project'
- Name the project
- Click 'Add'



Estop and Relay

BECKHOFF

- The Author and Internal Project Name can be supplied
- Click 'OK'



The image shows a screenshot of the 'TwinCAT Safety Project Wizard' dialog box. The window has a title bar that reads 'TwinCAT Safety Project Wizard'. The main area features a decorative graphic on the left consisting of a grid of green and yellow squares with white lines, and a blue background on the right with the text 'TwinCAT 3 Safety Wizard'. Below the graphic, there are four input fields: 'Target System' with a dropdown menu showing 'EL69XX', 'Programming Language' with a dropdown menu showing 'Graphical Editor', 'Author' with a text box containing 'User1', and 'Internal Project Name' with an empty text box. At the bottom right, there are two buttons: 'Ok' and 'Cancel'.

TwinCAT Safety Project Wizard

TwinCAT 3 Safety Wizard

Target System: EL69XX

Programming Language: Graphical Editor

Author: User1

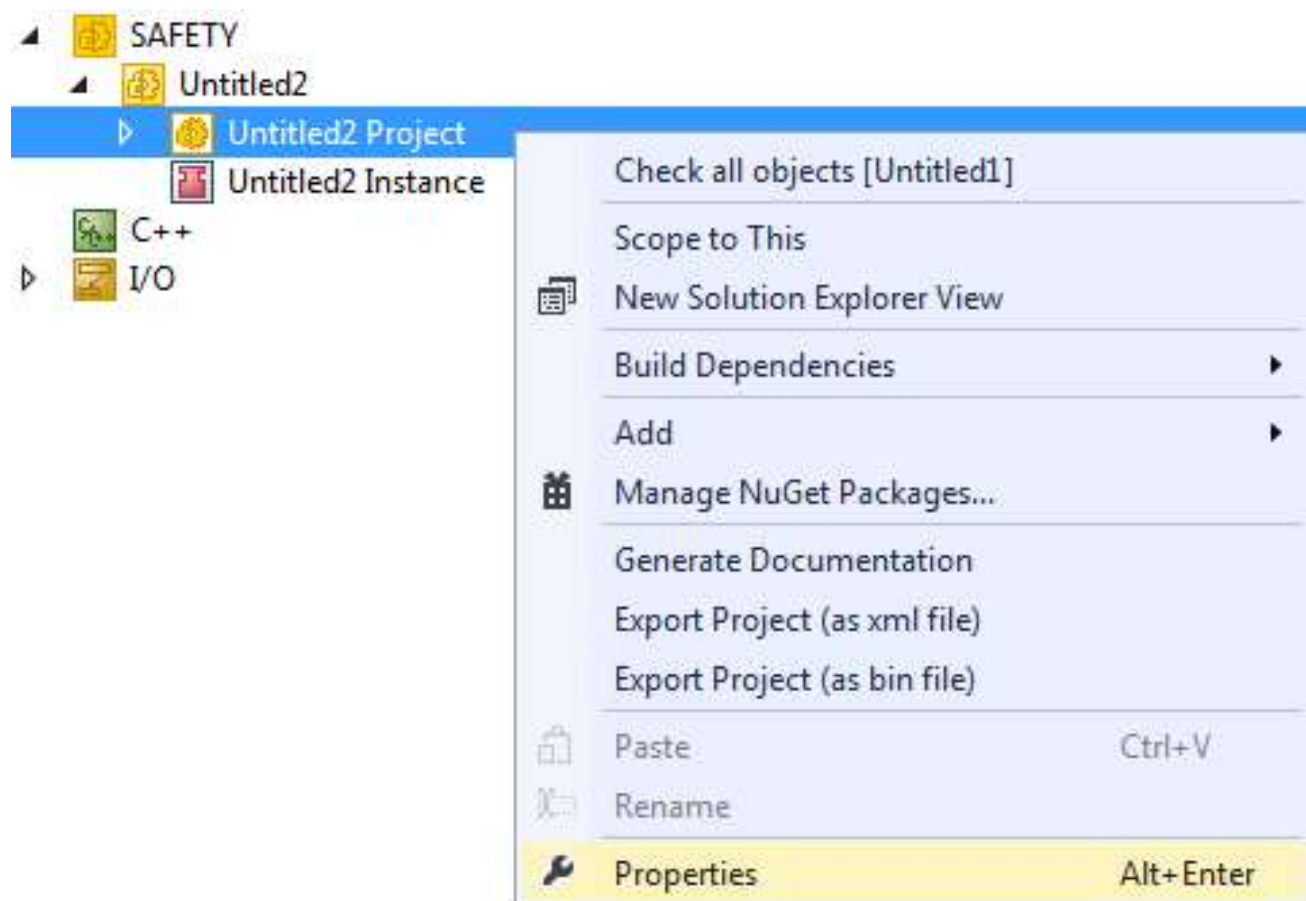
Internal Project Name:

Ok Cancel

Estop and Relay

BECKHOFF

- Right-Click on the 'Project' and select 'Properties'



Estop and Relay

BECKHOFF

Untitled1 ✕ MAIN [Online]

Target System

User Administration

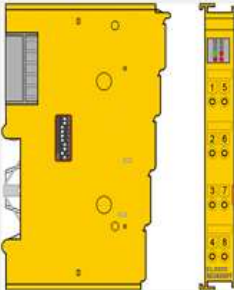
Backup/Restore

Documentation

Project Settings

Configuration: N/A

Platform: N/A



Target System: EL6900

Physical Device: not available  

☐ Device is an external device

Software Version: not available

Serial Number: not available

Project CRC: not available

Map Serial Number: ☐ Map Project CRC: ☐

Version Number: 1 

Safe Address: 1

☐ Take FSoE Connection Address

Hardware Address: not available  

Terminal View:
On 
Off

AmsNetId: not available

AmsPort: not available

TwinCAT System Manager Process Image

Connection Info Data

☐ Show Input/Output Data as byte array (old configuration)

ConnectionInputs/Outputs

☐ Take over Safety Alias Device names (Connection Info Data names will also be adjusted)

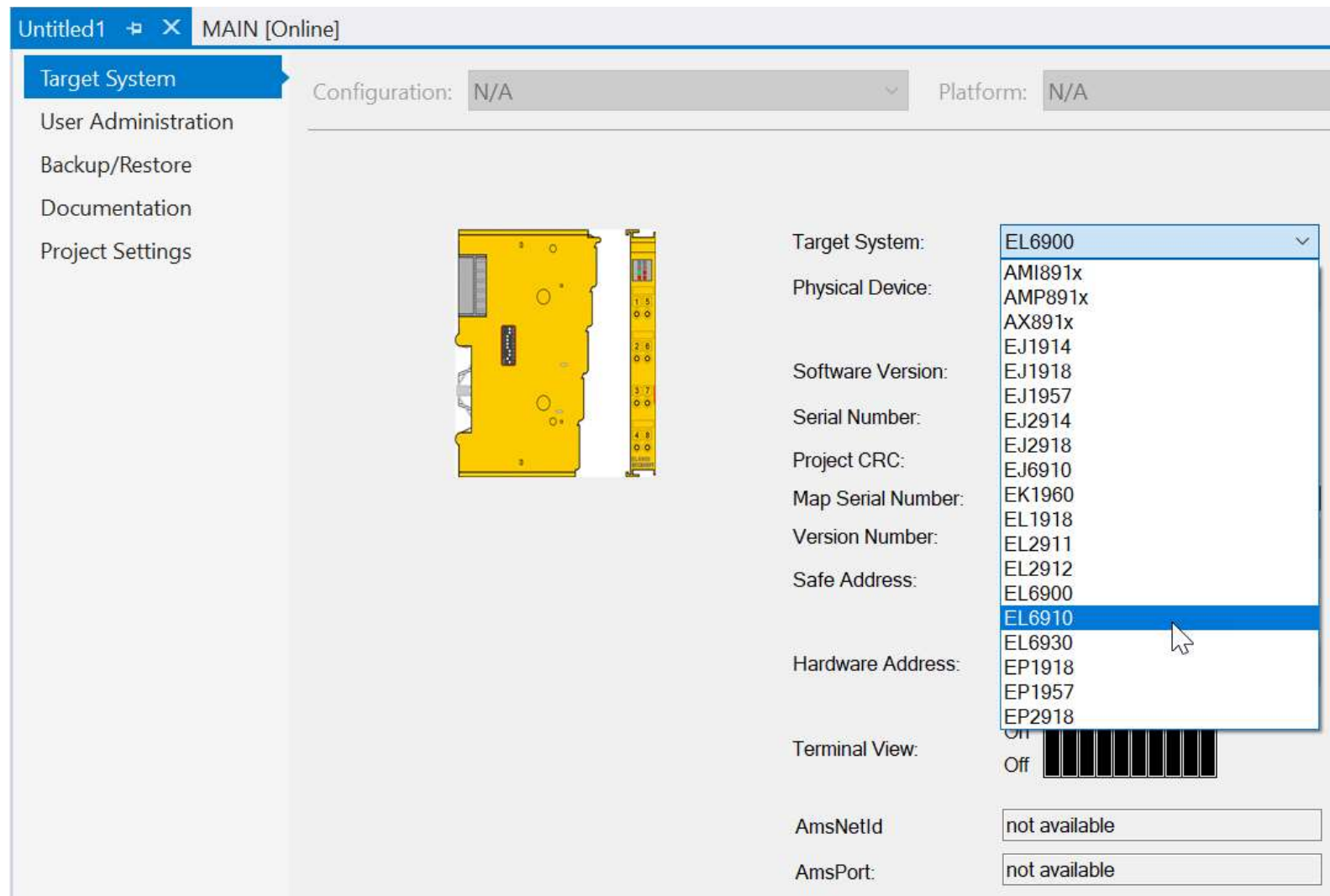
StandardInputs/Outputs

☐ Take over Standard Alias Device names

Estop and Relay

BECKHOFF

- Target System drop down
 - select the corresponding TwinSAFE Logic processor



Estop and Relay

BECKHOFF

- Click on the 'Map' button

Untitled1 X MAIN [Online]

Target System

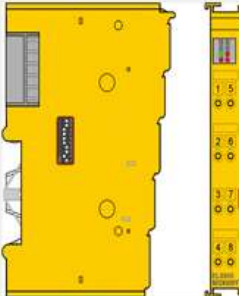
User Administration

Backup/Restore

Documentation

Project Settings

Configuration: N/A Platform: N/A



Target System: EL6910

Physical Device: not available

☐ Device is an external device

Software Version: not available

Serial Number: not available

Project CRC: not available

Map Serial Number: ☐ Map Project CRC: ☐

Version Number: 1

Safe Address: 1

☐ Take FSoE Connection Address

Hardware Address: not available

Terminal View:

On Off

1 2 3 4 5 6 7 8 9 10

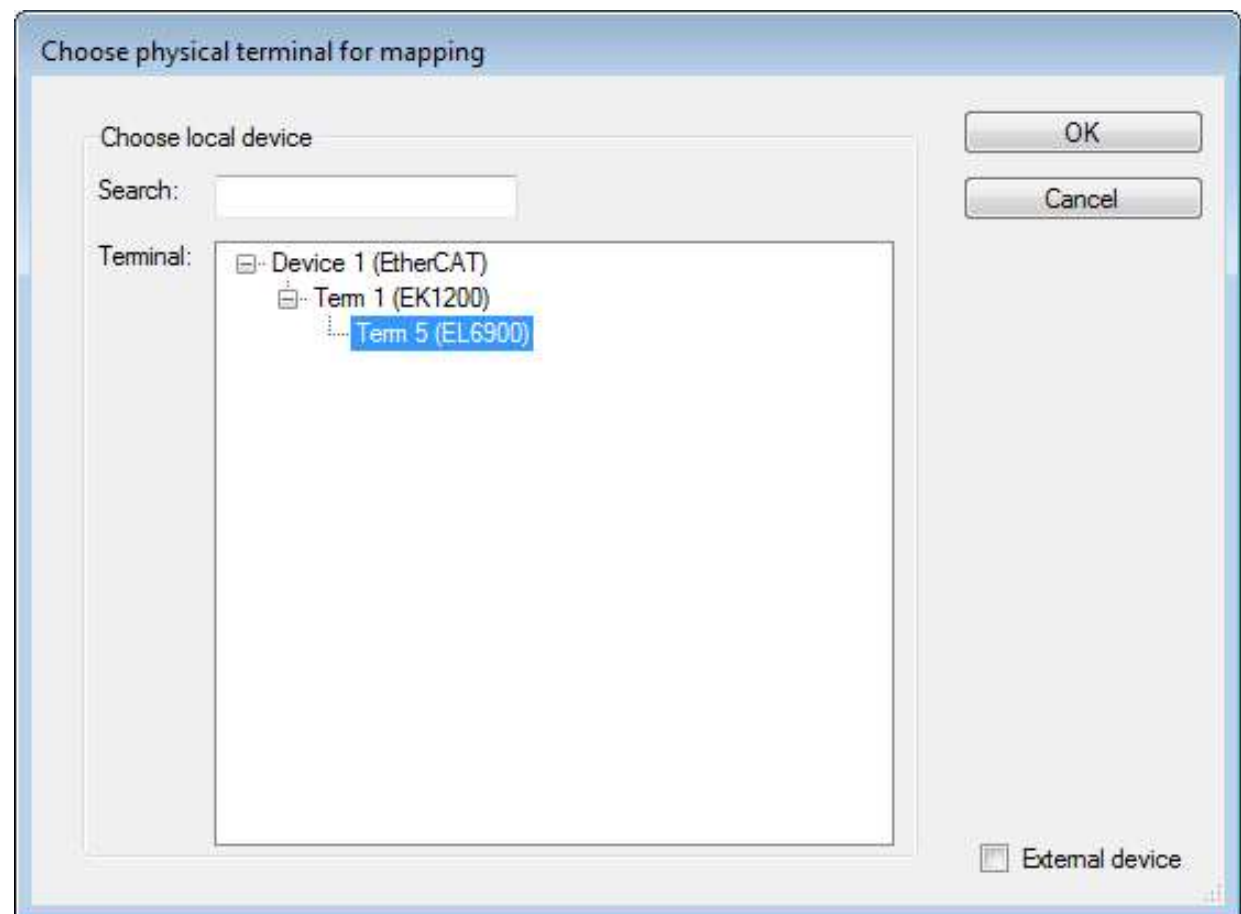
AmsNetId: not available

AmsPort: not available

Estop and Relay

BECKHOFF

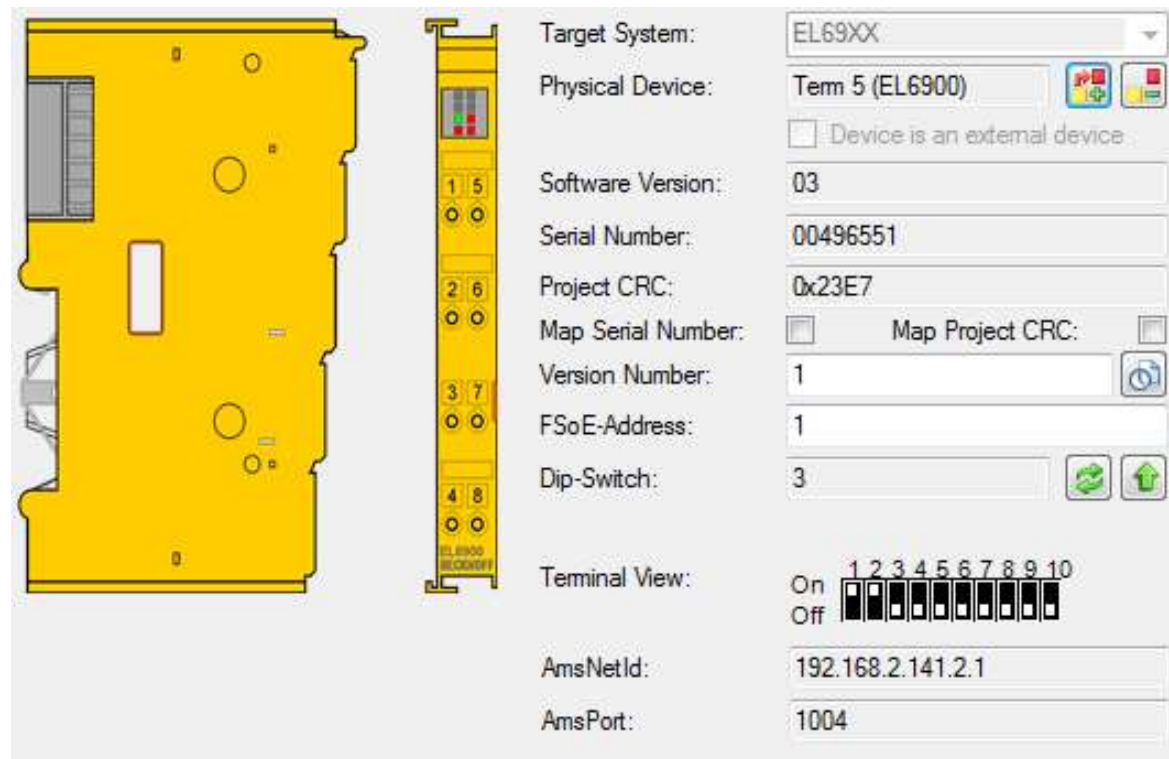
- Select the EL6900 that this TwinSAFE Project will be associated with
- Click 'OK'



Estop and Relay

BECKHOFF

- The information of the TwinSAFE Logic processor that was selected is displayed



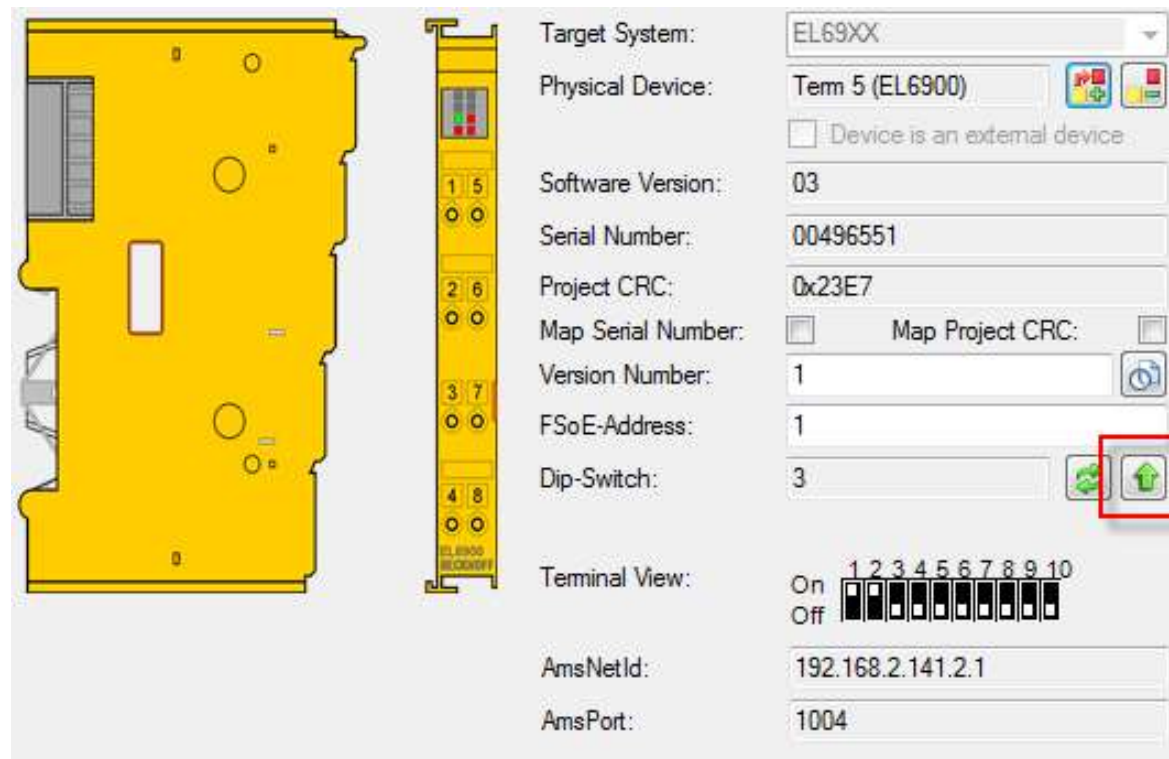
The screenshot displays the Beckhoff TwinSAFE configuration interface. On the left, there is a yellow 3D model of the EL6900 TwinSAFE Logic processor. To its right is a vertical strip showing the terminal block with pins 1 through 10. The main configuration area on the right contains the following fields:

- Target System: EL69XX
- Physical Device: Term 5 (EL6900)
- ☐ Device is an external device
- Software Version: 03
- Serial Number: 00496551
- Project CRC: 0x23E7
- Map Serial Number: ☐ Map Project CRC: ☐
- Version Number: 1
- FSoE-Address: 1
- Dip-Switch: 3
- Terminal View: On/Off status for pins 1 through 10 (pins 1-10 are all On)
- AmsNetId: 192.168.2.141.2.1
- AmsPort: 1004

Estop and Relay

BECKHOFF

- Verify the Dip-Switch address, then click the green Up arrow. This will copy the Dip-Switch value into the FSoE-Address



Target System: EL69XX

Physical Device: Term 5 (EL6900)

☐ Device is an external device

Software Version: 03

Serial Number: 00496551

Project CRC: 0x23E7

Map Serial Number: ☐ Map Project CRC: ☐

Version Number: 1

FSoE-Address: 1

Dip-Switch: 3

Terminal View:

On 1 2 3 4 5 6 7 8 9 10

Off

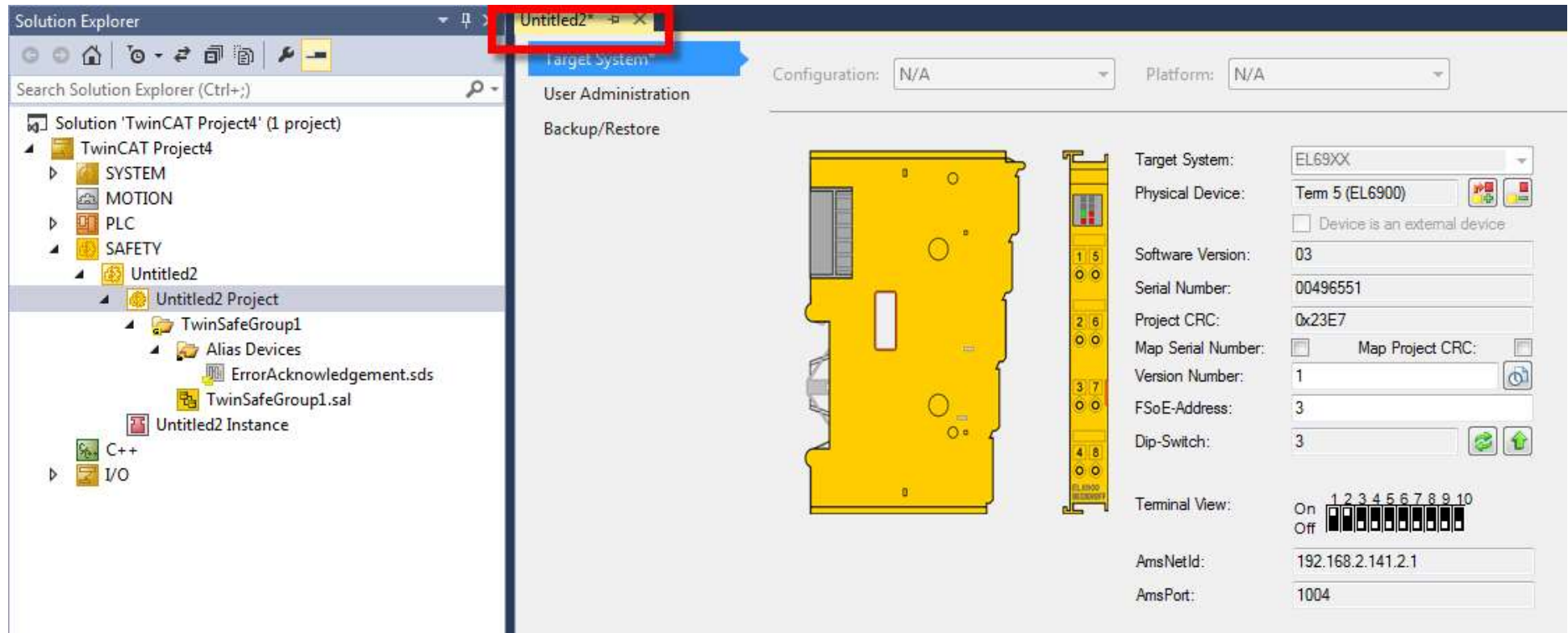
AmsNetId: 192.168.2.141.2.1

AmsPort: 1004

Estop and Relay

BECKHOFF

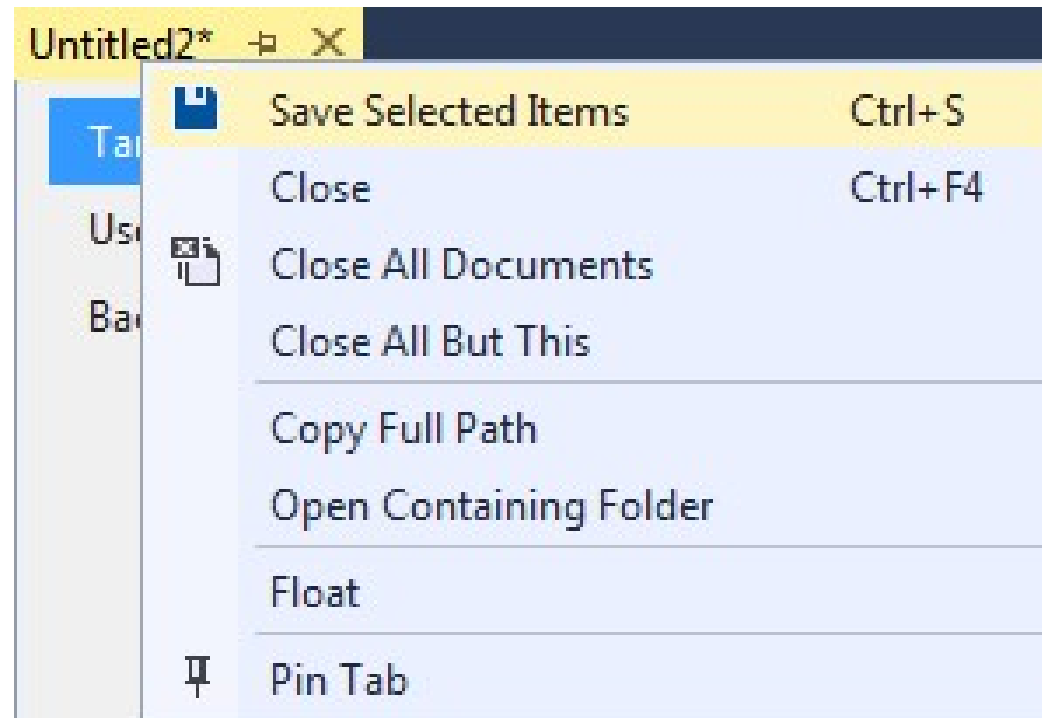
- Before moving on, these values need to be saved
- Notice the TAB at the top has an * next to it, this means the data has not been saved.



Estop and Relay

BECKHOFF

- Right-Click on the Project Tab and select 'Save Selected Items'



Estop and Relay

BECKHOFF

- Expand each Item in the tree under SAFETY
- Double-Click on the ErrorAcknowledgement.sds



- Click the 'Map' button

ErrorAcknowledgement.sds  

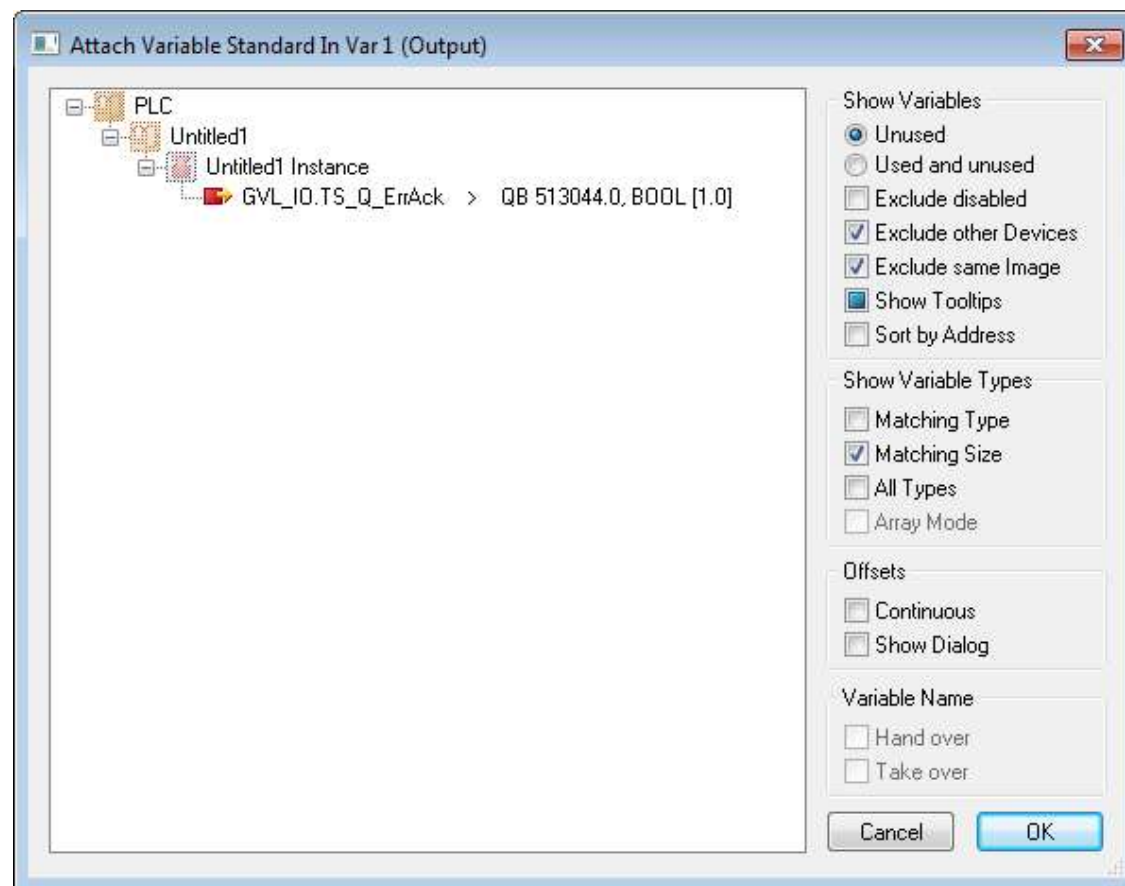
Link corresponding variable to:



Estop and Relay

BECKHOFF

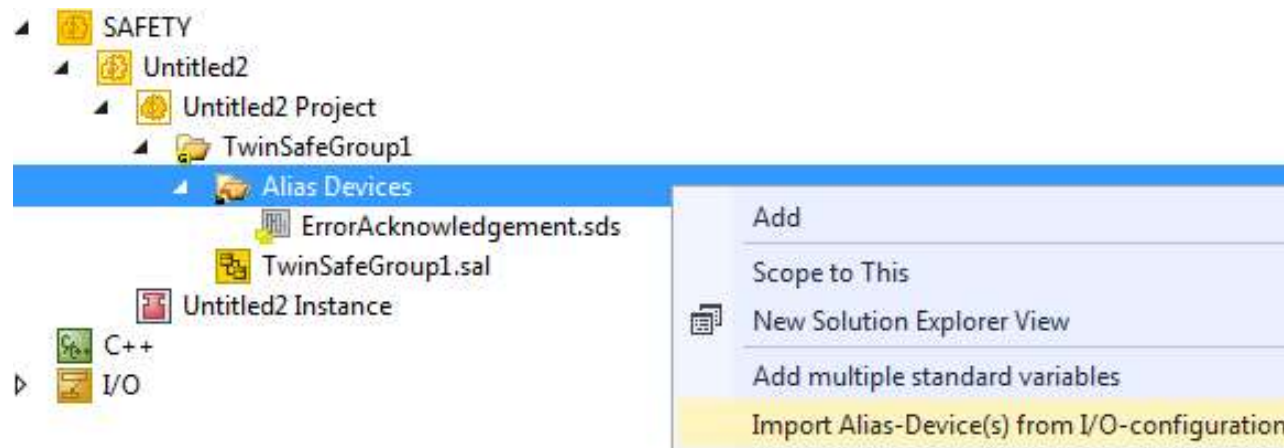
- Select the PLC variable for Error Acknowledge and click 'OK'



Estop and Relay

BECKHOFF

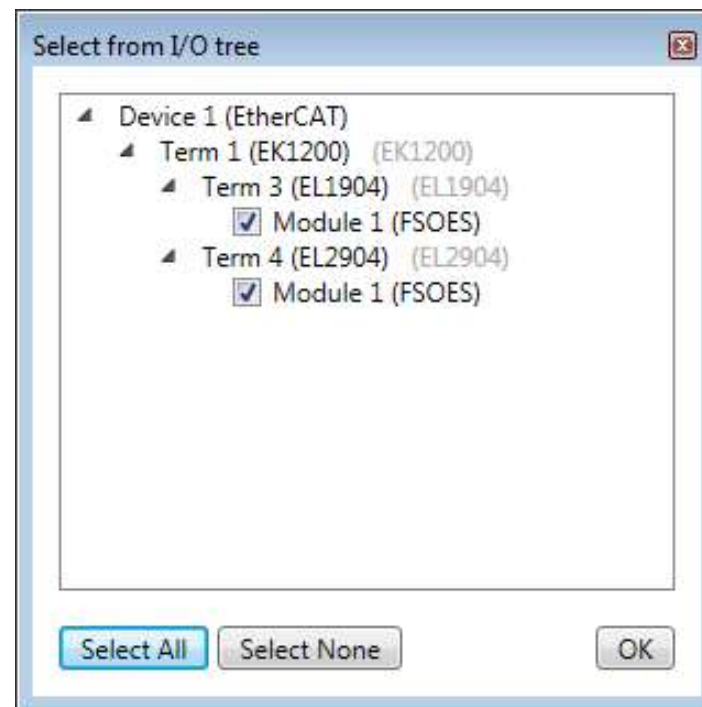
- Right click on 'Alias Devices' and select 'Import Alias-Devices from I/O-configuration'



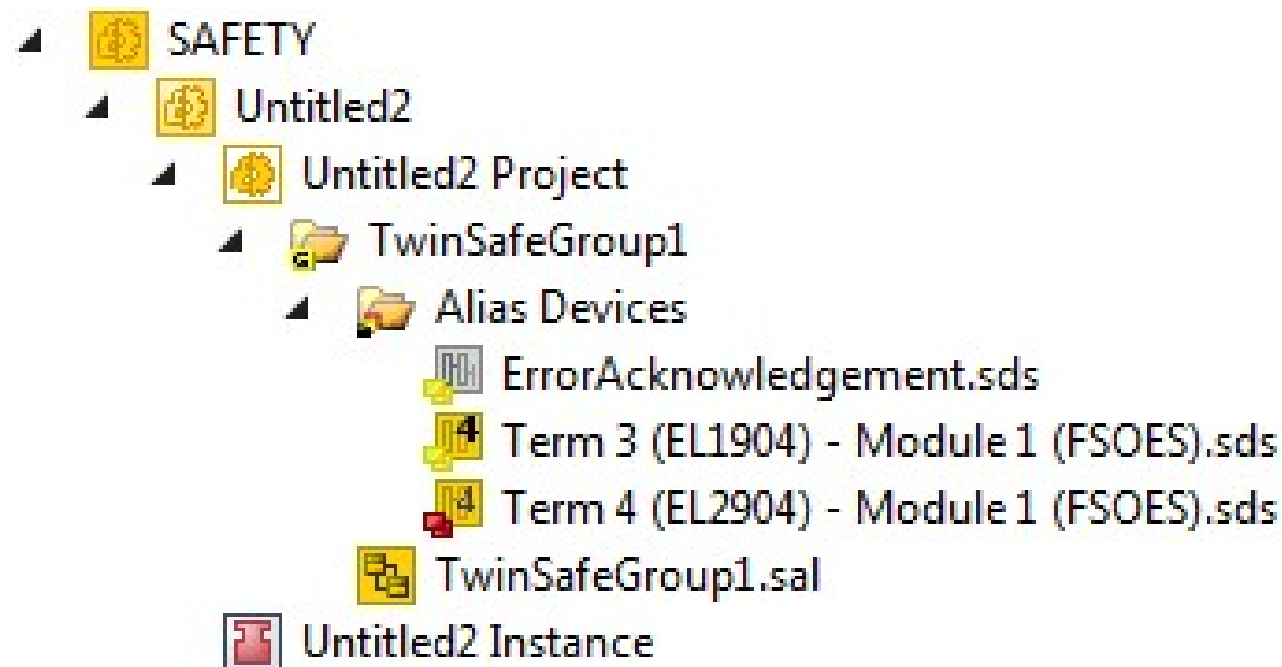
Estop and Relay

BECKHOFF

- Select All Safety I/O to be associated with this TwinSAFE Group
- Click 'OK'



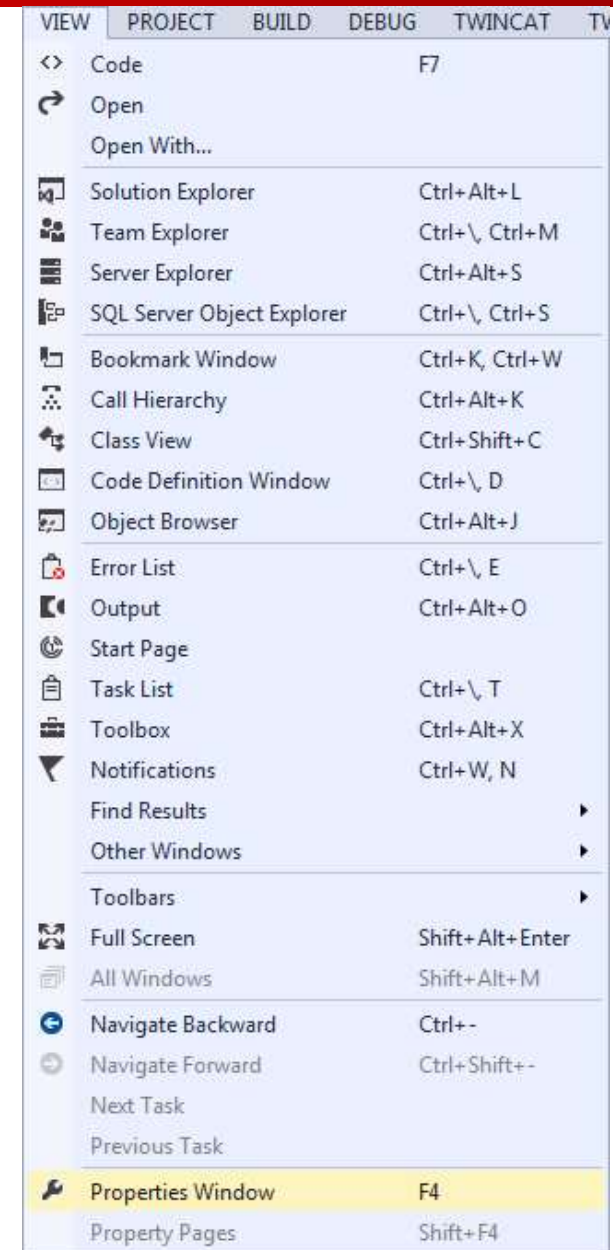
- The Aliases for the Safety I/O have now been added and are already mapped to the I/O



Estop and Relay

BECKHOFF

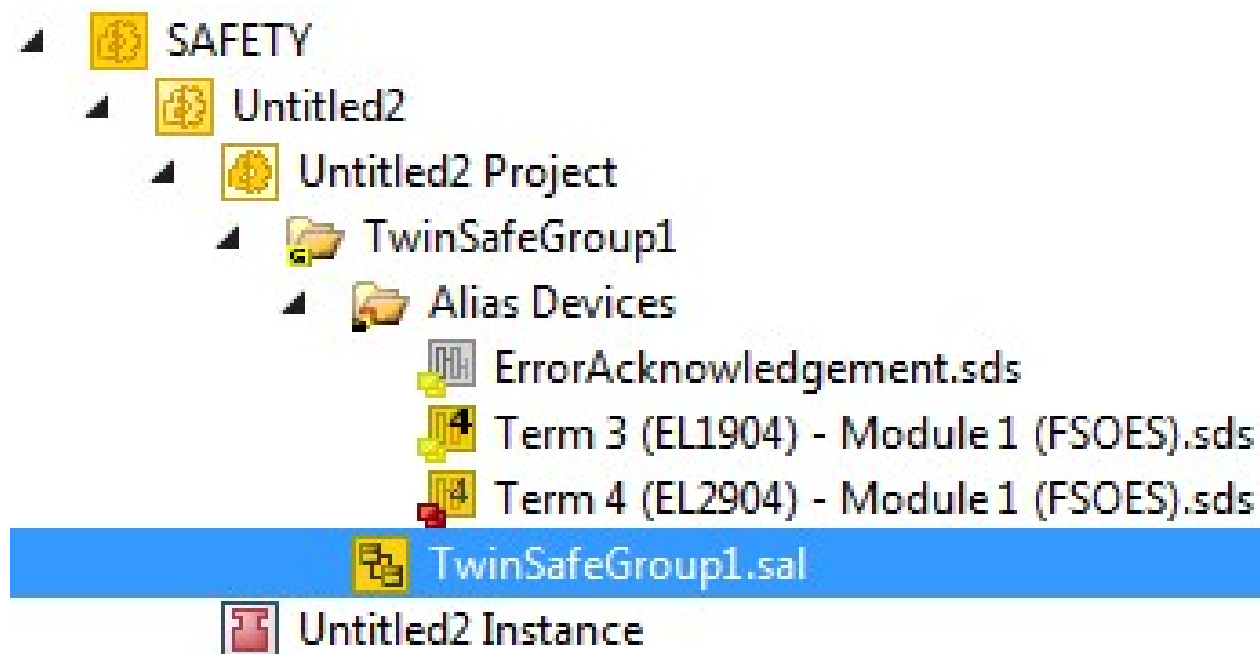
- From the 'View' menu select 'Properties Window'



Estop and Relay

BECKHOFF

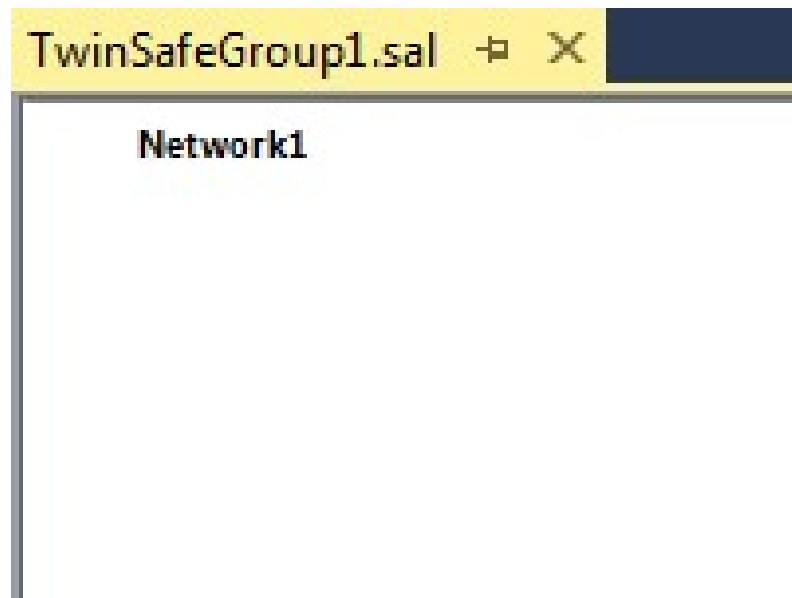
- Under the 'Safety' Item, Double-Click on 'TwinSafeGroup1.sal'



Estop and Relay

BECKHOFF

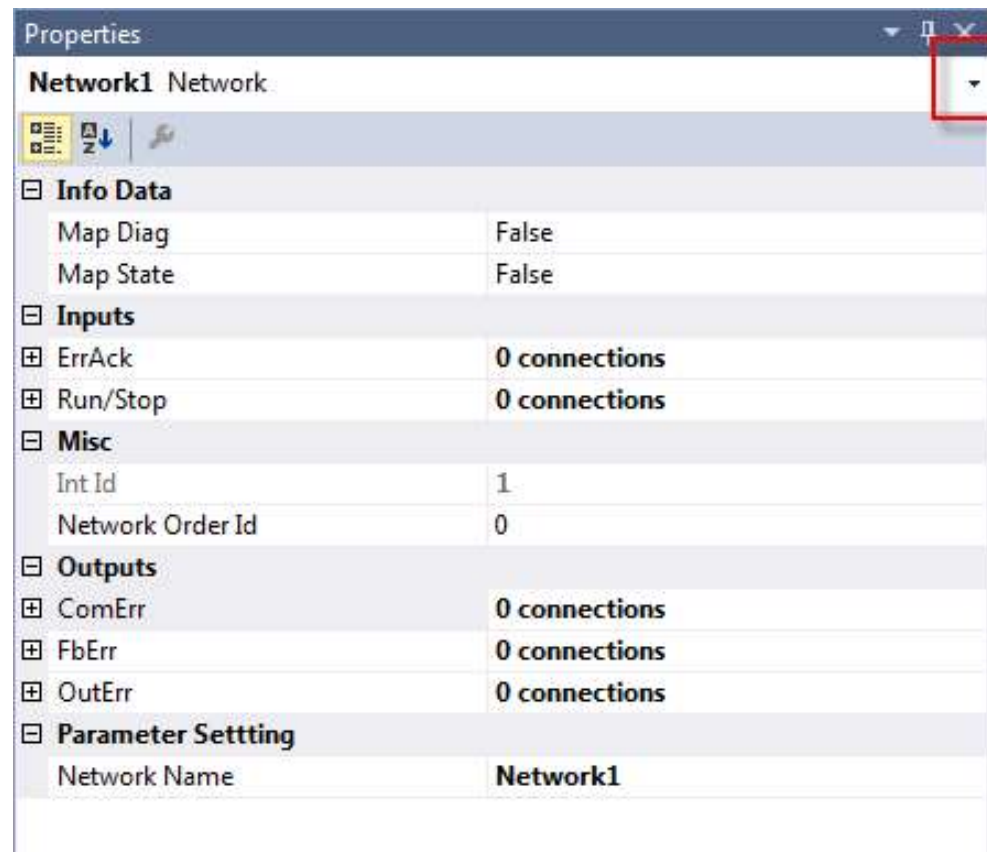
- Left-Click in the empty area of 'Network1'



Estop and Relay

BECKHOFF

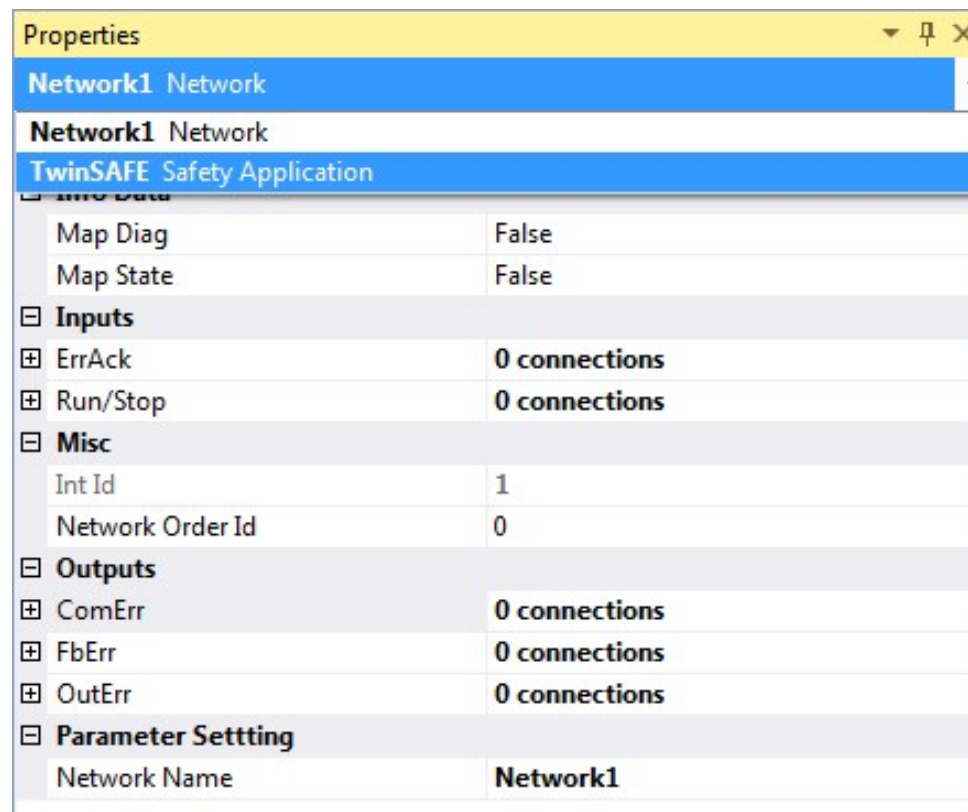
- In the 'Properties' windows select the down arrow



Estop and Relay

BECKHOFF

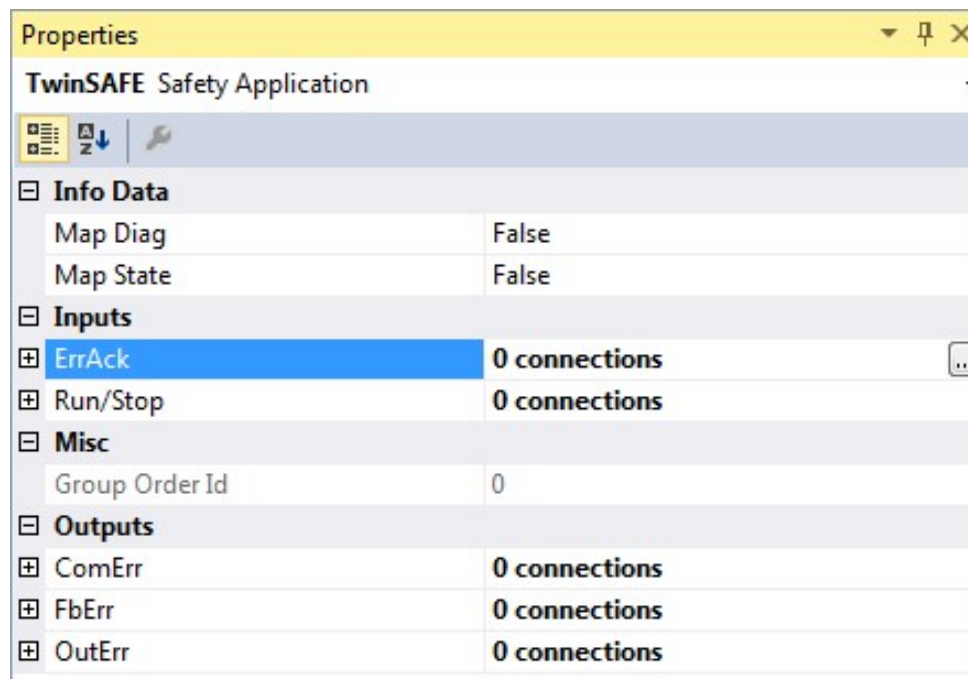
- Select 'TwinSAFE Safety Application' from the drop down list



Estop and Relay

BECKHOFF

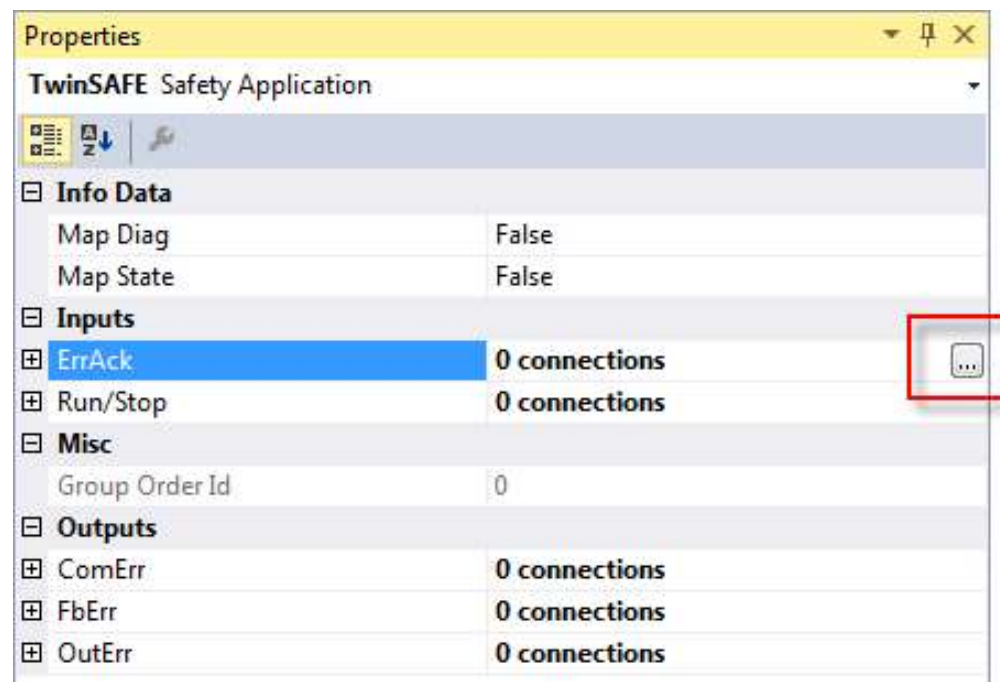
- The properties window now displays the 'Safety Application Variables' that can be connected to an Alias



Estop and Relay

BECKHOFF

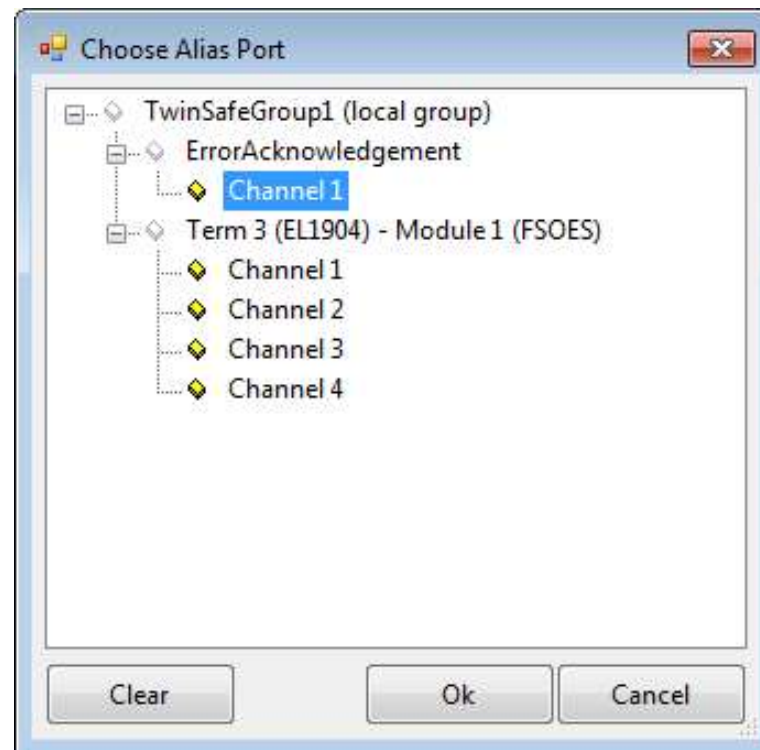
- Click on the Ellipse button to map the Alias



Estop and Relay

BECKHOFF

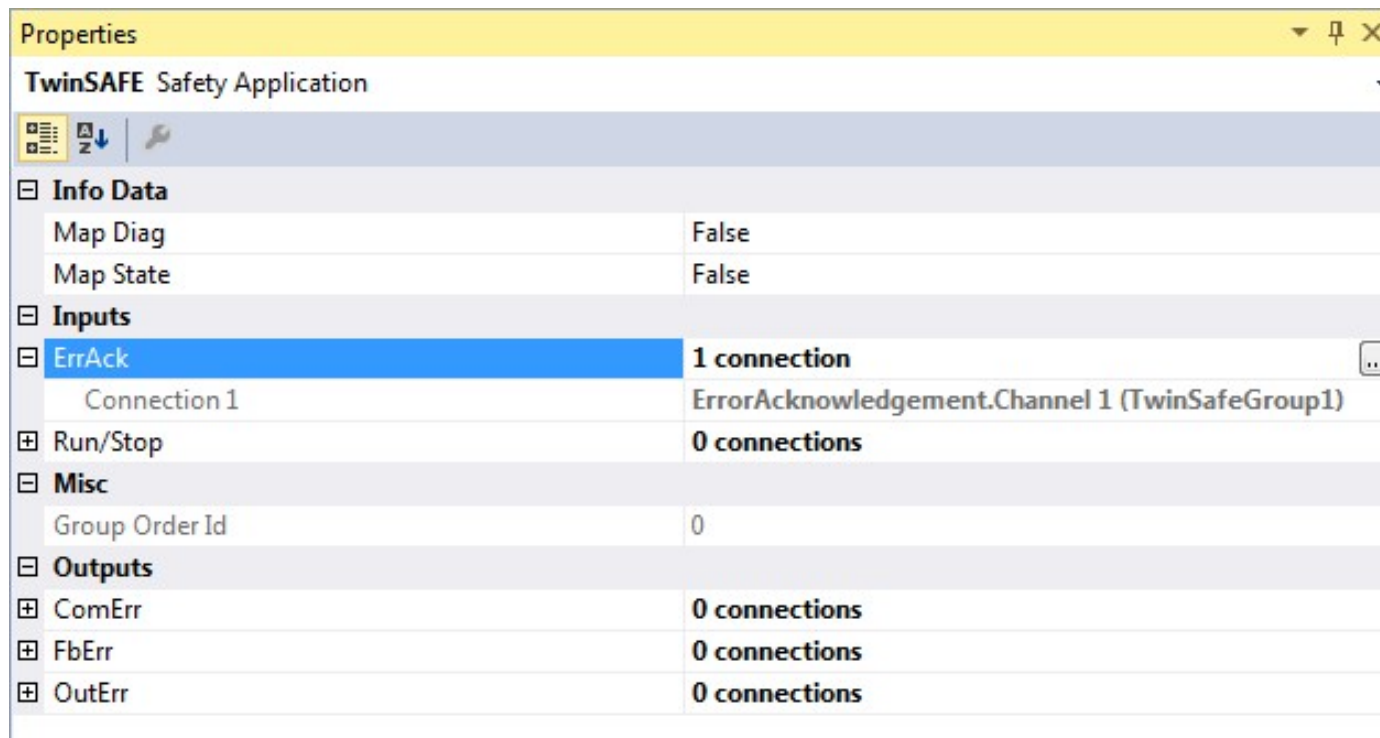
- Select 'Channel 1' of the 'ErrorAcknowledgement' Alias
- Click 'OK'



Estop and Relay

BECKHOFF

- It is now possible to expand the ErrAck and see what it is connected to



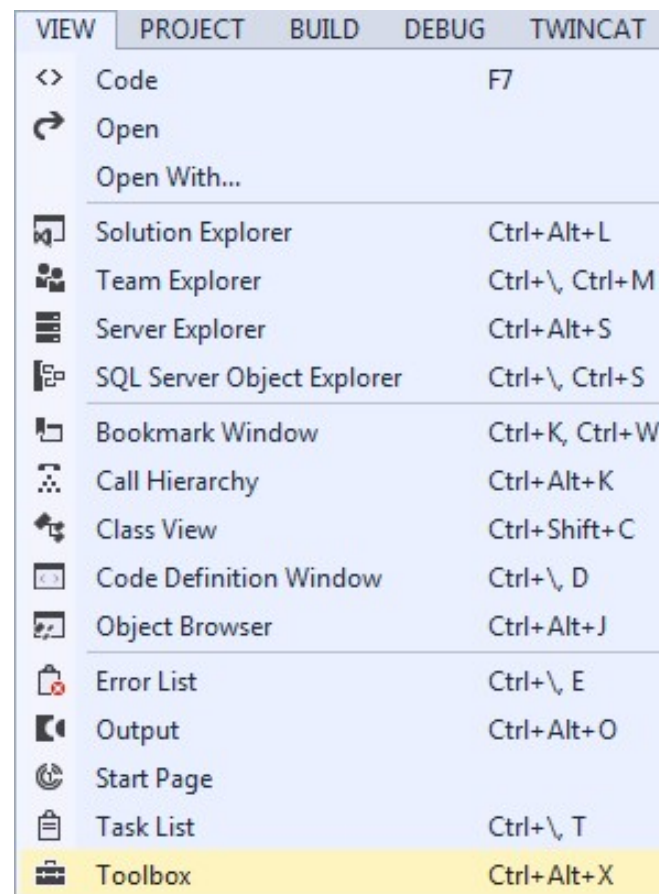
The screenshot shows the 'Properties' window for a 'TwinSAFE Safety Application'. The 'ErrAck' property is selected under the 'Inputs' section, showing it has '1 connection'. The connection is 'ErrorAcknowledgement.Channel 1 (TwinSafeGroup1)'. Other properties like 'Map Diag', 'Map State', 'Run/Stop', 'Misc', 'Outputs', 'ComErr', 'FbErr', and 'OutErr' are also visible.

Property	Value
Info Data	
Map Diag	False
Map State	False
Inputs	
ErrAck	1 connection
Connection 1	ErrorAcknowledgement.Channel 1 (TwinSafeGroup1)
Run/Stop	0 connections
Misc	
Group Order Id	0
Outputs	
ComErr	0 connections
FbErr	0 connections
OutErr	0 connections

Estop and Relay

BECKHOFF

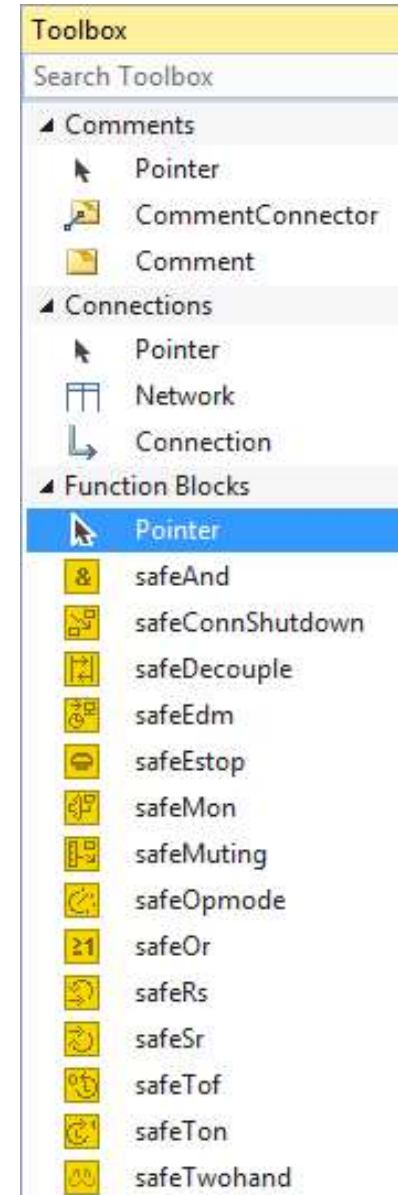
- From the 'View' menu, select 'Toolbox'



Estop and Relay

BECKHOFF

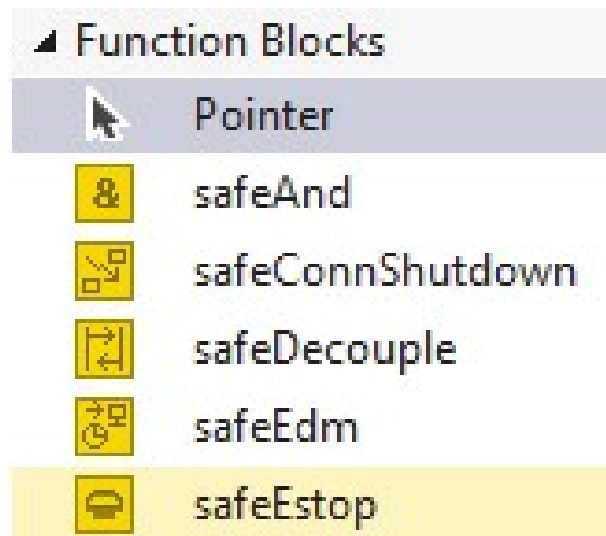
- The Safety Toolbox contains items that can be added to the TwinSafeGroup1.sal file



Estop and Relay

BECKHOFF

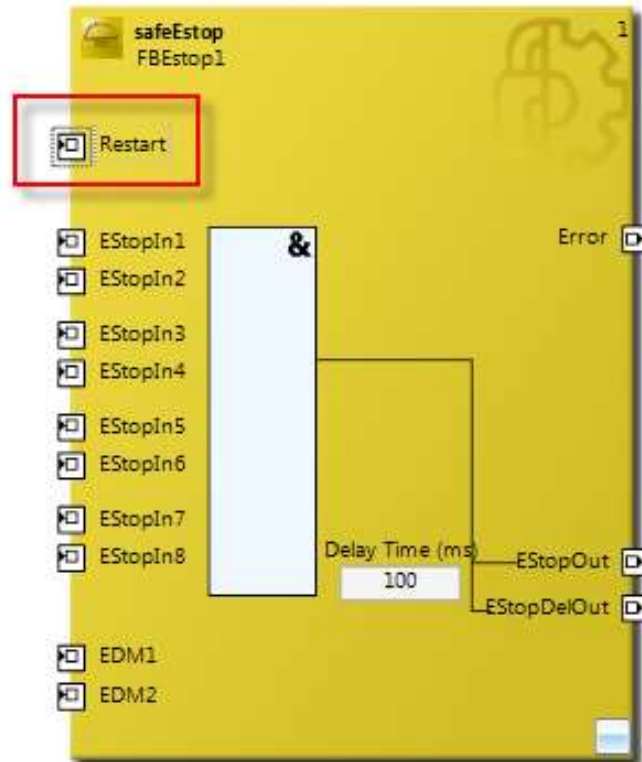
- Under the 'Function Blocks' group, select 'safeEstop'
- Click and drag the item to place it on the network



Estop and Relay

BECKHOFF

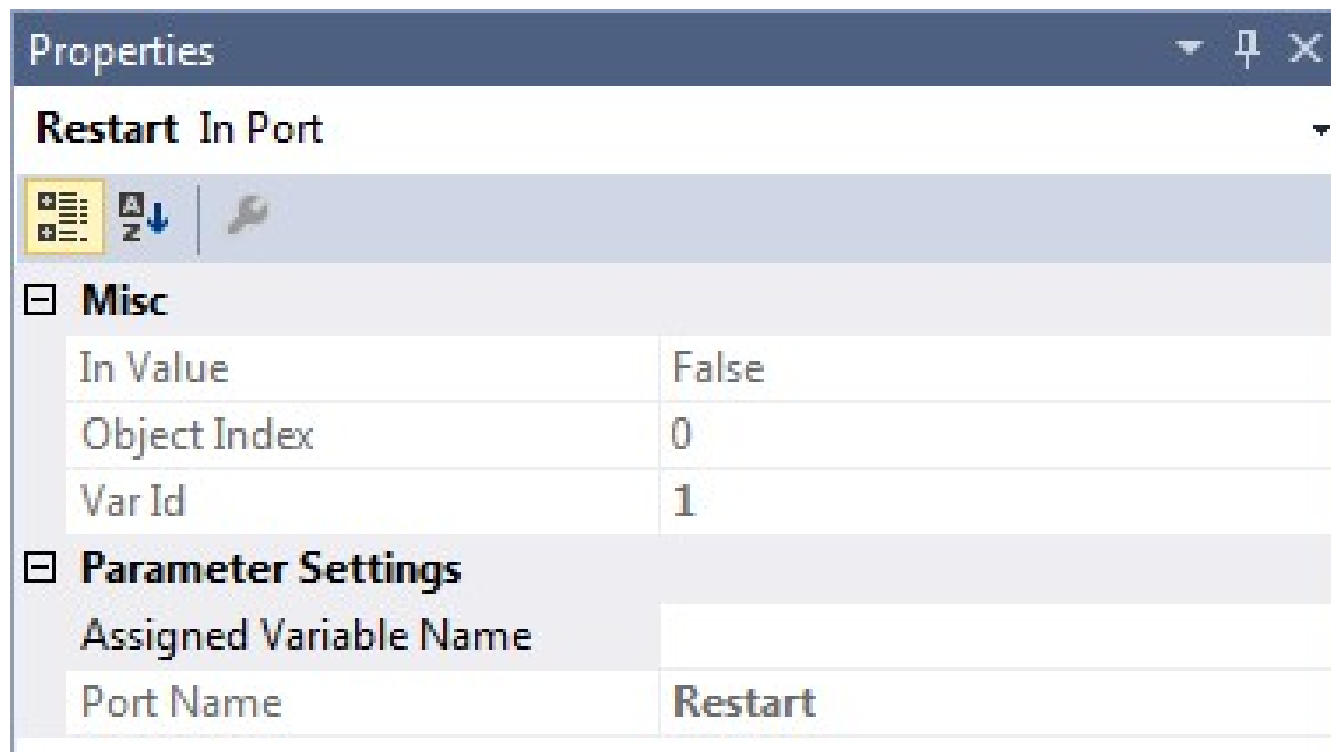
- Left-click on the 'Restart' input



Estop and Relay

BECKHOFF

- The 'Properties' window should now display the properties of the '**Restart** In Port'



Estop and Relay

BECKHOFF

- In the 'Assigned Variable Name' create a unique name for the Input and press 'Enter'
- SafetyRestartPB

Properties

Restart In Port

A↓

[-] Misc

In Value	False
Object Index	0
Var Id	1

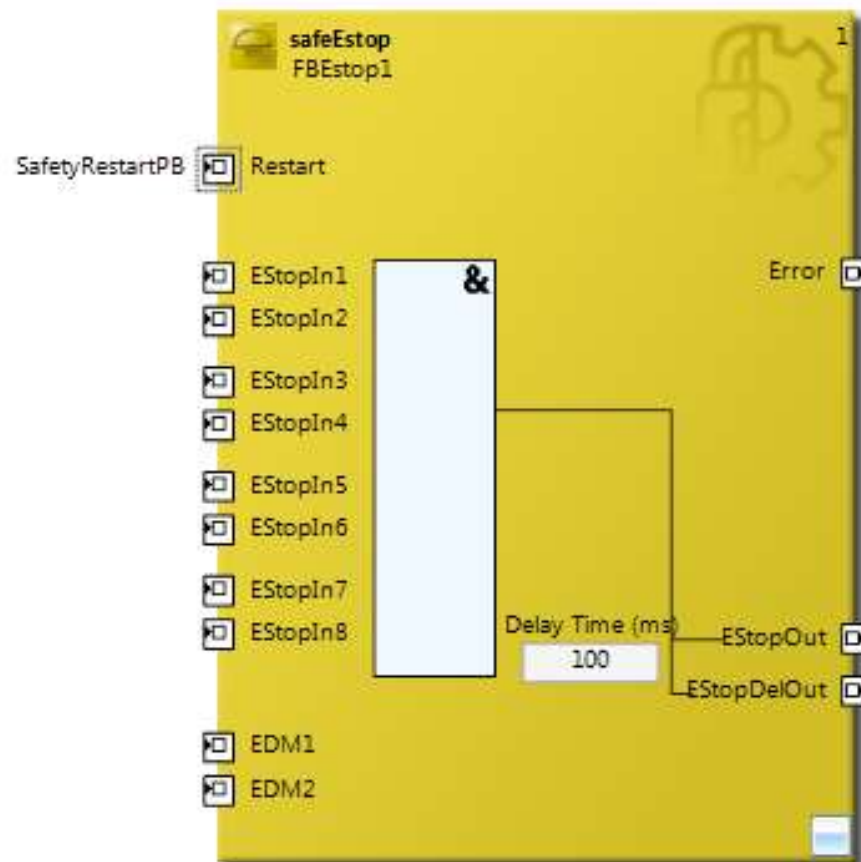
[-] Parameter Settings

Assigned Variable Name	SafetyRestartPB
Port Name	Restart

Estop and Relay

BECKHOFF

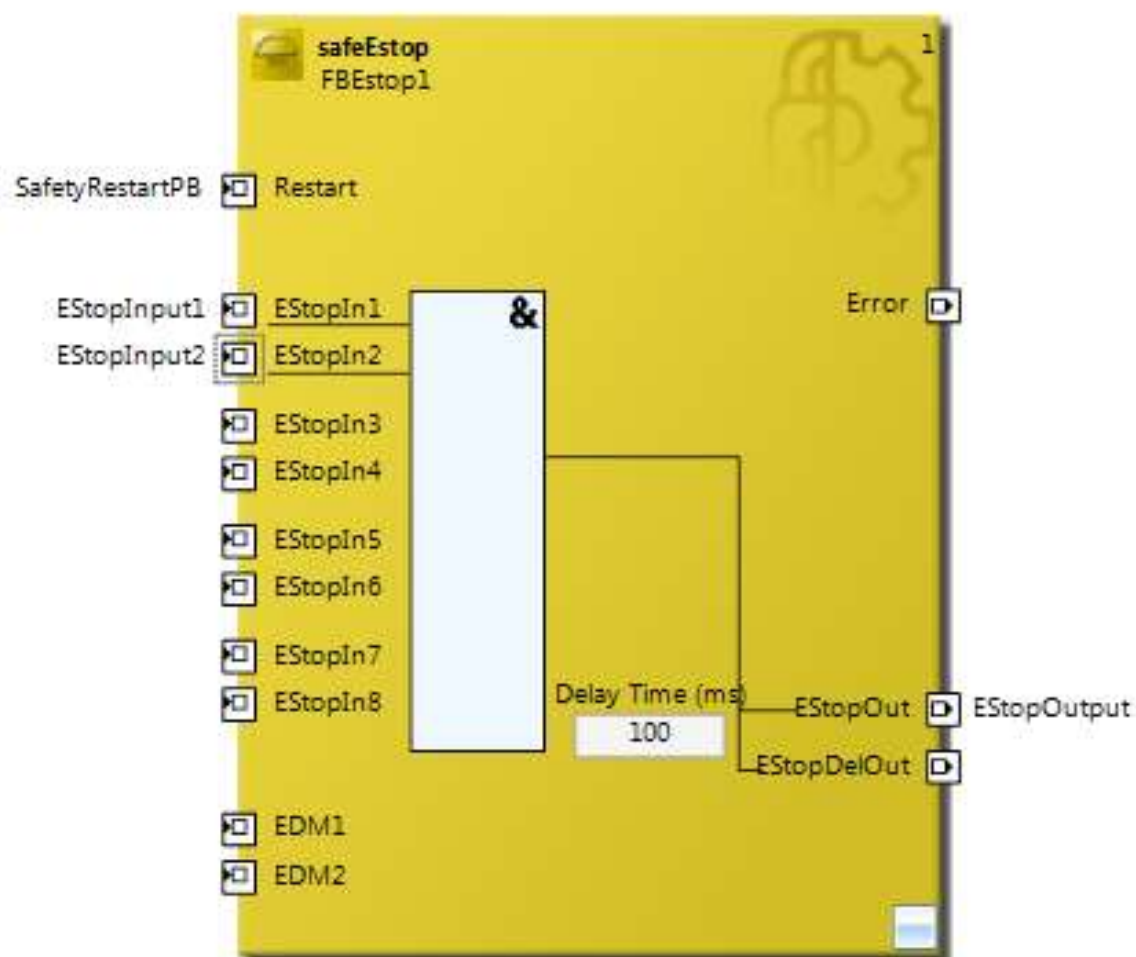
- The name should now be displayed next to the input of the Function Block



Estop and Relay

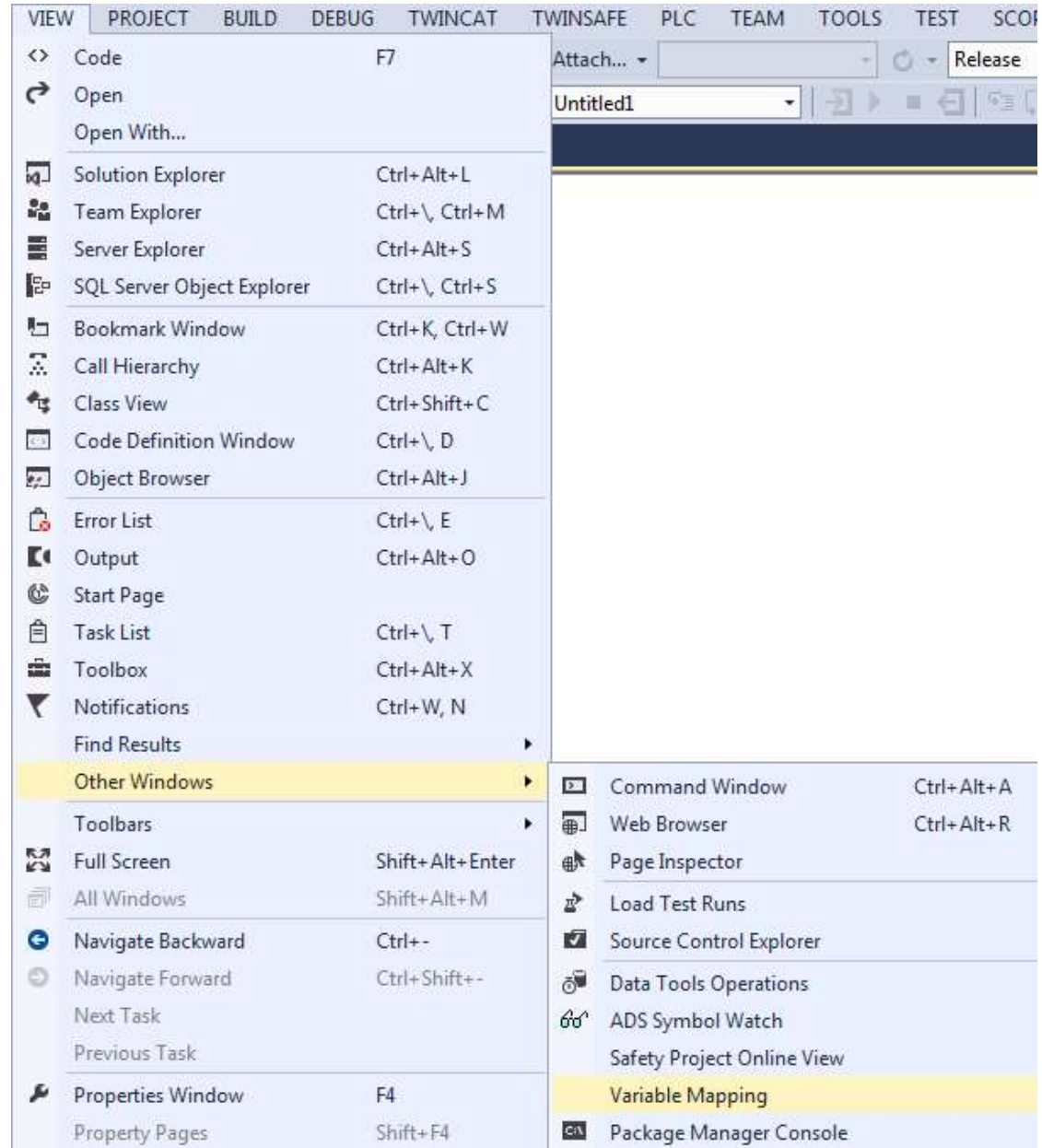
BECKHOFF

- Repeat these steps to Assign Variable Names to the first 2 Inputs and the Estop Output



BECKHOFF

- From the 'View' menu, select 'Other Windows' and then 'Variable Mapping'
- This window is typically opened automatically and can be found next to the 'Error' or 'Output' windows



Estop and Relay

BECKHOFF

- The 'Variable Mapping' window contains the variables that were created in the Safety Networks
- From here these variables can be connected to an Alias

Variable Mapping						
Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FBStop1	Restart	input	SafetyRestartPB	safeBool ▼	
safeEstop	FBStop1	ESopIn1	input	ESopInput1	safeBool ▼	
safeEstop	FBStop1	ESopIn2	input	ESopInput2	safeBool ▼	
safeEstop	FBStop1	ESopOut	output	ESopOutput	safeBool ▼	

Estop and Relay

BECKHOFF

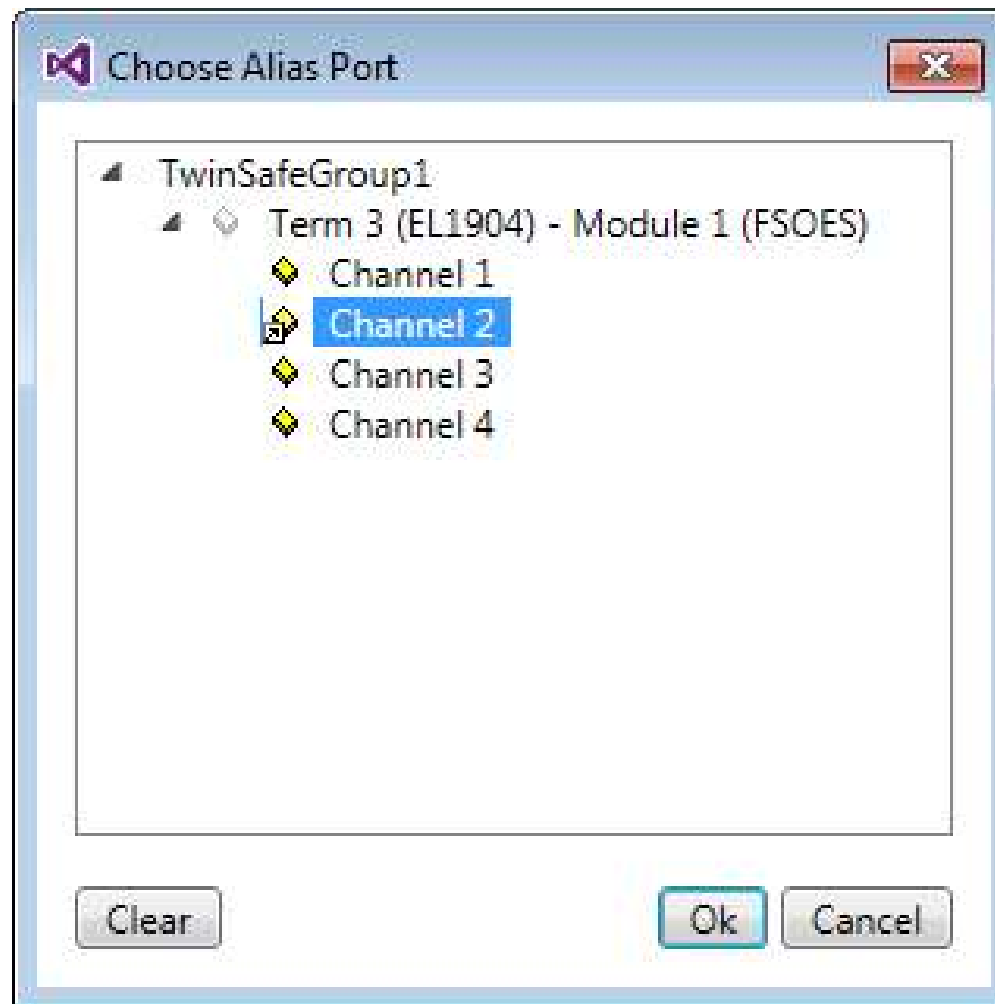
- Select the Ellipse button of the Restart

Variable Mapping						
Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FBStop1	Restart	input	SafetyRestartPB	safeBool	
safeEstop	FBStop1	ESopIn1	input	ESopInput1	safeBool	
safeEstop	FBStop1	ESopIn2	input	ESopInput2	safeBool	
safeEstop	FBStop1	ESopOut	output	ESopOutput	safeBool	

Estop and Relay

BECKHOFF

- Select the Alias that is connect to the Safety Hardware Input



Estop and Relay

BECKHOFF

- The 'Port Name' is provided by the 'Function Block'
- The 'Assigned Variable' is created by the programmer
- The 'Alias Port' is the connection to an Alias that will then connect to something outside of the TwinSAFE Group

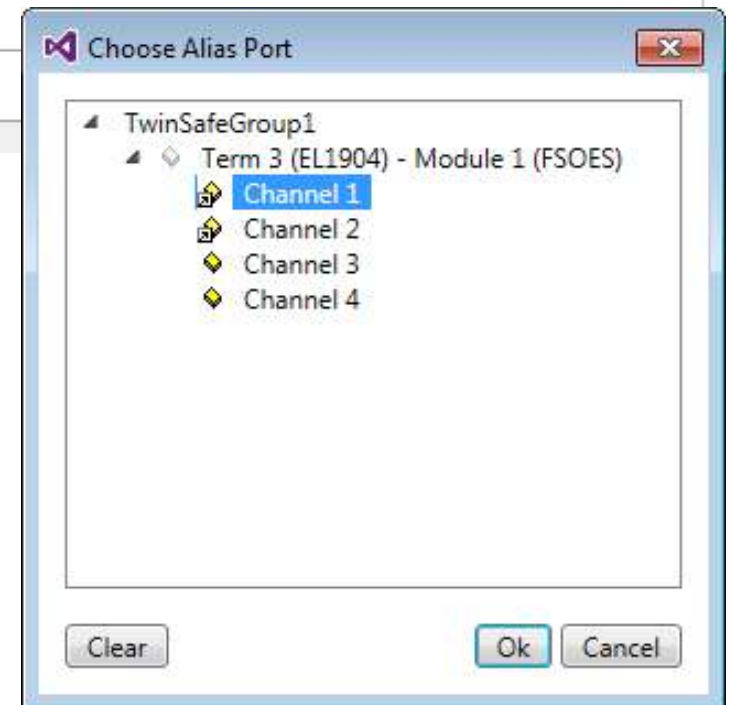
Variable Mapping						
Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FBEstop1	Restart	input	SafetyRestartPB	safeBool ▼	 Term 3 (EL1904) - Module 1 (FSOES).Channel 2 (TwinSafeGroup1)
safeEstop	FBEstop1	EStopIn1	input	EStopInput1	safeBool ▼	
safeEstop	FBEstop1	EStopIn2	input	EStopInput2	safeBool ▼	
safeEstop	FBEstop1	EStopOut	output	EStopOutput	safeBool ▼	

Estop and Relay

BECKHOFF

- Select the Ellipse button for EStopInput1
- Select the Alias for Channel 1 of the EL1904

Variable Mapping						
Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FBStop1	Restart	input	SafetyRestartPB	safeBool	Term 3 (EL1904) - Module 1 (FSOES).Channel 2 (TwinSafeGroup1)
safeEstop	FBStop1	EStopIn1	input	EStopInput1	safeBool	
safeEstop	FBStop1	EStopIn2	input	EStopInput2	safeBool	
safeEstop	FBStop1	EStopOut	output	EStopOutput	safeBool	



Estop and Relay

BECKHOFF

- Select the Ellipse button for EStopInput2
- Select the Alias for Channel 3 of the EL1904

Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FB_Estop1	Restart	input	SafetyRestartPB	safeBool	Term 3 (EL1904) - Module 1 (FSOES).Channel 2 (TwinSafeGroup1)
safeEstop	FB_Estop1	EStopIn1	input	EStopInput1	safeBool	Term 3 (EL1904) - Module 1 (FSOES).Channel 1 (TwinSafeGroup1)
safeEstop	FB_Estop1	EStopIn2	input	EStopInput2	safeBool	
safeEstop	FB_Estop1	EStopOut	output	EStopOutput	safeBool	

Choose Alias Port

- ▲ TwinSafeGroup1
 - ◆ Term 3 (EL1904) - Module 1 (FSOES)
 - Channel 1
 - Channel 2
 - Channel 3
 - Channel 4

Clear Ok Cancel

Estop and Relay

BECKHOFF

- Select the Ellipse button for EStopOutput
- Select the Alias for Channel 1 of the EL2904

Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FB_Estop1	Restart	input	SafetyRestartPB	safeBool	Term 3 (EL1904) - Module 1 (FSOES).Channel 2 (TwinSafeGroup1)
safeEstop	FB_Estop1	EStopIn1	input	EStopInput1	safeBool	Term 3 (EL1904) - Module 1 (FSOES).Channel 1 (TwinSafeGroup1)
safeEstop	FB_Estop1	EStopIn2	input	EStopInput2	safeBool	Term
safeEstop	FB_Estop1	EStopOut	output	EStopOutput	safeBool	

Choose Alias Port

- TwinsafeGroup1
 - Term 4 (EL2904) - Module 1 (FSOES)
 - Channel 1
 - Channel 2
 - Channel 3
 - Channel 4

Clear Ok Cancel

Estop and Relay

BECKHOFF

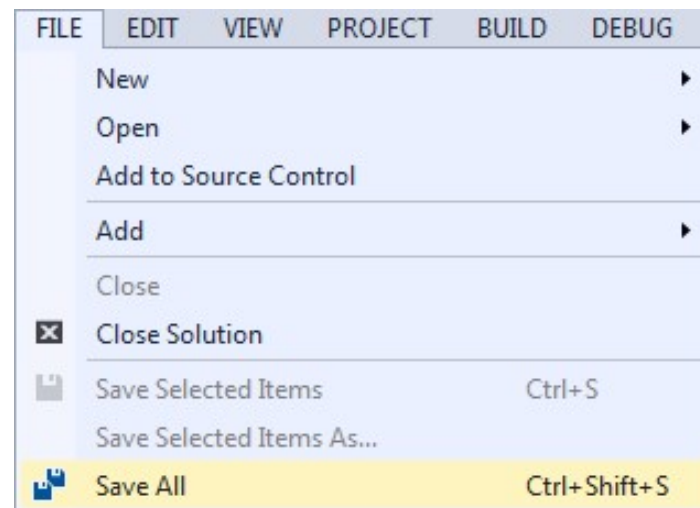
Variable Mapping						
Function Name	Instance Name	Port Name	Direction	Assigned Variable	Data Type	Alias Port
safeEstop	FBStop1	Restart	input	SafetyRestartPB	safeBool ▼	Term 3 (EL1904) - Module 1 (FSOES).Channel 2 (TwinSafeGroup1)
safeEstop	FBStop1	EStopIn1	input	EStopInput1	safeBool ▼	Term 3 (EL1904) - Module 1 (FSOES).Channel 1 (TwinSafeGroup1)
safeEstop	FBStop1	EStopIn2	input	EStopInput2	safeBool ▼	Term 3 (EL1904) - Module 1 (FSOES).Channel 3 (TwinSafeGroup1)
safeEstop	FBStop1	EStopOut	output	EStopOutput	safeBool ▼	Term 4 (EL2904) - Module 1 (FSOES).Channel 1 (TwinSafeGroup1)

- At this point the project has been created, the last step is to verify it and load it into the EL6900

Estop and Relay

BECKHOFF

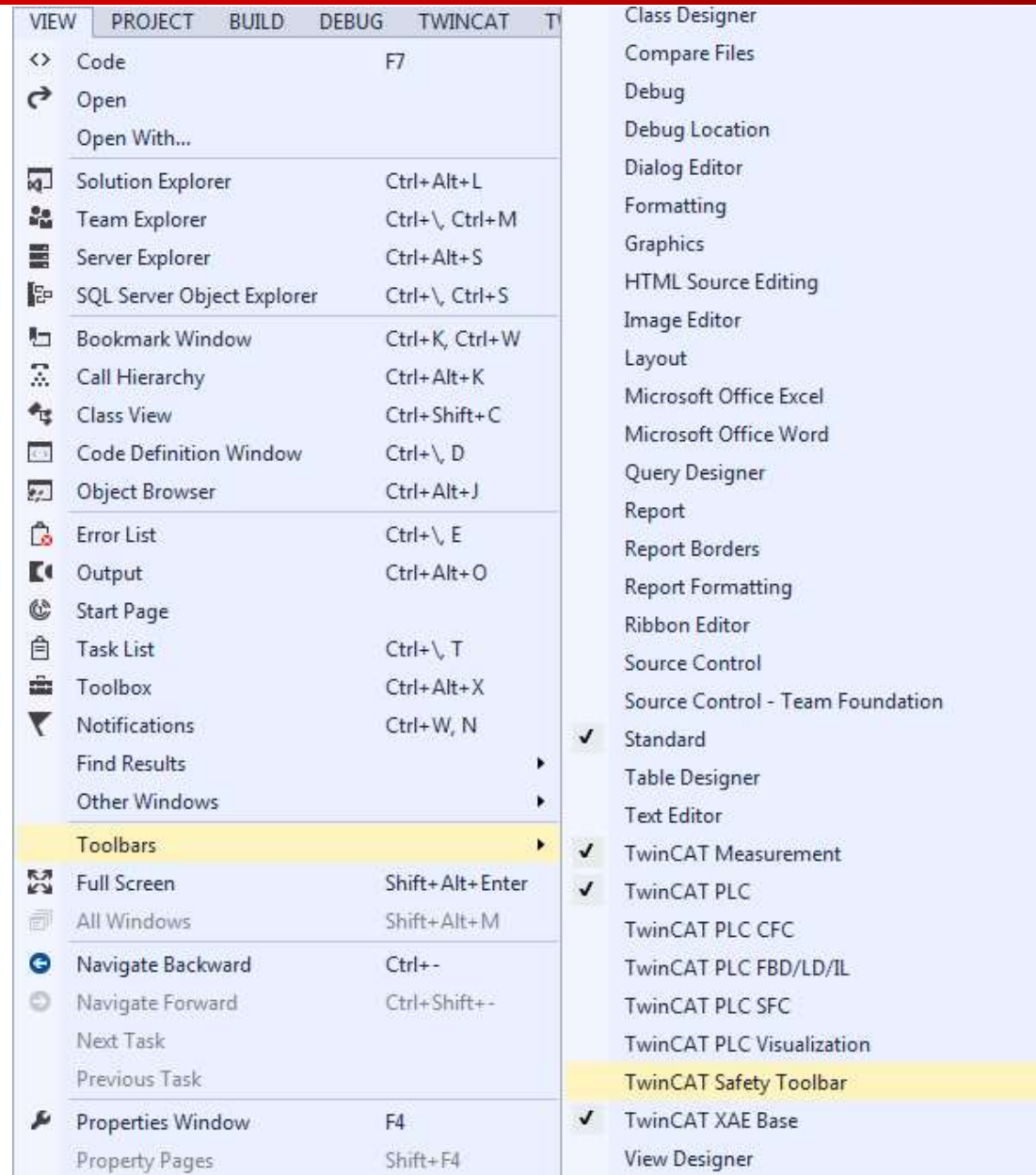
- At this point the project has been created, the last step is to verify it and load it into the EL6900
- Before continuing select 'Save All' from the 'File' menu



Estop and Relay

BECKHOFF

- From the 'View' menu, select 'Toolbars', and then select 'TwinCAT Safety Toolbar'



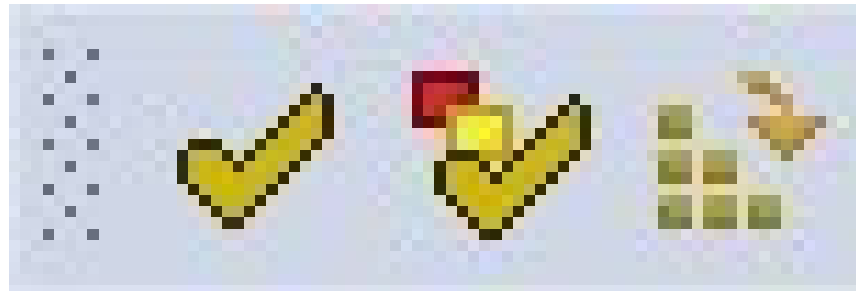
Estop and Relay

BECKHOFF

- The Safety Toolbar is configured in the order of operation for the needed commands
- The Toolbar will be grayed out if the active window is not part of the Safety Project.



- Verify Safety Project (Project Level)
- Verify Complete Safety Project (Project and Hardware Level)
- Download Safety Project



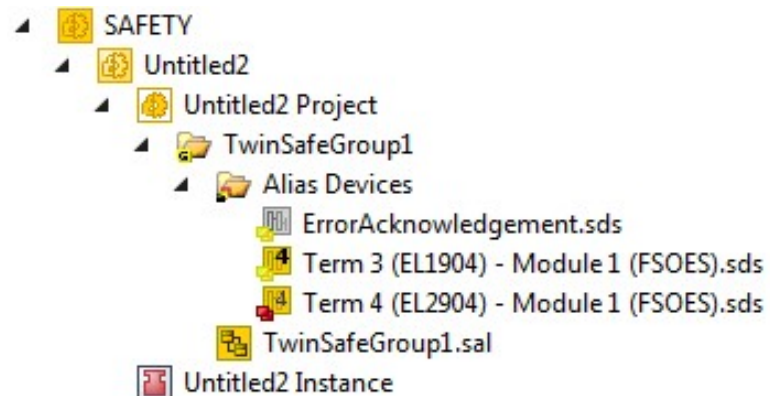
Estop and Relay

BECKHOFF

- Click on Verify Safety Project (Project Level)



- This will check for any errors within the Safety Project
- If any errors are found they will be shown in the 'Error' window



- Click on Verify Complete Safety Project (Project and Hardware Level)

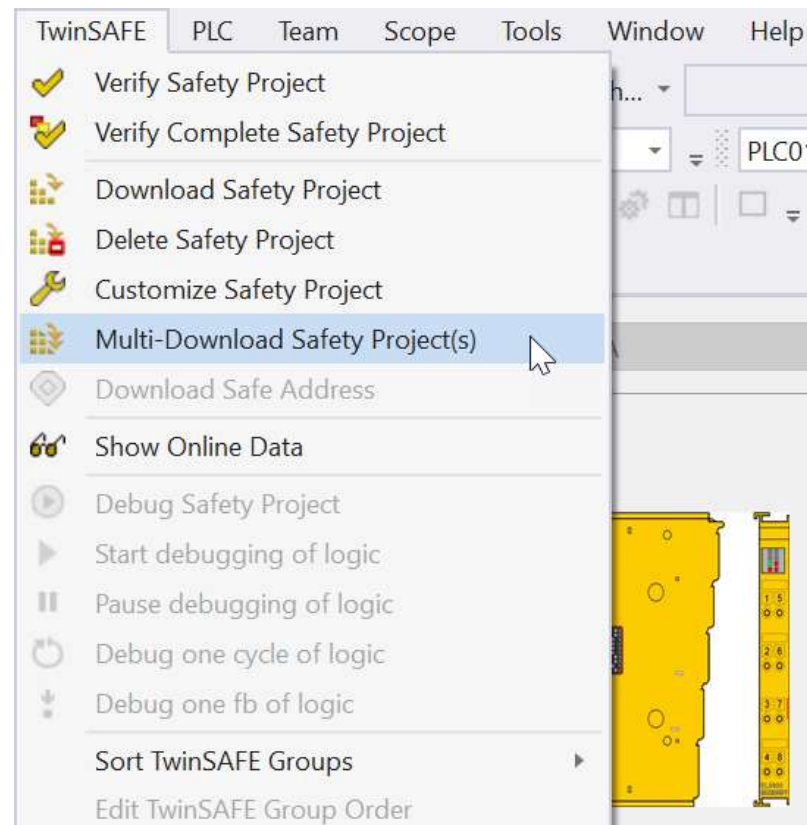


- In addition to the Safety Project, this will also check the Safety Hardware Configuration

Estop and Relay – TwinSAFE Download

BECKHOFF

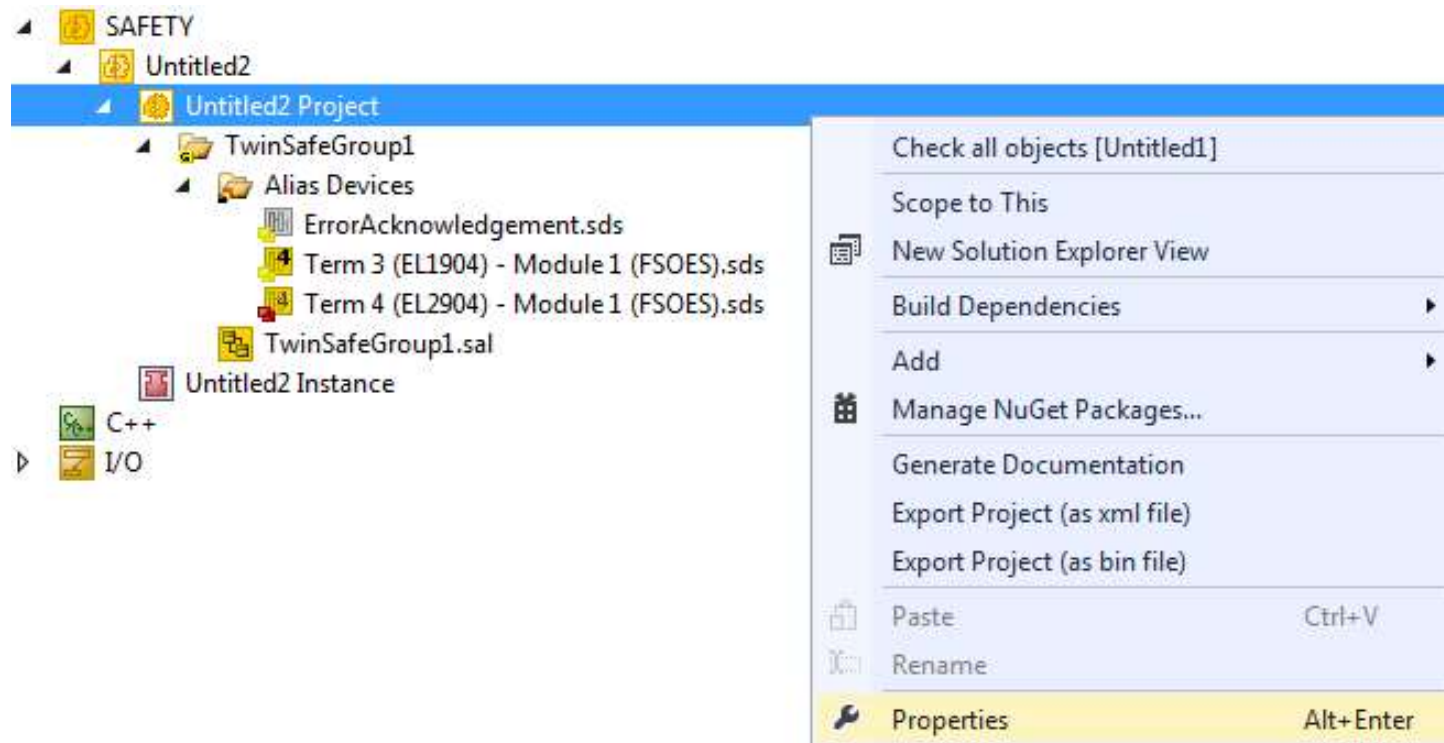
- With the TwinSAFE Logic open
- Click TwinSAFE from the command bar
- Click Multi-Download Safety Project(s)
Note: This works even if you only have one project



Estop and Relay – TwinSAFE Download (old way)

BECKHOFF

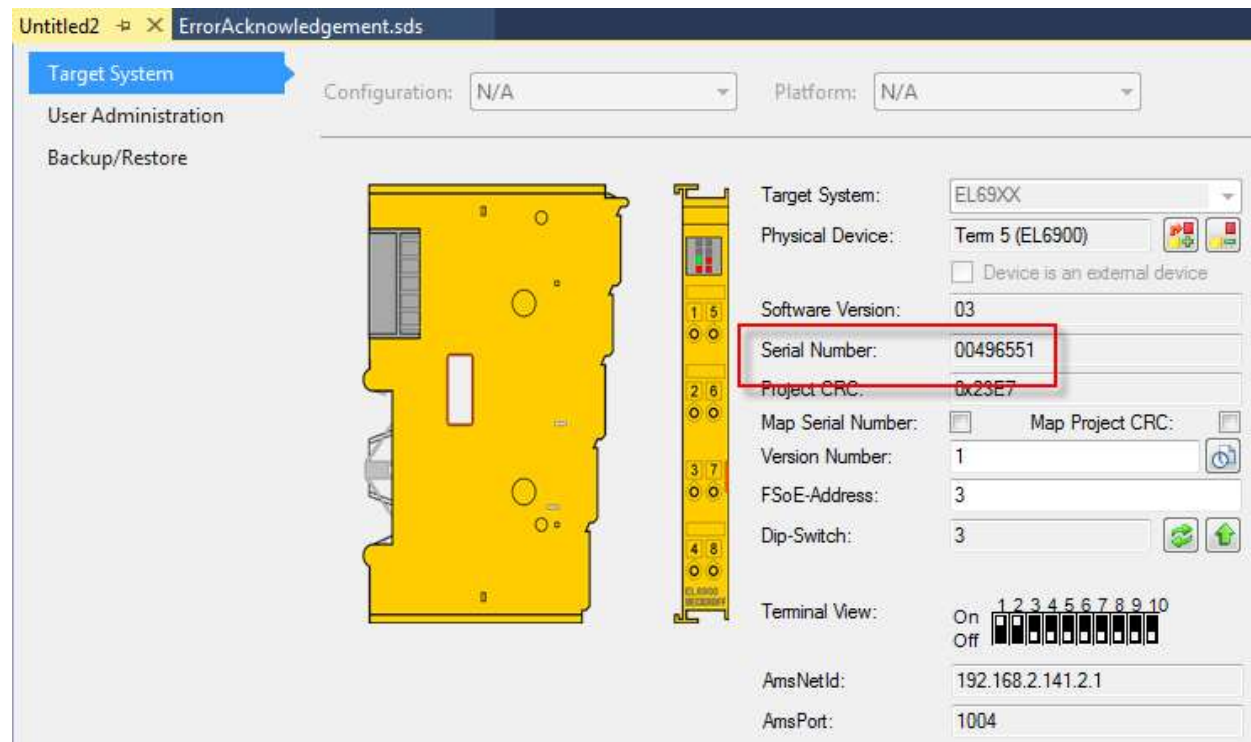
- Before downloading the Safety Project to the TwinSAFE Logic device, verify that the Serial Number is correct
- Right-Click on the Project and select 'Properties'



Estop and Relay – TwinSAFE Download (old way)

BECKHOFF

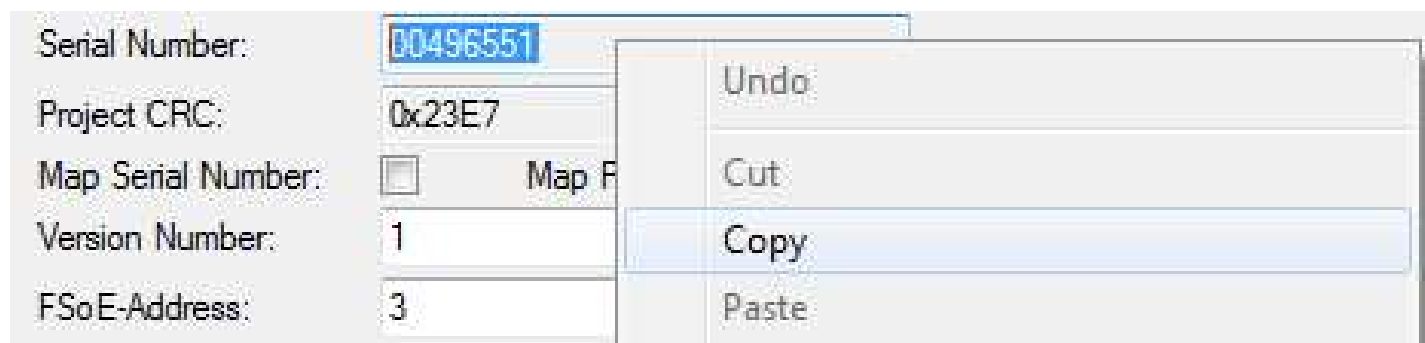
- Verify the Serial Number matches the serial number printed on the hardware
- When working with Multiple EL6900s, this will help to ensure that the correct program is being loaded



Estop and Relay – TwinSAFE Download (old way)

BECKHOFF

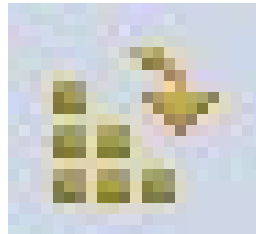
- Double-click the Serial Number to select it
- Right-click on it, then select 'Copy'



Estop and Relay – TwinSAFE Download (old way)

BECKHOFF

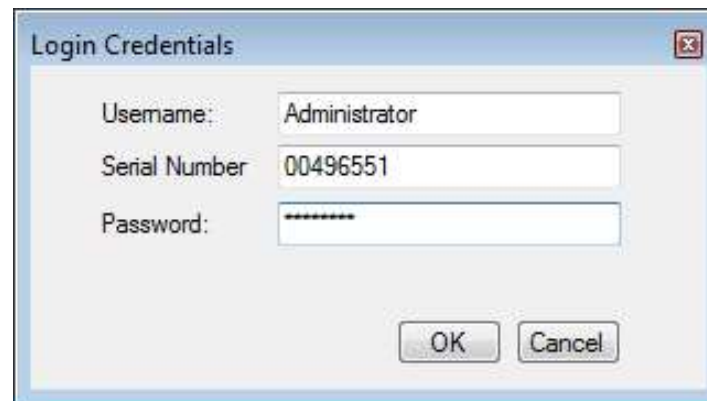
- Click on 'Download Safety Project'



Estop and Relay – TwinSAFE Download (old way)

BECKHOFF

- Provide the Login Information for the EL6900
- This information is CASE sensitive
- Username: Administrator
- Serial Number: Ctrl+V to paste
- Password: TwinSAFE

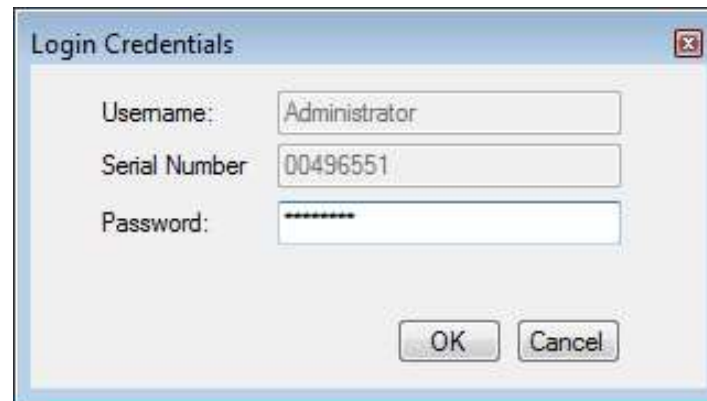


A screenshot of a Windows-style dialog box titled "Login Credentials". It contains three input fields: "Username:" with the text "Administrator", "Serial Number" with the text "00496551", and "Password:" with masked characters "*****". At the bottom right, there are "OK" and "Cancel" buttons.

Estop and Relay – TwinSAFE Download (old way)

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- Click 'OK'
- If the information was correct you will be asked for the password one more time
- Enter the same password and click 'OK'



A screenshot of a 'Login Credentials' dialog box. The dialog has a title bar with the text 'Login Credentials' and a close button. It contains three input fields: 'Username:' with the text 'Administrator', 'Serial Number' with the text '00496551', and 'Password:' with a masked password represented by eight asterisks. At the bottom right, there are two buttons: 'OK' and 'Cancel'.

- Activate the Configuration
- Restart TwinCAT in Run Mode
- Login and start the PLC

- The TwinSAFE Group will have a Com Error
- Press the ErrAck Push Button to clear it
- Depress and then twist the Estop push button to ensure that it is reset
- Press the Restart push button to restart the Safety Function Block
- The relay should now be pulled in

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