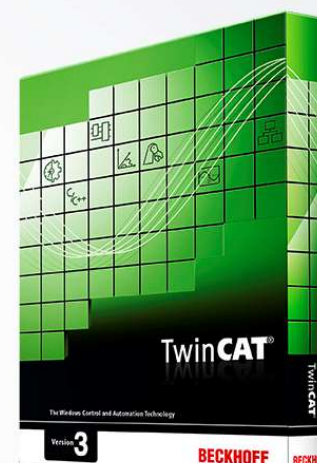
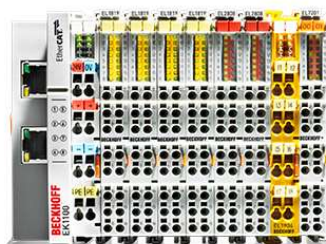


BECKHOFF



WARNING!

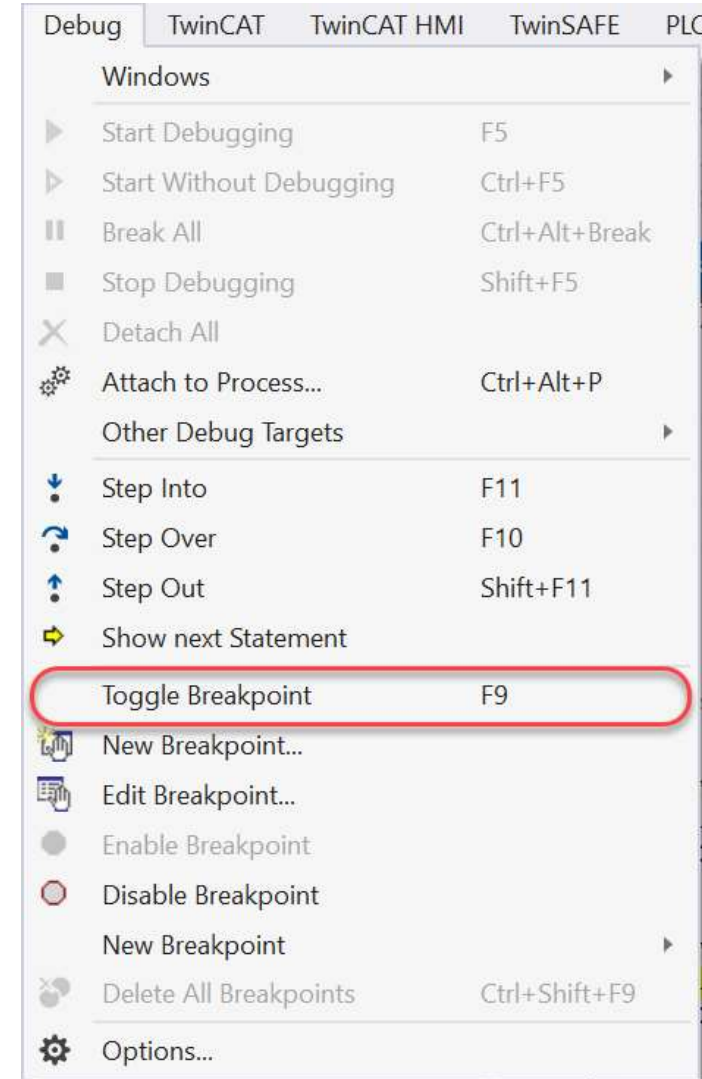
- A Breakpoint will stop the PLC
 - This will likely prevent your IO from updating
- Note: Logging out of the PLC will leave all breakpoints, and the code will not start running again.
- Restarting the PLC project will leave the breakpoints in place but they will not be enabled; PLC code execution will return to normal

- Breakpoints can be used to aid in debugging the PLC code
- When the line is selected where the Breakpoint is to happen the PLC code will run until that line of code is reached
 - This can be done inside conditional statements (like IF)
- When the breakpoint is reached the PLC will stop running and the status of variables can be seen in their current state
- This will allow the checking of the code to determine if the code is executing properly

- To set a breakpoint click on the line, placing the cursor where you wish the PLC to stop

```
1 |  
2 | ● FbPulse(bEnable FALSE := TRUE, bPulse FALSE => bLight FALSE );  
3 | ● RETURN
```

- From the DEBUG menu select Toggle Breakpoint
- Note: Breakpoints can only be set on lines that have the gray circle.

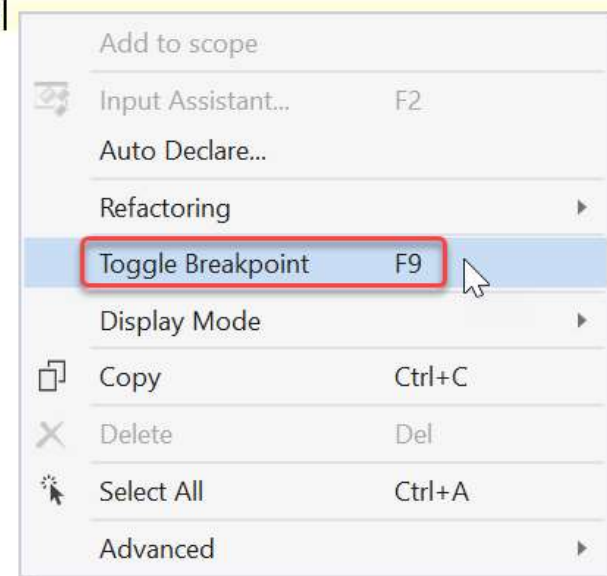


Breakpoints

- Alternative, you can right click and enable the breakpoint from the menu

```
8 IF bTest2 TRUE THEN  
9   iCountTens 15950 := iCountTens 15950 + 10;  
10 END_IF RETURN
```

- Note the line must first be selected



- You will not be able to add a breakpoint to an invalid line

The screenshot shows the TwinCAT IDE with a ladder logic program. Line 7 is highlighted in yellow, and a red arrow points to it. A context menu is open over line 7, showing options like 'Add to scope', 'Input Assistant...', 'Auto Declare...', 'Refactoring', 'Toggle Breakpoint', 'Display Mode', 'Copy', 'Delete', 'Select All', and 'Advanced'. A black arrow points from the 'Toggle Breakpoint' option to an error dialog box titled 'TcXaeShell'. The dialog box contains a yellow warning triangle icon and the following text:

TwinCAT PLC Control

Cannot set a breakpoint at "MAIN [TwinCAT_Project4: PLC: PLC01] - Line 7, Column 1 (Impl)" because this is not a valid breakpoint position.

OK

Breakpoints

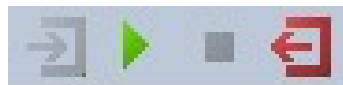
- The Breakpoint has now been set on Line 2

```
1  
2 ● fbPulse (bEnable FALSE := TRUE, bPulse FALSE => bLight FALSE );  
3 ○ RETURN
```

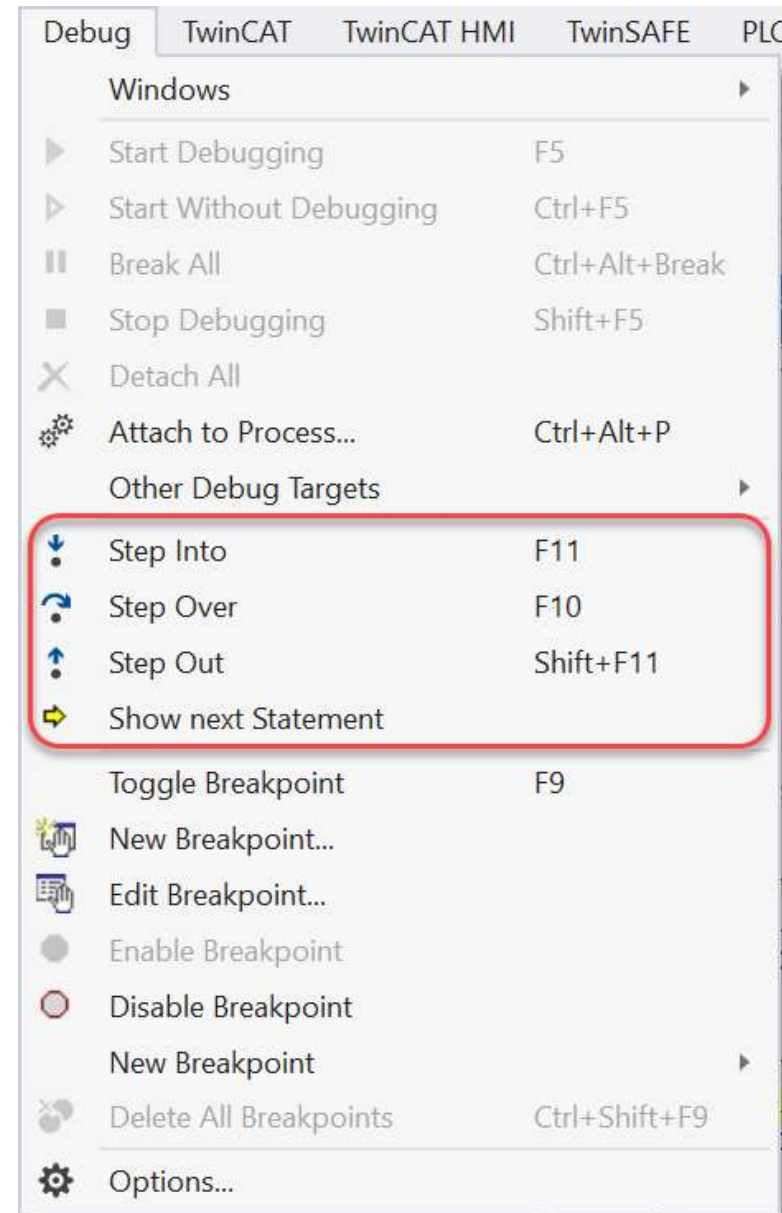
- When the PLC reaches this line of code the PLC will halt before running Line 2

```
1  
2 ⬅ fbPulse (bEnable FALSE := TRUE, bPulse FALSE => bLight FALSE );  
3 ○ RETURN
```

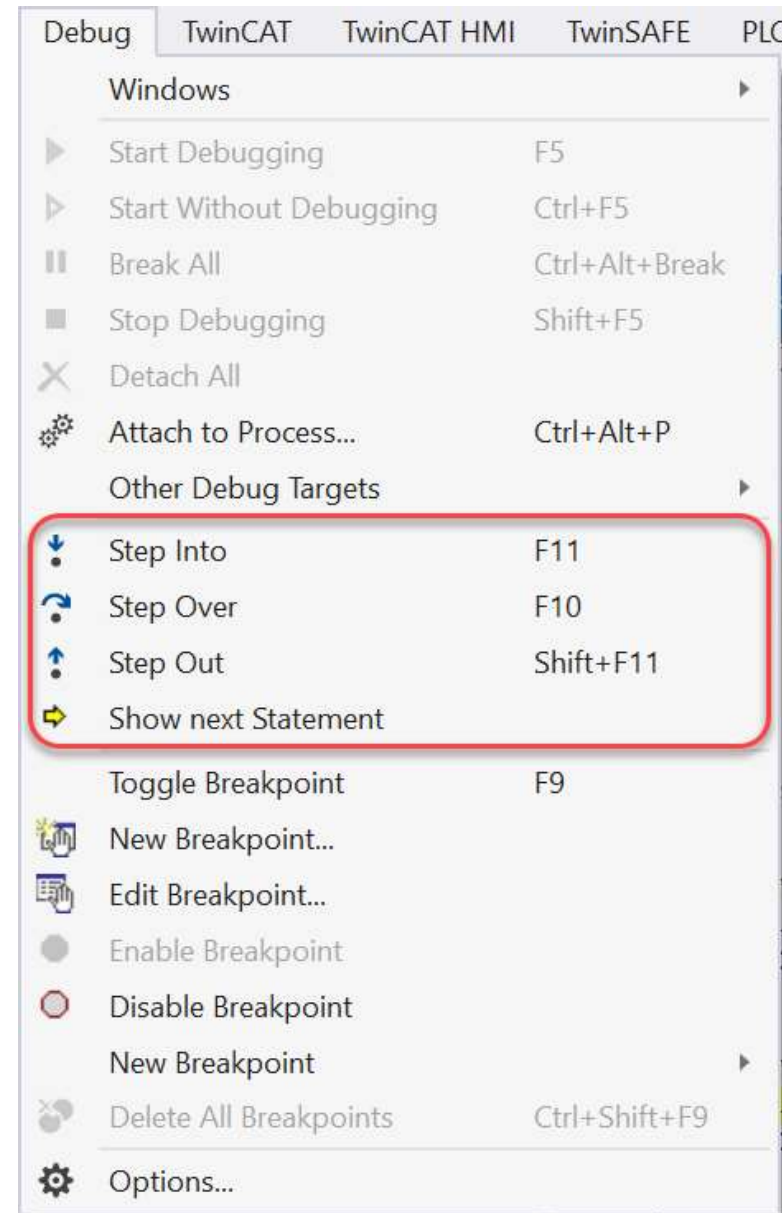
- You can also see that the Run command for the PLC is enabled.



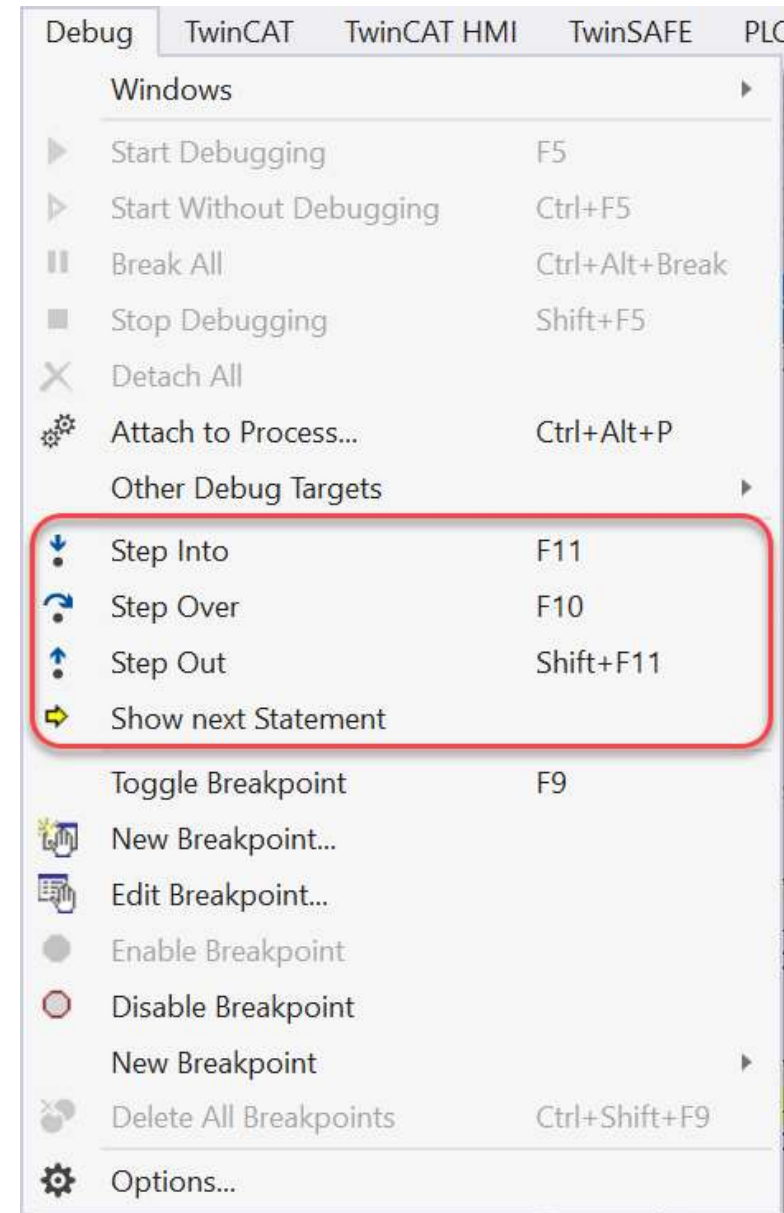
- The DEBUG menu provides the programmer with a list of options
- The Run (F5) command will start the PLC again and it will run until it hits a breakpoint
- The Toggle Breakpoint(F9) command will remove or add a Breakpoint at the line where the cursor is currently located



- Step over (F10) will execute the line of code and go to the next line of code.
- If a call to another POU call is on the selected line of code being executed, this POU will run in its entirety.

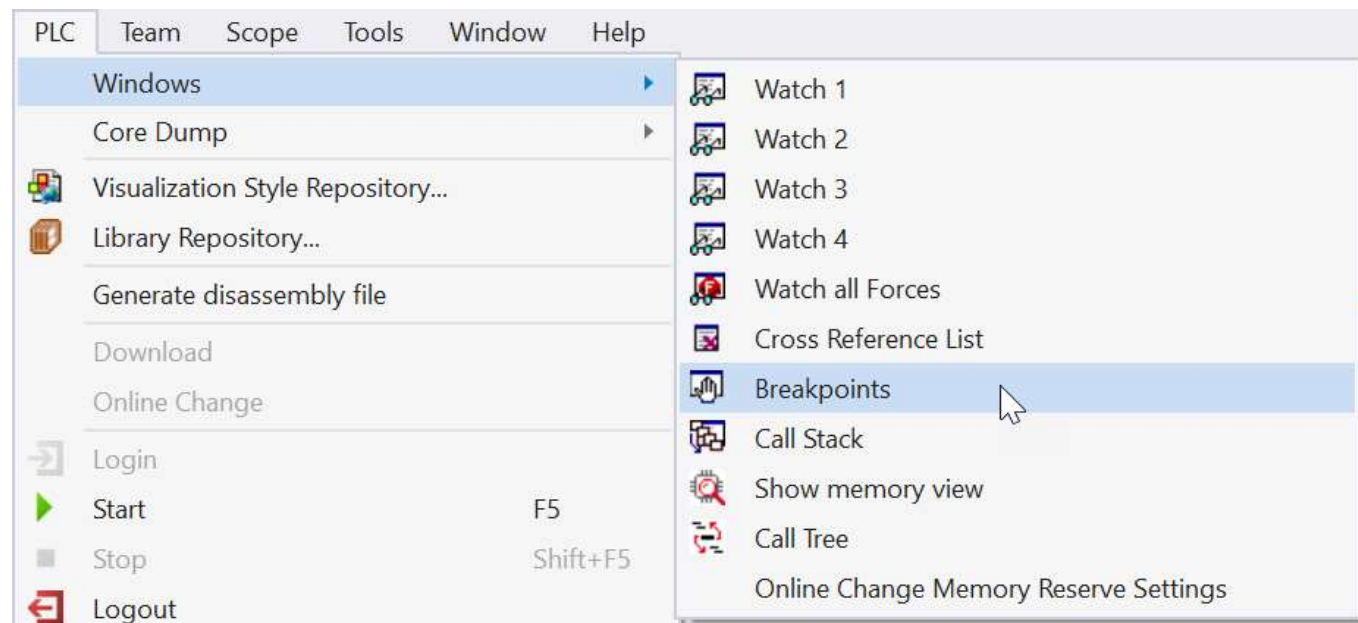


- Step Into (F11) will perform the same action as Step Over with the added functionality of opening the called POU and stepping through its code line by line
 - Note: will not open a POU inside of a compiled library
- Step Out (Shift + F11) will leave the current POU and return to the calling POU
- These controls can also be found on the tool bar



Breakpoints – Monitor Window

- From the PLC menu of the command bar
- The Open the Breakpoints window for advanced options and controls



- All configured Breakpoints will be displayed, and advanced operations can be configured here



The screenshot shows the 'Breakpoints' window in a software interface. The window title is 'Breakpoints'. Below the title bar, there is a text field for 'Application:' containing 'PLC01 [TwinCAT_Project4: PLC]'. To the right of this field is a toolbar with icons for 'New', 'Delete', 'Copy', 'Paste', 'Find', 'Print', and 'Help'. Below the toolbar is a table with the following columns: 'POU', 'Location', 'Instance path', 'Tasks', 'Condition', 'Hit count condition', 'Current hit count', and 'Watched values last updated'. The table contains one row with the following data: 'MAIN' in the 'POU' column, 'Line 9, Column 2 (Impl)' in the 'Location' column, '(any)' in the 'Instance path' column, '(any)' in the 'Tasks' column, 'Break always' in the 'Condition' column, 'Break always' in the 'Hit count condition' column, '1' in the 'Current hit count' column, and an empty cell in the 'Watched values last updated' column. A mouse cursor is visible over the table area.

POU	Location	Instance path	Tasks	Condition	Hit count condition	Current hit count	Watched values last updated
MAIN	Line 9, Column 2 (Impl)	(any)	(any)	Break always	Break always	1	

- All configured Breakpoints will be displayed, and advanced operations can be configured here



The screenshot shows the 'Breakpoints' window in a software interface. The title bar is blue with the text 'Breakpoints' and standard window controls. Below the title bar is a grey bar with the text 'Application: PLC01 [TwinCAT_Project4: PLC]' and a toolbar with icons for 'New', 'Delete', 'Copy', 'Paste', 'Find', and 'Help'. The main area is a table with the following columns: POU, Location, Instance path, Tasks, Condition, Hit count condition, Current hit count, and Watched values last updated. A single row is visible with the following data: POU: MAIN, Location: Line 9, Column 2 (Impl), Instance path: (any), Tasks: (any), Condition: Break always, Hit count condition: Break always, Current hit count: 1, and Watched values last updated: (empty). A mouse cursor is visible over the table area.

POU	Location	Instance path	Tasks	Condition	Hit count condition	Current hit count	Watched values last updated
MAIN	Line 9, Column 2 (Impl)	(any)	(any)	Break always	Break always	1	

Breakpoints							
Application: PLC01 [TwinCAT_Project4: PLC]							
POU	Location	Instance path	Tasks	Condition	Hit count condition	Current hit count	Watched values last updated
MAIN	Line 4, Column 2 (Impl)	(any)	(any)	iCountTens = 1000	Break always	1	

Breakpoint Properties

Condition | Location | Execution point settings

Tasks:

☐ Only break if the breakpoint is hit in one of the following tasks:

Hit Count:

Break always

Condition:

☒ Break, if true: iCountTens = 1000

OK Cancel

- Example: Breakpoint condition enabled if PLC value met

MAIN [Online] ✕

TwinCAT_Project4.PLC01.MAIN

Expression	Type	Value	Prepared va...	Address
✕ bTest	BOOL	TRUE		
✕ iCount	INT	32305		
✕ bTest2	BOOL	TRUE		
✕ iCountTens	INT	0		

```
1  
2  
3 IF bTest TRUE THEN  
4   iCount 32305 := iCount 32305 + 1;  
5 END_IF  
6  
7  
8 IF bTest2 TRUE THEN  
9   iCountTens 0 := iCountTens 0 + 10;  
10 END_IF RETURN
```

Breakpoints

Application: PLC01 [TwinCAT_Project4: PLC]

POU	Location	Instance path	Tasks	Condition	Hit count condition	Current hit count
✕ MAIN	Line 4, Column 2 (Impl)	(any)	(any)	iCountTens = 1000	Break always	0

- Example: Breakpoint condition enabled if PLC value met

The screenshot displays the TwinCAT Project4 interface. The top bar shows the project name, local address, and PLC01. The main window shows the ladder logic for the MAIN program. A variable declaration table is visible, and a breakpoint is set on line 4 of the ladder logic.

Expression	Type	Value	Prepared va...	Address
bTest	BOOL	TRUE		
iCount	INT	32405		
bTest2	BOOL	TRUE		
iCountTens	INT	1000		

```
1  
2  
3 IF bTest TRUE THEN  
4 iCount 32405 := iCount 32405 + 1;  
5 END_IF  
6  
7  
8 IF bTest2 TRUE THEN  
9 iCountTens 1000 := iCountTens 1000 + 10;  
10 END_IF RETURN
```

The Breakpoints window at the bottom shows the following details:

POU	Location	Instance path	Tasks	Condition	Hit count condition	Current hit count
MAIN	Line 4, Column 2 (Impl)	(any)	(any)	iCountTens = 1000	Break always	1

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