Fail-safe SIMATIC library for controlling Safety Integrated functions of the SIMATIC MICRO-DRIVE drive family via PROFIsafe

LDrvSafe

https://support.industry.siemens.com/cs/ww/en/view/109780472

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Table of contents

1 Library overview

The library contains fail-safe S7 blocks for implementing various safety applications in which an S7-1200F/1500F and a SIMATIC MICRO-DRIVE PDC-F interact via PROFIsafe.

For this purpose, the library provides fail-safe blocks, depending on the PROFIsafe telegram used (30, 31), for simple control and evaluation of these Safety Integrated drive functions.

1.1 Software components

Table 1-1 Software components

Component	Article number
TIA Portal V14 or higher	6ES7822-1AA04-0YA7
STEP 7 Safety Advanced V14 or higher	6ES7833-1FA14-0YA8

Note The library was created with TIA V14. After upgrading, the library can be used with TIA V15.1 and higher.

WARNING

Response time

The response time of the F-program also depends on the cycle time of the calling F-OB. Users are responsible for ensuring that the response time meets the requirements for their application.

For further information, see
https://support.industry.siemens.com/cs/ww/en/view/58856512

1.2 Hardware components

S7-1500F and S7-1200F fail-safe controllers are suitable.

2 The library

The function blocks (FBs) of the library are used for simple control and evaluation of Safety Integrated functions of drives of the SIMATIC MICRO-DRIVE family that support Safety Integrated functions via PROFIsafe.

Function blocks:

- LDrvSafe_PDCF_Tel30
- LDrvSafe_PDCF_Tel31

Data types:

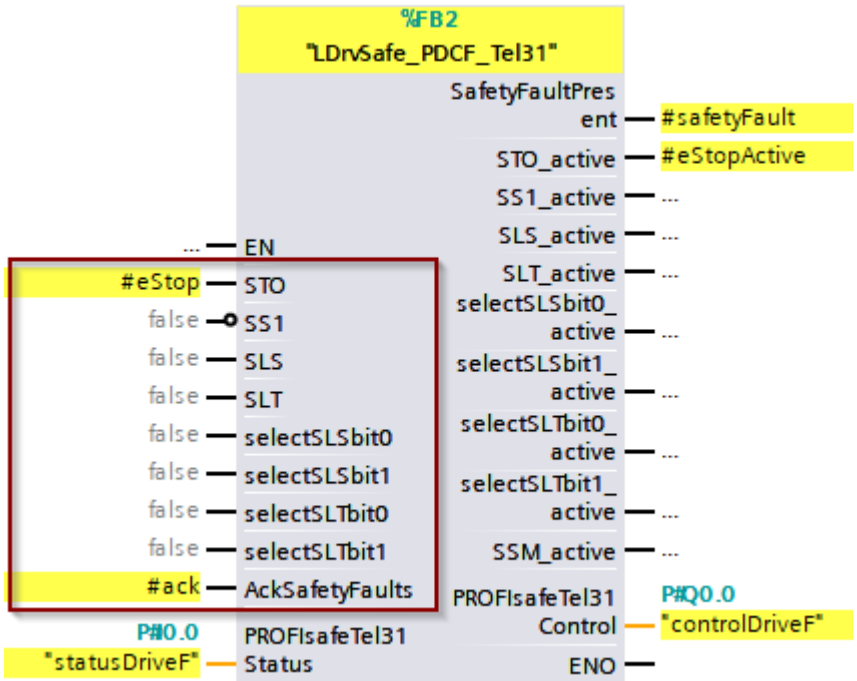
- LDrvSafe_PDCF_typeTel30Control
- LDrvSafe_PDCF_typeTel30Status
- LDrvSafe_PDCF_typeTel31Control
- LDrvSafe_PDCF_typeTel31Status

2.1 PROFIsafe control data

The Safety Integrated functions are displayed at the input of the blocks. Interconnect safe signals or sensors (e.g. Emergency Stop, safety door, etc.) with the Safety Integrated functions of the drive at the block input.

The "AckSafetyFaults" input is available for fail-safe acknowledgment of safety messages of the PDC drive. A positive edge acknowledges these messages.

Figure 1 Example of interconnection of Emergency Stop command device and acknowledgment signal



Procedure

Create a tag of the data type of the selected PROFIsafe control telegram in the tag table. The corresponding data types "LDrvSafe_PDCF_typeTel30Control" (control data from PROFIsafe telegram 30) and "LDrvSafe_PDCF_typeTel30Control"

(control data from PROFIsafe telegram 31) are included in the "LDrvSafe_PDCF" library.

Adapt the start address **(1)** of the tag. It must be the same as the initial output address **(2)** of the selected PROFIsafe telegram from HWCN.

Figure 2 Creating a control data tag of the type of the selected PROFIsafe telegram in the tag table

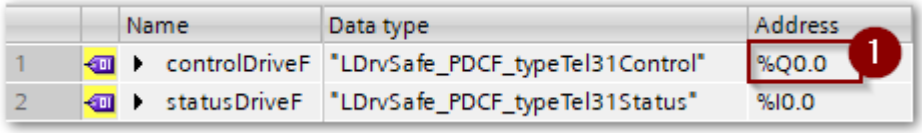
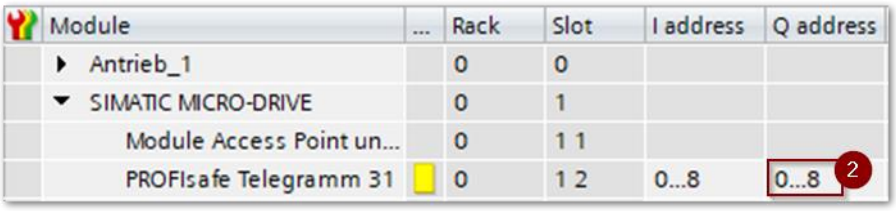


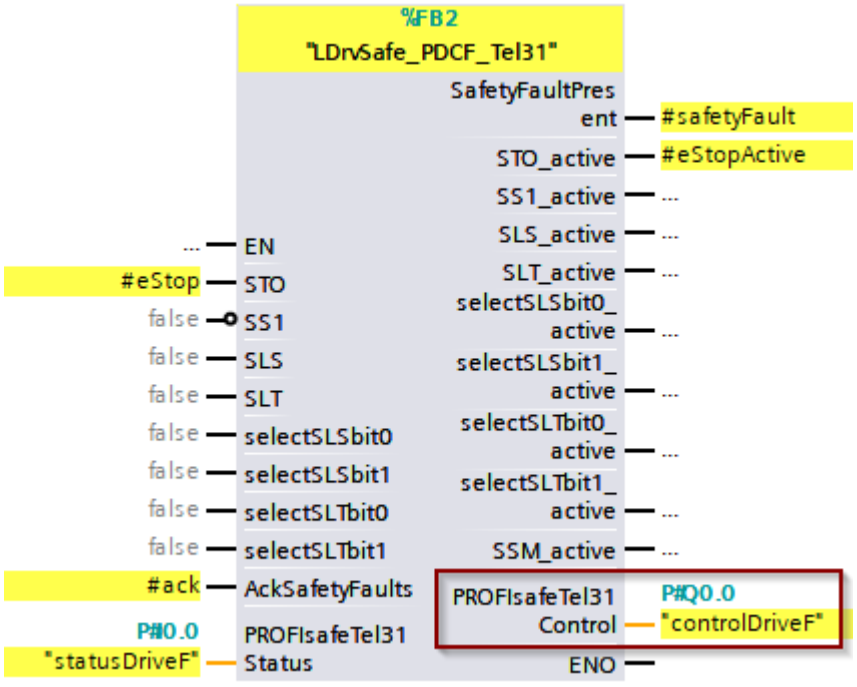
Figure 3 Output address of PROFIsafe telegram from HWCN



CAUTION	**Wrong start address** If the start address of the created tag is not identical to the initial output address of the PROFIsafe telegram, the Safety Integrated functions of the PDC-F drive cannot be controlled correctly.

Now, interconnect the "PROFIsafeTel30Control" or "PROFIsafeTel31Control" output of the block with the created tag.

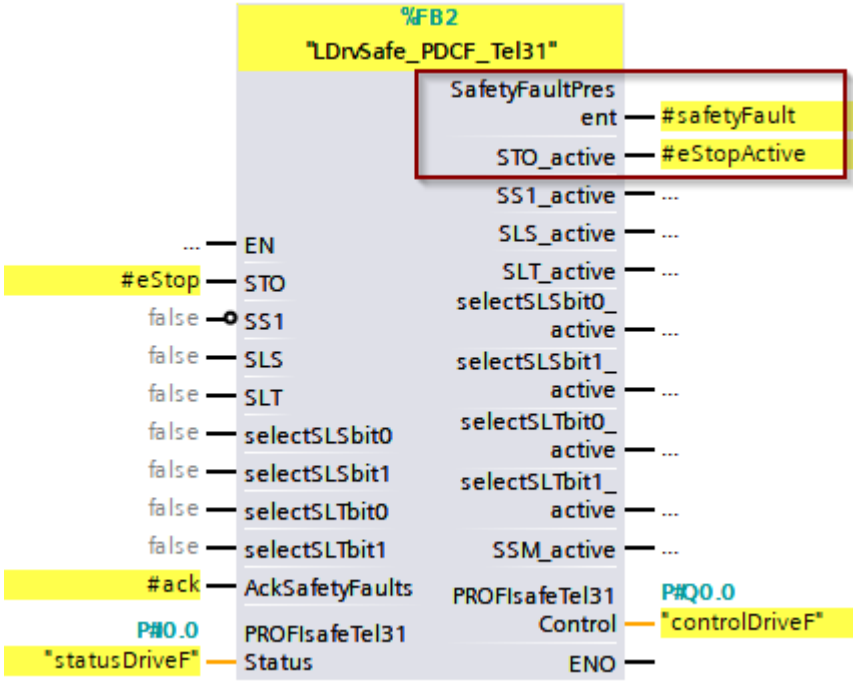
Figure 4 Interconnection of PROFIsafe control data at the block output



2.2 PROFIsafe status data

The status of the Safety Integrated drive functions is displayed at the output of the block. Interconnect the status information of the Safety Integrated functions at the block output with safe signals or actuators (e.g. safety door enable, contactor, etc.).

Figure 5 Example of interconnection of signals for display of STO and safety faults



Procedure

Create a tag of the data type of the selected PROFIsafe status telegram in the tag table. The corresponding data types "LDrvSafe_PDCF_typeTel30Status" (status data from PROFIsafe telegram 30) and "LDrvSafe_PDCF_typeTel30Status" (status data from PROFIsafe telegram 31) are included in the "LDrvSafe_PDCF" library.

Adapt the start address **(1)** of the tag. It must be the same as the initial input address **(2)** of the selected PROFIsafe telegram from HWCN.

Figure 6 Creating a status data tag of the type of the selected PROFIsafe telegram in the tag table

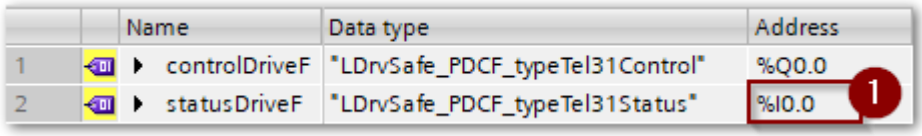
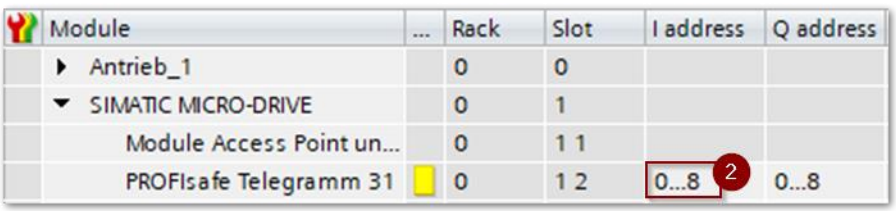


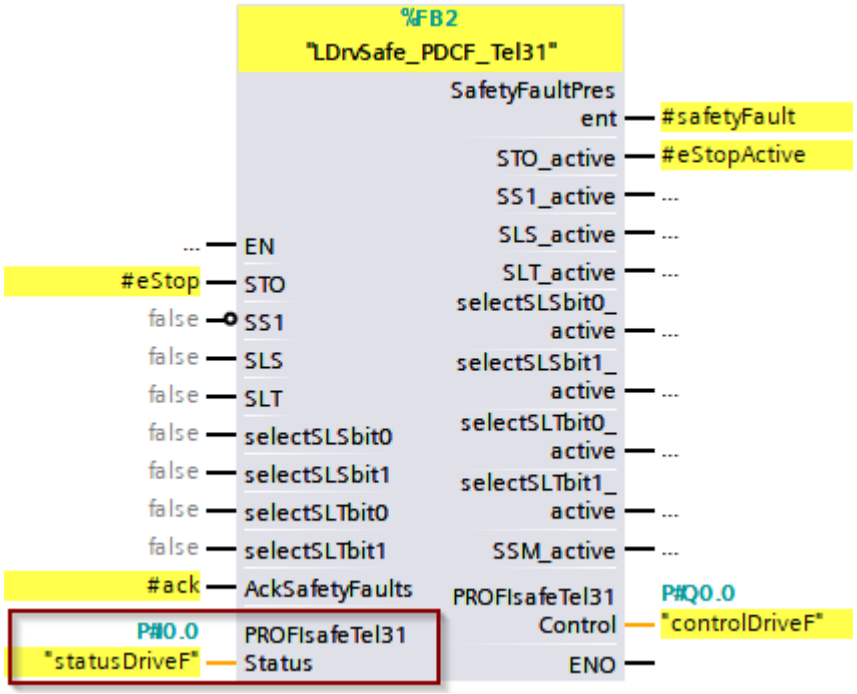
Figure 7 Input address of PROFIsafe telegram from HWCN



CAUTION	**Wrong start address** If the start address of the created tag is not identical to the initial input address of the PROFIsafe telegram, the Safety Integrated functions of the PDC-F drive cannot be evaluated correctly.

Now, interconnect the "PROFIsafeTel30Status" or "PROFIsafeTel31Status" input of the block with the created tag.

Figure 8 Interconnection of PROFIsafe status data at the block input



2.3 LDrvSafe_PDCF_Tel30

This function block is used for simple control and evaluation of the Safety Integrated functions of the SIMATIC MICRO_DRIVE PDC-F drive via PROFIsafe telegram 30.

Interfaces

Figure 9 Structure of FB LDrvSafe_PDCF_Tel30

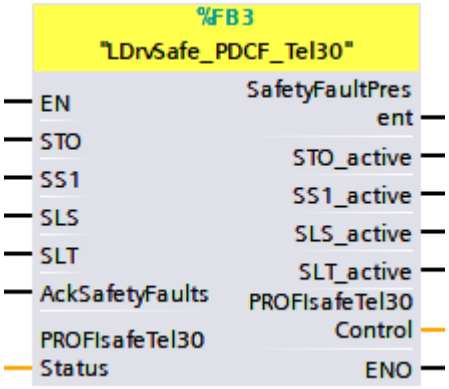


Table 2-1 Input parameters of FB LDrvSafe_PDCF_Tel30

Parameter	Data type	Description
STO	BOOL	Control of **Safe Torque Off (STO)** 1: Deselect STO 0: Select STO
SS1	BOOL	Control of **Safe Stop 1 (SS1)** 1: Deselect SS1 0: Select SS1
SLS	BOOL	Control of **Safely-Limited Speed (SLS)** 1: Deselect SLS 0: Select SLS
SLT	BOOL	Control of **Safely-Limited Torque (SLT)** 1: Deselect SLT 0: Select SLT
AckSafetyFaults	BOOL	Fail-safe acknowledgment of safety messages in the drive by a positive edge at this input
PROFIsafeTel30Status	LDrvSafe_PDCF_type Tel30Status	Status data of PROFIsafe telegram 30

Table 2-2 Output parameters of FB LDrvSafe_PDCF_Tel30

Parameter	Data type	Description
SafetyFaultPresent	BOOL	Display of **safety messages** in the drive: 1: Safety fault in the drive 0: Fault-free operation
STO_active	BOOL	Status of **Safe Torque Off (STO)** 1: STO active 0: STO inactive
SS1_active	BOOL	Status of **Safe Stop 1 (SS1)** 1: SS1 active 0: SS1 inactive

Parameter	Data type	Description
SLS_active	BOOL	Status of **Safely-Limited Speed (SLS)** 1: SLS active 0: SLS inactive
SLT_active	BOOL	Status of **Safely-Limited Torque (SLT)** 1: SLT active 0: SLT inactive
PROFIsafeTel30Control	LDrvSafe_PDCF_type Tel30Status	Control data of PROFIsafe telegram 30

Commissioning

You can find details on commissioning the block in sections 2.2 PROFIsafe status data and 2.1 PROFIsafe control data.

2.4 LDrvSafe_PDCF_Tel31

This function block is used for simple control and evaluation of the Safety Integrated functions of the SIMATIC MICRO_DRIVE PDC-F drive via PROFIsafe telegram 31.

Interfaces

Figure 10 Structure of FB LDrvSafe_PDCF_Tel31

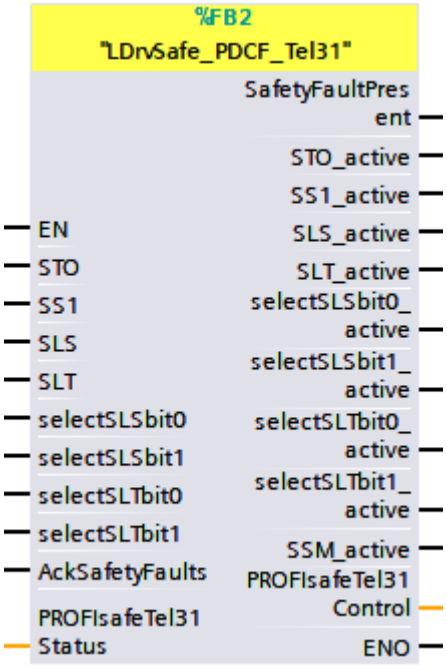


Table 2-3 Input parameters of FB LDrvSafe_PDCF_Tel31

Parameter	Data type	Description
STO	BOOL	Control of **Safe Torque Off (STO)** 1: Deselect STO 0: Select STO
SS1	BOOL	Control of **Safe Stop 1 (SS1)** 1: Deselect SS1 0: Select SS1

<table>
<tr><th>Parameter</th><th>Data type</th><th>Description</th></tr>
<tr><td>SLS</td><td>BOOL</td><td>Control of Safely-Limited Speed (SLS)
1: Deselect SLS
0: Select SLS</td></tr>
<tr><td>SLT</td><td>BOOL</td><td>Control of Safely-Limited Torque (SLT)
1: Deselect SLT
0: Select SLT</td></tr>
<tr><td>selectSLSbit0</td><td>BOOL</td><td rowspan="2">Switchover between the four SLS levels (acts as a combination of 2 bits)
<table><tr><th>SLS level</th><th>selectSLSbit1</th><th>selectSLSbit0</th></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>1</td></tr><tr><td>3</td><td>1</td><td>0</td></tr><tr><td>4</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>selectSLSbit1</td><td>BOOL</td></tr>
<tr><td>selectSLTbit0</td><td>BOOL</td><td rowspan="2">Switchover between the four SLT levels (acts as a combination of 2 bits)
<table><tr><th>SLT level</th><th>selectSLTbit1</th><th>selectSLTbit0</th></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>1</td></tr><tr><td>3</td><td>1</td><td>0</td></tr><tr><td>4</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>selectSLTbit1</td><td>BOOL</td></tr>
<tr><td>AckSafetyFaults</td><td>BOOL</td><td>Fail-safe acknowledgment of safety messages in the drive by a positive edge at this input</td></tr>
<tr><td>PROFIsafeTel31Status</td><td>LDrvSafe_PDCF_type Tel31Status</td><td>Status data of PROFIsafe telegram 31</td></tr>
</table>

Table 2-4 Output parameters of FB LDrvSafe_PDCF_Tel31

<table>
<tr><th>Parameter</th><th>Data type</th><th>Description</th></tr>
<tr><td>SafetyFaultPresent</td><td>BOOL</td><td>Display of safety messages in the drive:
1: Safety fault in the drive
0: Fault-free operation</td></tr>
<tr><td>STO_active</td><td>BOOL</td><td>Status of Safe Torque Off (STO)
1: STO active
0: STO inactive</td></tr>
<tr><td>SS1_active</td><td>BOOL</td><td>Status of Safe Stop 1 (SS1)
1: SS1 active
0: SS1 inactive</td></tr>
<tr><td>SLS_active</td><td>BOOL</td><td>Status of Safely-Limited Speed (SLS)
1: SLS active
0: SLS inactive</td></tr>
<tr><td>SLT_active</td><td>BOOL</td><td>Status of Safely-Limited Torque (SLT)
1: SLT active
0: SLT inactive</td></tr>
<tr><td>selectSLSbit0_active</td><td>BOOL</td><td rowspan="2">Display of active SLS level (as a combination of 2 bits)
<table><tr><th>SLT level</th><th>selectSLSbit0_active</th><th>selectSLSbit1_active</th></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>1</td></tr><tr><td>3</td><td>1</td><td>0</td></tr><tr><td>4</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>selectSLSbit1_active</td><td>BOOL</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Data type</th><th>Description</th></tr>
<tr><td>selectSLTbit0_active</td><td>BOOL</td><td rowspan="2">Display of active SLT level (as a combination of 2 bits)
<table><tr><th>SLT level</th><th>selectSLTbit0_active</th><th>selectSLTbit1_active</th></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>1</td></tr><tr><td>3</td><td>1</td><td>0</td></tr><tr><td>4</td><td>1</td><td>1</td></tr></table></td></tr>
<tr><td>selectSLTbit1_active</td><td>BOOL</td></tr>
<tr><td>PROFIsafeTel31Control</td><td>LDrvSafe_PDCF_type Tel31Status</td><td>Control data of PROFIsafe telegram 31</td></tr>
</table>

Commissioning

You can find details on commissioning the block in sections 2.2 PROFIsafe status data and 2.1 PROFIsafe control data.

3 Function test

Observe the following information on checking the safety functionality of the machine.

WARNING

Function test

Correct functioning of all safety functions of the programmed user program must be ensured by a complete function test on the machine and documented.

The fail-safe monitoring times of the I/O and controller must be checked for plausibility according to the SIMATIC Safety - Configuring and Programming manual. The configuration must be documented by a printout.

Examples for testing the safety functionality of the fail-safe blocks

In this section, testing of the interaction between the hardware wiring and the software evaluation for the individual blocks is shown using examples. These function tests are individual tests for the respective block. They do not replace the function test of the user program on the machine (see Function test warning).

Perform the following function test for the utilized function blocks "LDrvSafe_PDCF_Tel30" and "LDrvSafe_PDCF_Tel31".

Table 3-1 Function test of function block

Procedure	Expected response	Result
Select one of the utilized safety functions via the block input.	The selected safety function is selected on the controlled drive.	
	Feedback of the selected safety function is indicated as active ("1") at the block output of the controlled drive.	
Then, deselect this safety function again via the block input.	The selected safety function is deselected on the controlled drive	
	Feedback of the deselected safety function is indicated as inactive ("0") at the block output of the controlled drive	
Repeat these two steps for all the utilized safety functions.		

4 Working with the library

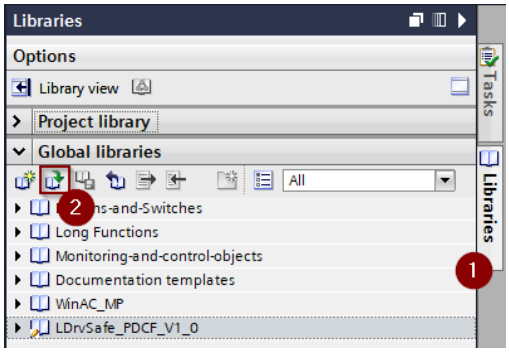
In this section, you will find information regarding integration of the LDrvSafe_PDCF library into a TIA project and instructions on using the library blocks.

4.1 Integration of the library in TIA Portal

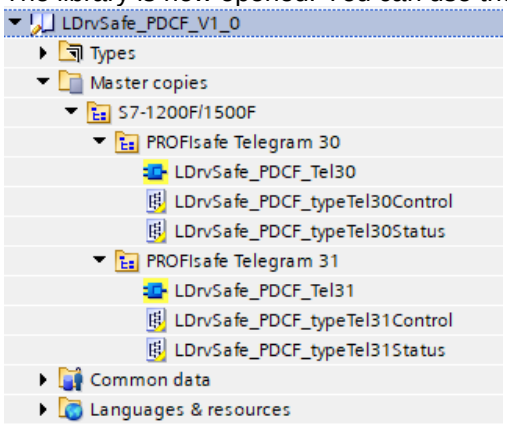
The steps for integrating the LDrvSafe_PDCF library into your TIA project are listed below. You can then use the blocks of the library.

Procedure

1. First, unpack the supplied application.
2. Open or create a project in the TIA Portal engineering tool.
3. On the right edge of the screen, open the Libraries tab **(1)**, and then open the library **(2)**.



4. Specify the location where the LDrvSafe_PDCF library is saved, and open the unpacked library.
5. The library is now opened. You can use the blocks of the library in your project.



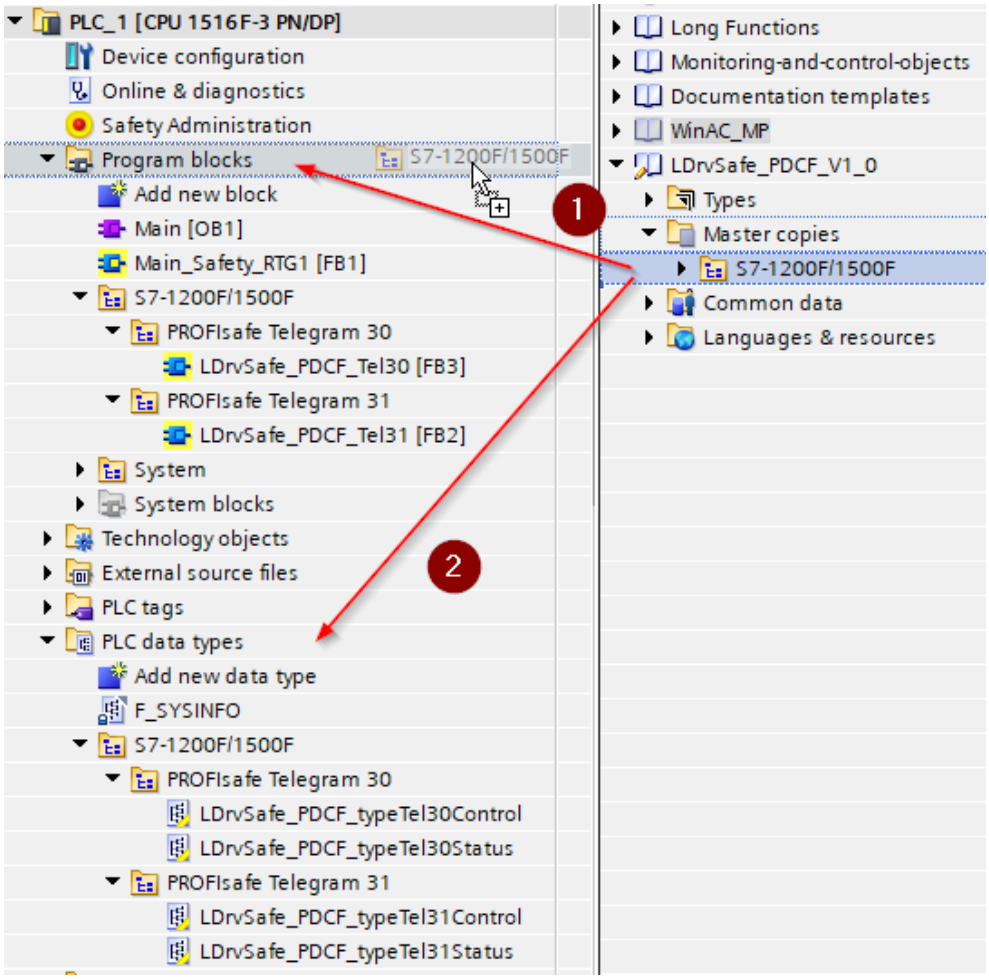
4.2 Integration of the library blocks in TIA Portal

The steps for integrating the blocks of the LDrvSafe_PDCF library into your TIA program are listed below.

Procedure

Using drag-and-drop, move the blocks or whole folders from the library to your project.

In the following figure, the "S7-1200F/1500F" folder from the library is inserted into the "Program blocks" folder **(1)** and the "PLC data types" folder **(2)** of the PLC. All blocks and data types of the library are then available in your project.



5 Appendix

5.1 Application support

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5.2 Links and literature

Table 5-1 References

	Subject area
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	SIMATIC MICRO-DRIVE https://support.industry.siemens.com/cs/ww/en/ps/25460
\3\	SIMATIC STEP 7 Safety - Configuring and Programming https://support.industry.siemens.com/cs/ww/en/view/54110126

5.3 Change documentation

Table 5-2 History

Version	Date	Change
V1.0	05/2020	First edition