

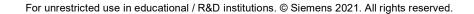
Learn-/Training Document

Siemens Automation Cooperates with Education (SCE) | As of Version V15.1 SP1

TIA Portal Modul 072-100 PROFIsafe and PROFINET with ET 200SP and SIMATIC S7-1500

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Matching SCE trainer packages for this Learn-/Training Document

SIMATIC ET 200SP Distributed IO

- SIMATIC ET 200SP Digital PROFINET Order no.: 6ES7155-6AU00-0AB0
- SIMATIC ET 200SP Digital with input module ENERGY METER PN
- Order no.: 6ES7155-6AU00-0AB1
- SIMATIC ET 200SP Digital with communication module IO-LINK MASTER V1.1 PN Order no.: 6ES7155-6AU00-0AB2
- SIMATIC ET 200SP Digital with communication module CM AS-i MASTER ST PN Order no.: 6ES7155-6AU00-0AB3
- SIMATIC ET 200SP Safety expansion module Order no.: 6ES7136-6BA00-0AB1

SIMATIC controllers

- SIMATIC ET 200SP Open Controller CPU 1515SP PC2 F with WinCC RT Advanced 512 PTs Order no.: 6ES7677-2SB42-4AB1
- SIMATIC ET 200SP Distributed Controller CPU 1512SP F-1 PN Safety Order no.: 6ES7512-1SK00-4AB2
- SIMATIC CPU 1516F PN/DP Safety with software Order no.: 6ES7516-3FN00-4AB2

SIMATIC STEP 7 Software for Training

- SIMATIC STEP 7 Professional V15.1 Single license Order no.: 6ES7822-1AA05-4YA5
- SIMATIC STEP 7 Professional (V15.1) Classroom license for 6 users Order no.: 6ES7822-1BA05-4YA5
- SIMATIC STEP 7 Professional (V15.1) Upgrade license for 6 users Order no.: 6ES7822-1AA05-4YE5
- SIMATIC STEP 7 Professional V15.1 Student license for 20 users Order no.: 6ES7822-1AC05-4YA5

Note:

 The SIMATIC STEP 7 Safety software for TIA Portal as of V15.1 is included in all the above-named "SIMATIC STEP 7 Software for Training" Trainer Packages.

Please note that these trainer packages are replaced with successor packages when necessary. An overview of the currently available SCE packages is provided under: <u>siemens.com/sce/tp</u>

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We wish to thank the TU Dresden and the Michael Dziallas Engineering company and all other involved persons for the support in the preparation of this SCE Learn-/Training Document.

Table of contents

1	1 Objective					
2		Req	uirem	ent	6	
3		Harc	dware	and software required	6	
4		Theo	ory		8	
	4.	1	Obje	ctive of safety engineering	8	
	4.	2	Safe	ty concept of SIMATIC Safety Integrated in the TIA Portal	9	
		4.2.1	1	Principle of the safety functions in SIMATIC Safety Integrated	9	
		4.2.2	2	Safety program	9	
		4.2.3	3	Program structure of safety program in the TIA Portal	10	
		4.2.4	4	Achievable safety requirements	10	
	4.	3	STE	P 7 Safety software (TIA Portal) as of V15.1	11	
		4.3.1	1	Safety concept	11	
		4.3.2	2	Programming	11	
	4.	4	SIM	ATIC S7-1500 automation system with F-CPU	12	
		4.4.1	1	Example configuration of F-CPU	12	
	4.	5	PRO	FIsafe bus profile with PROFINET IO	13	
		4.5.1	1	Fail-safe modules	13	
		4.5.2	2	PROFIsafe address	13	
		4.5.3	3	PROFIsafe monitoring time	13	
	4.	6	SIM	ATIC ET 200SP Distributed IO	14	
		4.6.1	1	Range of modules	15	
		4.6.2	2	Example configuration	18	
	4.	7	Inter	face settings and reset for F-CPU and ET 200SP	19	
		4.7.1	1	Setting the IP address in the CPU	19	
		4.7.2	2	Formatting a memory card in the CPU	22	
		4.7.3	3	Resetting the CPU to factory settings	23	
		4.7.4	4	Setting the IP address in the ET 200SP	24	
		4.7.5	5	Reading out the firmware version of the ET 200SP	27	
5		Tasł	‹		.28	
6		Plan	ining.		.28	
	6.	1	Conr	nection of the F-modules	28	
	6.	2	Refe	rence table	30	
7		Stru	cture	d step-by-step instructions	.31	
	7.	1	Retri	eving an existing project	31	
	7.	2	Activ	rating the safety setting for the CPU 1516F-3 PN/DP	33	

Learn-/Training Document | TIA Portal Module 072-100, Edition 02/2021 | Digital Industries, FA

	7.3	Configuration of ET 200SP/IM 155-6PN HF	. 37
	7.4	Changing components in the hardware configuration	. 52
	7.5	Inserting the server module	. 53
	7.6	Configuration of the potential groups of the BaseUnits	. 54
	7.7	Assigning the device name to interface module IM 155-6PN HF	. 58
	7.8	Downloading the hardware configuration to the device	. 61
	7.9	Assigning the PROFIsafe addresses	65
	7.10	Creating and downloading the safety program	. 69
	7.11	Diagnostics functions for the safety program	. 86
	7.12	Archiving the project	. 91
	7.13	Checklist – step-by-step instructions	. 92
8	Exe	ercise	93
	8.1	Task – Exercise	. 93
	8.2	Planning	. 93
	8.3	Checklist – Exercise	. 94
9	Add	litional information	95

PROFIsafe and PROFINET with IO controller CPU 1516F-3 PN/DP and IO device ET 200SP

1 Objective

In this module, the reader will learn how to commission a safety-related application on PROFINET (PROFIsafe). The module uses the CPU 1516F-3 PN/DP on PROFINET as IO controller with an ET 200SP as IO device to monitor the safety door on a sorting station. It also implements an EMERGENCY STOP using the ET 200S.

The module shows the basic procedure using a simple example.

The SIMATIC S7 controllers listed in chapter 3 can be used.

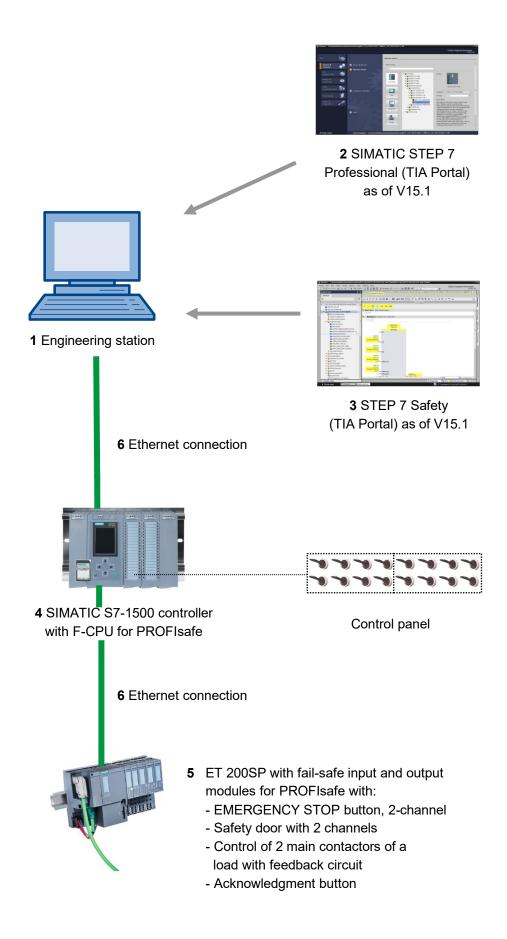
2 Requirement

This chapter builds on the chapter "Global data blocks for SIMATIC S7". To implement this chapter, you can use the following project, for example:

"SCE_EN_032-600_Global_Data_Blocks...".

3 Hardware and software required

- 1 Engineering station: Hardware and operating system requirements apply (for additional information, see Readme on the TIA Portal Installation DVDs)
- 2 SIMATIC STEP 7 Professional software in TIA Portal as of V15.1
- **3** Software STEP 7 Safety as of Basic V15.1 already included in all the "SIMATIC STEP 7 Software for Training" Trainer Packages.
- 4 SIMATIC S7-1500 controller with F-CPU, e.g. CPU 1516F-3 PN/DP as of firmware V2.0 with memory card and 16DI/16DO Note: The digital inputs should be fed out to a control panel.
- 5 ET 200SP with fail-safe input/output modules for PROFIsafe with:
 - EMERGENCY STOP button, 2-channel
 - Safety door with 2 channels
 - Control of 2 main contactors of a load with feedback circuit
 - Acknowledgment button
- 6 Ethernet connection between the engineering station and controller and between the controller and ET 200SP



4 Theory

For further details, see the manuals at

support.automation.siemens.com.

4.1 Objective of safety engineering

The objective of safety engineering is to keep potential hazards for both humans and the environment as low as possible without restricting, more than necessary, the production, the use of machines or the manufacture of specific products.

Through guidelines that have been internationally harmonized to some extent, persons and the environment are to be protected equally in all countries. At the same time, unfair competition arising from different safety requirements in international trade is to be avoided.

There are different concepts and requirements for ensuring safety in the various regions and countries of the world. The legal concepts and the requirements governing proof of adequate safety (when and how proof must be provided) are also different. The same applies to the allocation of responsibilities. For example, in the EU, there are requirements placed on both the manufacturer and the plant operator, which are set out by directives, laws and standards.

On the other hand, in the US there are different requirements depending on the region or even the locale. However, throughout the USA there is a basic principle that an employer must guarantee a safe place of work. As a result of product liability laws, a manufacturer can be made liable for damage caused by its product.

The important thing for machine manufacturers and constructors is that the laws and regulations in the country where the machine or plant is being operated always apply. For instance, the control system of a machine that is to be used in the EU must fulfill the EU requirements even if the machine manufacturer is headquartered in the US.

4.2 Safety concept of SIMATIC Safety Integrated in the TIA Portal

The SIMATIC Safety Integrated fail-safe system is available in the TIA Portal for implementing safety concepts in the area of machine and operator protection.

4.2.1 Principle of the safety functions in SIMATIC Safety Integrated

The functional safety is achieved primarily through safety functions in the software.

If a dangerous event occurs, safety functions are executed in order to bring the system to a safe state or to keep it in a safe state.

The safety functions are mainly contained within the following components:

- Safety-related user program of the F-CPU (z. B.: 1516F-3 PN/DP)
- Fail-safe inputs and outputs of the F-IO (e.g.: ET 200SP).

The F-IO ensures the safe processing of information from the field, such as information from

- Sensors: EMERGENCY STOP buttons, safety doors, light barriers
- Actuators: Motor control, valve blocks

The user only programs the user safety function.

In the event of a fault, if the F-system can no longer execute its actual user safety function, it executes the fault reaction function, for example, the associated outputs are disabled.

4.2.2 Safety program

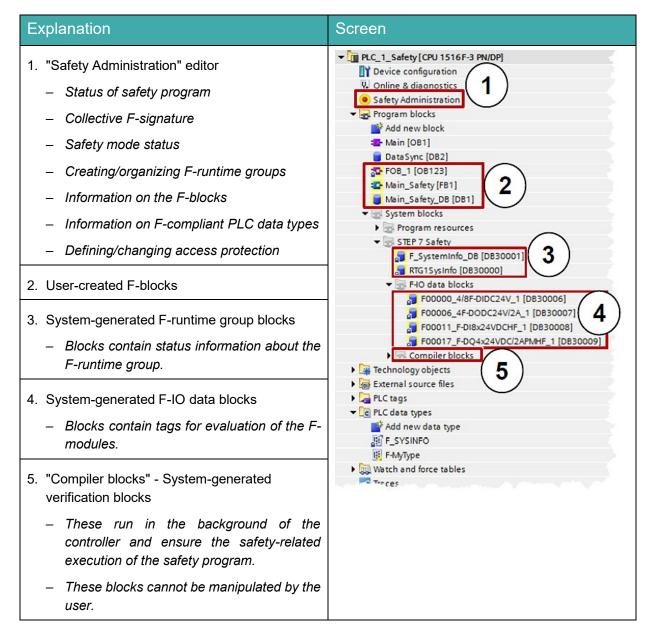
You create a safety program in the program editor. You program fail-safe FBs and FCs in the FBD or LAD programming language with the instructions from the option package and create fail-safe DBs.

When you compile the safety program, safety checks are automatically performed and additional fail-safe blocks for fault detection and fault reaction are incorporated. This ensures that failures and faults are detected, and appropriate reactions are triggered to maintain the F-system in a safe state or bring it to a safe state.

Besides the safety program, a standard user program can also be run in the F-CPU. The co-existence of the standard program and safety program in an F-CPU is possible because the safety-related data of the safety program is protected from unwanted interference by data of the standard user program.

Data exchange between the safety program and the standard user program in the F-CPU is possible using bit memory and data of a standard DB and by accessing the process image input and output.

4.2.3 Program structure of safety program in the TIA Portal



4.2.4 Achievable safety requirements

F-systems with SIMATIC Safety Integrated can meet the following safety requirements:

- Safety class (Safety Integrity Level) SIL3 according to IEC 61508:2010
- Performance Level (PL) e and Category 4 according to ISO 13849-1:2015 or EN ISO 13849-1:2015

4.3 STEP 7 Safety software (TIA Portal) as of V15.1

The software package, which is included in all "SIMATIC STEP 7 Software for Training" Trainer Packages, contains all the functions and blocks required to create the F-program.

The F-program with the safety functions is interconnected in F-FBD or F-LAD or with special function blocks from the F-library. Use of F-FBD or F-LAD simplifies the configuring and programming of the system as well as its acceptance thanks to uniform display for all systems. Programmers can fully concentrate on configuring of the safety-related application without having to use additional tools.

4.3.1 Safety concept

The safety functions of the S7-1500 F-CPUs are contained in the F-program of the CPU and in the failsafe signal modules. The fail-safe modules can be used in the ET 200 distributed IO systems.

The fail-safe signal modules monitor output and input signals through discrepancy analyses and test signal injections.

The CPU checks the proper operation of the controller through regular self-tests, command tests and logical and chronological program flow monitoring. In addition, the IO is checked through retrieval of signs-of-life.

If a fault is diagnosed in the system, the system is brought to a safe state.

An F-Runtime license is not required to operate the S7-1500 F-CPUs.

Besides the fail-safe modules, standard modules can also be used.

This makes it possible to establish a fully integrated control system for a system where safety-related and standard areas co-exist.

The entire system is configured and programmed with the same standard tools.

4.3.2 Programming

The S7-1500 F-CPUs are programmed in the same manner as other SIMATIC S7 systems. The user program for non-fail-safe parts of the system is created with the proven programming tools of STEP 7 Professional (TIA Portal) as of V15.1.

The software package "STEP 7 Safety as of V15.1" is essential for programming the safety-related programs. It contains all the elements that are needed for engineering.

The programming for the S7-1500 F-CPUs is done with the STEP 7 F-LAD or F-FBD language. Examples of safety functions that can be implemented here are:

- User-programmable, safe linking of sensors with actuators
- Selective safe shutdown of actuators

The scope of functions with regard to operations and data types is restricted here.

A safety-related, password-protected program is generated through a specific compilation setting. Besides the fail-safe program, a standard program can also run in parallel on a CPU (coexistence) with no restrictions.

An additional component of this software package is the F-library with off-the-shelf, programming examples for safety-related functions approved by the technical inspectorate. These programming

examples can be adapted by the user; however, the changes must then be newly certified.

4.4 SIMATIC S7-1500 automation system with F-CPU

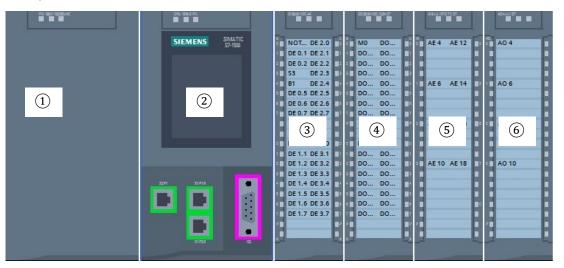
The SIMATIC S7-1500 automation system is a modular control system for the medium and highperformance range. A comprehensive range of modules is available for optimal adaptation to the automation task with fail-safe and non-fail-safe CPUs and modules.

Fail-safe F-CPUs for which safety-related user programs can be created are available for SIMATIC S7-1500.

These F-CPUs support the safety-related PROFIsafe bus profile with PROFINET IO and PROFIBUS for communication between the safety program and the fail-safe modules of the F-IO.

4.4.1 Example configuration of F-CPU

The following configuration of an S7-1500 automation system with F-CPU is used for the program example in this document.



- 1 Power module PM with input 120/230V AC, 50Hz / 60Hz, 190W and output 24V DC / 8A
- (2) Central processing unit F-CPU 1516F-3 PN/DP with integrated PROFIBUS and PROFINET IO interfaces also for PROFIsafe
- ③ IO module 32x digital input DI 32x24V DC HF
- (4) IO module 32x digital output DQ 32x24V DC/0.5A HF
- 5 IO module 8x analog input AI 8xU/I/RTD/TC ST
- 6 IO module 4x analog output AQ 4xU/I ST

4.5 **PROFIsafe bus profile with PROFINET IO**

The safety-related bus profile of PROFINET IO for communication between the safety program and the fail-safe modules of the F-IO is called PROFIsafe.

4.5.1 Fail-safe modules

Fail-safe modules (F-modules) are designed with two channels internally. This means that the two integrated processors monitor each other and automatically test the input or output connection.

In the event of a fault, fail-safe modules are put into the safe state.

The F-CPU communicates with the fail-safe modules via the safety-related PROFIsafe bus profile.

4.5.2 PROFIsafe address

The PROFIsafe address serves to protect standard addressing mechanisms such as e.g. IP addresses. The PROFIsafe address consists of the F-source address and F-destination address.

4.5.3 **PROFIsafe monitoring time**

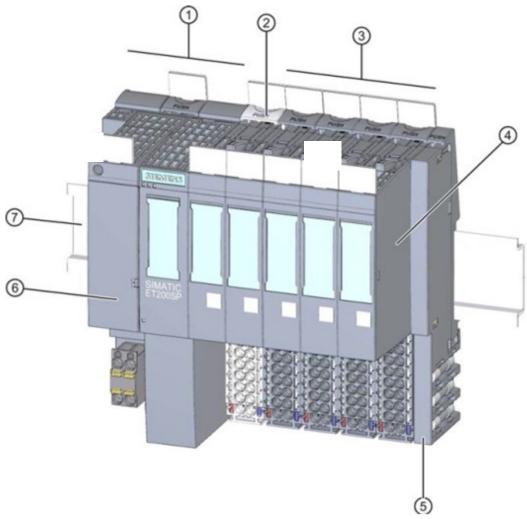
The monitoring time for safety-related communication between the F-CPU and F-IO, together with additional measures, guarantees a maximum reaction time of the safety application.

4.6 SIMATIC ET 200SP Distributed IO

SIMATIC ET 200SP is a modular distributed IO system for connecting fail-safe and non-fail-safe process signals to a central automation system such as SIMATIC S7-1500. Thanks to its comprehensive range of modules, ET 200SP can be modularly expanded for optimal adaptation to the automation task.

Distributed IO are often used when signals must be transferred over long distances and the wiring effort for this is too great. Thus, the signals can be gathered locally and connected to a central controller via a bus system. In the case of the ET 200SP system, devices can be connected via PROFINET or PROFIBUS.

The ET 200SP distributed IO is mounted on a standard mounting rail (7) and consists of an interface module (1) with bus adapter (6), up to 32/64 IO modules (4) plugged onto BaseUnits (2), (3) and a terminating server module (5).



The distributed IO provides inputs and outputs for the local process connection, which can be read and written by the central module via a bus protocol. The IO modules are queried and addressed in the S7 program in the normal way using input addresses (%I) and output addresses (%Q), respectively. It is possible to mix fail-safe and non-fail-safe IO modules in an ET 200SP configuration.

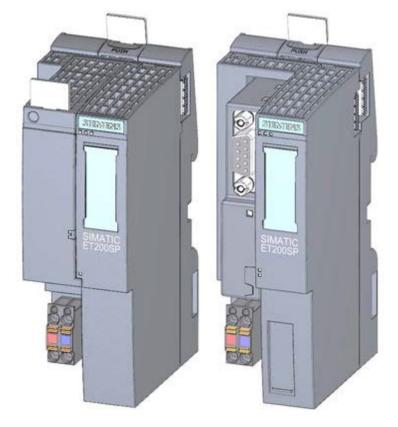
4.6.1 Range of modules

SIMATIC ET 200SP is a modular distributed IO system and offers the following range of modules:

Interface modules with pluggable bus adapters

for connection of distributed IO to a central module.

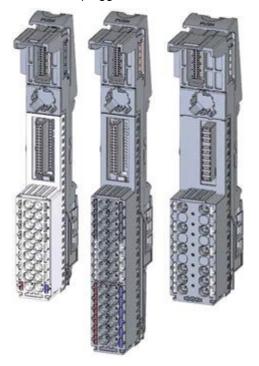
Bus adapters enable users to use the connection system of their choice. Interface modules have their own power supply, which is not coupled via the backplane bus.



BaseUnits

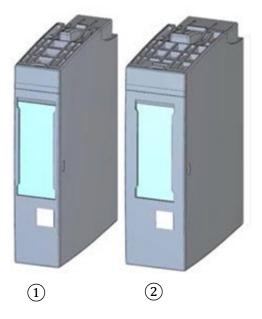
as universal base modules for electrical and mechanical connection of IO modules.

They are available in a light version BU..D, which opens a new potential group over the backplane bus for the power supply, and a dark version BU..B, which continues the potential group. Thus, at least one light BaseUnit BU..D must be used in order to supply at least one potential group with voltage. The IO modules are plugged onto the BaseUnits.



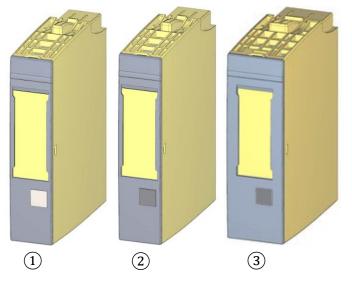
IO modules

for digital input (DI) / digital output (DQ) / analog input (AI) / analog output (AQ). They are available in versions for 24V DC ① and 400V AC ②.



F-IO modules

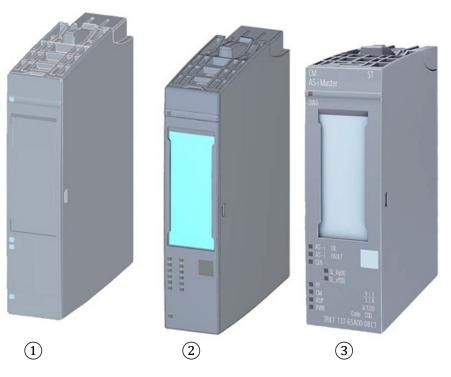
For the connection of fail-safe signals, a digital input module F-DI 8x24VDC HF (1) and the digital output modules F-DQ 4x24VDC/2A PM HF (2) and F-RQ 1x24VDC/24.230VAC/5A (3), among others, are offered.



You can find further details on the F-IO modules in manuals at <u>support.automation.siemens.com</u>.

Communication modules (CM)

For a point-to-point connection (PtP) 1 or for connection to the IO-Link 2 and AS-i 3 communication systems.



Server module

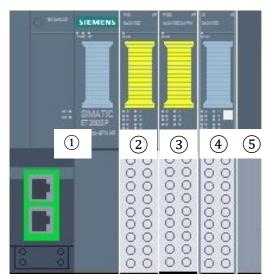
As termination for the ET 200SP system configuration.

It can be used as a holder for 3 standby fuses. It serves as a terminating resistor for the backplane bus and is thus required.



4.6.2 Example configuration

The following configuration of an ET 200SP distributed IO system is used for the program example in this learning/training document.



- (1) Interface module IM155-6PN HF with Bus Adapter BA 2xRJ45
- (2) IO module 4/8x fail-safe digital input F-DI 8x24V DC HF
- ③ IO module 4x fail-safe digital output F-DQ 4x24V DC/2A PM HF
- (4) IO module 8x digital input DI 8x24V DC HF
- 5 Server module

4.7 Interface settings and reset for F-CPU and ET 200SP

4.7.1 Setting the IP address in the CPU

The IP address of the SIMATIC S7-1500 controller is set as follows.

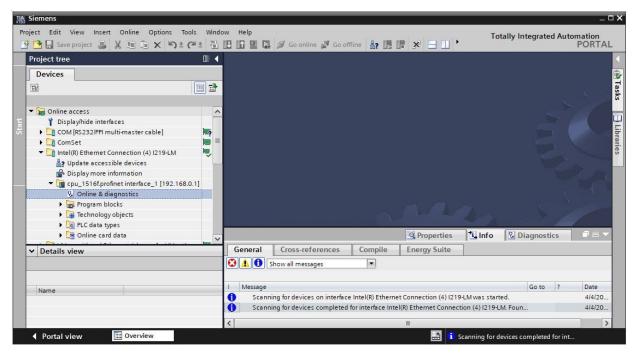
 \rightarrow To do this, select the Totally Integrated Automation Portal, which is opened with a double-click. (\rightarrow TIA Portal V15.1)



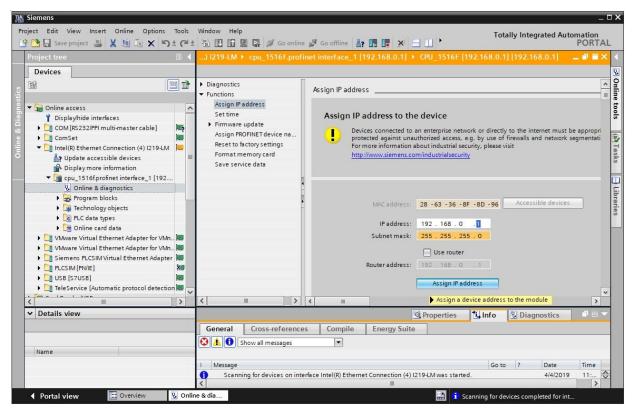
 \rightarrow Select the \rightarrow "Online & diagnostics" item and open the \rightarrow "Project view".

K Siemens			_ _ X
			Totally Integrated Automation PORTAL
	\$ ^{\$}	Show all devices Online status	
	-		
	10	Accessible devices	
Visualization	1		
Online & Diagnostics	~~	Melp	
Project view			

→ In the project tree, select the network adapter that was set previously under → "Online access". When you click → "Update accessible devices", you see the IP address (if already set) or the MAC address (if the IP address has not yet been assigned) of the connected SIMATIC S7-1500. Select → "Online & diagnostics".



→ Under → "Functions", you will find the → "Assign IP address" item. Enter the following IP address and subnet mask, for example: → IP address: 192.168.0.1 → Subnet mask: 255.255.255.0. Click → "Assign IP address", and this new address will be assigned to your SIMATIC S7-1500.



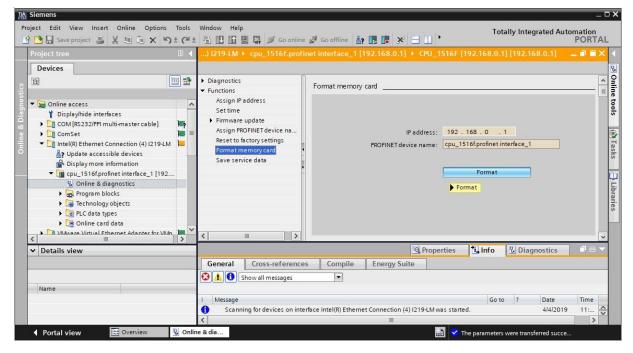
Note:

- The IP address of the SIMATIC S7-1500 can also be set via the display on the CPU, if this is enabled in the hardware configuration.
- → If the assignment of the IP address was not successful, you receive a message in the \rightarrow "Info" window \rightarrow "General" tab.

				Q Properties	14	nfo	🛚 🔁 Diagnost	ics	
General	Cross-references	Compile	Energy Suite						
	Show all messages	*							
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	address could not be assig	gned.				?	11/23/2017	1:33:48 PM	^
😣 The	e set command could not b	be executed.					11/23/2017	1:33:48 PM	~

4.7.2 Formatting a memory card in the CPU

- → If the IP address could not be assigned, the program data on the CPU must be deleted. This is done in 2 steps: → "Format memory card" and → "Reset to factory settings".
- \rightarrow First, select the \rightarrow "Format memory card" function and click the \rightarrow "Format" button.



 \rightarrow Confirm the prompt "Do you really want to format the memory card?" with \rightarrow "Yes".

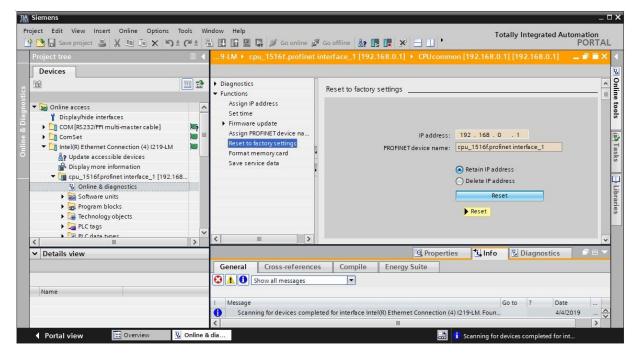
Online 8	diagnostics (02	41:000024)	×
	Do you really memory card?	want to format	t the
		Yes	No

 \rightarrow Stop the CPU if necessary. (\rightarrow "Yes")

Online &	diagnostics (0241:000025)	×
	Formatting a memory card is or you want to stop the CPU?	nly permitted in STOP mode. Do
		Yes No

4.7.3 Resetting the CPU to factory settings

→ Before you can finally reset the CPU memory, you must wait until the formatting of the CPU is finished.
 You must then select again → "Update accessible devices" and → "Online & diagnostics" of your
 CPU. To reset the controller, select the → "Reset to factory settings" function and click → "Reset".



 \rightarrow Confirm the prompt "Do you really want to reset the module?" with \rightarrow "Yes".

Online &	diagnostics (0241:000056)	×
	Do you really want to reset the module	?
	Yes No	

 $\rightarrow~$ Stop the CPU if necessary. ($\rightarrow~$ "Yes")

Online &	diagnostics (0241:000020)	×
	Resetting is only allowed in STOP mode. Do you want to stop the CPU?	
	Yes No	

4.7.4 Setting the IP address in the ET 200SP

The IP address of the ET 200SP is set as follows.

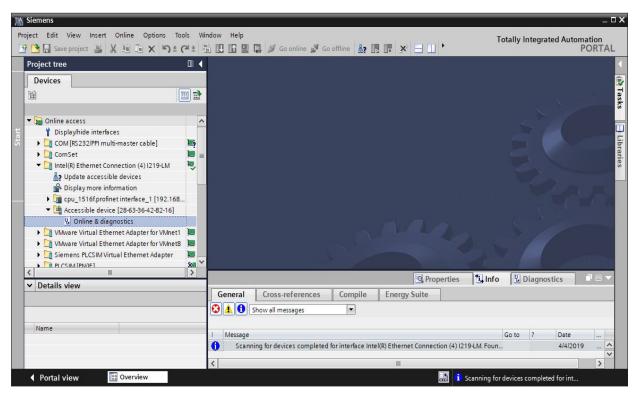
 \rightarrow Select the Totally Integrated Automation Portal and open it with a double-click. (\rightarrow TIA Portal V15.1)



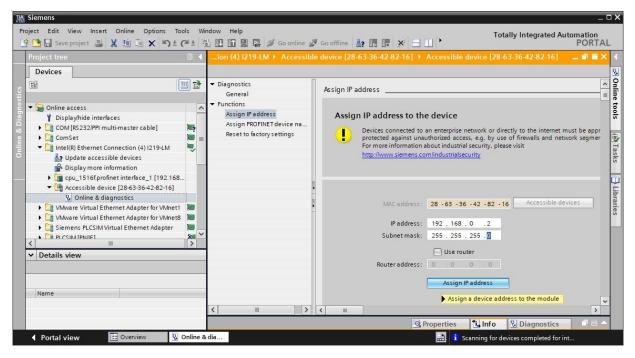
 $\rightarrow~$ Select the \rightarrow "Online & diagnostics" item and open the \rightarrow "Project view".

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		Totally Integrated Automation PORTAL
Start 🦓		
Devices &	Show all devices Online status	
	Chime status	
Motion & technology	20	
Drive parameterization	Accessible devices	
Online & Jiagnostics	e Help	
	3	
Project view		

→ In the project tree, select the network adapter that was set previously under → "Online access". When you click → "Update accessible devices", you see the IP address (if already set) or the MAC address (if the IP address has not yet been assigned) of the connected ET 200SP. Select → "Online & diagnostics".



→ Under → "Functions", you will find the → "Assign IP address" item. Enter the following IP address and subnet mask, for example: → IP address: 192.168.0.2 → Subnet mask: 255.255.255.0. Click → "Assign IP address", and this new address will be assigned to your ET 200SP.



→ You receive feedback regarding the assignment of the IP address as a message in the → "Info" window → "General" tab.

			🔍 Pr	operties	1, Info	2	Diagno	ostics	78	•
Ge	eneral Cross-references	Compile	Energy Suite							
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Note:

 If a communication connection already exists between the ET 200SP as device and a higher-level controller as controller, the IP address cannot be changed.

4.7.5 Reading out the firmware version of the ET 200SP

→ Before you can read out the firmware version of the ET 200SP, you must again select → "Update accessible devices" and → "Online & diagnostics" of your ET 200SP. In the menu item → "Diagnostics" → "General", you can read out the short description, article number, hardware version and firmware version.

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5 Task

In the following, a safety application is to be added to the project from chapter "SCE_EN_032-600_Global_Data_Blocks".

The safety of the operators of a sorting station will be ensured by blocking access by a guard with safety door. In addition, an EMERGENCY STOP will be incorporated that can be used to stop the station in an emergency.

6 Planning

The signals for the safety engineering are connected to a distributed ET 200SP IO device, which is assigned as a device to the CPU 1516F-3 PN/DP via PROFINET.

The safety program safely switches off all loads of the sorting station if:

- A safety door monitored by two contacts is opened or
- An EMERGENCY STOP connected via two channels is actuated.

After actuation of the EMERGENCY STOP or opening of the safety door, a local user acknowledgment is necessary before the production operation can be restarted.

This is implemented by programming a fail-safe block with

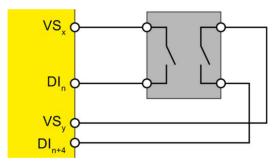
- A safety door function,
- an EMERGENCY STOP function (safety circuit for shutdown when EMERGENCY STOP is actuated and when safety door is opened),
- A feedback circuit (as a restart protection in case of a faulty load) and
- A user acknowledgment for the re-integration

and generating a safety program.

6.1 Connection of the F-modules

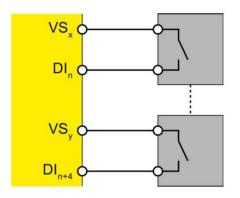
For the EMERGENCY STOP, a two-channel sensor is connected to the two inputs DI0 and DI1 of the Fmodule. The evaluation of the sensors must be set to 10o2 (2v2) evaluation for this.

A cross circuit of the inputs is also checked through the internal sensor supply of the sensors from two different sensor supplies.

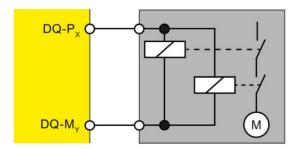


For the safety door, two sensors are connected via 1 channel to DI1 and DI5 of the F-module. The evaluation of the sensors must be set to 1001 (1v1) evaluation for this.

A cross circuit of the inputs is also checked through the internal sensor supply of the sensors from two different sensor supplies.



For control of the main contactors of the load, 2 relays are connected in parallel to the DQ0 of the Fmodule. The feedback circuit of the main contactors is connected to a non-fail-safe input channel.



Note:

- You can find further information in the manuals for the ET 200SP and the fail-safe modules.

6.2 Reference table

The following signals are required as global operands for this safety-related program expansion.

DI	Туре	Identifier	Function	NC/NO
I 200.0	BOOL	-S10_EMERG_STOP	Emergency stop 2-channel (F)	NC
I 200.1	BOOL	-S11.1_DOOR_CONTACT_1	First door contact (F)	NC
I 200.5	BOOL	-S11.2_DOOR_CONTACT_2	Second door contact (F)	NC
I 20.1	BOOL	-K20_FEEDBACK_LOOP	Feedback loop main load contactors	NC
I 20.0	BOOL	-S12_ACKNOWLEDGE	Push-button acknowledge	NO
I 201.1	BOOL	-S11.1_DOOR_CONTACT_1_VS	Value status (0==substitute value) First door contact	NC
I 201.5	BOOL	-S11.2_DOOR_CONTACT_2_VS	Value status (0==substitute value) Second door contact	NC
I 210.0	BOOL	-K20_LOAD_CONTACTOR_VS	Value status (0==substitute value) main load contactors	NC

DO	Туре	Identifier	Function	
Q 210.0	BOOL	-K20_LOAD_CONTACTOR	Control main load contactors (F)	

Legend for reference list

- DI Digital Input DO Digital Output
- AI Analog Input AO Analog Output
- I Input Q Output
- NC Normally Closed F Failsafe Signal
- NO Normally Open

7 Structured step-by-step instructions

You can find instructions on how to perform planning below. If you already have a good understanding of everything, it is enough to focus on the numbered steps. Otherwise, simply follow the steps of the instructions illustrated below.

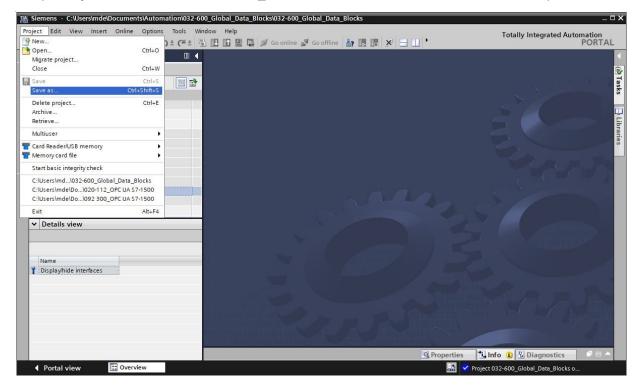
7.1 Retrieving an existing project

→ Before we can extend the project "sce-032-600-global-data-blocks..." from chapter "sce-032-600global-data-blocks", we have to retrieve it. To retrieve an existing project, you must select the respective archive from the Project view under → Project → Retrieve. Confirm your selection with Open. (→ Project → Retrieve → selection of a .zap archive → Open)

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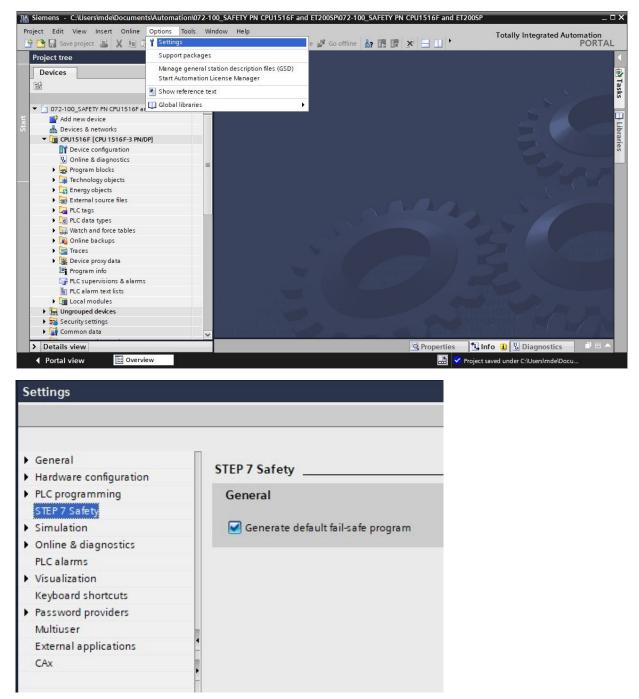
→ Next, the target directory in which the retrieved project is to be stored can be selected. Confirm your selection with "OK". (→ Target directory → OK)

→ Save the opened project under the name "072-100_SAFETY PN CPU1516F and ET200SP" (\rightarrow Project \rightarrow Save as ... \rightarrow 072-100_SAFETY PN CPU1516F and ET200SP \rightarrow Save).



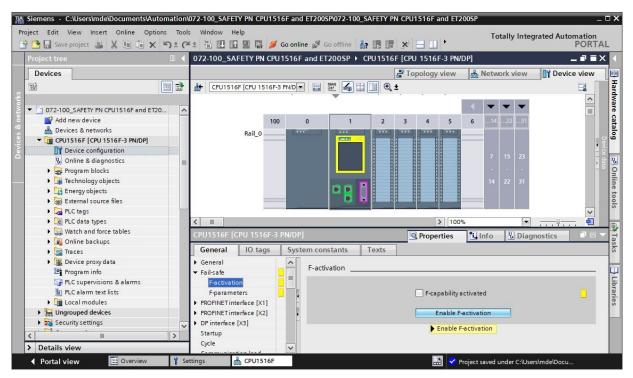
7.2 Activating the safety setting for the CPU 1516F-3 PN/DP

→ First, it should be checked whether the "Generate default fail-safe program" check box has been selected under "STEP 7 Safety" in the "Options" menu. (→ Options → Settings → STEP 7 Safety → Generate default fail-safe program)

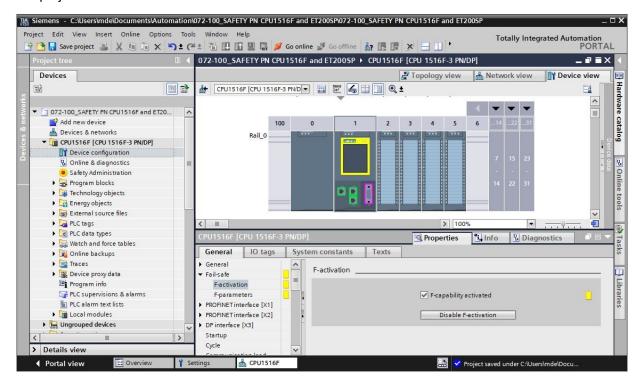


Note:

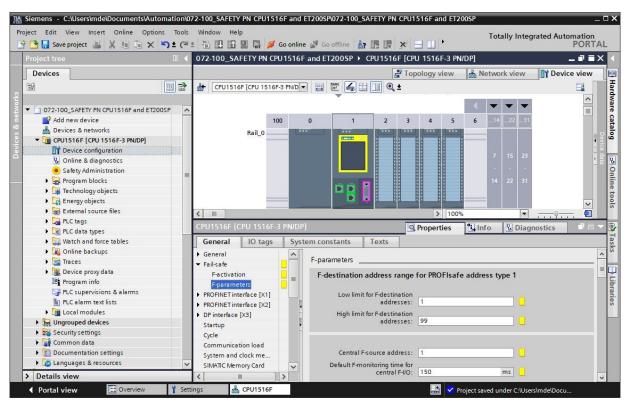
As a result of this setting, when a fail-safe CPU is used, the fail-safe support is enabled in the TIA Portal and a safety program is automatically created. If a fail-safe CPU without safety functions is to be used, the "Generate default fail-safe program" check box must be cleared before using the F-CPU. → Open the "Device configuration" of the "CPU 1516F-3 PN/DP". Double-click the CPU to select it, and in the → "Properties" window, open menu → "Fail-safe" → "F-activation". There select → "Enable Factivation". (→ Enable F-activation)



→ Now, "F-capability activated" is displayed and the subitem "■ Safety Administration" appears in the project tree.

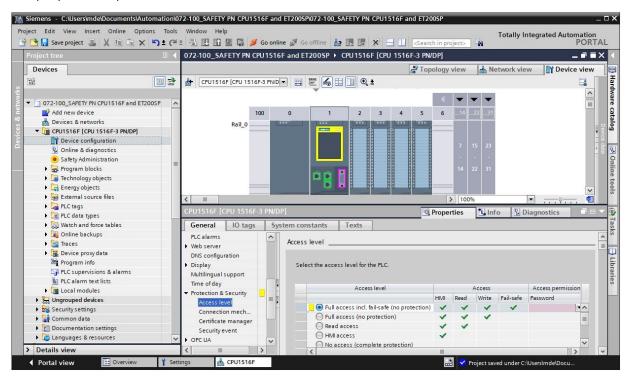


→ In menu → "Fail-safe" → "F-parameters", the ranges for the "F-addresses" and the "Default F-monitoring time for central F-IO" are now set. (→ Fail-safe → F-parameters → Low limit for F-destination addresses: 1 → High limit for F-destination addresses: 99 → Central F-source address: 1 → Default F-monitoring time for central IO: 150 ms)



Note:

 The safety-relevant "F-monitoring time" setting should be coordinated with the requirements from the risk assessment of the plant. This also applies to the other safety-relevant settings in this document. → Go to the → "Protection & Security" menu and select → "Access level" → "Full access incl. fail-safe (no protection)".



Note:

The "Full access incl. fail-safe (no protection)" setting has been selected here because a password will be assigned later for the safety program and then only a password has to be assigned.

7.3 Configuration of ET 200SP/IM 155-6PN HF

→ Now open the network view. Find the correct interface module IM155-6PN HF from the hardware catalog and insert it into the network view using drag-and-drop. (→ Network view → Hardware catalog → Distributed IO → ET 200SP → Interface module → PROFINET → IM155-6 PN HF → 6ES7 155-6AU00-0CN0 → Version: V3.3)

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→ Assign the field device to the CPU 1516F by first clicking on the interface of the IM155-6PN HF in the network view and then connecting it to the PROFINET interface (X1) of the CPU 1516F.

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→ To configure the IM155-6PN HF, first select the IO device. In the → "General" tab in the → "Properties" window, open the → "Ethernet addresses" menu → and set the IP address under → "IP protocol". (→ IO device_1 → Properties → General → Ethernet addresses → IP protocol → IP address: 192.168.0.2)

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 \rightarrow Click on the name \rightarrow "IO-device 1" and change it to \rightarrow "IO-Safety".

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Note:

- This name is now also applied as the device name for the PROFINET communication.

→ In the → "Ethernet addresses" → menu, the "PROFINET device name" and the "Diagnostics address", which is automatically assigned for the diagnostics", can be checked under → "PROFINET". (→ Ethernet addresses → PROFINET → PROFINET device name: io-safety → Diagnostics address: 1)

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	PROFINET device name: io-safety	
	Converted name: io-safety	
	Device number: 1	

→ Settings for the "IO cycle" such as the "Update time" and 'Watchdog time" can also be set for the device here. (→ Advanced options → Real time settings → IO cycle → Update time → 1,000 ms → Watchdog time → 3,000 ms)

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Note:

- The watchdog time should always be significantly shorter than the F-monitoring time set beforehand.

→ To obtain an overview of the assigned addresses within a project, you can click the " $\frac{1}{5}$ " button in the "Network view". (→ Network view → Display **u** addresses)

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→ Change to the device view of the ET 200SP by double-clicking on the PROFINET device. (→ IO-Safety)

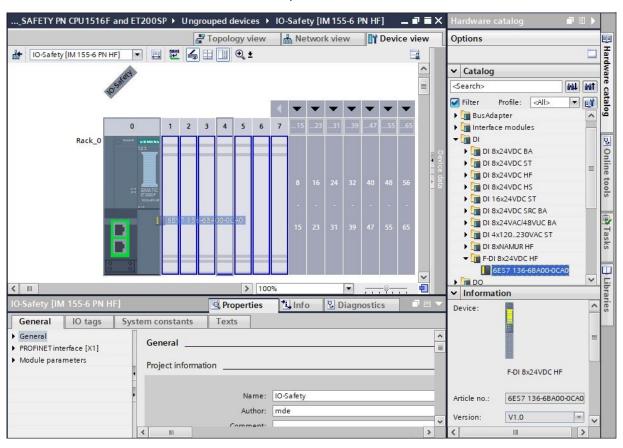
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CPU1516F CPU 1516F-3 PN 192.168.1.1 PN/IE_1: 192.168.0.1 2	IO-Safety IM 155-6 PN HF CPU1516F IO-Safety PN/IE_1: 192.168.0.2	

Note:

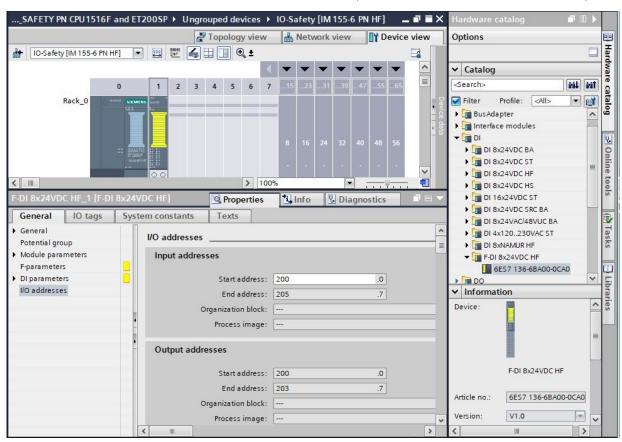
 You can also open the device view of the various devices in the drop-down menu at the top left of the device view.

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	IO-Safety [IM 155-6 PN HF]			

→ Find the correct digital fail-safe input module with matching order number and version in the hardware catalog. Insert the digital F-input module on slot 1. (→ Hardware catalog → DI → F-DI 8x24VDC HF → 6ES7 136-6BA00-0CA0 → Version: V1.0)



→ The settings for the fail-safe input module "F-DI 8x24VDC HF" must still be made in the properties. First, the IO addresses are set to "Start address: 200". (→ IO addresses → Start address: 200).



→ For the general "F-parameters", the "F-destination address" and the "Behavior after channel fault" are entered (\rightarrow F-parameters \rightarrow F-destination address: 65534 \rightarrow Behavior after channel fault: Passivate channel).

F-DI 8x24VDC HF_1 [F	-DI 8x24VDC HF]	Properties	L Info	🛿 Diagnostics		78 -
General IO tags	System constants Te	ts				
 General Potential group 	F-parameters					<u>^</u>
Module parameters		_				
F-parameters		Manua	lassignment	of F-monitoring time		
DI parameters	F-monitoring tin	e: 150		ms		
I/O addresses	F-source addre	s: 1				
	F-destination addre	s: 65534				
	F-parameter signature (w addresse					
	 F-parameter signature (with addresse 					
	Behavior after channel fa	lt: Passivate	channel		-	
	RIOforFA safe	ty: Passivate Passivate	the entire mo	odule	-1	
	PROFIsafe mo		enormer		-	
	PROFIsafe protocol versi	n: Loop-bac	k extension (L	P)		
		F-I/O DI	B manual num	nberassignment		
	F-I/O DB-numb	er: 30000				
	F-I/O DB-nan	e: F00200_F	-DI8x24VDCH	F_1		

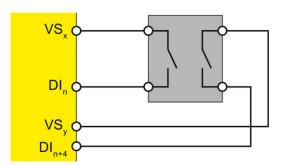
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F-DI 8x24VD	C HF_1 [F-D	I 8x24VDC HF]	Q Properties	i Info	Diagnostics		•
General	IO tags	System constants	Texts				
▶ General	1 1	 Sensor supply 0 				[^
Potential gro	up						
Module parar	meters		Short-r	ircuit test		n i	=
F-parameters	s 📒			incure cost			
▼ DI parameter	rs 📒	Time for short-cire	uit test: 4.2		ms		
▼ Sensor su	pply 📃	Startup time of sen					
Sensor	sup 📃	short-circ	uit test: 4.2		ms		
Sensor	sup	-					
Sensor	sup	Sensor supply 1					
Sensor	sup						
Sensor	sup		Short-o	ircuit test			
Sensor	sup 📘	Time for short-circ	uit test: 4.2		ms		
Sensor	sup				m2		
Sensor	sup 🔤 🕨	Startup time of sen short-circ			ms		
Channel p	aram 📃	Shoreene	une test. [4.2				
I/O addresse:	s	Sensor supply 2					
			Short-c	circuit test			
		Time for short-circ	uit test: 4.2		ms		
		Startup time of sen	sorafter				
		short-cire			ms		
		 Sensor supply 3 					
<	>	and the second sec					¥

 \rightarrow Activate the "short-circuit test" for the "Sensor supplies" 0/1/4/5.

For the EMERGENCY STOP, a two-channel sensor is connected to the two inputs DI0 and DI1 of the Fmodule. The evaluation of the sensors must be set to 10o2 (2v2) evaluation for this.

A cross circuit of the inputs is also checked through the internal sensor supply of the sensors from two different sensor supplies.



You can find further information in the manuals for the ET 200SP and the fail-safe modules.

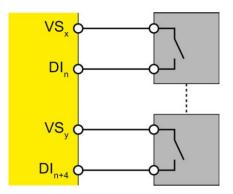
→ The following DI parameters are to be set for the EMERGENCY STOP that is wired to "Channel 0, 4". (\rightarrow DI parameters \rightarrow Channel parameters \rightarrow Channel 0, 4)

F-DI 8x24VDC HF_1 [F-DI	8x24VDC HF]	Q Properties	🗓 Info 🖳 Di	agnostics	1 🗄 🔻
General IO tags	System constants Tex	ts			
General Potential group Module parameters	Channel 0, 4				^
F-parameters	Sensor eval		valuation, equivalent	•	-
 Sensor supply Channel parameters Channel 0, 4 	Discrepano Reintegration after discr	epancy 150	ms 🕻 e range: [530000]. 💙		
Channel 0 Channel 4 ▼ Channel 1, 5	> > Channel 0	error: Test 0-S	ignal not necessary	•	
Channel 1 Channel 5 I Channel 2, 6	- Sensor	Activa			
▶ Channel 3, 7 I/O addresses	•	t delay: 3,2	er monitoring	ms 🔻	ē.
	Number of signal ch Monitoring v		sec]]	
	> > Channel 4				
	Sensor	Activa supply: Sensor t delay: 3,2		ms 💌	
	Number of signal ch Monitoring w	anges: 5	er monitoring sec]]	•

Note:

 Through the selected sensor evaluation, the two inputs DI0 and DI4 are combined into one input signal for the EMERGENCY STOP. The EMERGENCY STOP thus receives the address "%I200.0". For the safety door, two sensors are connected via 1 channel to DI1 and DI5 of the F-module. The evaluation of the sensors must be set to 1001 evaluation for this.

A cross circuit of the inputs is also checked through the internal sensor supply of the sensors from two different sensor supplies.



You can find further information in the manuals for the ET 200SP and the fail-safe modules.

→ The following DI parameters are to be set for the two safety door contacts that are wired to "Channel 1, 5". (→ DI parameters → Channel parameters → Channel 1, 5)

F-DI 8x24VDC HF_1 [F-DI	8x24VDC HF] Properties Linfo Diagnostics	
General IO tags	System constants Texts	
 General Potential group Module parameters 	Channel 1, 5	*
F-parameters DI parameters Sensor supply Channel parameters Channel 0, 4 Channel 1, 5	Sensor evaluation: 1001 evaluation Discrepancy behavior: 1001 evaluation Discrepancy time: 1002 evaluation, equivalent Discrepancy time: 1002 evaluation, non-equivalent Reintegration after discrepancy error: Test 0-Signal not necessary	
Channel 1 Channel 5 I Channel 2, 6 Channel 3, 7 I/O addresses	 > > Channel 1 Activated Sensor supply: Sensor supply 1 Input delay: 3,2 Monitoring window: 2 	
	 Channel 5 Activated Sensor supply: Sensor supply 5 Input delay: 3,2 Monitoring window: 2 	• • • • • • • • • • • • • • • • • • •

Note:

 Through the selected sensor evaluation, the two inputs DI1 and DI5 are designated separately for the safety door contacts. They thus receive the addresses "%I200.1" and "%I200.5". → Channels 2 and 6 are not needed and are therefore deactivated in the DI parameters. (\rightarrow DI parameters \rightarrow Channel parameters \rightarrow Channel 2, 6)

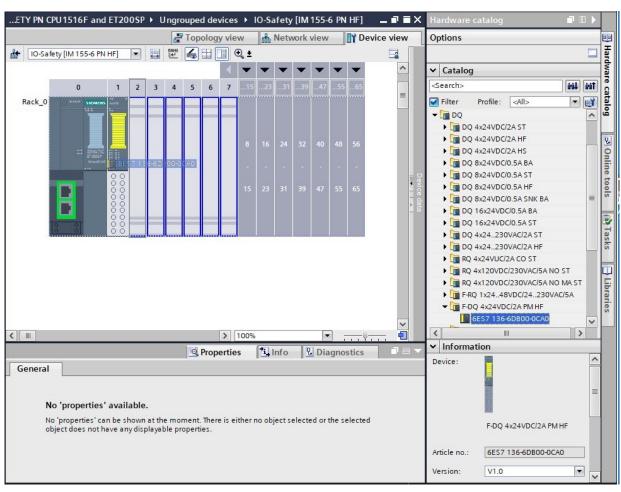
F-DI 8x24VDC H	IF_1 [F-DI	8x24VDC HF]	Q Pro	perties 🗓 Info	Diagnostics	s	
General	IO tags	System constants	Texts				
General Potential group		Channel 2, 6 _	ll				×
 Module parame F-parameters 	ters	Conc	or evaluation:	1001 evaluation			-
✓ DI parameters			ancy behavior:				H I
 Sensor supplet Channel para 	meters	Disc	repancy time:		ms 🌲 📒		- I.
Channel 0 Channel 1	,5	Reintegration afte	er discrepancy error:	Test 0-Signal not neo	cessary	-	
Channel 2 Channel 3	-	> > Channel 2 _					
I/O addresses		•		Activated			0
		s	ensor supply:	Activated or supp	oly		
			Input delay:	3,2		ns 💌	
			gnal changes: oring window:	Chatter monitorin Chatter monitor Chatter monitorin Chatter monitorin Chatter monito	g sec		
		> > Channel 6 _					_
			ensor supply:	Activated	vlc		

→ Channels 3 and 7 are also deactivated in the (→ DI parameters → Channel parameters → Channel 3, 7)

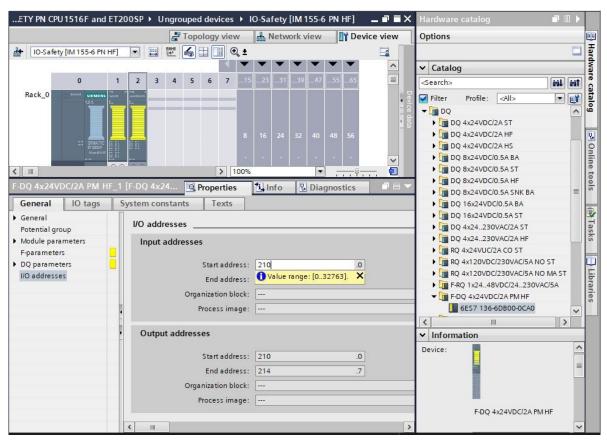
F-DI 8x24VD	DC HF_1 [F-D	I 8x24VDC HF]	Q Pro	perties	i Info	L Diagnostics		
General	IO tags	System constants	Texts					
 General 		> Channel 3, 7						
Potential gr								
 Module para 	ameters							
F-paramete	rs	Sens	or evaluation:	1001 eva	luation			
 DI parameter 	ers	Discrepa	ancy behavior:	Supply va	lue 0		-	
Sensors	upply		repancy time:		and the state	ms 🌲 📘		-
 Channel 	parameters			2		ms -		
Chann	nel 0, 4	Reintegration after	er discrepancy error:	Test 0-Sig	nal not nece	can/		
Channel	nel 1, 5		enor:	lest 0-sig	narnotnece	5501y		-
Chann	nel 2, 6							
Chann	nel 3, 7	> Channel 3 _						
I/O address	es		Sensor supply:	Activat	ed ed <mark>orsuppl</mark> y	1		
			Input delay:	3,2		m	ns 💌	
				Chatter	r monitoring			
			gnal changes: oring window:	<u></u>		sec 📃		
								_
				Activat	ed			
			Sensor supply:	Externals	ensor supply	/	-	

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→ Find the correct digital fail-safe output module, with matching order number and version from the hardware catalog. Insert the digital F-output module on slot 2. (→ Hardware catalog → DQ → F-DQ 4x24VDC/2A PM HF → 6ES7 136-6DB00-0CA0 → Version: V1.0)



→ The settings for the fail-safe output module "F-DQ 4x24VDC/2A PM HF" must still be made in the properties. First, the IO addresses are set to "Start address: 210". (→ IO addresses → Start address: 210)

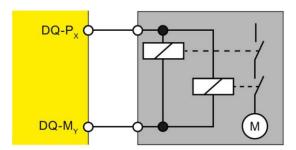


→ For the general "F-parameters", the "F-destination address" and the "Behavior after channel fault" are entered (→ F-parameters → F-destination address: 65533 → Behavior after channel fault: Passivate channel).

-DQ 4x24Vl	ос/2а рм н	F_1 [F-DQ 4x24VDC/	Properties	<u>Info</u>	Diagnostics		
General	IO tags	System constants	Texts				
General Potential gro	oup	F-parameters					
Module para							
F-parameter DQ paramet		E construito da		ual assignme	nt of F-monitoring time	•	-
I/O addresse	the second s	F-monitoring F-source ad	-		ms		
		F-source ad					
		F-parameter signatur					
			esses): 43619				
	4	F-parameter signature (v addre	without esses): 56891		0		
	•	Behavior after channe	el fault: Passiva	ate channel		-	
		RIOforFA		ate the entire ate channel	module		
		PROFIsafe					
		PROFIsafe protocol v	ersion: Loop-b	ack extension	(LP)		
			F-1/0	DB manual n	umber assignment	1	
		F-I/O DB-nu	umber: 30001				
		F-I/O DB-	name: F00210	_F-DQ4x24VD	C/2APMHF_1		

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For control of the main contactors of the load, 2 relays are connected in parallel to the DQ0 of the F-module.



You can find further information in the manuals for the ET 200SP and the fail-safe modules.

→ The following DQ parameters are to be set for the control of the main contactors of the load that are wired to "Channel 0". Channels 1,2,3 are not wired and are therefore deactivated. (→ DQ parameters
 → Channel 0 → Channel 1 → Channel 2 → Channel 3)

F-DQ 4x24VDC/2A PM H	IF_1 [F-DQ 4x24VDC/	Properties	1 Info	B Diagnostics		•
General IO tags	System constants	Texts				
General Potential group	DQ parameters					*
Module parameters F-parameters DQ parameters	Maximum test	period: 1000		se	c 🕶 📒	
I/O addresses	Channel 0					-
	Max. readback time da Max. readback time sv	witch on test: 0.6	rated rated light test nosis: Wire bre		ms _	
	Channel 1	Activ	rated			_
	Max readback time of				ms	~

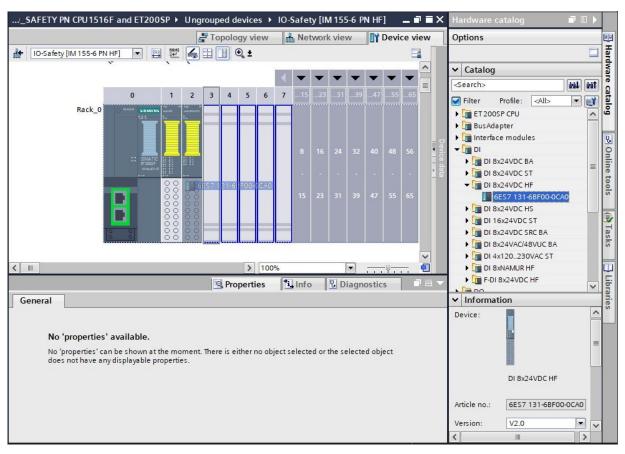
Note:

The output to the contactors of the load thus has address "%Q210.0".

🔻 🐻 System b	locks
🔻 😹 STEP :	7 Safety
🔻 🐻 F-I	/O data blocks
5	F00200_F-DI8x24VDCHF_1 [DB30000]
5	F00210_F-DQ4x24VDC/2APMHF_1 [DB30001]

Note:

 For each F-IO module, an associated F-IO data block is also generated for the system blocks. The designation results from the name and address of the F-IO module. → Next, find the correct digital input module with matching order number and version in the hardware catalog and insert it on slot 3. (→ Hardware catalog → DI → DI 8x24VDC HF → 6ES7 136-6BF00-0CA0 → Version: V2.0)

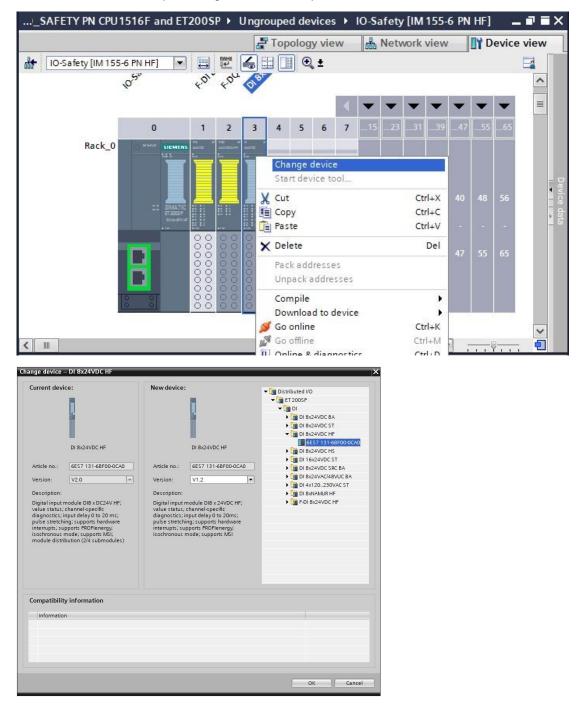


→ In the properties, the input addresses must be set to "Start address: 20". (→ IO addresses → Start address: 20)

DI 8x24VDC HF_1 [DI 8x2	24VDC HF]	perties	L Info	L Diagnostics	
General IO tags	System constants Texts				
General Potential group	I/O addresses				
Module parameters Input 0 - 7	Input addresses				
General	Start address:	20		.0	
Configuration ov	End address:	1 Value	range: [032	767]. 🗙	
Inputs I/O addresses		Isochro	onous mode		
No addresses	Organization block:	(Auton	natic update)		
	Process image:	Automati	c update		
< III >					

7.4 Changing components in the hardware configuration

→ If it is necessary to replace a component in the hardware configuration with a newer version or a different type, this can be done by right clicking the component and then selecting "Change device".
 A dialog then opens where you can select a new component for the replacement and confirm the selection with "OK". (→ Change device → OK)

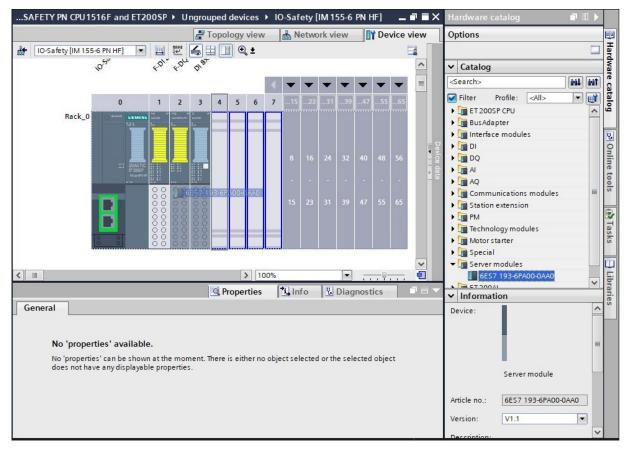


Note:

If the new component is not displayed for selection, it is not compatible with the previous component.
 In this case, the old component must be deleted first, and the new component must then be inserted from the hardware catalog.

7.5 Inserting the server module

→ Find the correct server module with matching order number and version in the hardware catalog.
 Insert the server module in slot 5. (→ Hardware catalog → Server module → 6ES7 193-6PA00-0AA0
 → Version: V1.1)

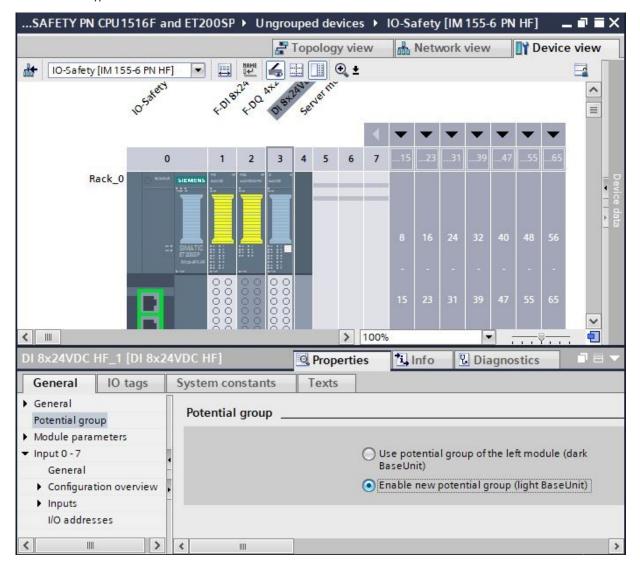


Note:

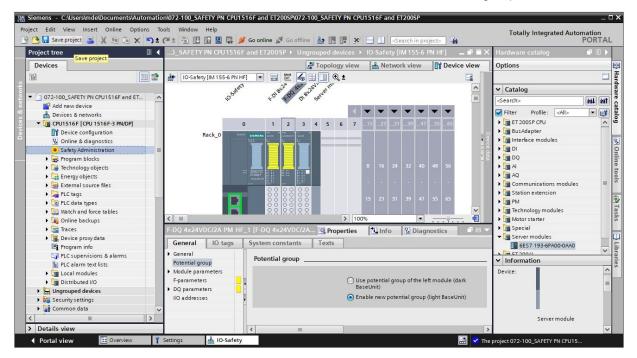
 If you forget to insert the server module, it will be created automatically when the device configuration is compiled.

7.6 Configuration of the potential groups of the BaseUnits

→ To change the potential group of a BaseUnit, select the associated module and open the "Potential group" section in the general properties. Select the "Enable new potential group (light BaseUnit)" option. (Slot 3 → Properties → General → Potential group → Enable new potential group (light BaseUnit))



- → The BaseUnit in the configuration has now become a light BaseUnit. Repeat these steps for slot 2 and compare the device configuration with the figure below.
- → Save your project by clicking the → \square Save project button, and select menu item → " Safety Administration" with a double-click in order to create and edit the F-runtime group there.



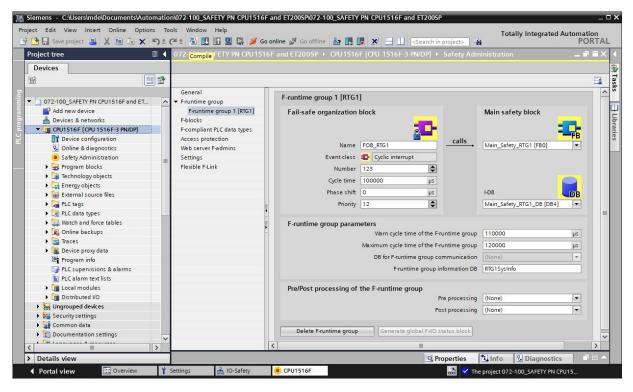
→ In "Safety Administration", select menu item "F-runtime group" and click on "Add new F-runtime group". (→ F-runtime group → Add new F-runtime group)

072-100_SAFETY PN CPU151	I6F and ET200SP → CPU1516F [CPU 1516F-3 PN/DP] → Safety Administration 📃 🖬 🖬 🗙
General	Add F-runtime group
F-runtime group	
F-blocks	An F-runtime group consists of an F-OB (cycle OB, cyclic interrupt OB or synchronous cycle interrupt OB) that calls a main safety block (FB or FC). Additional user-specific safety functions are called from the main safety block. More
F-compliant PLC data types	main safety block (15 of 1 c), haddonal aser specific safety lancadins are called notifiate main safety block. Note
Access protection	Add new F-runtime group
Web server F-admins	- And new Hannie group
Settings	
Flexible F-Link	P

→ You can then assign a name for an F-runtime group as shown here. You can also have the fail-safe organization block "FOB_RTG1" created with the suitable "Cycle time" for the safety application. Likewise, the Main safety block "Main_Safety_RTG1" and the associated data block "Main_Safety_RTG1_DB" will also be created there. (→ FOB_RTG1 → Cycle time 100ms → Main_Safety_RTG1 → Main_Safety_RTG1_DB → OK)

F-runtime group 1	1				
P		e -	ca	lls 🔸	-
F-runtime group	Fail-safe orga	nization block		Main safety b	lock
	Name Event class Number Cycle time Phase shift Priority	FOB_RTG1 Cyclic interrupt 123 Manual Automatic 100000 0 12	т 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Name Type Number Data block Name Number	Main_Safety_RTG1 Function block Manual Automatic Main_Safety_RTG1_DB Manual Automatic Automatic
	main safety block		ific safety	functions are called	onous cycle interrupt OB) that calls a d from the main safety block. More

→ Before you compile the configuration, you should save your project again by clicking the →
 Save project button. To compile your CPU with the device configuration, first select the →
 "CPU_1516F [CPU1516F-3 PN/DP]" folder and click the → "Compile" button



Note:

- You should use the "Save project" function periodically when working on a project because automatic saving of the project does not occur. The only time you are prompted to save the project is when you close the TIA Portal.
- \rightarrow If the configuration is compiled without errors, you see the following:

					Q Properti	es	<u>i</u> Info	🞖 Di	agnostics	
Gen	eral	Cross-references	Compile	Energy Suite						
۵ 👍	1 Sh	ow all messages	-							
Comp	iling finish	ned (errors: 0; warnings:	2)							
Pa	th		Description			Go to	?	Errors	Warnings	Time
1 -	CPU1516	6F				~		0	2	1:24:18 PM
1	▼ Hard	ware configuration				~		0	2	1:24:18 PM
4	▼ 5 [*]	71500/ET200MP station_	1			~		0	2	1:24:20 PM
1	•	Rail_O				~		0	2	1:24:20 PM
1		 CPU1516F 				~		0	2	1:24:20 PM
A		 CPU1516F 				~		0	1	1:24:20 PM
4			CPU1516F do	es not contain a configured	protection level	~				1:24:20 PM
4		 CPU display_1 				~		0	1	1:24:20 PM
A			The \$7-1500	CPU display does not contai	in any password prote	. >				1:24:20 PM
0	Safet	ty	Compile safe	ty program 'Safety Administ	tration'.	~				1:24:22 PM
0	Progr	ram blocks				~		0	0	1:24:25 PM
0	▼ Cons	istency check	Consistency	heck for safety program 'Sa	afety Administration'.	~		0	0	1:24:29 PM
0	F-	runtime group 1	Consistency	heck for F-runtime group 'F	-runtime group 1'.	~				1:24:29 PM
0			The F-module	'F-DI 8x24VDC HF_1' was n	ot interconnected in t					1:24:29 PM
0			The F-module	'F-DQ 4x24VDC/2A PM HF_1	'was not interconne	~				1:24:29 PM
1			Compiling fin	shed (errors: 0; warnings: .	2)					1:24:40 PM
				ш						

Note:

 Warnings appear here because no protection level has been configured and the fail-safe inputs and outputs are not yet being used in the program. The warnings can be ignored.

7.7 Assigning the device name to interface module IM 155-6PN HF

→ To obtain an overview of the assigned IP addresses within a project, you can click the "⁵" button in the "Network view". (→ Network view → ⁵ Display addresses)

072-100_SAFETY PN CPU1516F and ET200SP > Devices & networks			_ = = ×
	ology view	Network view	Device view
	€ ±		
Show addr	ess labels	m: CPU1516F.PROFINET	0-System (100)
CPU1516F CPU 1516F-3 PN 192.168.1.1 PN/IE_1: 192.168.0.1 2			Network data
 III 	> 100	D% 🔽	····· •

		🚰 Topolog	y view 🔒 Network view	w Device view
Network Connections HMI conne	ction 💌 🖪 Relat	tions 🕎 🖫 🛄 🔍 🛨		
		Assign device name	D system: CPU1516F.PROFIN	IET IO-System (100)
CPU1516F CPU 1516F-3 PN	1 	O-Safety M 155-6 PN HF PU1516F •		

Note:

 The IP addresses set in the project are assigned by the controller to the devices later during establishment of the communication connection. → The online access must be correctly set in the dialog for assignment of the PROFINET device names. Then, each device can be individually selected and filtered by devices of the same type. If a new device is connected first, the list must be updated again. (→ PROFINET device name: io-safety → Type of the PG/PC interface: PN/IE → PG/PC interface: here: Intel(R) Ethernet Connection (4)I219-LM → I Only show devices of the same type → Update list

n PROFINET device	name.					
		Configured PRO	FINET dev	vice		
		PROFINET devic	e name:	io-safety		-
-		Dev	/ice type:	IM 155-6 PN HF		
		Online access				
		Type of the PG/PC i	interface:	L PN/IE		-
		PG/PC i	interface:	Intel(R) Ethernet Con	nection (4) I219-LI	M 🔻 🖲 🖳
		Device filter				
		🛃 Only show	devices of t	he same type		
		Only show	devices wit	n bad parameter setting:	s	
			devices wit			
	Accessible devi IP address	ices in the network: MAC address	Device	PROFINET device name	Canadra	
	192.168.0.2	28-63-36-67-F8-2A	ET200SP		Status	ame assigned
	192.100.0.2	20-05-50-07-1-0-2A	120051		A NO GENCE II	anie assigned
Flash LED						
	<				al-ad-	
					Update list	Assign name
					Update list	Assign name
ine status information:						
		ere found.				
ine status information: Search completed. Search completed.	0 of 0 devices we 0 of 1 devices we	ere <mark>f</mark> ound.				
Search completed.	0 of 0 devices we 0 of 1 devices we	ere <mark>f</mark> ound.				
Search completed. Search completed.	0 of 0 devices we 0 of 1 devices we	ere <mark>f</mark> ound.				
Search completed. Search completed.	0 of 0 devices we 0 of 1 devices we	ere <mark>f</mark> ound.				
Search completed. Search completed.	0 of 0 devices we 0 of 1 devices we	ere <mark>f</mark> ound.	110			Close

→ The correct device must be unambiguously determined based on the MAC address printed on the device before the name is assigned with "<u>Assign name</u>". You can also have the LEDs flash on the device for checking purposes. (→ <u>Flash LED</u> → <u>Assign name</u>)

P address	MAC address	Device	PROFINET device name	Status
192.168.0.2	28-63-36-67-F8-2A	ET2005P	-	No device name assigned
د [Ш	

→ The successful assignment of the PROFINET device name should still be checked before the dialog is closed. (→ Close)

Assign	PROFINET device	name.		_			×
	-		Configured PRO	FINET dev	/ice		
			PROFINET devic	ce name:	io-safety		-
				vice type:	IM 155-6 PN HF		
			Online access Type of the PG/PC i		PN/IE		
			PGIPC	interface:	Intel(R) Ethernet Conn	ection (4) I219-LN	<u>a</u> 💌 💽
			Device filter				
			💽 Only show	devices of t	he same type		
			Only show	devices wit	h bad parameter settings		
				devices wit	-		
			_ ·				
-		IP address	ices in the network: MAC address	Device	PROFINET device name	Status	
		192.168.0.2	28-63-36-67-F8-2A	ET200SP	io-safety	✓ ОК	
	Flash LED						
		<					>
					L	Jpdate list	Assign name
Onlin	e status information:						
0	Search completed.						^
0	Search completed.						
0	Search completed.	. 1 of 2 devices we	ere found.				~
<				110			
							Close

7.8 Downloading the hardware configuration to the device

→ To download your complete CPU, select the \rightarrow "CPU_1516F [CPU1516F-3 PN/DP]" folder again and click the \rightarrow "Download to device" button \square .

I Siemens - C:\Users\mde\Documents\Automatic	on\072-100_SAFETY PN CPU1516F and	ET200SP\072-100_SAFETY PN CPU1516F and ET200	SP	_ - x
Project Edit View Insert Online Options To	and the second		Totally Integ	grated Automation
📑 📑 🔚 Save project 📑 🐰 🛅 🔚 🗙 🏷 ±	(~ 🛨 🐻 🖳 🏠 🚆 🥁 Go online	🛿 🖉 Go offline 🛛 🚹 🖪 🖪 🔛 📩		PORTAL
Project tree 🔲 🖣	072-100_SAFETY PN CPU1516F an			_ # #× 4
Devices	Download to device	🚽 Topology view	Network view	Device view
	Network Connections HMI con	nection 💌 🔒 Relations 🕎 📆 🛄	€ ±	I) Device view
s Ž			em: CPU1516F.PROFINET	IQ-System (100)
▼ 7 072-100_SAFETY PN CPU1516F and ET ▲		4 10 syste		
Add new device				8
Devices & networks	CPU1516F	IO-Safety	IIIIII	tal
🗧 🔻 📊 CPU1516F [CPU 1516F-3 PN/DP]	CPU 1516F-3 PN	IM 155-6 PN HF		ğ
Device configuration		CPU1516F 🧶		_ <u>z</u>
Online & diagnostics				• two
 Safety Administration 	192,168,1,1	CPU1516F.PROFINET IO-S	1.0.2	Online tools twork data
Program blocks	PN/IE 1: 192.168.0.1 2			
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External source files				
PLC tags	1			
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🕨 🚰 Traces		Q Properties	🚺 🗓 🚺 🗓 Diag	nostics
Device proxy data	General () Cross-references	Compile Energy Suite		
Program info				ibra
PLC supervisions & alarms	🔇 🔔 🕕 Show all messages			Libraries
Local modules	Compiling finished (errors: 0; warnings:			1993
Distributed I/O	! Path	Description	Go to ?	Errors Warnings
Ungrouped devices				0 0 ^
Security settings	Hardware configuration		-	0 0 🔳
Common data		Hardware was not compiled. The configuration is up-to	o-date.	
< III >	Safety	Compile safety program 'Safety Administration'.	<u>_</u>	~
> Details view	<	Ш		
🖣 Portal view 🔛 Overview 🍸	Settings 🔒 Devices & ne	🔝 😒	The project 072-100_SAFE	TY PN CPU15

- → The manager for configuration of connection properties (Extended download) opens. First, the interface must be correctly selected here. This is done in three steps.
 - Type of the PG/PC interface \rightarrow PN/IE
 - PG/PC interface \rightarrow here: Intel(R) Ethernet Connection (4)I219-LM
 - Connection to interface/subnet \rightarrow "PN/IE_1"
- → The → "Show all compatible devices" field must then be selected and the search for devices in the network must be started by clicking the → $\boxed{\text{Start search}}$ button.

Learn-/Training Document | TIA Portal Module 072-100, Edition 02/2021 | Digital Industries, FA

	ess nodes of "CPU1516F"	Slot	Interface type	Address	Subnet
					Subnet
Cruisior					PN/IE_1
					FIME_1
	Type of the PG/PC inte	erface:	PN/IE		-
	PG/PC inte	rface:	Intel(R) Ethern	et Connection (4) I2	219-LM 🔻 🤇
	Connection to interface/su	ubnet:	PN/IE_1		- (
	1st gat	teway:			-
Device	Device type				Target device
-	-	PN/IE	Acc	ess address	_
					<u>Start se</u>
:			(Display only erro	or messages Star
	Device CPU1516F	CPU1516F CPU 1516F-3 PN/ CPU 1516F-3 PN/ CPU 1516F-3 PN/ CPU 1516F-3 PN/ Type of the PG/PC inte PG/PC inte Connection to interface/su 1st gat Select target device: Device Device type	CPU1516F CPU 1516F-3 PN/ 1 X3 CPU 1516F-3 PN/ 1 X1 CPU 1516F-3 PN/ 1 X1 CPU 1516F-3 PN/ 1 X2 Type of the PG/PC interface: PG/PC interface: Connection to interface/subnet: 1st gateway: Select target device: Device Device type Interf	CPU1516F CPU1516F-3 PN/ 1 X3 PROFIBUS CPU1516F-3 PN/ 1 X1 PN/IE CPU1516F-3 PN/ 1 X2 PN/IE Type of the PG/PC interface: PN/IE PG/PC interface: PN/IE Connection to interface/subnet: PN/IE_1 1st gateway: Select target device: Device Device type Interface type Add 	CPU1516F CPU1516F-3 PN/ 1 X3 PROFIBUS 2 CPU1516F CPU1516F-3 PN/ 1 X1 PN/IE 192.168.0.1 CPU1516F-3 PN/ 1 X2 PN/IE 192.168.1.1 Type of the PG/PC interface: PG/PC interface: PN/IE 192.168.1.1 Connection to interface/subnet: PN/IE 192.168.1.1 Select target device: Show all compatible Device Device type Interface type Address - PN/IE Access address

→ If your CPU is displayed in the "Compatible devices in target subnet" list, select it and start the download. (→ CPU 1516F-3 PN/DP → "Load")

	Device	Device type	Slot	Interface type	Address	Subnet
	CPU1516F	CPU 1516F-3 PN/	1 X3	PROFIBUS	2	
		CPU 1516F-3 PN/	1 X1	PN/IE	192.168.0.1	PN/IE_1
		CPU 1516F-3 PN/	1 X2	PN/IE	192.168.1.1	
		Type of the PG/PC inte	orface :	PN/IE		-
		PG/PC inte		-0		
				10	net Connection (4) I2	
		Connection to interface/si		PN/IE_1		•
		1st gat	teway:			
	Select target dev				Show all compatib	la da tina i
						1
	Device CPUcommon	Device type CPU 1516F-3 PN/DP	PN/IE		dress 2.168.0.1	Target device CPUcommon
	-	CFU 1516F-5 FINIDF	PN/IE		ess address	-
0.0 1			THE	7.00		
R.L						
Flash LED						
						<u>S</u> tart sea
	1:				Display only erro	r messages
ne status information	vice io-safety					,
		of 3 accessible devices for	und.			
Found accessible de						
Found accessible de	n retrieval complete					

→ You first receive a preview. Confirm the control window → "Consistent download" and continue with \rightarrow "Load".

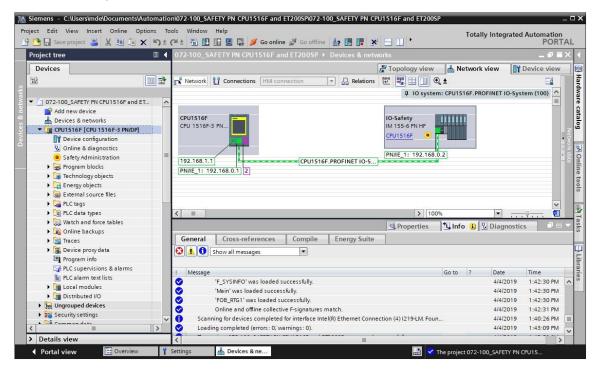
tatus	1	Target	Message	Action
1	%	▼ CPU1516F	Ready for loading.	Load 'CPU1516F'
	Δ	 Protection 	Protection from unauthorized access	
	4		Devices connected to an enterprise network or directly to the internet must be appropriately protected against unauthorized access, e.g. by use of frewalls and network segmentation. For more information about industrial security, please visit http://www.siemens.com/industrialsecurity	
	Δ	 Different modules 	Differences between configured and target modules (online)	
	0	Software	Download software to device	Consistent download
	0	Safety program	Load safety program to device	Consistent download
	0	Text libraries	Download all alarm texts and text list texts to device	Consistent download
				Refresh

Note:

- In the "Load preview", you should see the 'S' symbol in each line. You can see additional information in the "Message" column.
- \rightarrow The \rightarrow "Start module" option is now selected before the download operation can be completed with \rightarrow "Finish".

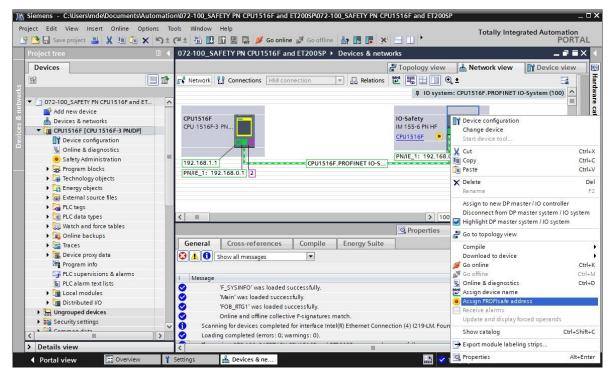
tus	1	Target	Message	Action
1	0	CPU1516F	Downloading to device completed without error.	Load 'CPU1516F'
	0	 Start modules 	Start modules after downloading to device.	Start module
	0		The module "CPU1516F" can be started.	
	0	CRC comparison	Result of CRC comparison	

→ The project view is opened again automatically after a successful download operation. A download report appears in the "General" tab of the Info window. This can be helpful for troubleshooting if the download operation was unsuccessful.



7.9 Assigning the PROFIsafe addresses

→ Finally, the PROFIsafe addresses must still be assigned in the safety modules of the ET 200SP. To do so, right-click on the ET 200SP as shown here and select → "● Assign PROFIsafe address". (→
 ● Assign PROFIsafe address)



- \rightarrow The interface for online access can be selected in the following dialog. This is done in three steps.
 - Type of the PG/PC interface \rightarrow PN/IE
 - PG/PC interface \rightarrow here: Intel(R) Ethernet Connection (4)I219-LM
 - Connection to interface/subnet \rightarrow "PN/IE_1"
- \rightarrow Select the two modules "F-DI 8x24VDC HF_1" and "F-DQ 4x24VDC/2A PM HF_1" by setting the "

 \blacksquare in the "Assign" column. Select "Identification " \bigcirc " by LED flashing" and click on the "Identification" button. (\rightarrow Assign $\blacksquare \rightarrow$ Assign $\blacksquare \rightarrow$ Identification \bigcirc by LED flashing \rightarrow Identification)

Image: Server module Connection to interface/subret: Interface/subret: Interface	gn PRO	Flsafe address									
							Onl	ine access			
Image: Source of the Fundal is the table: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the current hardware configuration before you assign the RPOFIsafe address: 100whold the table to be identified. Then click on the 'Identification' button. 100whold the table to be identified. Then click on the 'Identification' button. 100whold the table table table that in the table. 100whold table table table table table the difter (Identification e. Status Identification Confirm 101ba24VDC 0 101ba24VDC 0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td>Type of the P</td><td>G/PC interface:</td><td>PN/IE</td><td></td><td></td><td>-</td></td<>						Type of the P	G/PC interface:	PN/IE			-
Isrgerwy: Device address: 100wnload the current hardware configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To configuration before you assign the PROPIsafe address. 2. To poly address. 2. To poly address. 2. To poly address.						F	G/PC interface:	Intel(R)	Ethernet Con	nection (4) I219-LM	
Is gateway: Is gateway: Device address: 192.168.0.1 Image: Stateway: Image: Stateway: Image: Stateway: Image:						Connection to int	erface/subnet:				•
							1st gateway	_			
Download the current hardware configuration before you assign the PROFIsafe address. Text select the F-module to be identified. Then click on the "Identification" button. Confirm teraction of the F-module to to that in the table. Confirm teraction of the F-module to to that in the table and then click on the "Assign PROFIsafe address" button. Confirm		_			• •			100 100 0	4		
• Download the current hardware configuration before you assign the PROFIsafe address. 2. For a set of the F-module to be identified. Then click on the "Identification" button. 3. Compare the reaction of the F-module to be identified. Then click on the "Assign PROFIsafe address" button. 1. Order no. Profession are activated by the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign Profession are activated by the provide in the table and then click on the "Assign PROFIsafe address" button. Assign PROFIsafe address are activated by the provide interval address are activated by the provide address							evice address.	192.100.0.			
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Image: P-D1 8x24VDC 0 1 F-D1 8x24VDC HF 6ES7 136-6BA00-0CA0 65534 Image: P-D2 4x24VDC.H 0 2 F-D2 4x24VDC.HE 6ES7 136-6DB00-0CA0					1			Status		Identification	Confirm
P-DQ 4x24VD 0 2 F-DQ 4x24VDC/ 6ES7 136-6DB00-0CA0 - DI 8x24VDC H 0 3 DI 8x24VDC HF 6ES7 131-6BF00-0CA0 - Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - - Image: Server module 0 4 Server module 6ES7 193-6PA00-0AA0 - - Image: Server module 1 1 1 1 1 1 Image: Server module 1 1 1 1 1 1 1 Image: Server module 1 1 1 1			1.5								
DI 8x24VDC H 0 3 DI 8x24VDC HF 6ES7 131-68F00-0CA0 - <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>											
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								-	Identifica	tion Assign	PROFIsafe add
	Online st	tatus information:							• Identifica	ition	
Clara											
										-	Close

→ Confirm the flashing of the LEDs on the two modules "F-DI 8x24VDC HF_1" and "F-DQ 4x24VDC/2A PM HF_1" by setting the " In the "Confirm" column. Then click on the "Assign PROFIsafe address" button. (→ Confirm I → Confirm I → Assign PROFIsafe address)

							Onli	ne	access		
						Type of the P	G/PC interface:	٤	.PN/IE		v
						P	G/PC interface:		Intel(R) Ethernet Co	onnection (4) I219-LM	- 💎 🖸
		n -			1	Connection to int	erface/subnet:	PN	I/IE_1		- 0
							1st gateway:	Ē			-
					• 🔤	D	evice address:	19	2.168.0.1	品?	
		<u></u>			-						
							Iden	ntifi	cation:		
									📀 by LED flashi	ng	
									O by serial nun	-	
. Confirn ssign		e reaction of the F-modul Module			e and then click or Type	the "Assign PROFIsafe ac Order no.	ddress" button. F-destination a		Status	Identification	Confirm
	***	▼ IO-Safety	O	0	IM 155-6 PN HF	6ES7 155-6AU00-0CN0			Status	identification	
		F-DI 8x24VDC	1.2	1	F-DI 8x24VDC HF	6ES7 136-6BA00-0CA0	65534	٨	unassigned	LED flashing?	
			0	1 2		6ES7 136-6BA00-0CA0 6ES7 136-6DB00-0CA0	65534 65533	-	unassigned unassigned	LED flashing? LED flashing?	
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		F-DI 8x24VDC F-DQ 4x24VD	0 0 0 0	2	F-DQ 4x24VDC/	6ES7 136-6DB00-0CA0	65533	-			
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		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-			
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-			
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-			
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-			
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-			
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	
		F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H Server module	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	
	atus	F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	
	atus	F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H Server module	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	PROFIsafe addr
	atus	F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H Server module	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	PROFIsafe addr
	atus	F-DI 8x24VDC F-DQ 4x24VD DI 8x24VDC H Server module	0 0 0 0	2 3	F-DQ 4x24VDC/ DI 8x24VDC HF	6ES7 136-6DB00-0CA0 6ES7 131-6BF00-0CA0	65533 	-	unassigned	LED flashing?	PROFIsafe addr

→ Confirm the assignment of the PROFIsafe address within 55 seconds by clicking the \rightarrow "Yes" button. (\rightarrow Yes)

Confirm F	ROFIsafe address assignment	×
4	Please confirm the PROFIsafe address assignment within 55 seconds!	
	The PROFIsafe address will be assigned to the fail-se modules.	

 \rightarrow Close the dialog window for assigning the PROFIsafe address. (\rightarrow Close)

						Onli	ine	access		
					Type of the P	G/PC interface:	Ł	PN/IE		-
					P	G/PC interface:		Intel(R) Ethernet Con	nection (4) I219-LM	- •
-					Connection to int	erface/subnet:	PN	/IE 1		
			_			1st gateway:				
	_			• 🔛						
			_			evice address:	19	2.168.0.1	<u></u>	
						Ider	ntifi	cation:		
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								O by serial numb		
. Confirm	re the reaction of the F-mod the reaction of the F-modu Module	le in the			the "Assign PROFIsafe ac Order no.	ldress* button. F-destination a		Status	Identification	Confirm
ssign	▼ IO-Safety	O		5-6 PN HE	6ES7 155-6AU00-0CN0			Status	Identification	Connirm
	F-DI 8x24VDC				6ES7 136-6BA00-0CA0	65534	0	assigned		
					6ES7 136-6DB00-0CA0		-	assigned		
	F-DQ 4x24VD									
	F-DQ 4x24VD DI 8x24VDC H		3 DI 8x2	4VDC HF	6ES7 131-68F00-0CA0	-				
		0			6ES7 131-6BF00-0CA0 6ES7 193-6PA00-0AA0					
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Dnline sta	DI 8x24VDC H	0						Identifica	ation Assign F	PROFIsafe addr
	DI 8x24VDC H Server module.	0	4 Serve	rmodule	6ES7 193-6PA00-0AA0			Identifica	ation Assign F	PROFIsefe addr
The PF	DI 8x24VDC H Server module.	0 0	4 Serve	r module	6ES7 193-6PA00-0AA0			Identifica	ation Assign f	ROFIsafe addr
The PF	DI 8x24VDC H Server module.	0 0	4 Serve	r module	6ES7 193-6PA00-0AA0			Identifica	ation Assign F	ROFIsafe addi

Note:

 For the ET 200SP, the PROFIsafe addresses are stored in the small white coding plugs of the Fmodules.

7.10 Creating and downloading the safety program

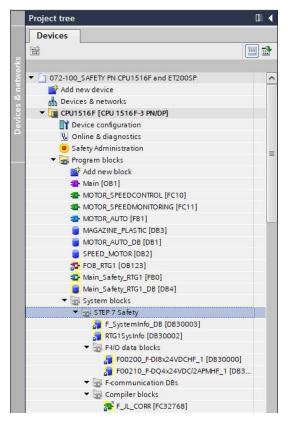
According to the task, a safety-related shutdown of a plant as a consumer is to be performed in the following safety program if:

- A safety door monitored by two contacts is opened or
- An EMERGENCY STOP connected via two channels is actuated.

After actuation of the EMERGENCY STOP or opening of the safety door, a local user acknowledgment is necessary before the production operation can be restarted.

In our example, a fail-safe block with a safety door function, an EMERGENCY STOP function (safety circuit for shutdown when EMERGENCY STOP is actuated and when safety door is opened), a feedback circuit (as restart protection in case of faulty load) and a user acknowledgment for the re-integration is to be programmed and generated to form a safety program.

The prerequisite for the programming is a correctly created hardware configuration as was previously described.



F-IO data blocks

For each F-IO, an "F-IO DB" is automatically generated in the hardware configuration during compilation and a symbolic name for it is simultaneously entered in the symbol table. You can see the F-IO DBs generated for the example IO in the block container.

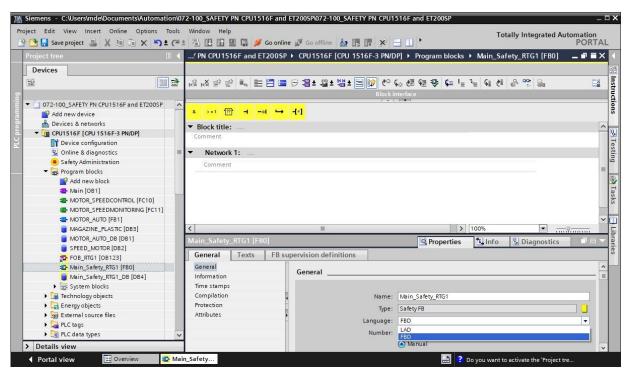
The symbolic name of the F-IO DB is formed from the fixed prefix "F", the start address of the F-IO and the name entered in the device configuration for the F-IO.

→ First, the global PLC tags must be specified for the safety program. To do this, select the "CPU_1516F [CPU 3156F-3 PN/DP]" in the project tree and create a new "Tag_table_safety" under "PLC tags". Open the "Tag table_safety" with a double-click and enter the "Name", "Data type", "Address" and "Comment" for the inputs and outputs of the safety program. (→ CPU_1516F [CPU 3156F-3 PN/DP] → PLC tags → Tag table_safety)

Project tree		072-100_SAFETY P	I CPU 1516F and	ET200SP	▶ CPU15	16F [CP	U 1516F	-3 PN/D	P] ▶ P	LC tag	s → Tag table_safety [9]	_ = = >	
Devices											🕣 Tags	User constants	
密	🔟 🖻	🔮 🔮 🖻 😫 😤	en										
		Tag table_safety											
 072-100_SAFETY PN CPU1516F and ET200 	SP 🔨	Name		Data type	Address	Retain	Acces	Writa	Visibl	Sup	Comment		
📑 Add new device	12	1 -512_ACKI	OWLEDGE	Bool	%120.0						push-button acknowledge (no)		
Devices & networks			BACK_LOOP	Bool	%120.1						feedback loop main load contacto	rs (nc)	
 CPU1516F [CPU 1516F-3 PN/DP] 		3 📶 -S10_EME		Bool	%1200.0						emergency stop 2-channel (nc)		
Device configuration			OR_CONTACT_1	Bool	%1200.1						first door contact (nc)		
 Safety Administration 	a =	100 Tel 100 Te	OR_CONTACT_2	Bool Bool	%I200.5 %I201.1						second door contact (nc) value status(0== substitute value)	First door contact (nc)	
Galety Administration	1		OR_CONTACT_1_V		%1201.1						value status(0== substitute value)		
Technology objects			CONTACTOR VS	Bool	%1210.0						value status(0== substitute value)		
🕨 📴 Energy objects		9 📶 -K20_LOAI	CONTACTOR	Bool	%Q210.0						control main load contactors		
External source files		10 <add new<="" td=""><td>></td><td></td><td>1</td><td></td><td> Image: A start of the start of</td><td> Image: A start of the start of</td><td> Image: A start of the start of</td><td></td><td></td><td></td></add>	>		1		 Image: A start of the start of	 Image: A start of the start of	 Image: A start of the start of				
🔻 浸 PLC tags													
a Show all tags													
Add new tag table													
Default tag table [66] Tag table_safety [9]													
Tag table_sorting station [31]													
-S12_ACKNOWLEDGE	Bool	%120.0			nowledge (no)								
-K20_FEEDBACK_LOOP	Bool	%120.1					fee	feed	feedback loop main load contactors (nc)				
-S10_EMERG_STOP	Bool	%1200.0		3 6	2	~		eme	emergency stop 2-channel (nc)				
-S11.1_DOOR_CONTACT_1	Bool	%I200.1]				first door contact (nc)						
-S11.2_DOOR_CONTACT_2	Bool	%1200.5			2			seco	nd doo	or cor	ntact (nc)		
-S11.1_DOOR_CONTACT_1_VS	Bool	%I201.1		3 6	2			value	e statu	s (0==	= substitute value) first do	oor contact (nc)	
-S11.2_DOOR_CONTACT_2_VS	Bool	%1201.5			2			value	e statu	s (0==	= substitute value) secon	d door contact (no	
-K20_LOAD_CONTACTOR_VS	Bool	%1210.0		3 6	~			value	e statu	s (0==	= substitute value) main l	oad contactors	
-K20 LOAD CONTACTOR	Bool	%Q210.0			2			contr	rol ma	in loa	d contactors		

Note:

 The value status tags are available in the F-modules of the ET 200SP to obtain diagnostic information on the value status of individual channels. The F-IO DBs have only a QBAD tag that indicates the status of the overall module. → Open the "Main_Safety_RTG1" block in the Program blocks folder and change the programming language to FBD in the Properties window under General. (→ CPU_1516F [CPU 3156F-3 PN/DP] → Program blocks → Main_Safety_RTG1 → Properties General → FBD)



The safety program for our plant will now be created in the "Main_Safety_RTG1" block. Additional blocks will be called from the safety functions for this purpose. Additionally, created local (and thus fail-safe) tags will be used to interconnect the blocks.

Only the 'Bool', 'DInt', 'DWord', 'Int', 'Time' and 'Word' data types are permitted in the safety program.

 \rightarrow Create the static tag "Release_safety_door" with the "Bool" data type. (\rightarrow Static \rightarrow Release_safety_door \rightarrow Bool)

	Ma	in_	Safety_RTG1								
		Na	me	Data type	Default value	Retain	Accessible f	Writa	Visible in	Setpoint	Sup
		•	Input								
		•	<add new=""></add>								
		•	Output								
			<add new=""></add>								
		•	InOut								
		•	<add new=""></add>								
		•	Static								
		•	Release_safety_door	Bool	false	Non-ret 💌					
			<add new=""></add>	Bool	~						
0		•	Temp	Dint							
1			<add new=""></add>	Int							
2		•	Constant	Time							
	<			Word		D				1	>
			1 []]] • I → title:		~	•					
C	omr	me	nt								
20	N	let	twork 1:								
	12	0.000	ment								

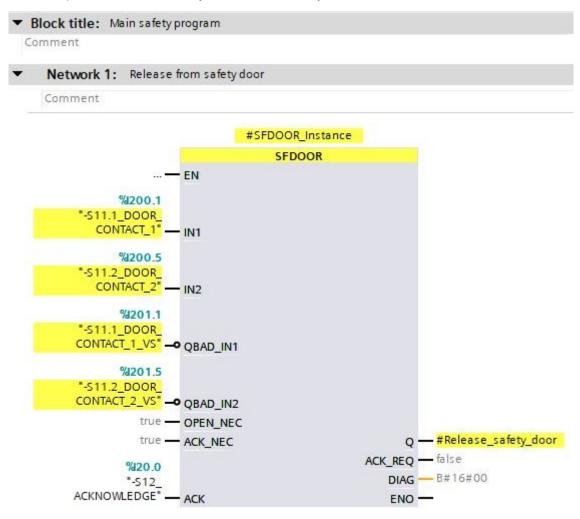
→ Enter here, as well as in the other steps, the block title and network heading for Network 1. Using drag-and-drop, move the block for the safety door monitoring "SFDOOR" from the safety functions to the first network of the "Main_Safety_RTG1" block. (→ SFDOOR)

iP	• CPU1516F [CPU 1516F-3	PN/DP] • Program	n blocks 🕨 Mai	n_Safety_R	FG1 [FB0]	_ = = ×	h	structions		7 1	
							0	ptions			
छैं।	ð 🖻 🔮 🐛 🖿 🗖 🗖	🖻 📲 ± 📲 ± 🖼 ±	🖃 😰 🍋 💊	. 付 🗺 😍	¢ ≡ ¹ ≡ ³ ≡	91 ° 📑	E	i	🕉 🔂 thi Li		
٨	ain_Safety_RTG1						5	Favorites			
	Name	Data type	Default value	Retain	Accessible f.	Writa	V				
7 ⊀	🔟 🔻 Static						-	me	Description		
8 ⊀	🔟 = Release_safety_door	Bool	false	Non-ret			INC	General	Description	-	-
9	Add new>						Ľ	Bit logic operation	2		-
10	🔟 🔻 Temp						14000	Safety functions	5		
			25 2020-0222-21			>	Ľ	ESTOP1			-
			- lest						Emergency STOP		-
8	>=1 ??? -1 -01 ->	-[=]					L	TWO_H_EN	Two-hand monito	oring	-=
- P	ock title: Main safety program						-	MUT_P	Parallel muting		-
	nment						١.,	EV1002DI	1002 evaluation		4 4
Co	nment							FDBACK	Feedback monit		-
•	Network 1: Release from saf	fetv door					_	SFDOOR	Safety door mon		-
								ACK_GL	Global acknowle	dgme	4
	Comment							Timer operations			
-							100	+1 Counter operation			
								Comparator opera	ti		
							•	🗄 Math functions			
							•	Move operations			
							•	🚭 Conversion operat	i		4
							•	Program control of	D		
								🛄 Word logic operati.			~
							<			>	•
							>	Extended instruct	ions		
							>	Technology			
<			> 100	10/			1	Communication			-

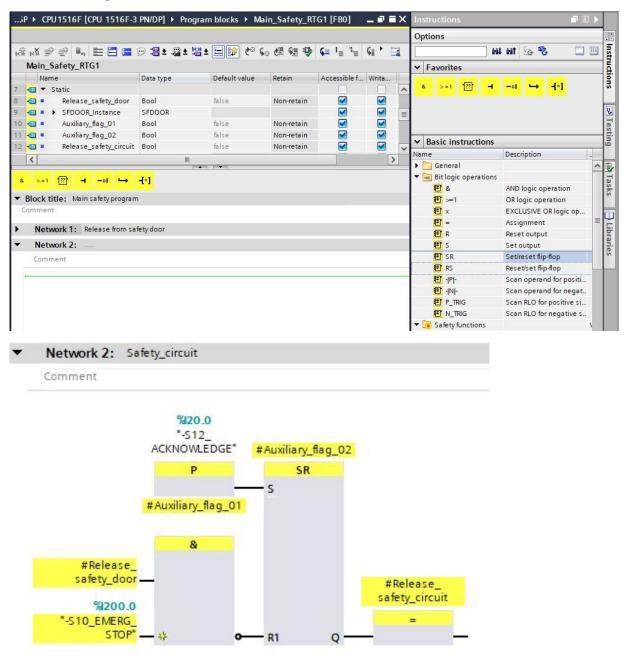
 \rightarrow For the call option, select 'Multi-instance' and confirm with 'OK' (\rightarrow Multi-instance \rightarrow OK)

Call options	×
Single instance	Multiple instance Name in the interface If you call the function block as a multi-instance, it saves its data in the instance data block of the calling function block and not in its own instance data block. This allows you to concentrate the instance data blocks in your program.
	more
	OK Cancel

→ A safety door function is programmed with the help of "SFDOOR". Inputs "IN1" and "IN2" are interconnected with the door contacts "QBAD_IN1" and "QBAD_IN2" are used to query the fault-free function of the utilized channels of the F-IO. With "OPEN_NEC = TRUE", a check of the safety device (fully open door and close again) is required after a restart of the safety program. "ACK_NEC = TRUE" means that a user acknowledgment is required after the safety door has been opened. The signal of the user acknowledgment is interconnected at the "ACK" input. The "Release_safety_door" occurs at output "Q" when the safety door is in the safely closed state.



→ The release of the safety circuit is programmed in the second step. Additional static tags must first be created for this, as shown here. The EMERGENCY STOP signal can be directly interconnected because safe functioning of the "EMERGENCY STOP" is already provided due to the settings in the device configuration of the F-IO.



→ The feedback monitoring is configured using the "FDBACK" block in the third network. To do so, drag the block for the feedback circuit monitoring "FDBACK" from the safety functions to the third network of the "Main_Safety_RTG1" block.(→ FDBACK)

							Options	
ы м 学 👻 💺 🗮 🗮	🗩 📲 ± 📲 ± 🗄	월 🗄 📰 🎲 🥙 🦕	. 付 🕅 🤒	⊊ [⊥] ≡ ¹ ≡	SI 1			l Mit 😼 🍪 🔲 🗐
Main_Safety_RTG1							✓ Favorites	
Name	Data type	Default value	Retain	Accessible f	Writa			
7 📶 🔻 Static						^	& >=1 ??? ⊣	-oI ↦ -[=]
🛚 📶 = 🛛 Release_safety_door	Bool	false	Non-retain					
🗧 📶 = 🕨 SFDOOR_Instance	SFDOOR							
10 📶 = Auxiliary_flag_01	Bool	false	Non-retain					
11 🕣 💷 Auxiliary_flag_02	Bool	false	Non-retain				✓ Basic instructions	
12 📶 🔹 Release_safety_circuit	Bool	🔳 false	Non-ret 💌			~		-
<						>	Name	Description
		1 * 1 / * 1					General	
& >=1 ??? -I -ol ↦	-[=]						Bit logic operations	
 Block title: Main safety program 							 Safety functions 	c croni
Comment	n						ESTOP1	Emergency STOP/emergen
comment							TWO_H_EN	Two-hand monitoring wit
Network 1: Release from safety door							MUT_P	Parallel muting
Network 1: Release from sa							EV1002DI	1002 evaluation with discr
							FDBACK	Feedback monitoring
Network 1: Release from sa Network 2: Safety_circuit							SFDOOR	Safety door monitoring
Network 2: Safety_circuit	monitoring							
Network 2: Safety_circuit	monitoring						ACK_GL	Global acknowledgment o
 Network 2: Safety_circuit Network 3: Feedback loop 	monitoring						O Timer operations	Global acknowledgment o
 Network 2: Safety_circuit Network 3: Feedback loop 	monitoring							Global acknowledgment o.

 \rightarrow For the call option, select 'Multi-instance' and confirm with 'OK'. (\rightarrow Multi-instance \rightarrow OK)

Call options	>	<
В	Multiple instance Name in the interface FDBACK_Instance If you call the function block as a multi-instance, it saves its	
Single instance	data in the instance data block of the calling function block and not in its own instance data block. This allows you to concentrate the instance data in a single block and to get by with fewer instance data blocks in your program.	
Multi instance		
	more	
	OK Cancel	

→ The feedback monitoring is configured using the "FDBACK" block in the third network. The "ON" input is connected together with the release of the safety circuit by the switch-on signal "-K0" "main switch ON" (no). As long as a 1 signal is present, the "Q" output to the load is activated. The signal at the "FEEDBACK" input must fall from 1 to 0 within the set "FDB_TIME" time. Otherwise, the "Q" output will be disabled again, and a block fault occurs. A fault can be acknowledged with the user acknowledgment at input "ACK". "QBAD_FIO" is used to query the fault-free function of the utilized channel of the F-IO.

Comment		
&	_	
#Release_safety_	#FDBACK	_Instance
circuit —	FDB	ACK
%0.1	— EN	
"-K0" — 💥	ON	
	%J20.1	
	-K20_FEEDBACK_ LOOP" — FEEDBACK	
	FEEDBACK	
	%1210.0	
	-K20_LOAD_	%Q210.0
	CONTACTOR_VS [®] - QBAD_FIO	"-K20_LOAD_
	true — ACK_NEC	Q - CONTACTOR
	%420.0	ERROR - false
	"-S12_	ACK_REQ - false

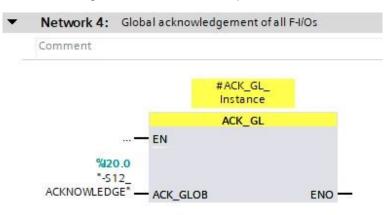
→ The depassivation of the F-IO is configured using the ACK_GL in the fourth network. To do so, drag the block for the global acknowledgment of all F-IO of a runtime group "ACK_GL" from the safety functions to the fourth network of the "Main_Safety_RTG1" block. (→ ACK_GL)

16F [CPU 1516F-3 PN/DP] > F	Program blocks 🔸	Main_Safety_R	TG1 [FB0]	_ 🗖 🗖	×	Instructions	- D)	
					-	Options		
ыйый 🥩 👻 💺 🔚 🚍 і	፼ 2 ± 2 ± 2 ±	🖃 🤢 🍋 🖕	. 🖑 🗺 🍫	⊊ • ⊒		iri iri	wit 🐻 🗞 📃 🗉	" Instructions
Main_Safety_RTG1						✓ Favorites		- uc
Name	Data type	Default value	Retain	Accessi				tion
7 🕣 👻 Static					~	& >=1 ??? ⊣	-oi └→ -[=]	SL
8 📶 = Release_safety_door	Bool	false	Non-retain		1			
9 📶 🔹 🕨 SFDOOR_Instance	SFDOOR							У,
10 📶 = Auxiliary_flag_01	Bool	false	Non-retain		=			⊃ Testing
11 📹 🔹 Auxiliary_flag_02	Bool	false	Non-retain			✓ Basic instructions		- stin
12 📶 🔹 Release_safety_circuit	Bool	false	Non-ret 💌					9
13 📶 🔹 🕨 FDBACK_Instance	FDBACK				~	Name	Description	-
14 Codd pours				>		General		
					-	Bit logic operations Generations		Tasks
& >=1 ???0 →	-[=]					 Estop1 	Emergency STOP/emergency OFF up	ks
						TWO_H_EN	Two-hand monitoring with enable	-
Block title: Main safety program							Parallel muting	L
omment						EV1002DI	1002 evaluation with discrepancy a	Lib
Network 1: Release from safety of	door				- 1	FDBACK	Feedback monitoring	Libraries
						SFDOOR	Safety door monitoring	es
Network 2: Safety_circuit						ACK_GL	Global acknowledgment of all F-I/Os	
Network 3: Feedback loop monit	toring					Timer operations	clobal deknowledgine it of dirt wos	
	an a					Fill Counter operations		
Network 4 Global acknowledge	ment of all F-I/Os							
Network 4: Global acknowledge	ment of all F-I/Os					Comparator operati		
Network 4: Global acknowledger	ment of all F-I/Os					 Comparator operati Math functions 	-	
The second se	ment of all F-I/Os				-	The termination of terminatio of termination of termination of termination of termination of te		
The second se	ment of all F-I/Os							

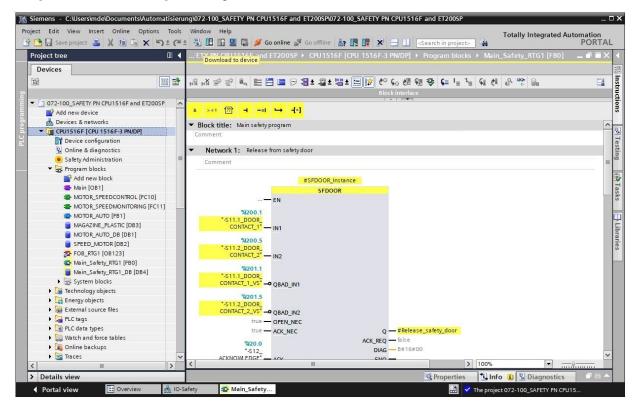
 \rightarrow For the call option, select 'Multi-instance' and confirm with 'OK' (\rightarrow Multi-instance \rightarrow OK)

Call options	×
Single instance	Multiple instance Name in the interface If you call the function block as a multi-instance, it saves its data in the instance data block of the calling function block and not in its own instance data block. This allows you to concentrate the instance data in a single block and to get by with fewer instance data blocks in your program.
	more OK Cancel

→ The **"ACK_GL"** serves the global acknowledgment of all F-IO of a runtime group and thus the depassivation of the F-IO. With the user acknowledgment at input **"ACK_GLOB"**, a global acknowledgment of all F-IO can be performed.



→ Before you download the safety program, however, you should save your project again by clicking the → \square Save project button. To download the safety program, select the → "CPU_1516F [CPU1516F-3 PN/DP]" folder again and click the → "Download to device" button \square .



 $\rightarrow~$ You first receive a preview. Continue with \rightarrow "Load".

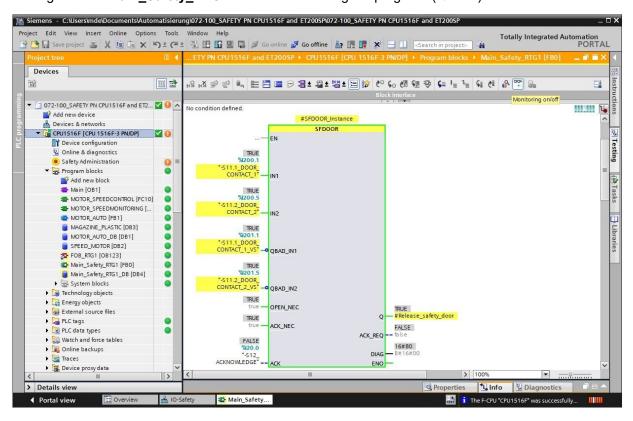
atus	1	Target	Message	Action
10	N	▼ CPU1516F	Ready for loading.	Load 'CPU1516F'
	<u>^</u>	Different modules	Differences between configured and target modules (online)	
	0	Stop modules	The modules are stopped for downloading to device.	Stop all
	0	Data block re-initi	The data blocks will be re-initialized with their start values.	Re-initialize 💌
	0	Software	Download software to device	Consistent download
	0	 Safety program 	Load safety program to device	Consistent download
			III	

Note:

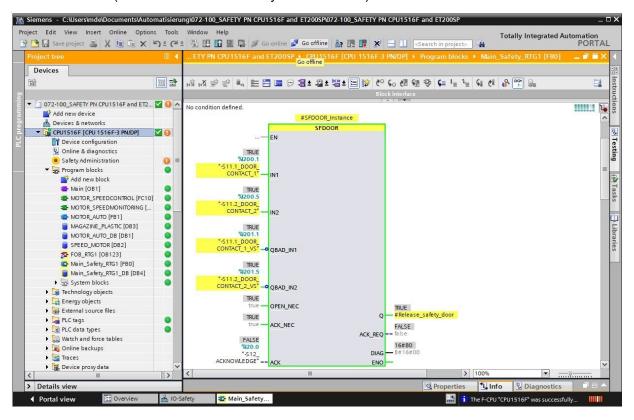
- In the "Load preview", you should see the 'S' symbol in each line. You can see additional information in the "Message" column.
- \rightarrow The \rightarrow "Start module" option is now selected before the download operation can be completed with \rightarrow "Finish".

tatus	1	Target	Message	Action
4	0	CPU1516F	Downloading to device completed without error.	Load 'CPU1516F'
	0	 Start modules 	Start modules after downloading to device.	Start module
	0		The module "CPU1516F" can be started.	
	0	CRC comparison	Result of CRC comparison	

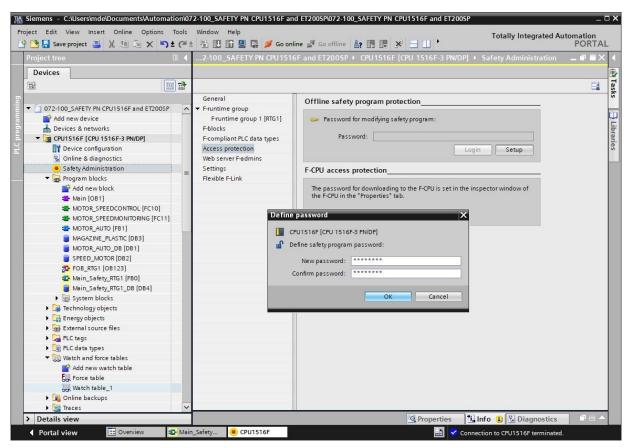
→ By clicking on the " \square Monitoring On/Off" button, you can monitor the state of the input and output tags at the "Main_Safety_RTG1" block when testing the program. (→ \square)



→ However, a warning is still displayed at menu item "Safety Administration". To eliminate this, the online connection must first be disconnected. Then you open → "Safety Administration" with a double-click. (→ Go offline → Safety Administration)



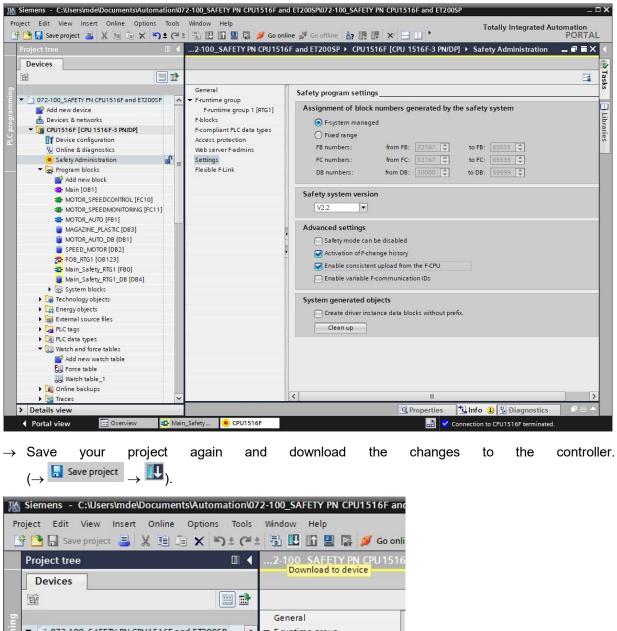
→ Here, access protection must be activated for the safety program. Click on "Setup" under "Access protection" and assign the password "**pw_fprog**" for the safety program. (→ Access protection → Setup → pw_fprog → pw_fprog → OK)



→ You can log off from the safety program in the Access protection menu or by right clicking the " symbol next to " "Safety Administration". However, this should not be done until later.

roject Edit View Insert Online Options T Project Tree	🧨 🗄 🛄 🌆 📱 🙀 💋 Go online	Go offline 🔐 🖪 🖪 🗶 🖃 🛄 🔭
Devices		
OT2-100_SAFETY PN CPU1516F and ET200SP Add new device Devices & networks	General F-runtime group F-runtime group 1 [RTG1] F-blocks F-compliant PLC data types Access protection Web server F-admins	Offline safety program protection
 Safety Administration 	Open	-CPU access protection
Program blocks Add new block Main [OB1] MOTOR_SPEEDCONTROL [FC10] MOTOR_SPEEDMONITORING [FC11] MOTOR_AUTO [FB1]	Authorized Cross-references F11 Print Ctrl+P Go to protection Log of from the offline safety program	The password for downloading to the F-CPU is set in the inspector window of the F-CPU in the "Properties" tab. Go to the "Protection" area of the F-CPU

→ Activate the options indicated here in the settings for the safety program. (→ Activation of Fchange history → Enable consistent upload from the F-CPU)



Devices			
Ē		•	
			General
072-100_SAFETY PN CPU1516F and ET200SP		^	 F-runtime group
💕 Add new device		1	F-runtime group 1 [RTG1]
Devices & networks			F-blocks
CPU1516F [CPU 1516F-3 PN/DP]			F-compliant PLC data types
Device configuration			Access protection
🗓 Online & diagnostics			Web server F-admins
Safety Administration	L.	=	Settings
Program blocks	-	=	Flevible FJ ink

 \rightarrow You first receive a preview where you must select stopping of the CPU. Continue with \rightarrow "Load".

tatus	1	Target	Message	Action
10	<u> </u>	▼ CPU1516F	Ready for loading.	Load 'CPU1516F'
	Δ	Different modules	Differences between configured and target modules (online)	
	0	Stop modules	The modules are stopped for downloading to device.	Stop all 👻
	0	 Safety program 	Load safety program to device	Consistent download
<			100	

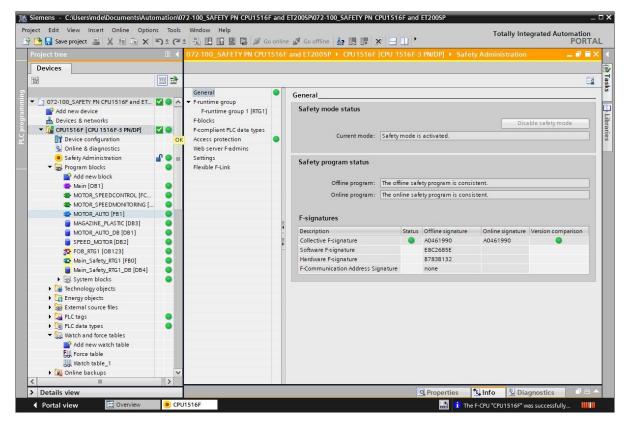
Note:

- Changes to the safety program can only be loaded consistently when the CPU is in STOP state.
- $\rightarrow\,$ Now, the \rightarrow "Start all" option is selected before the download operation can be completed with $\rightarrow\,$ "Finish".

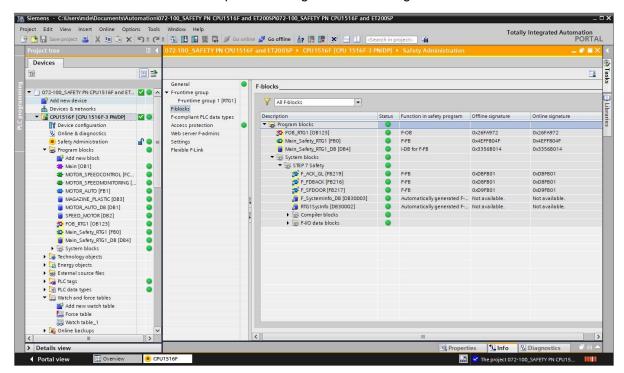
tatus	1	Target	Message	Action
4	0	▼ CPU1516F	Downloading to device completed without error.	Load 'CPU1516F'
	0	 Start modules 	Start modules after downloading to device.	Start module
	0		The module "CPU1516F" can be started.	
	0	 CRC comparison 	Result of CRC comparison	

7.11 Diagnostics functions for the safety program

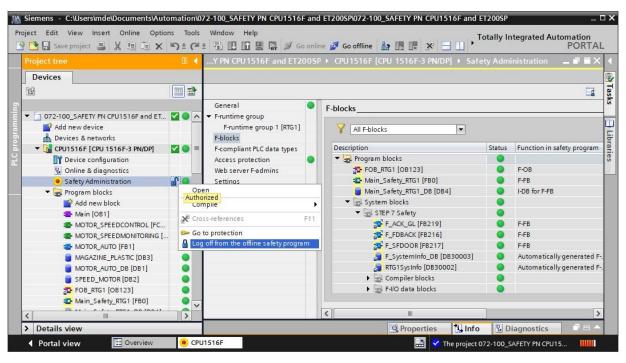
→ The status of the collective F-signature can be displayed in "General" under "Safety Administration". For acceptance of a system, this signature must be identical online and offline and must be documented.



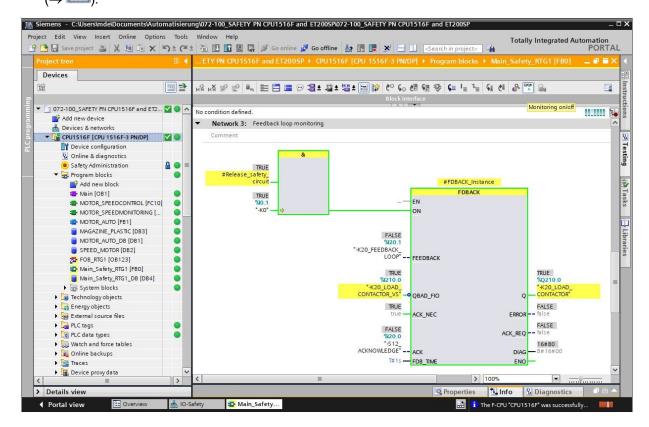
→ The status of the individual block signatures can be displayed in "F-blocks" under "Safety Administration". This can be helpful for finding out where changes have been made.



 \rightarrow Now, log off from the safety program. (\rightarrow Log off from offline safety program)



 \rightarrow The fail-safe block "Main_Safety_RTG1" can still be monitored, nevertheless.



→ The diagnostics data for the "SFDOOR" and "FDBACK" blocks called in the "Main_Safety_RTG1" block can be monitored via the multi-instances in the "Main_Safety_RTG1_DB" instance data block.

ect Edit View Insert Online Option						1000	😭 🚿 Go online	e 💋 Go offline	🌆 🖪 🖪 🗶			Totally Integ	grated A	utomatic POF	
Project tree	Ш	1	0	PU 1	516	F and	ET200SP ► CF	PU1516F [CPU	1516F-3 PN/DP]	Program blocks	▶ Main_Saf	ety_RTG1_DB	8 [DB4]	_ 7	J
Devices															
		7	1	100	1. 1.		E 🔭 Keep ad	tual values 🛛 🔒	Snapshot 🏘 🛤	Copy snapshots t	o start values	B- B-			
				Mai	n_S	afety_	RTG1_DB								
 072-100_SAFETY PN CPU1516F and ET 		^			Nam	e		Data type	Start value	Monitor value	Retain	Accessible f	Writa	Visible in	
🎽 Add new device			1	-00	Ir	nput									
📥 Devices & networks			2	-	c	Output									
CPU1516F [CPU 1516F-3 PN/DP]			3	-	Ir	nOut									
Device configuration			4		▼ S	tatic									
🚱 Online & diagnostics		=	5	-00		Relea	se_safety_door	Bool	false	TRUE		V	 Image: A start of the start of	Image: A start and a start	
Safety Administration	8		6	-		SFDC	OR_Instance	SFDOOR				 Image: A start of the start of	 Image: A start of the start of	 Image: A start of the start of	
🔻 🛃 Program blocks	•		7	-	•	Auxili	ary_flag_01	Bool	false	FALSE		~			
💣 Add new block			8			Auxili	ary_flag_02	Bool	false	TRUE		V	 Image: A start of the start of	 Image: A start of the start of	
🖀 Main [OB1]	•		9	-00	•	Relea	se_safety_circuit	Bool	false	TRUE		V	1	 Image: A start of the start of	
MOTOR_SPEEDCONTROL [FC	•		10	-00	• •	FDBA	CK_Instance	FDBACK				~	V	Image: A start and a start	
MOTOR_SPEEDMONITORING [11	-		▼ In	put								
Torrauto [FB1]	•		12				ON	Bool	false	TRUE		 Image: A start of the start of	 Image: A start of the start of		
MAGAZINE_PLASTIC [DB3]	•		13	-00			FEEDBACK	Bool	false	TRUE		 Image: A start of the start of	1	Image: A start and a start	
MOTOR_AUTO_DB [DB1]	•		14	-00			QBAD_FIO	Bool	false	FALSE			1	\checkmark	
SPEED_MOTOR [DB2]	•		15				ACK_NEC	Bool	true	TRUE		~			
FOB_RTG1 [OB123]	•		16	_			ACK	Bool	false	FALSE			\checkmark		
Main_Safety_RTG1 [FB0]	•		17				FDB_TIME	Time	T#Oms	T#15			1	\checkmark	
Main_Safety_RTG1_DB [DB4]			18	_		• 0	utput								
System blocks	•		19	_			Q	Bool	false	FALSE					
Technology objects			20			-	ERROR	Bool	false	TRUE					
Energy objects			21	_			ACK_REQ	Bool	false	TRUE					
External source files	-		22	Contract of the		-	DIAG	Byte	B#16#00	16#45			 Image: A start of the start of		
PLC tags		~			-		Out								
PLC data types		CONTRACT OF	7/	<		51	tatic								>
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→ In the "RTG1SysInfo" data block you obtain information on the collective F-signature, generation date, cycle time of runtime group, version of STEP 7 Safety, etc.

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 Safety Administration 		6	-		TCYC CURR	Dint	0	100				
Program blocks		7	-		TCYC_LONG	Dint	0	101				
Add new block		8	-		TRTG_CURR	DInt	0	1				
- Main [OB1]	•		-		TRTG_LONG	DInt	0	2				
MOTOR_SPEEDCONTROL [FC	•	10	-		T1RTG_CURR	DInt	0	0				
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MOTOR_AUTO [FB1]		12	-00		F_PROG_SIG	DWord	DW#16#1DD41	16#1DD4_17FD		 Image: A start of the start of		
MAGAZINE_PLASTIC [DB3]		13	-		F_PROG_DAT	DTL	DTL#2019-4-4	DTL#2019-04-04-1				
MOTOR_AUTO_DB [DB1]		14	-0		F_RTG_SIG	DWord	DW#16#D3650	16#D365_013E		 Image: A start of the start of		
SPEED_MOTOR [DB2]		15	-		F_RTG_DAT	DTL	DTL#2019-4-4	DTL#2019-04-04-1		V		
🔂 FOB_RTG1 [OB123]	•	16	-		VERS_S7SAF	DWord	DW#16#15010	16#1501_0000		V		
💁 Main_Safety_RTG1 [FB0]	•	17	-	InC	Dut							
🧧 Main_Safety_RTG1_DB [DB4]		18		Sta	itic							
 System blocks 												
 STEP 7 Safety 	•											
F_ACK_GL [FB219]	•											
F_FDBACK [FB216]	•											
F_SFDOOR [FB217]	•											
🗾 F_SystemInfo_DB [DB												
RTG1SysInfo [DB30002]	•											
► 😹 F-I/O data blocks	• •											
111	>	1	<							-		

→ You obtain diagnostic information for the F-modules in the usual way by right-clicking on the module and selecting "Online & diagnostics".

🖞 🔜 Save project 📑 🐰 📺 📺 🗙 ject tree	0				1	ty [IM 155-6 PN HF] → F-DI 8x24VDC HF_1	
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Ungrouped devices	•	<u> </u>				rs. User acknowledgment may be required. earching for the event ID in the STEP 7 online help.	
 IO-Safety [IM 155-6 PN HF] 	67	Search in project	Ctrl+F			entening for the effective in the sher 7 officie help.	
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h IO-Safety [IM 155-6 PN HF]	2	Q Properties	Alt+Enter				×
F-DI 8x24VDC HF_1 F-DQ 4x24VDC/JA PM HF_1 DI 8x24VDC/HF_1 Server module_1 Security settings Gorwmon data Documentation settings			ALTERIET				
Languages & resources							

 \rightarrow You also obtain information on the state of the F-modules in the F-IO DBs.

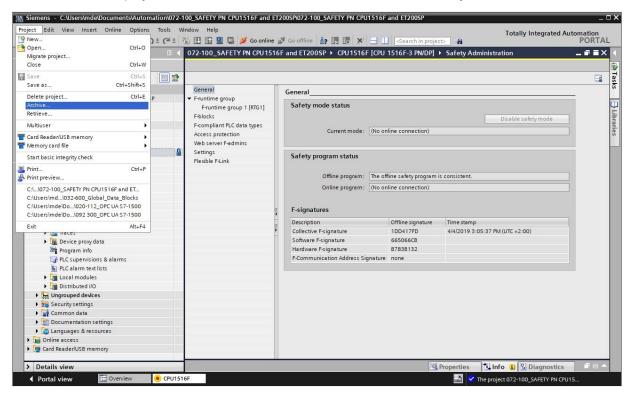
			Program	m blocks ♦ S	stem bloc	ks > STEP 7	Safety + F-I/O	data	bloc	ks ⊧	F00.	200_F-I	DI8x24VDCHF_1 [DB30000] 🛛 💻 🗐 🗐
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CPU1516F [CPU 1516F-3 PN/DP]		3		ACK_NEC	Bool	true	TRUE						1=Acknowledgment for reintegration require
Transformation		4	-	ACK_REI	Bool	false	FALSE			\checkmark			1=Acknowledgment for reintegration
😼 Online & diagnostics		5		IPAR_EN	Bool	false	FALSE						Tag for parameter reassignment of fail-safe
Safety Administration	A 😐	6		DISABLE	Bool	false	FALSE						1=Disables F-I/O
🕶 🕁 Program blocks		7	-	Output									
📑 Add new block		8	-	PASS_OUT	Bool	true	TRUE						Passivation output
📲 Main [OB1]		9	-	QBAD	Bool	true	TRUE						1=Fail-safe values are output
MOTOR_SPEEDCONTROL [FC10]	•	10		ACK_REQ	Bool	false	FALSE						1=Acknowledgment requirement for reinteg
MOTOR_SPEEDMONITORING [FC11]	•	11	-	IPAR_OK	Bool	false	FALSE						Tag for parameter reassignment of fail-safe
MOTOR_AUTO [FB1]	•	12		DIAG	Byte	16#0	16#02						Non-fail-safe service information
MAGAZINE_PLASTIC [DB3]	•	13		DISABLED	Bool	false	FALSE						1=F-I/O disabled
MOTOR_AUTO_DB [DB1]	•	14	-00	InOut									
SPEED_MOTOR [DB2]	•	15	-	Static									
🔂 FOB_RTG1 [OB123]	•												
Main_Safety_RTG1 [FB0]	•												
Main_Safety_RTG1_DB [DB4]	•												
 System blocks 	•												
 STEP 7 Safety 	•												
F_ACK_GL [FB219]	•												
F_FDBACK [FB216]													
F_SFDOOR [FB217]	•												
F_SystemInfo_DB [DB30003]													
RTG1SysInfo [DB30002]	•												
▼ → F-I/O data blocks													
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F00210_F-DQ4x24VDC/2APMHF_1	[DB 🔵 🔊												

 \rightarrow Finally, disconnect the online connection (\rightarrow ^{Go offline})

P02200_F-DI8x24VDCHF_1 Mare Data type	oject tree	Ш	•	Press and a second		C 40:		🔚 🛄 <ean Safety → F-I/O</ean 				2 P	200_F-D18	x24VDCHF_1 [DB30000] 🛛 🗖 🗐
PO200_F-DI8x24/DCHF_1 Marre Data type Sate value Monitor value R Acc, Wr, Visi S. Sup Comment Monitor value R Acc, Wr, Visi S. Sup Comment Acc, Wr, Visi Sup Comment	Devices													
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Main [081] 9 QBAD Bool true TRUE V V 1 1=Failsafe values are output MOTOR_SPEEDCONTROL [FC10] 10 ACK_REQ Bool fails FALSE V V I 1=Acknowledgment requirement for reintered MOTOR_SPEEDCONTROL [FC11] 10 ACK_REQ Bool fails FALSE V V I T=Acknowledgment requirement for reintered MOTOR_AUTO [FB1] 12 DIAG Byte 1650 16#02 V V V Nonfailsafe service information MOTOR_AUTO [FB1] 13 Imout	💌 🙀 Program blocks	•	7	-00	▼ Output									
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•••••••••••••••••••••••••••••	📲 Main [OB1]	•	9	-00	QBAD	Bool	true	TRUE						1=Fail-safe values are output
•••••••••••••••••••••••••••••	MOTOR_SPEEDCONTROL [FC10]	•	1	0 -00	ACK_REQ	Bool	false	FALSE				\checkmark		1=Acknowledgment requirement for reinteg
MGAZNE_PLASTC [D83] 13 DiSABLED Bool faise FALSE V V 1=Fil0 disabled MOTOR_AUTO_D8 [D81] 14 inOut inOut I <	MOTOR_SPEEDMONITORING [FC11]	•	1	1 📶	IPAR_OK	Bool	false	FALSE						Tag for parameter reassignment of fail-safe
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MOTOR_JMOTOR_(D02) 14 Inout SPEED_MOTOR(D02) 15 Static Prog_RTG1 [0812] 15 Static Wain_Safety_RTG1_D08 [D84] 15 Static System blocks 15 Static SF_F_ACK_GL [F2219] 15 15 SF_F_Stafety 15 15 F_F_ACK_GL [F219] 15 15 SF_F_Stafety 15 15 SF_FACK_GL [F219] 15 15 SF_FStafety 15 15 SF_FStafety 15 15 SF_FStafety 15 15 SF_FACK_GL [F216] 15 15 SF_FStafety 15 15 STafety 15 15 <td>MAGAZINE_PLASTIC [DB3]</td> <td>•</td> <td>1</td> <td>3 📶</td> <td>DISABLED</td> <td>Bool</td> <td>false</td> <td>FALSE</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1=F-I/O disabled</td>	MAGAZINE_PLASTIC [DB3]	•	1	3 📶	DISABLED	Bool	false	FALSE						1=F-I/O disabled
POB_RTG1 [08123] ■ Main_Safey_RTG1 [FB0] ■ Main_Safey_RTG1 De [D84] ■ ■ System blocks ■ System blocks ■ F_ACK_GL [F8219] ■ F_PORACK [F8216] ■ F_System blocks ■ F_System blocks ■ F_PORACK [F8217] ■ F_System blocks ■ F_System blocks ■ F_System blocks ■ FACK_GL [F8217] ■ F_System blocks ■ F_System blocks ■ FACK_GL [F8217] ■ FACK_GL [F8217] ■ FACK_GL [F8217] ■ FACK_GL [F82000] ■ FACK_GL [F82000] ■ FACK_GL [F82000] ■ FACK_GL [F82000] ■ FACK_GL [F082002] ■ FACK_GL [F082002] ■ FACK_GL [F082002] ■ FACK_GL [F082002] ■ FACK_GL [F042002/APMMF_1 [D820002]	MOTOR_AUTO_DB [DB1]	•	1	4 🕣	InOut									
Main_Safety_RTG1 [FB0] Main_Safety_RTG1_DB [DB4] StEP.7 Safety STEP 7 Safety F.PACK_Cl [FB219] F.F.PACK_Cl [FB216] F.SFDOOR [FB217] F.SFDOOR [FB217] F.System Inic_DB [DB30003] F.System Inic_DB [DB30003] F.System Inic_DB [DB30003] F.SFDOOR [FB217] F.	SPEED_MOTOR [DB2]	•	1	5 -00	Static									
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P.ACK_GL [F8219] P.F.pBACK [F8216] P.System find_DB [D830003] P.System find_DB [D830002] P.System find_DB [D830002] P. Full data blocks P. PLO data blocks P. PLO poly-SAVDC/APMMF_1 [D830000]	🔻 🔯 System blocks	•												
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	F_FDBACK [FB216]	•												
IFG15ysInfe [DB30002] IEG200 IEG200 IEG200 IEG200 IEG200	F_SFDOOR [FB217]	•												
	F_SystemInfo_DB [DB30003]	•												
F00200_F-DI8\:24VDCHF_1 [D830000] F024\:24VDC/24FM-HF_1 [D8	RTG1SysInfo [DB30002]	•												
	 F-I/O data blocks 	•												
		0												
	F00210_F-DQ4x24VDC/2APMHF_1 [DB	2	~	<						111				

7.12 Archiving the project

 \rightarrow To archive the project, select the \rightarrow "Archive..." command in the \rightarrow "Project" menu.



→ Select a folder in which you want to archive your project and save the project. (\rightarrow sce-072-100-safety-pn-cpu1516f-et200sp... \rightarrow Archive)

Archive		×
Select source to	be archived:	
Name:	072-100_SAFETY PN CPU1516F and ET200SP]
Source path:	ET200SP\072-100_SAFETY PN CPU1516F and ET200SP.ap15_1]
Select settings f	or archiving:	
	Archive as compressed file	
	Discard restorable data	
	Add date and time to target name	
Target path:	C:\Users\mde\Desktop\sce-072-100-safety-pn-cpu1516f-et200:]
	Archive Cancel	

7.13 Checklist – step-by-step instructions

The following checklist helps trainees/students to independently check whether all steps of the step-bystep instruction have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Safety settings for the CPU 1516F-3 PN/DP activated.	
2	ET 200SP with IM 155-6PN HF configured.	
3	Device name of the ET 200SP assigned.	
4	Hardware configuration downloaded to the CPU1516F-3 PN/DP.	
5	PROFIsafe addresses assigned to the safety modules of the ET 200SP.	
6	Safety program created and downloaded.	
7	Program blocks successfully compiled and downloaded without error message. CPU is in RUN.	
8	Open the safety door -S11.1_DOOR_CONTACT_1 = 0 -S11.2_DOOR_CONTACT_2 = 0	
9	Close safety door and acknowledge -S11.1_DOOR_CONTACT_1 = 1 -S11.2_DOOR_CONTACT_2 = 1 -S12_ACKNOWLEDGE = 1	
10	Release EMERGENCY STOP and acknowledge -S10_EMERG_STOP = 1 -S12_Acknowledge = 1	
11	Signal feedback circuit at 1 -K20_FEEDBACK_LOOP = 1 Switch on system -K0 (main switch "ON") = 1 The main load contactors are then switched on -K20_LOAD_CONTACTOR = 1	
12	The signal feedback circuit changes to 0 within 1 second -K20_FEEDBACK_LOOP = 0	
13	Project archived successfully.	

8 Exercise

8.1 Task – Exercise

Program the two displays "-P4" (display "EMERGENCY STOP activated") and "-P8" (display "Acknowledgment requested") in a "SAFETY_DIAGNOSTICS" function and call them in organization block "Main".

In so doing, the display "-P4" (display "EMERGENCY STOP activated") is to light up when no safe release exists for switching on the main contractor for the load.

The display "-P8" (display "Acknowledgment requested") is always to light up when the "-S12_Acknowledge" button is to be actuated for acknowledging an error in the safety program or an error in the F-modules.

This is possible by programming within the "SAFETY_DIAGNOSTICS" function with access to the failsafe inputs and outputs and to the fail-safe data blocks.

At the block call of "MOTOR_AUTO[FB1]" the Signal "-A1" should be replaced by the release of the safety circuit.

DO	Туре	Identifier	Function	
Q 1.0	BOOL	-P4	Display "Emergency Stop activated"	
Q 1.4	BOOL	-P8	Display "Acknowledgment requested"	

8.2 Planning

Plan the implementation of the task by yourself.

8.3 Checklist – Exercise

The following checklist helps trainees/students to independently check whether all steps of the exercise have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Function "SAFETY_DIAGNOSTICS" created.	
1	Call and changes in OB1 completed.	
2	Program blocks successfully compiled and downloaded without	
2	error message.	
	Open the safety door	
	-S11.1_DOOR_CONTACT_1 = 0	
	$-S11.2_DOOR_CONTACT_2 = 0$	
3	or	
	Actuate EMERGENCY STOP	
	-S10_EMERG_STOP = 0	
	-P4 (display "Emergency Stop activated") = 1	
	Open the safety door	
	-S11.1_DOOR_CONTACT_1 = 0	
	-S11.2_DOOR_CONTACT_2 = 0	
4	Close the safety door again	
-	-S11.1_DOOR_CONTACT_1 = 1	
	-S11.2_DOOR_CONTACT_2 = 1	
	Safety door opened and closed again	
	-P8 (display "Emergency Stop activated") = 1	
	Actuate EMERGENCY STOP	
	-S10_EMERG_STOP = 0	
5	Release EMERGENCY STOP	
0	-S10_EMERG_STOP = 1	
	EMERGENCY STOP actuated and released again	
	-P8 (display "Acknowledgment requested") =1	
6	Fault in feedback circuit occurred and eliminated again	
	-P8 (display "Acknowledgment requested") =1	
	Fault in input module	
7	F-DI8x24VDCHF_1 occurred and eliminated again	
	-P8 (display "Acknowledgment requested") =1	
	Fault in fail-safe output module	
8	F-DQ4x24VDC/2APMHF_1 occurred and eliminated again	
	-P8 (display "Acknowledgment requested") =1	
13	Project archived successfully.	

9 Additional information

You can find additional information as an orientation aid to familiarize yourself or deepen your knowledge, for example: Getting Started, videos, tutorials, apps, manuals, programming guidelines and trial software/ firmware, under the following link:

siemens.com/sce/safety

"Additional information" preview \rightarrow in preparation

Additional information

Siemens Automation Cooperates with Education siemens.com/sce

SCE Learn-/Training Document siemens.com/sce/module

SCE Trainer Packages siemens.com/sce/tp

SCE Contact Partners siemens.com/sce/contact

Digital Enterprise siemens.com/digital-enterprise

Industrie 4.0 siemens.com/future-of-manufacturing

Totally Integrated Automation (TIA) siemens.com/tia

TIA Portal siemens.com/tia-portal

SIMATIC Controller siemens.com/controller

SIMATIC Technical Documentation siemens.com/simatic-docu

Industry Online Support support.industry.siemens.com

Industry Mall catalog and ordering system mall.industry.siemens.com

Siemens Digital Industries, FA P.O. Box 4848 90026 Nuremberg Germany

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