TECHNICAL INFORMATION

microScan3 - PROFINET

Safety laser scanner

SIMATIC STEP 7

SICK
Sensor Intelligence.

Described product

microScan3 - PROFINET

Manufacturer

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Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Purpose of this document

This integration example guides you step by step through the process of integrating a safety laser scanner of type microScan3 – PROFINET (all variants) into a SIMATIC STEP 7 project.

Depending on the application, it is possible that this integration example may not suit your specific application case. The experts at SICK can, on request, assist you with the integration.

SICK cannot guarantee that the following integration example will be error-free when implemented, e.g., due to future changes to SIMATIC Manager STEP 7. SICK assumes no liability for any damage that may result from the use of this integration example.

This example was created using version V5.5 + SP4 + HF11 of SIMATIC Manager STEP 7. The descriptions in this document may therefore vary for future versions of the software.

1.2 Scope

Product

This document applies to the following products:

- Product designation: microScan3 - PROFINET

Document identification

Document part number:

- This document has the following part number: 8026537
- All available language versions of this document are available under the following part number: 8026530

You can find the current version of all documents at www.sick.com.

1.3 Target groups

This document is intended for system integrators who want to integrate the safety laser scanner into their application.

1.4 Symbols and document conventions

The following symbols and conventions are used in this document:

Safety notes and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Indicates useful tips and recommendations.

Instructions to action

▶ The arrow denotes instructions to action.

1. The sequence of instructions for action is numbered.
2. Follow the order in which the numbered instructions are given.

✓ The check mark denotes the result of an instruction.

2 Integration

2.1 Preparing for the integration

Approach

1. Update Safety Designer and SIMATIC STEP 7 to the latest release (version and, if applicable, hotfix).
2. Configure the safety laser scanner using Safety Designer. Some parameters can only be specified via Safety Designer.

2.2 Installing microScan3 - PROFINET GSDML

Overview

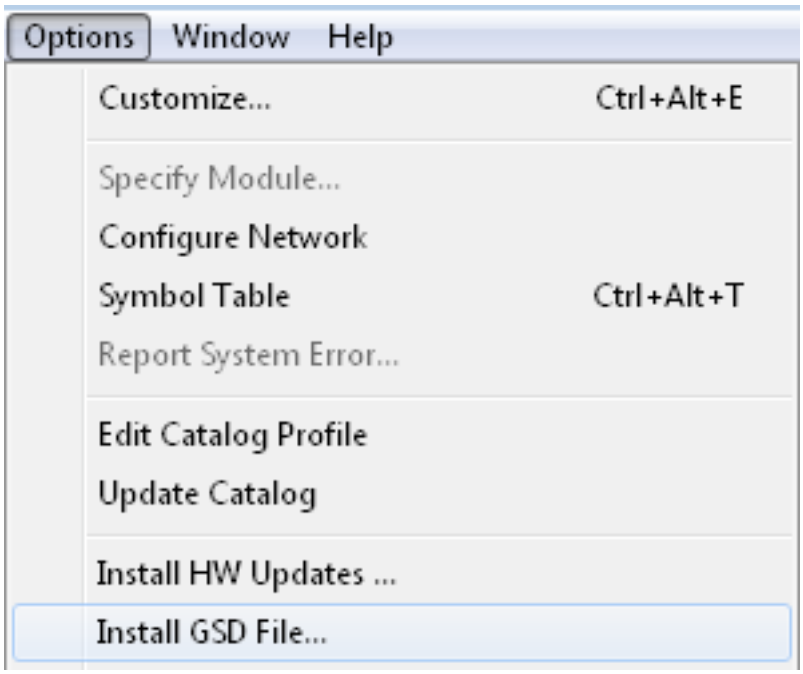
The GSDML file contains the device description of the safety laser scanner for the controller. It only needs to be installed once.

Important information

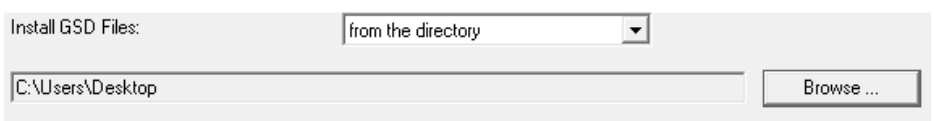
NOTE
Always install the latest GSDML file in the controller.

Approach

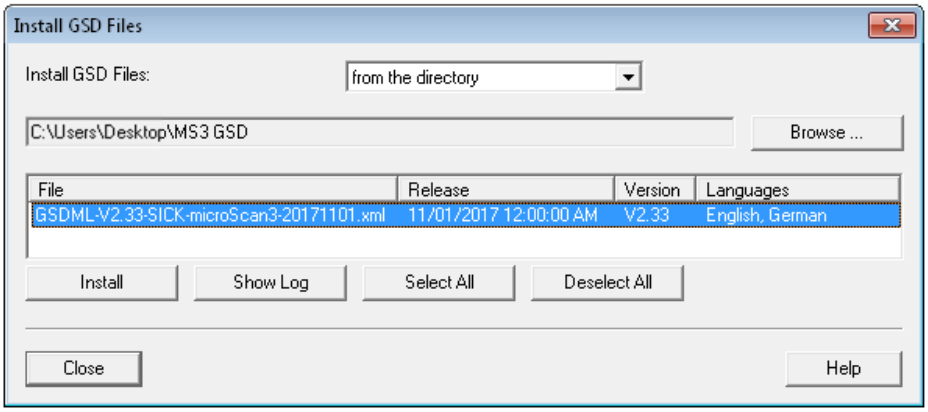
1. The current GSDML file for integrating the safety laser scanner into the controller can be downloaded at www.sick.com.
2. In SIMATIC STEP 7 (**HW Config**): **Options** > **Install GSD File...**



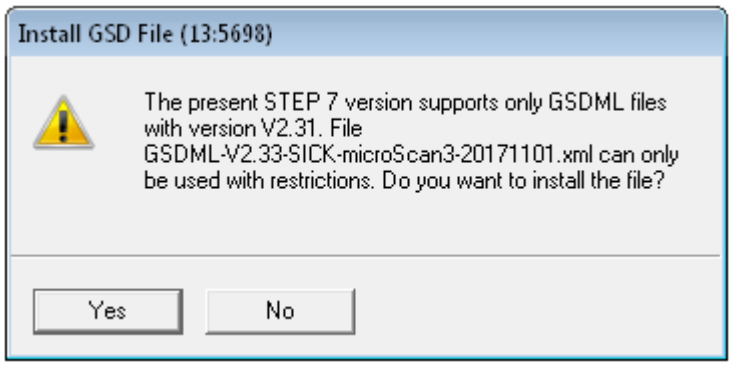
3. Select the folder containing the GSDML file.



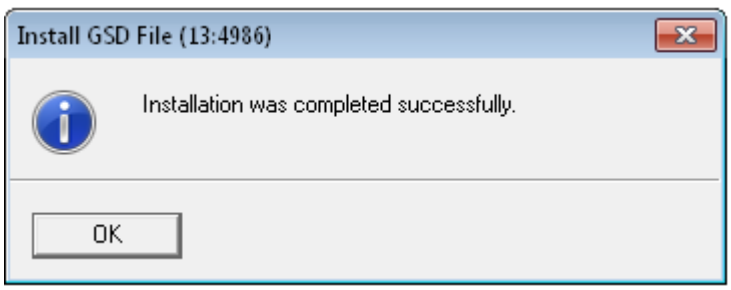
4. Select the GSDML file and click on **Install**.



5. If the following message appears, click **Yes** to confirm it.



✓



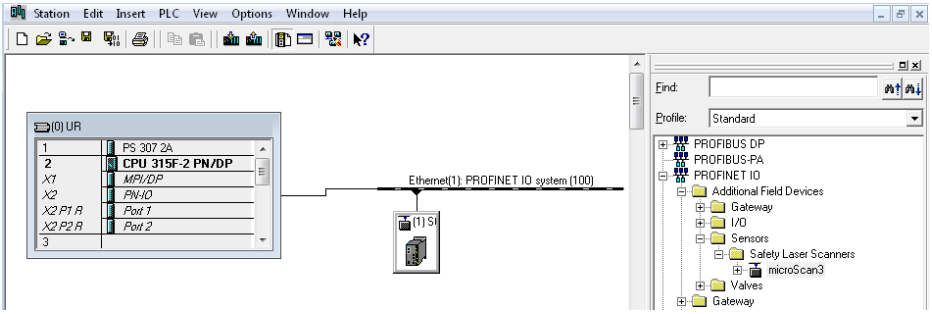
2.3 Integrating the safety laser scanner

Prerequisites

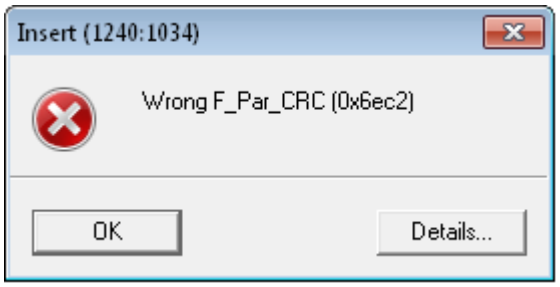
The GDSML file of the safety laser scanner has been installed.

Approach

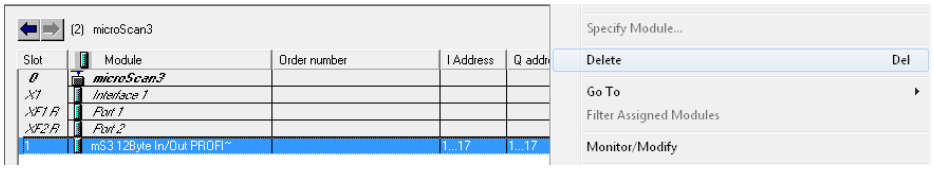
1. In the **HW Config** tab: Using drag and drop, drag **microscan3** from the **Catalog** to **PROFINET IO system**. You will find microScan3 under **PROFINET IO** > **Additional Field Devices** > **Sensors** > **Safety Laser Scanners**.



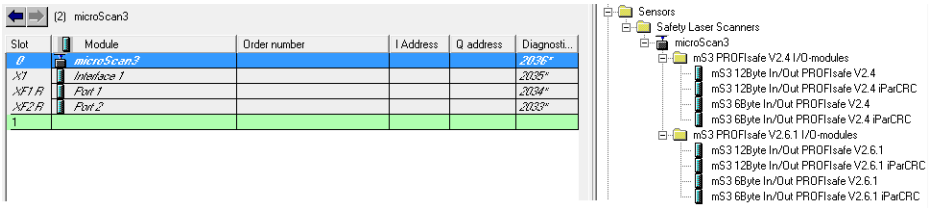
2. If the following message appears, click **OK** to confirm it.

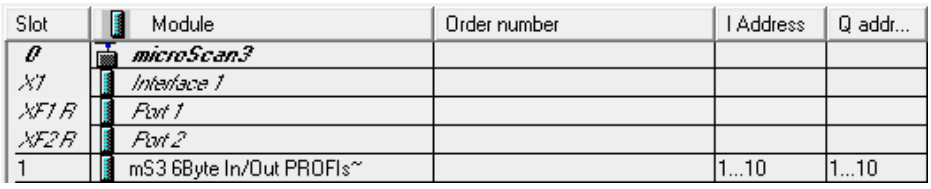


3. Select a suitable module.
see "Overview of the process images", page 13
4. If applicable, right-click on the standard module (**Slot 1**) and select Delete to remove it.

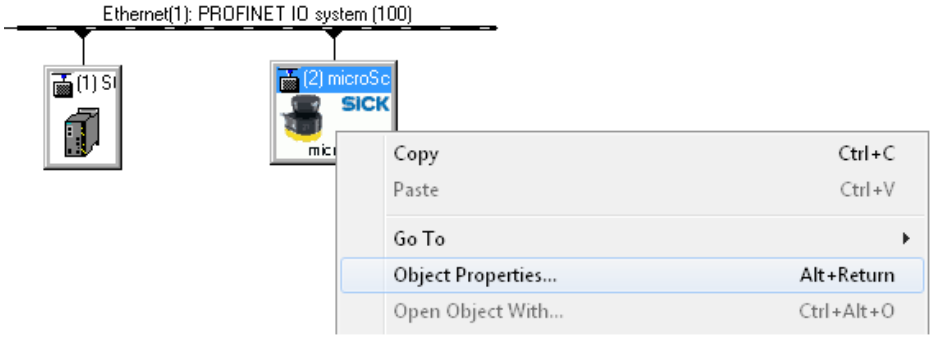


5. To add a new module, double-click on the desired module in the **Catalog**. Alternatively, use drag and drop to drag the desired module into **Slot 1**.

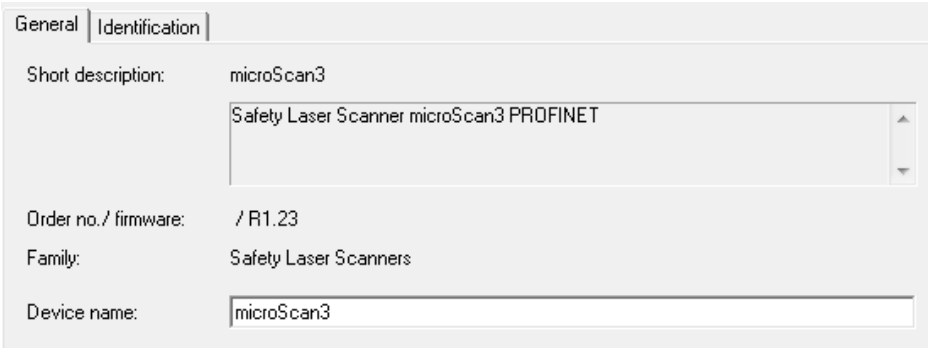




6. Double-click on **microScan 3**. Alternatively, right-click > **Object Properties**.

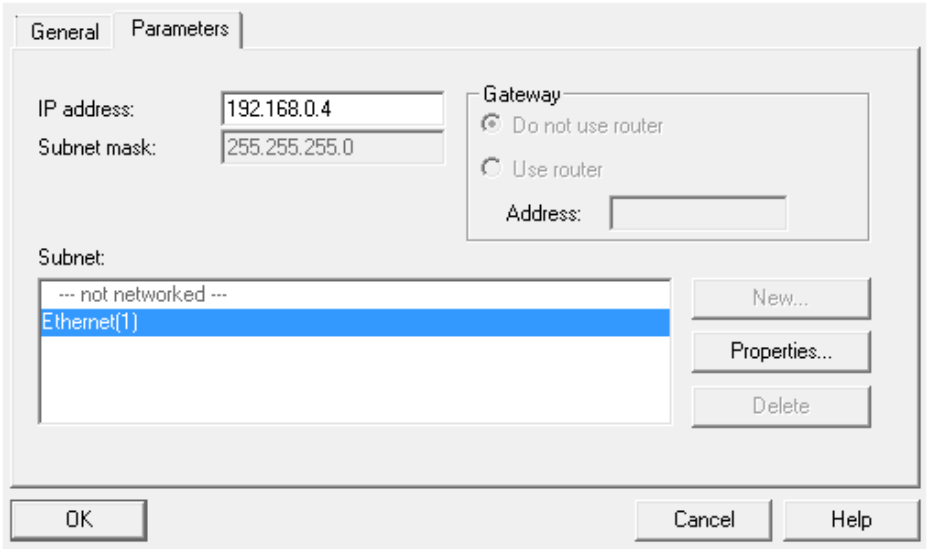


7. **General** > **Properties**
8. Enter the **Device name** (PROFINET name). The entered **Device name** must match the **Profinet Name** field in Safety Designer.

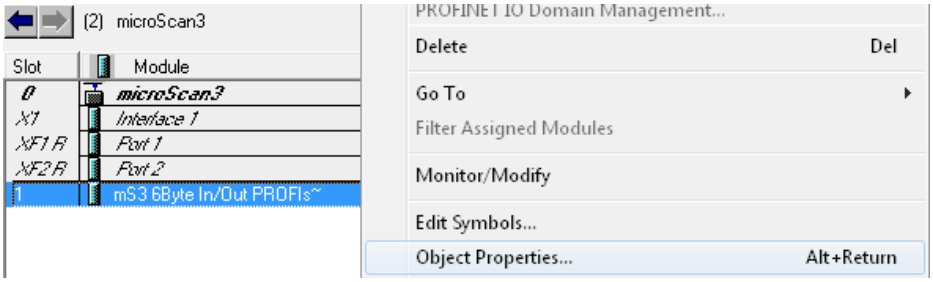


9. **General** > **Properties** > **Ethernet...**

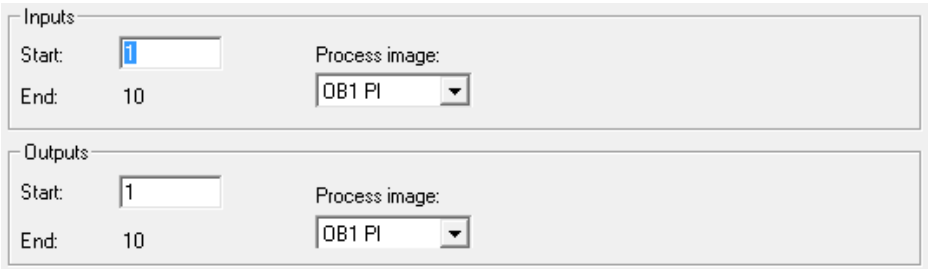
10. Enter the **IP address** and click **OK** to confirm. The entered value must match the value configured in Safety Designer.
11. Close the window.



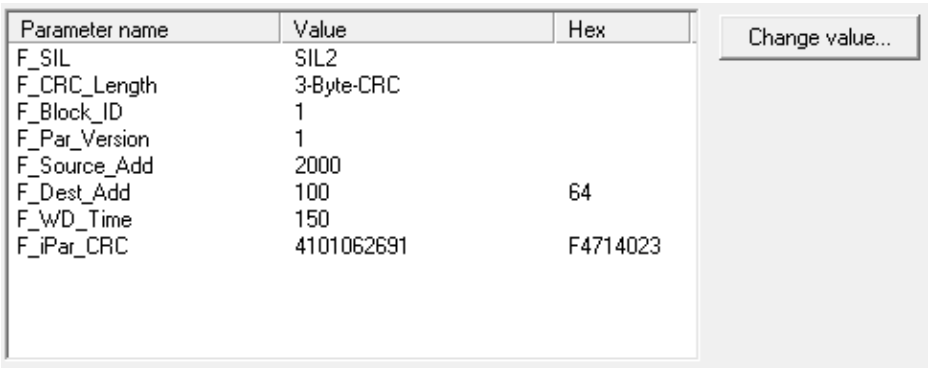
12. Double-click on the module in **Slot1** (e.g., mS3 6Byte In/Out...). Alternatively, right-click > **Object Properties...**.



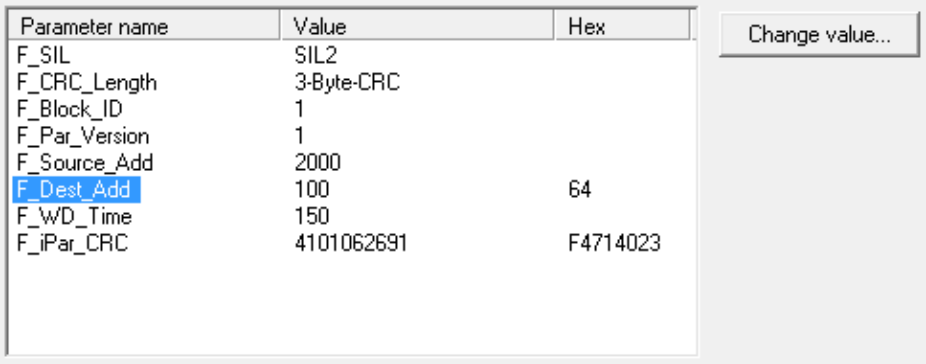
13. Under **Addresses:** Enter the **Start address**. The value is generated automatically in SIMATIC STEP 7 but can be modified if necessary.



14. **Properties** > **PROFIsafe**
15. Enter the **F_Dest_Add**, **F_WD_Time** and, if applicable, **F_iPar_CRC**.



16. To modify a value: Select the parameter and click **Change value...**. The entered values must match the values configured in Safety Designer.
see "Overview of the PROFIsafe parameters", page 12



✓ The safety laser scanner has been successfully integrated into the hardware configuration.

3 Overview of the PROFIsafe parameters

Several PROFIsafe parameters are available. Of these parameters, the following are relevant for integrating the device.

- **F_Dest_Add**
  F destination address. For PROFIsafe communication, the safety laser scanner needs a clear F_Dest_Add. You need to enter the same value as the one configured in Safety Designer.
- **F_WD_Time**
  Watchdog time (monitoring time) for the cyclical service. The watchdog time should be long enough to tolerate short delays in communication. It does, however, have an effect on the response time of the overall system (for example in the event of a fault) and is therefore safety-relevant.
  The default value is 150 ms. This is adequate in many cases. The integrator needs to check the value and, if necessary, adjust it to avoid errors at a later time.
- **F_iPar_CRC**
  Checksum of the safety configuration. Is used to check whether the safety-relevant settings were changed. The entered value must match the value configured in Safety Designer for the configuration checksum (function and network). It is only needed if a process image is used where F_iPar_CRC is checked (module with the suffix –iParCRC). This parameter must be updated if the configuration of the safety laser scanner is modified in any way. If the parameter is not updated (e.g., due to an unauthorized modification of the configuration), the controller goes into the safe state.

4 Overview of the process images

Variants

The microScan3 - PROFINET supports 8 PROFIsafe process images (in the controller: **modules**). The 8 process images can be divided into 2 groups depending on the PROFIsafe version (2.4 or 2.6.1). Which process images to use depends on the version of PROFIsafe that the controller supports. If you do not know which PROFIsafe version your controller supports, use the process images for PROFIsafe version 2.4.

PROFIsafe version 2.4	PROFIsafe version 2.6.1
12-byte 12-byte with iParCRC 6-byte 6-byte with iParCRC	12-byte 12-byte with iParCRC 6-byte 6-byte with iParCRC

The process images differ with regard to their size (6 bytes or 12 bytes) and the incorporation of the iParCRC parameter.

6-byte process images must be used in the following cases:

- Only a limited range of peripheral addresses are available in your application.
- The microScan3 PROFINET is replacing a safety laser scanner of type S3000 PROFINET.
- The safety software for your S7 does not support 12-byte process images.

If your application requires constant monitoring of the checksums of the sensor configuration, use a process image with iParCRC.

Structure of the process image (12 bytes)

Table 1: Safety-related PROFIsafe process image: input of the device, output of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved				ActivateStandbyMode	StopAlarmDetection	Reserved	TriggerRunMode
1	SetMonitoringCaseNoTable1							
2	Reserved							
3	Reserved							
4	Reserved							
5	Reserved							
6	Reserved							
7	Reserved							
8	Reserved							
9 [1]	TriggerResetCutOffPath08	TriggerResetCutOffPath07	TriggerResetCutOffPath06	TriggerResetCutOffPath05	TriggerResetCutOffPath04	TriggerResetCutOffPath03	TriggerResetCutOffPath02	TriggerResetCutOffPath01
10	Reserved							
11	Reserved						TriggerDeviceRebootWithNetwork	TriggerDeviceRebootWithoutNetwork

[1] Cut-off paths 5 to 8 are only available for the Pro performance package.

Table 2: Safety-related PROFIsafe process image: output of the device, input of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		ManipulationStatus	ReferenceContourStatus	ContaminationError	ContaminationWarning	StandbymodeActive	RunModeactive
1 [1]	SafeCutOffPath08	SafeCutOffPath07	SafeCutOffPath06	SafeCutOffPath05	SafeCutOffPath04	SafeCutOffPath03	SafeCutOffPath02	SafeCutOffPath01
2	Reserved							
3 [1]	NonsafeCutOffPath08	NonsafeCutOffPath07	NonsafeCutOffPath06	NonsafeCutOffPath05	NonsafeCutOffPath04	NonsafeCutOffPath03	NonsafeCutOffPath02	NonsafeCutOffPath01
4	Reserved							
5 [1]	ResetRequiredCutOffPath08	ResetRequiredCutOffPath07	ResetRequiredCutOffPath06	ResetRequiredCutOffPath05	ResetRequiredCutOffPath04	ResetRequiredCutOffPath03	ResetRequiredCutOffPath02	ResetRequiredCutOffPath01
6	Reserved							
7	CurrentMonitoringCaseNoTable1							
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved						DeviceError	ApplicationError

[1] Cut-off paths 5 to 8 are only available for the Pro performance package.

Table 3: Non-safety-related PROFINET process image: output of the device, input of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		ManipulationStatus	ReferenceContourStatus	ContaminationError	ContaminationWarning	StandbymodeActive	RunModeactive
1 [1]	StatusSafeCutOffPath08	StatusSafeCutOffPath07	StatusSafeCutOffPath06	StatusSafeCutOffPath05	StatusSafeCutOffPath04	StatusSafeCutOffPath03	StatusSafeCutOffPath02	StatusSafeCutOffPath01
2	Reserved							
3 [1]	NonsafeCutOffPath08	NonsafeCutOffPath07	NonsafeCutOffPath06	NonsafeCutOffPath05	NonsafeCutOffPath04	NonsafeCutOffPath03	NonsafeCutOffPath02	NonsafeCutOffPath01
4	Reserved							
5 [1]	ResetRequiredCutOffPath08	ResetRequiredCutOffPath07	ResetRequiredCutOffPath06	ResetRequiredCutOffPath05	ResetRequiredCutOffPath04	ResetRequiredCutOffPath03	ResetRequiredCutOffPath02	ResetRequiredCutOffPath01
6	Reserved							
7	CurrentMonitoringCaseNoTable1							
8	Reserved							
9	Reserved							
10	Reserved							
11	Reserved						DeviceError	ApplicationError

[1] Cut-off paths 5 to 8 are only available for the Pro performance package.

Structure of the process image (6 bytes)

Table 4: Safety-related PROFIsafe process image: input of the device, output of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved				ActivateS-tandbyMode	StopAlarm-Detection	Reserved	TriggerRun-Mode
1	SetMonitoringCaseNoTable1							
2	Reserved							
3 [1]	TriggerReset-CutOff-Path08	TriggerReset-CutOff-Path07	TriggerReset-CutOff-Path06	TriggerReset-CutOff-Path05	TriggerReset-CutOff-Path04	TriggerReset-CutOff-Path03	TriggerReset-CutOff-Path02	TriggerReset-CutOff-Path01
4	Reserved							
5	Reserved						TriggerDevi-ceReboot-WithNetwork	TriggerDevi-ceRebootWi-thoutNet-work

1) Cut-off paths 5 to 8 are only available for the Pro performance package.

Table 5: Safety-related PROFIsafe process image: output of the device, input of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Manipula-tionStatus	Reference-ContourSta-tus	Contamina-tionError	Contamina-tionWarning	Standbymo-deActive	RunModeac-tive
1 [1]	SafeCutOff-Path08	SafeCutOff-Path07	SafeCutOff-Path06	SafeCutOff-Path05	SafeCutOff-Path04	SafeCutOff-Path03	SafeCutOff-Path02	SafeCutOff-Path01
2 [1]	NonsafeCu-tOffPath08	NonsafeCu-tOffPath07	NonsafeCu-tOffPath06	NonsafeCu-tOffPath05	NonsafeCu-tOffPath04	NonsafeCu-tOffPath03	NonsafeCu-tOffPath02	NonsafeCu-tOffPath01
3 [1]	ResetRequir-edCutOff-Path08	ResetRequir-edCutOff-Path07	ResetRequir-edCutOff-Path06	ResetRequir-edCutOff-Path05	ResetRequir-edCutOff-Path04	ResetRequir-edCutOff-Path03	ResetRequir-edCutOff-Path02	ResetRequir-edCutOff-Path01
4	CurrentMonitoringCaseNoTable1							
5	Reserved						DeviceError	Applicatio-nError

1) Cut-off paths 5 to 8 are only available for the Pro performance package.

Table 6: Non-safety-related PROFINET process image: output of the device, input of the control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved		Manipula-tionStatus	Reference-ContourSta-tus	Contamina-tionError	Contamina-tionWarning	Standbymo-deActive	RunModeac-tive
1 [1]	StatusSafe-CutOff-Path08	StatusSafe-CutOff-Path07	StatusSafe-CutOff-Path06	StatusSafe-CutOff-Path05	StatusSafe-CutOff-Path04	StatusSafe-CutOff-Path03	StatusSafe-CutOff-Path02	StatusSafe-CutOff-Path01
2 [1]	NonsafeCu-tOffPath08	NonsafeCu-tOffPath07	NonsafeCu-tOffPath06	NonsafeCu-tOffPath05	NonsafeCu-tOffPath04	NonsafeCu-tOffPath03	NonsafeCu-tOffPath02	NonsafeCu-tOffPath01
3 [1]	ResetRequir-edCutOff-Path08	ResetRequir-edCutOff-Path07	ResetRequir-edCutOff-Path06	ResetRequir-edCutOff-Path05	ResetRequir-edCutOff-Path04	ResetRequir-edCutOff-Path03	ResetRequir-edCutOff-Path02	ResetRequir-edCutOff-Path01
4	CurrentMonitoringCaseNoTable1							
5	Reserved						DeviceError	Applicatio-nError

1) Cut-off paths 5 to 8 are only available for the Pro performance package.

Addressing the bits in the controller

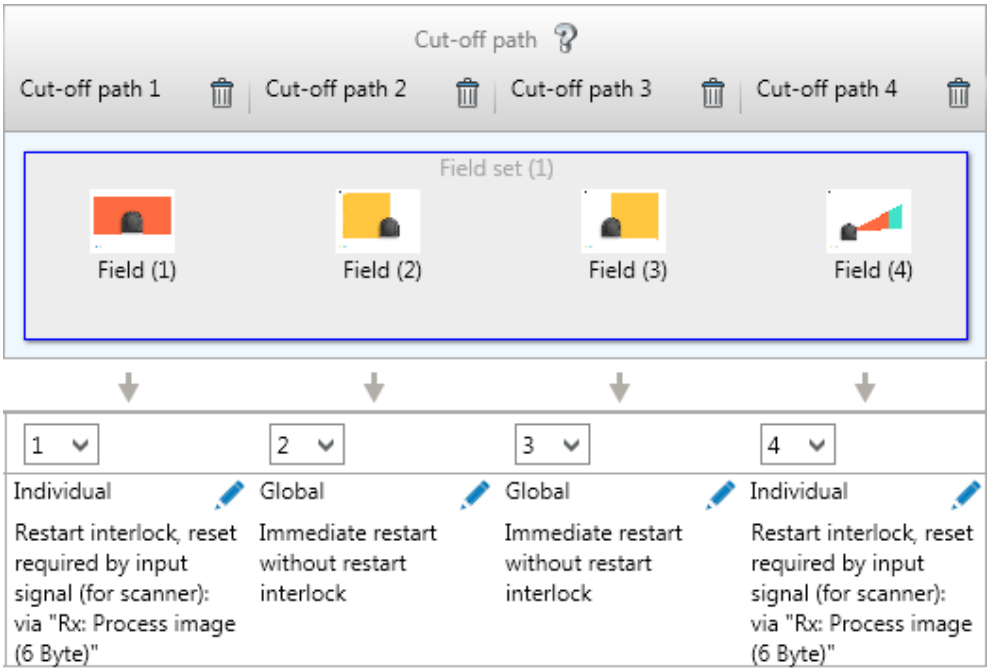
The bits of the process images can be accessed in the logic using the following scheme: **Ix.x** and **Qx.x.** The start byte (byte 0) is relative to the specified **Start address.**

If **Start address** is set to the value 17, then the output bit 0.0 in the logic can be accessed as **Q17.0**. The input bit 3.1 then corresponds to **I20.1**.

5 Notes on implementing the process images

Safety-related cut-off paths and non-safety-related cut-off paths

In the following example, cut-off paths 1 (protective field) and 4 (contour detection field) are safety-related. Cut-off paths 2 and 3 (warning fields) are non-safety-related.



When incorporating the cut-off paths into the logic, the user can select a suitable byte from the assembly. A cut-off path with a protective field or contour detection field is always regarded as safety-related. A cut-off path with a warning field is always regarded as non-safety-related.

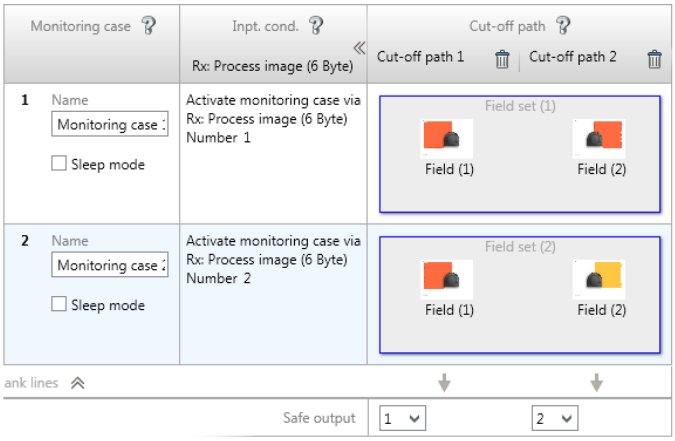
Table 7: Example 6-byte process image

Function (Safety Designer)	Field type	Allocation in the process image	Data	Safe
Cut-off path 1	Protective field	Safety-related cut-off path 1	I1.0	Yes
Cut-off path 2	Warning field	Non-safety-related cut-off path 2	I2.1	No
Cut-off path 3	Warning field	Non-safety-related cut-off path 3	I2.2	No
Cut-off path 4	Contour detection field	Safety-related cut-off path 4	I1.3	Yes

Behavior with mixed field types

When a cut-off path with safe and non-safe fields (e.g., protective field and warning field) is used in different monitoring cases and the monitoring case with the warning field is active, then the safe cut-off path is deactivated. As a result, the bit for this safe cut-off path is LOW and the display of the safety laser scanner indicates the OFF state.

The following example illustrates this behavior in the configuration and in the display of the device. All fields are clear in this example (no field detection).


Monitoring case
Inpt. cond.
Rx: Process image (6 Byte)
Cut-off path
Cut-off path 1
Cut-off path 2
1
Name
Monitoring case 1
Sleep mode
Activate monitoring case via Rx: Process image (6 Byte) Number 1
Field set (1)
Field (1)
Field (2)
2
Name
Monitoring case 2
Sleep mode
Activate monitoring case via Rx: Process image (6 Byte) Number 2
Field set (2)
Field (1)
Field (2)
ank lines
Safe output
1
2


SICK
0001
SICK
1

6 Troubleshooting

Error indicators in SIMATIC STEP7

*Table 8: **Online "Module information..." of the microScan3 (online in HW Config):***

General	IO Device Diagnostics	Possible causes
Failed	Incorrect module in slot: n	• Incorrect microScan3 PROFIsafe module configured in TIA Portal. • Incorrect process image selected in Safety Designer.
Faulty module (diagnostics interrupt detected)	PROFIsafe transmission error: timeout (F_WD_Time elapsed)	• F_WD_Time set too short. • Problems executing the safety program. Check the organizational components and the program structure.
Module configured, but not available	Empty	• Incorrect PROFINET device name • Faulty connection between the safety laser scanner and the controller (e.g., defective cable) • Voltage supply to the safety laser scanner is interrupted
Faulty module (diagnostics interrupt detected)	Mismatch of failsafe destination address (F_Dest_Add)	F_Dest_Add does not match the configuration in Safety Designer.
Faulty module (diagnostics interrupt detected)	Inconsistent iParameters iParCRC error)	F_iPar_CRC does not match the configuration in Safety Designer.

Table 9: After saving and compiling the HW Config configuration

Message	Possible cause
The system data could not be recreated because the configuration is inconsistent (Details: CRC error in the F-I/O with the I/O address...)	The selected module or process image is not supported by the controller.
Could not complete initialization of the safety program (Details: A parameter S7FTO_COUNT_PS_Input...)	The selected module or process image is not supported by the controller.

Error indicators on the microScan3 – network LEDs

The safety laser scanner has two PROFINET LEDs in addition to the Ethernet LEDs.

Table 10: Bus error LED, inscription: BF

LED status	Meaning	Troubleshooting
○	No supply voltage or PROFINET communication not active or device is not configured	▶ Check power supply, wiring and connected communication partners. ▶ Restart device. ▶ Check the configuration of the device.
● Green	PROFINET communication is active	–
☼ Green	No connection to control unit	▶ Check PROFINET names. ▶ Check the control unit. ▶ Start the controller.

LED status	Meaning	Troubleshooting
● Red	Serious error, device not ready	▶ Check device. ▶ Restart device. ▶ Replace device.
☼ Red	Incorrect PROFINET configuration	▶ Check the PROFINET configuration, in particular F_Dest_Add.
☼ Red/green	PROFINET alarm is active	▶ Check the cause of the error in the configuration program of the controller and observe the help text. ▶ Check the alarm in the Safety Designer.

Table 11: System error LED, inscription: BF

LED status	Meaning	Troubleshooting
○	No supply voltage or PROFIsafe communication not initialized or not active or incorrect process image selected	▶ Trigger or launch PROFIsafe communication. ▶ Check whether the same process image is selected in the controller and in the device (6 bytes or 12 bytes)
● Green	PROFIsafe communication is active	–
☼ 0.5 Hz, green	Passivation of the device has been completed, e.g. after communication error or connection termination	▶ Perform reintegration of the device.
☼ 2 Hz, green	A process image with F_iPar_CRC is used, but value 0 is specified as F_iPar_CRC.	▶ Enter the correct F_iPar_CRC in the configuration program of the controller. ▶ Use process image without F_iPar_CRC.
● Red	Serious error, device not ready	▶ Check and restart the device. ▶ Replace device.
☼ Red	Incorrect PROFIsafe configuration	▶ Check the PROFIsafe parameters, in particular, F_Dest_Add, WD_Time, F_iPar_CRC. ▶ Check the PROFINET connection (see table 10, page 19).

Error indicators on the microScan3 – network LEDs

The safety laser scanner has two PROFINET LEDs in addition to the Ethernet LEDs.

Table 12: Bus error LED, inscription: BF

LED status	Meaning	Troubleshooting
○	No supply voltage or PROFINET communication not active or device is not configured	▶ Check power supply, wiring and connected communication partners. ▶ Restart device. ▶ Check the configuration of the device.
● Green	PROFINET communication is active	–
☼ Green	No connection to control unit	▶ Check PROFINET names. ▶ Check the control unit. ▶ Start the controller.
● Red	Serious error, device not ready	▶ Check device. ▶ Restart device. ▶ Replace device.

LED status	Meaning	Troubleshooting
Red	Incorrect PROFINET configuration	▶ Check the PROFINET configuration, in particular F_Dest_Add.
Red/green	PROFINET alarm is active	▶ Check the cause of the error in the configuration program of the controller and observe the help text. ▶ Check the alarm in the Safety Designer.

Table 13: System error LED, inscription: BF

LED status	Meaning	Troubleshooting
○	No supply voltage or PROFIsafe communication not initialized or not active or incorrect process image selected	▶ Trigger or launch PROFIsafe communication. ▶ Check whether the same process image is selected in the controller and in the device (6 bytes or 12 bytes)
● Green	PROFIsafe communication is active	–
0.5 Hz, green	Passivation of the device has been completed, e.g. after communication error or connection termination	▶ Perform reintegration of the device.
2 Hz, green	A process image with F_iPar_CRC is used, but value 0 is specified as F_iPar_CRC.	▶ Enter the correct F_iPar_CRC in the configuration program of the controller. ▶ Use process image without F_iPar_CRC.
● Red	Serious error, device not ready	▶ Check and restart the device. ▶ Replace device.
Red	Incorrect PROFIsafe configuration	▶ Check the PROFIsafe parameters, in particular, F_Dest_Add, WD_Time, F_iPar_CRC. ▶ Check the PROFINET connection (see table 10, page 19).

Diagnostics using the display

You can use the buttons at the front of the safety laser scanner to display the PROFINET alarms.

1. Press the OK button twice.
2. **Diagnostics** > **PROFINET alarms**

NOTE

Active alarms are also displayed in the **online module information** in Safety Designer and in SIMATIC Step 7.

Why does “Waiting for input” appear on the display?

- The safety laser scanner has not yet received a valid bit from the controller for selecting a monitoring case.
- There is an error in the PROFINET/PROFIsafe parameters.

S3000 PROFINET vs microScan3 - PROFINET

If the microScan3 - PROFINET is replacing a safety laser scanner of type S3000 PROFINET, take into consideration that the process image has a different structure even though the size of the process image remains the same at 6 bytes.