EUCHNER

Application

Integrating MGB2 Modular in STEP 7 V5.5

EN

From V1.5.8

Contents

1. About this document

1.1. Version

Version	Date	Change/addition	Chapter
01-12/18	05.12.2018	Prepared	All

1.2. Scope

The purpose of this document is to integrate and configure the MGB2 *Modular* using SIEMENS SIMATIC Manager and STEP 7 version 5.5.

1.3. Target group

Design engineers and installation planners for safety systems on machines, as well as setup and servicing staff possessing special expertise in handling safety components as well as expertise in the installation, setup, programming and diagnostics of programmable logic controllers (PLC) and bus systems.

1.4. Supplementary documents

The overall documentation for this application consists of the following documents:

Document title (document number)	Contents	
Operating Instructions (2500235)	System and configuration manual for the modular bus module	
Safety Information and Maintenance (2500232)	Information sheet with important safety information	
Operating instructions for the modules connected and their submodules	Device-specific information for the related module and the submodules installed.	
Possibly enclosed data sheets	Item-specific information about deviations or additions	

1.5. Notice

This application is based on the MGB2 *Modular* operating instructions. Please refer to the operating instructions for the technical details and other information.

EN

2. Components/modules used

2.1. EUCHNER

Description	Order number / item number
Safety system MGB2 *Modular* with modular bus module MBM (PROFINET interface), guard locking with guard locking monitoring	156386 / MGB2-L1HB-PN-U-S4-D-R-156386
	156387 / MGB2-L1HB-PN-U-S4-D-L-156387
	156388 / MGB2-L1HB-PN-U-S3-D-R-156388
	156389 / MGB2-L1HB-PN-U-S3-D-L-156389
	156390 / MGB2-L2HB-PN-U-S3-D-R-156390
	156391 / MGB2-L2HB-PN-U-S3-D-L-156391

2.1.1. Items included in the MGB2 *Modular* set

Description	Order number/item number	MGB2 *Modular* set					
		156386	156387	156388	156389	156390	156391
Modular bus module MBM	156310 / MBM-PN-S3-MLI-3B-156310	-	-	●	●	●	●
	156312 / MBM-PN-S4-MLI-3B-156312	●	●	-	-	-	-
Locking module MGB2-L	136776 / MGB2-L1-MLI-U-Y0000-BJ-136776	●	●	●	●	-	-
	156392 / MGB2-L2-MLI-U-Y0000-BJ-156392	-	-	-	-	●	●
Submodule: emergency stop + two pushbuttons	136687 / MSM-1-P-CA-BPP-A1-136687	●	●	●	●	●	●
Submodule: three slide-in labels	137610 / MSM-1-N-AA-QQQ-B1-137610	●	●	●	●	●	●
Handle module	136691 / MGB2-H-BA1A3-R-136691	●	-	●	-	●	-
	156394 / MGB2-H-BA1A3-L-156394	-	●	-	●	-	●
Module connector MLI	157024 / AC-MC-SB-M-A-157024	●	●	●	●	●	●
Blanking cover MLI	156718 / AC-MC-00-0-B-156718	●	●	●	●	●	●

Key to symbols		
	●	Included in the MGB2 *Modular* set
	-	Not included in the MGB2 *Modular* set

Tip: More information and downloads about the aforementioned EUCHNER products can be found at www.euchner.com. Simply enter the order number in the search box.

2.2. Others

Description	Order number / item number
SIMATIC S7-300 CPU315F-2 PN/DP	6ES7 315-2FJ14-0AB0

2.3. Software

Description	Version
S7 Distributed Safety Programming	V5.4 + SP5
STEP 7	V5.5 + SP4+HF11
S7 F ConfigurationPack	V5.5 + SP12

3. Functional description

The MGB2-L1HB-PN-.. is a guard locking device in accordance with EN ISO 14119 according to the closed-circuit current principle, the MGB2-L2HB-PN-.. is a guard locking device in accordance with EN ISO 14119 according to the open-circuit current principle. In this example, all safety functions are processed via the PROFIsafe protocol. The MGB2 *Modular* is connected to a SIMATIC S7-300 CPU315F-2 PN/DP from Siemens via the bus module.

4. Overview of the communication data

4.1. Input

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	BM.E_G	-	BM.E_SYS	-	-	BM.E_ML2	BM.E_ML1	BM.D_RUN
2nd byte	Diagnostics byte (pluggable)							

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	LM.E_G	LM.E_ER	LM.E_SM1	LM.E_SM0	-	LM.I_UK	LM.I_SK	LM.D_RUN
2nd byte	-	-	-	-	-	LM.I_OL	LM.I_OT	LM.I_OD
3rd byte	Diagnostics byte (pluggable)							

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	-	-	SM.E_S1	-	-	SM.I_S3	SM.I_S2	SM.I_S1
2nd byte	Diagnostics byte (pluggable)							

PROFIsafe	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	-	-	-	-	-	SM.FI_ES	LM.FI_UK	LM.FI_SK
2nd byte	-	-	-	-	-	-	-	-
Byte 3-6	Used within PROFIsafe (control byte, CRC, etc.)							

4.2. Output

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	BM.ACK_G	-	-	-	-	-	-	-

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	LM.ACK_G	LM.ACK_ER	-	-	-	-	-	LM.O_CL

PROFINET	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	-	-	SM.O_H3_B	SM.O_H2_B	SM.O_H1_B	SM.O_H3	SM.O_H2	SM.O_H1

PROFIsafe	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	-	-	-	-	-	-	-	LM.FO_CL
2nd byte	-	-	-	-	-	-	-	-
Byte 3-6	Used within PROFIsafe (status byte, CRC, etc.)							

Tip: The individual abbreviations are explained in the operating instructions

NOTE!

While PROFINET data are always incorporated by bytes, for PROFIsafe the data are always incorporated by individual bits. For this reason, the *module PROFIsafe 2 Bytes* was used for this application example and offers a sufficiently large safe memory area for the bits: *LM.FI_SK, LM.FI_UK* and *SM.FI_ES*.

5. Installing the GSD file

You will require the corresponding GSD file in the GSDML format to integrate the MGB2 *Modular* into the STEP 7 hardware configuration:

- GSDML-V2.33-EUCHNER-MBM_2512512_T13-YYYYMMDD.xml

You will find the GSD files in the download area at www.euchner.com. Always use the latest GSD file.

Please proceed as follows to install the GSD file in the STEP 7 hardware configurator:

1. Click *Options* and select *Install GSD File...*.

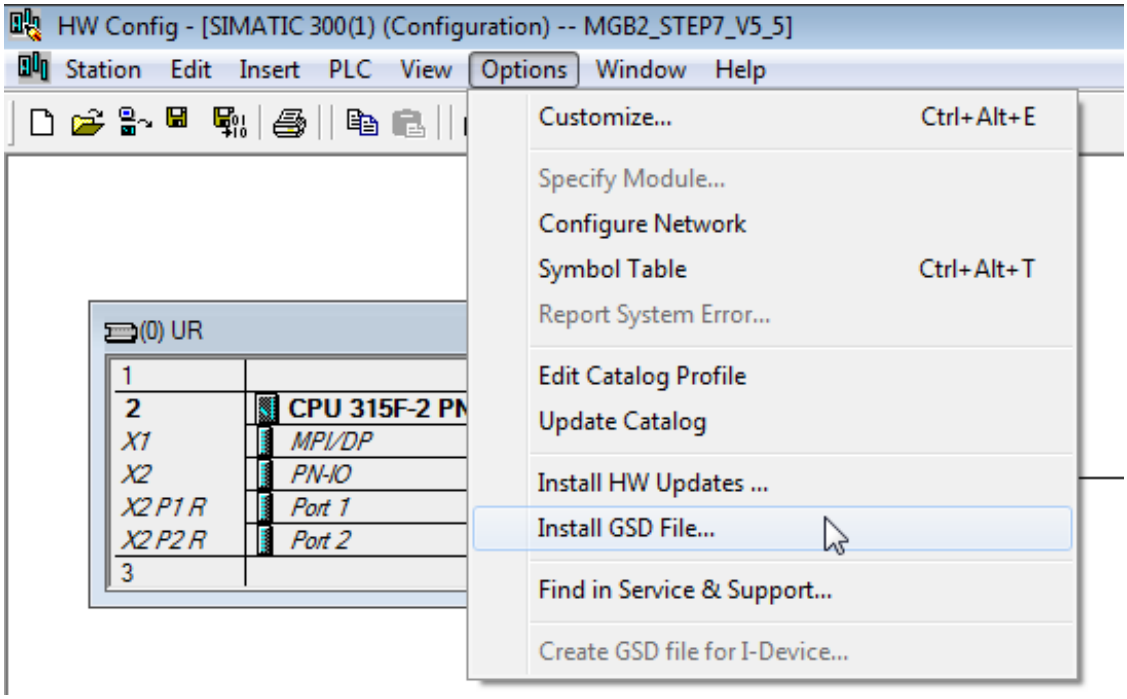

Figure 1: GSD file installation

2. Select the source path for the GSD file and install it.

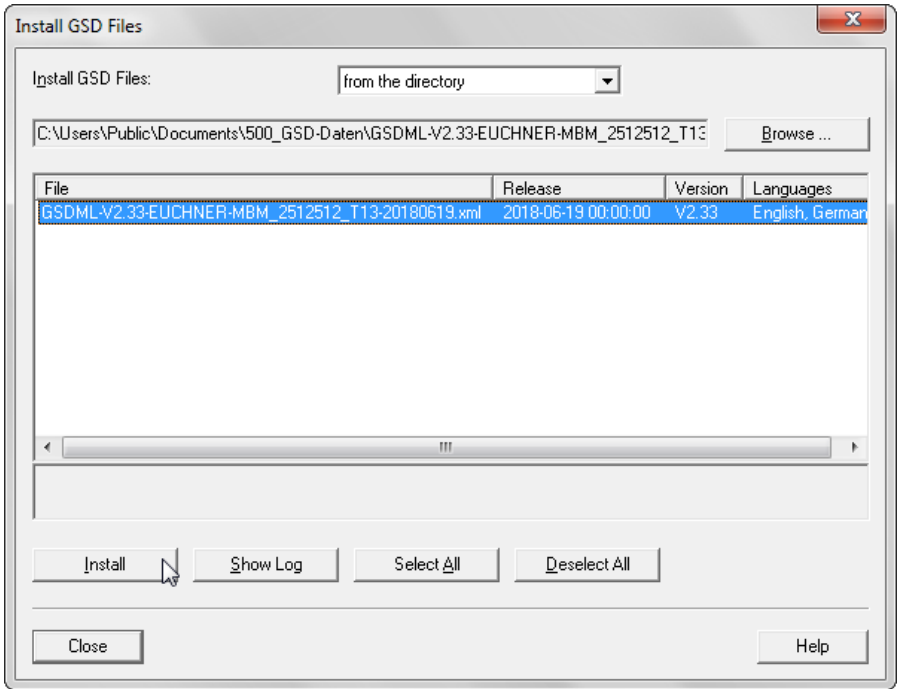

Figure 2: GSD file installation

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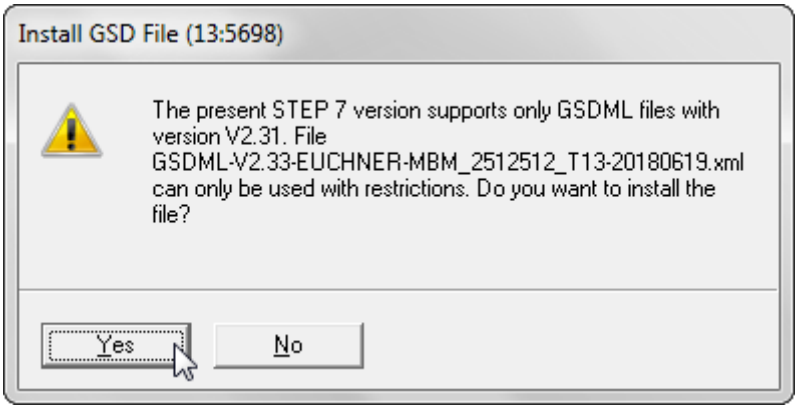
NOTE!

During the installation of the GSD file there is a warning message that the file can only be used with restrictions:



The GSD file can be used to its full extent and installed even with this error. You will find a breakdown of the differences between GSDML version 2.31 and version 2.33 in _[chapter 11.1]

6. Configuring the bus module MBM

Select the bus module MBM from the hardware catalog and assign to the PROFINET IO system using drag & drop.

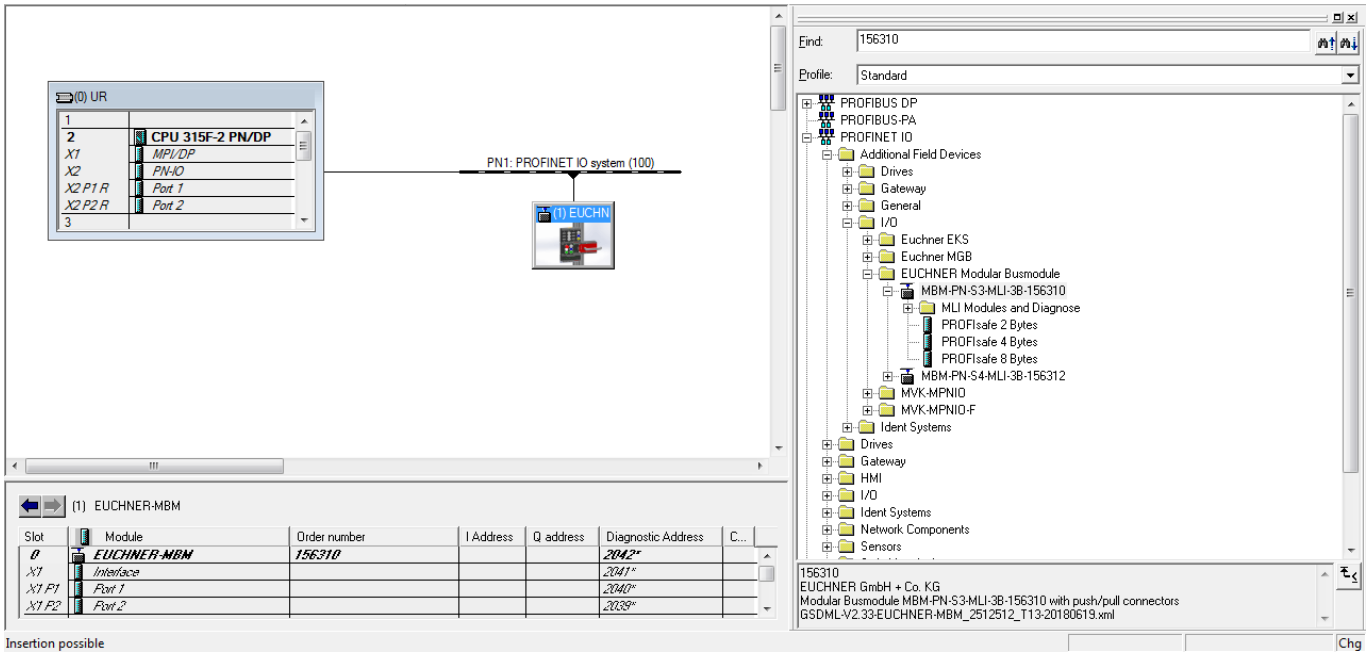


Figure 3: Network view for the MBM

The following PROFINET parameters must be set:

- Device name (factory setting from GSD file): [*euchner-mbm*].
- IP address: optionally fixed or dynamic

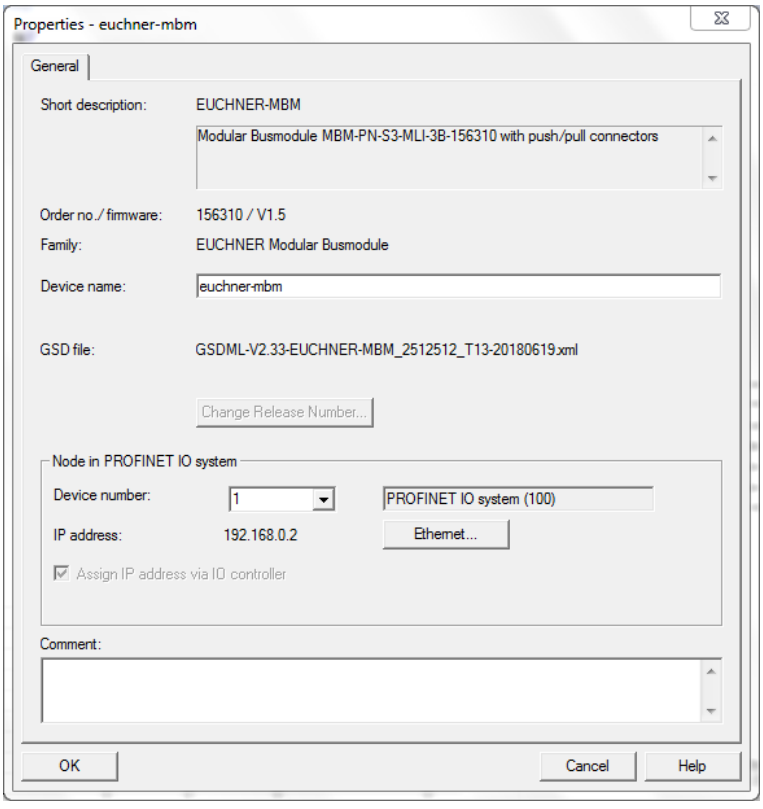


Figure 4: PROFINET parameters

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NOTE!

The default DCP name is saved in the GSD file in uppercase letters ("EUCHNER-MBM"). Assigning the device name in uppercase letters to the MBM can cause an error during the assignment. This error can be prevented by using lowercase for the DCP name.

- Real time settings, IO cycle
  Update time: Calculate update time automatically (recommended)
  Watchdog time: Number of accepted update cycles with missing IO data: 3 (recommended)

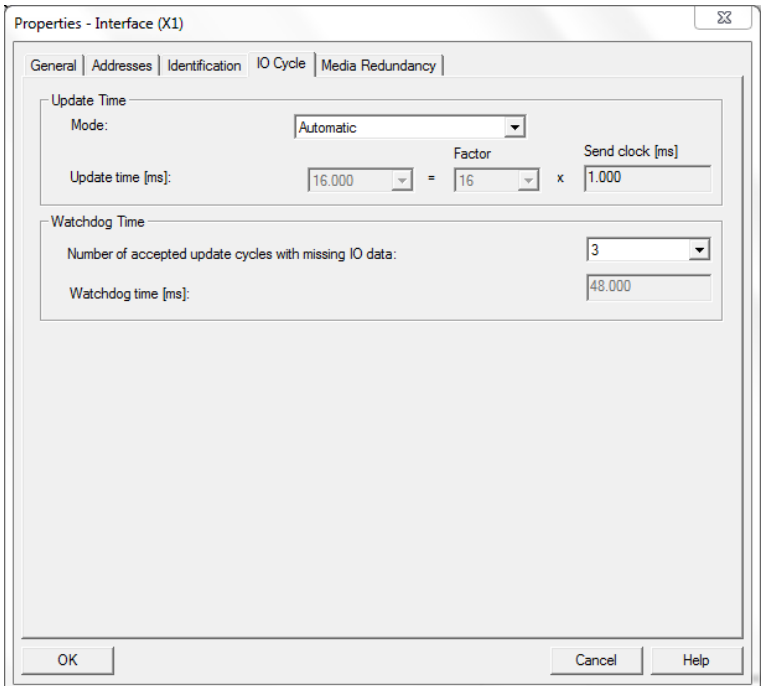


Figure 5: PROFINET real time settings

7. Configuration of the PROFIsafe communication

Select the bus module MBM in the hardware configurator tool. In the hardware catalog, select the module *PROFIsafe 2 Bytes*, *PROFIsafe 4 Bytes* or *PROFIsafe 8 Bytes*. You will find further information on the PROFIsafe modules in the operating instructions for the bus module MBM. Using drag & drop, drag the module to MBM slot 1. The PROFIsafe modules can only be placed in slot 1 on the MBM.

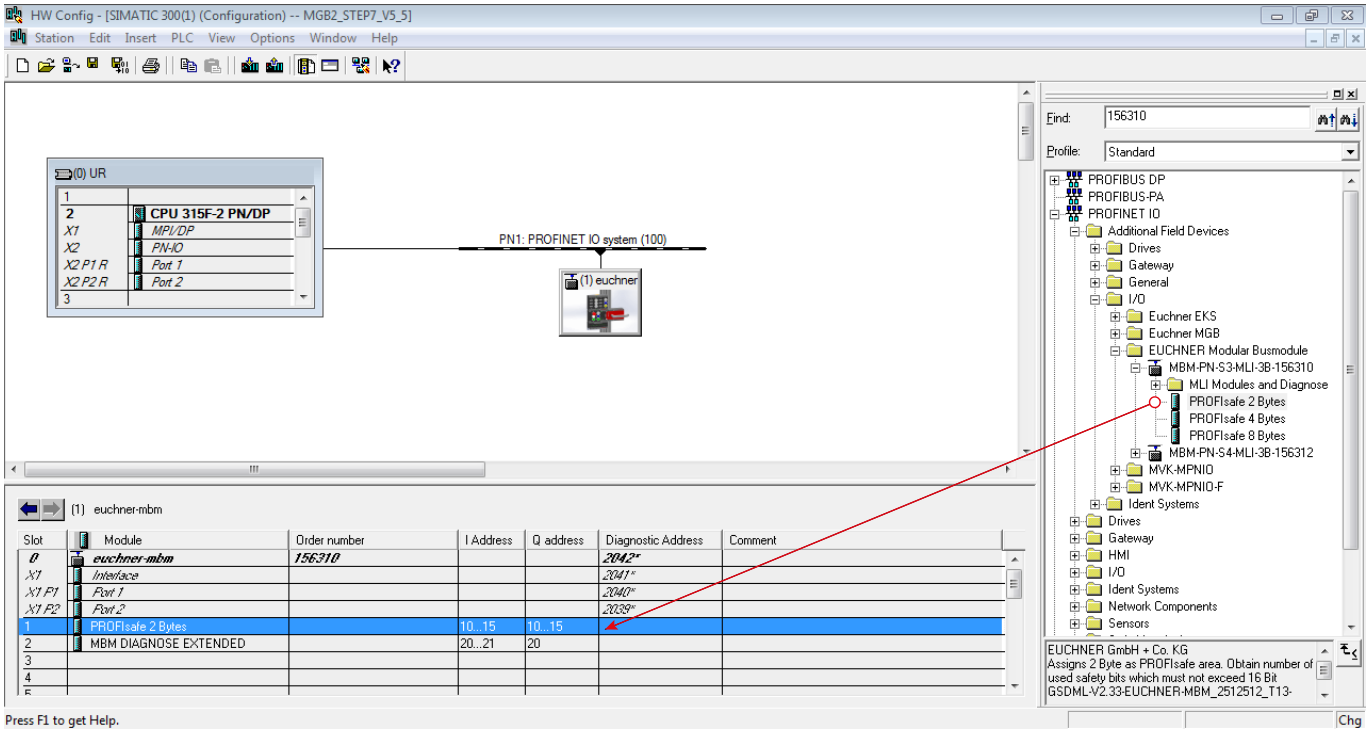


Figure 6: Adding module *PROFIsafe 2 Bytes*

The following PROFIsafe parameters must be set:

- F_Dest_Add (PROFIsafe address): 12 (The PROFIsafe default address is assigned by the STEP 7 hardware configurator, the addressing can be changed manually).
- F_WD_Time (Time during which the control system expects a response from the PROFIsafe device): 600 ms. Factory setting from GSD file: [600 ms].
- Input and output address range for the PROFIsafe data (if the sequential addressing from the hardware configuration is not required).

EN

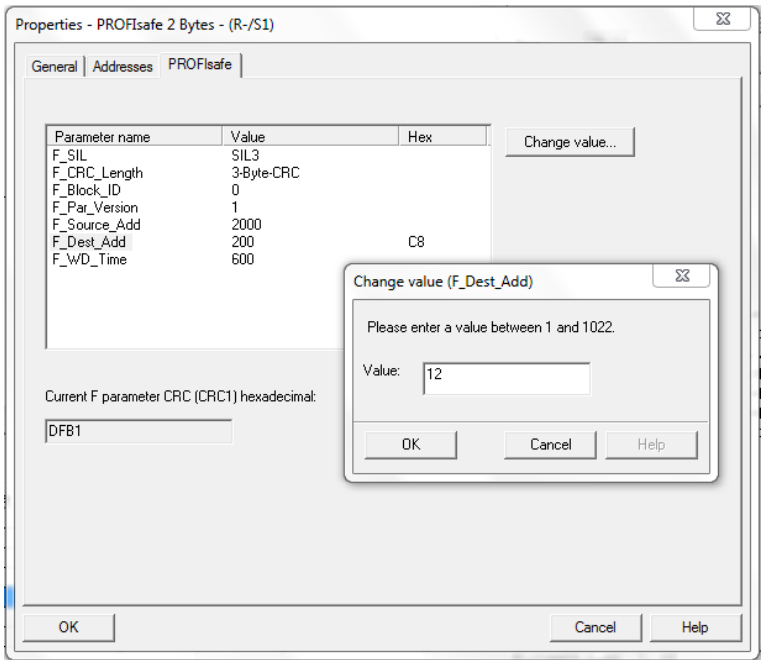
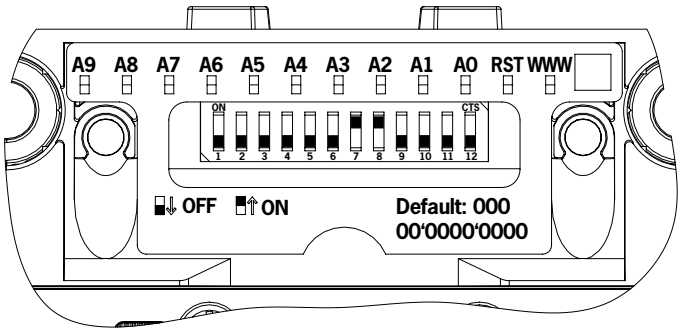


Figure 7: Properties of the PROFIsafe module

2. Set the PROFIsafe address (F_Dest_Add) on the bus module MBM using the DIP switches. The PROFIsafe address must be set to the value configured.



Switch	Description
A0 ... A9	Address switch, bit zero to nine For setting the PROFIsafe address in binary (factory setting: 0000000000)
RST	Factory reset (factory setting: off)
WWW	Activate device web interface with extended diagnostic options. (factory setting: off)

The DIP switch setting is as follows for the F_Dest_Add 12 as configured in the hardware configurator:

Switch	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
DIP switch position MBM	off	off	off	off	off	off	on	on	off	off
Significance	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Decimal value	512	256	128	64	32	16	8	4	2	1

Table 1: DIP switch settings

ATTENTION!

- The PROFIsafe address set on the MBM and the address configured in the hardware configurator must match.
- The PROFIsafe address set using the DIP switches is only applied after restarting the MBM.

8. Configuration of the locking module and the submodule

Add the locking module MGB2-L.-MLI-....-BJ-... from the folder *MLI Modules and Diagnose* in the hardware catalog to slot 3 on the modular bus module using drag & drop. Use the submodule (MSM-1-P-CA-BPP-A1-136687) from the folder *Submodules* and drag the submodule to slot 3.3. . Set the parameters for the locking module and the submodule in the parameters for the related module.

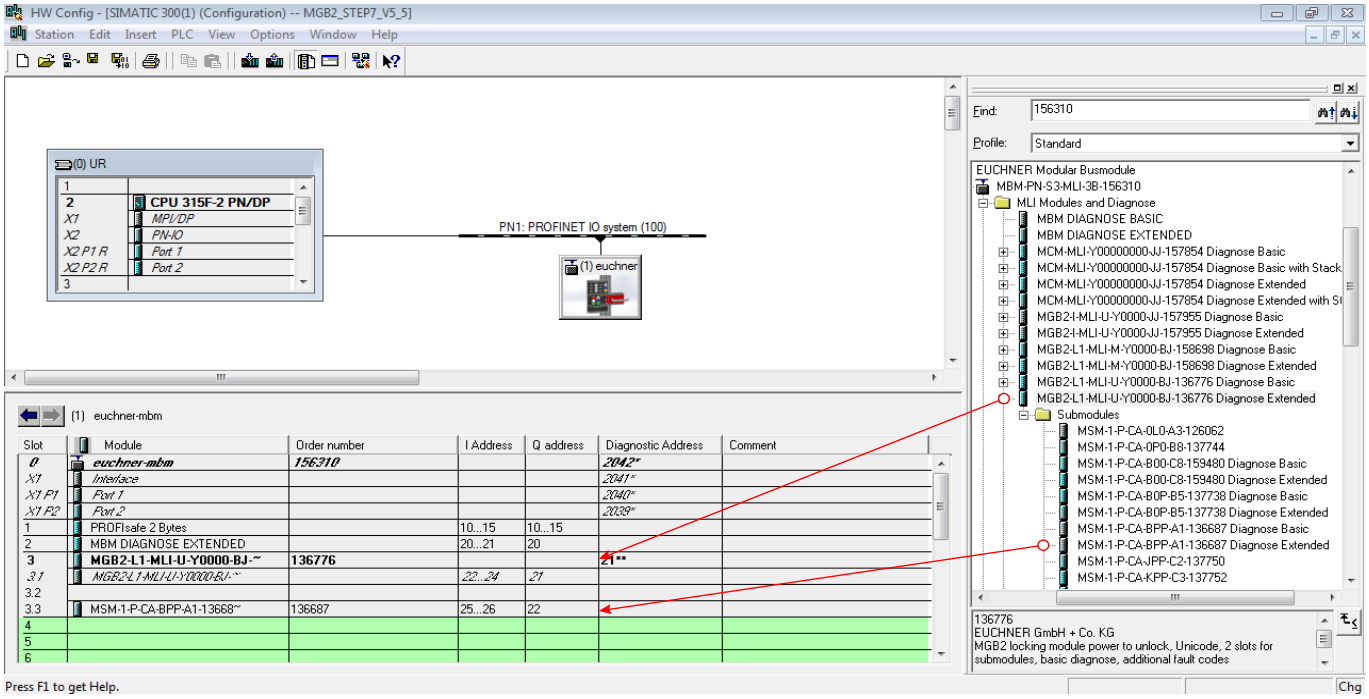


Figure 8: Adding locking module/submodule

NOTE!

- Only modules with extended diagnostics are configured in the application example. It is possible to configure the modules and submodules with basic diagnostics.
- You will find the list of parameters that can be set for modules and submodules in the operating instructions for the bus module.
- The module MBM DIAGNOSE EXTENDED is automatically inserted in slot 2. It can be replaced with the module MBM DIAGNOSE BASIC.

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9. Assigning PROFINET device names to the bus module MBM

1. In the hardware configurator, open the *PLC* menu and, via *Ethernet*, select *Assign Device Name*. All available PROFINET devices are displayed.

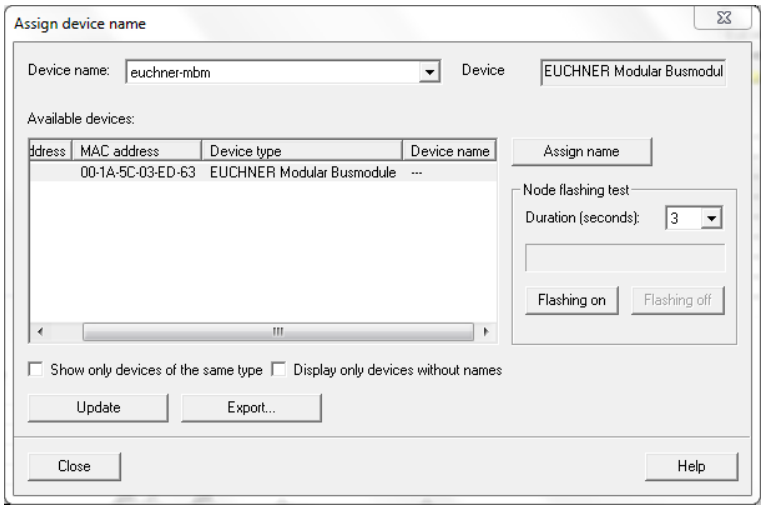


Figure 9: Assigning device names

2. Compare the MAC address on the type label with the MAC address of the subscriber available in the network and assign the PROFINET name to the MAC address using *Assign name*.

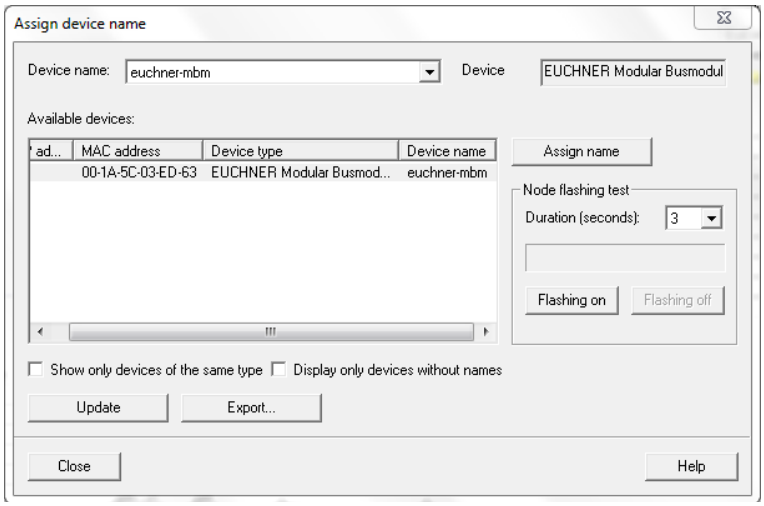


Figure 10: Device name assigned

TIP: As an alternative to the MAC address comparison, you can see from the *Flash LED* whether you have selected the correct subscriber.

10. Creating the safety program

The F-runtime group, the FB and the associated DB are not generated automatically in STEP 7. The creation of the F blocks is not part of this application.

ⓘ	**NOTICE** There must be at least one call for an MBM safety bit in the safe part of the program to prevent the device from being passivated!

10.1. Example safety program

In the following example the safe flag *F_Flag_UK/DB3.DBX0.0* is controlled by the bit *LM.FI_UK*. The conditions for the bit *LM.FI_UK* are met if the door is closed, the bolt tongue is in the locking module and the guard locking is active.

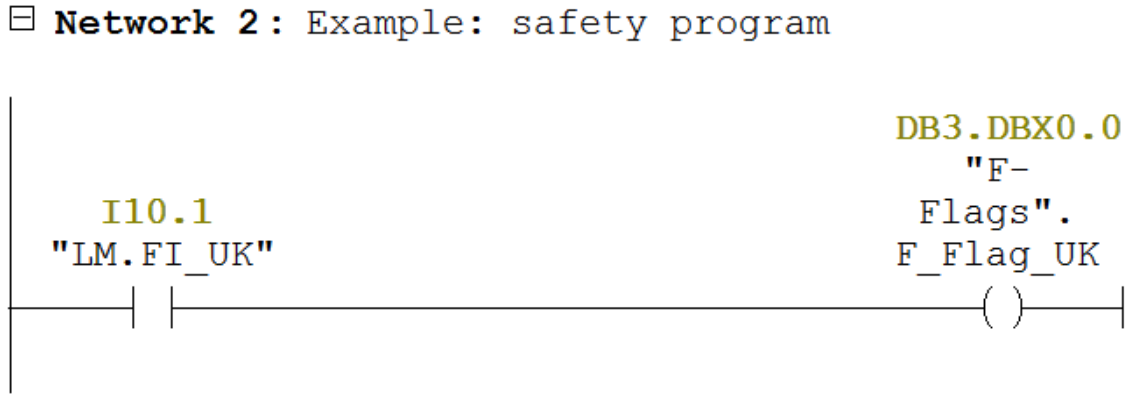


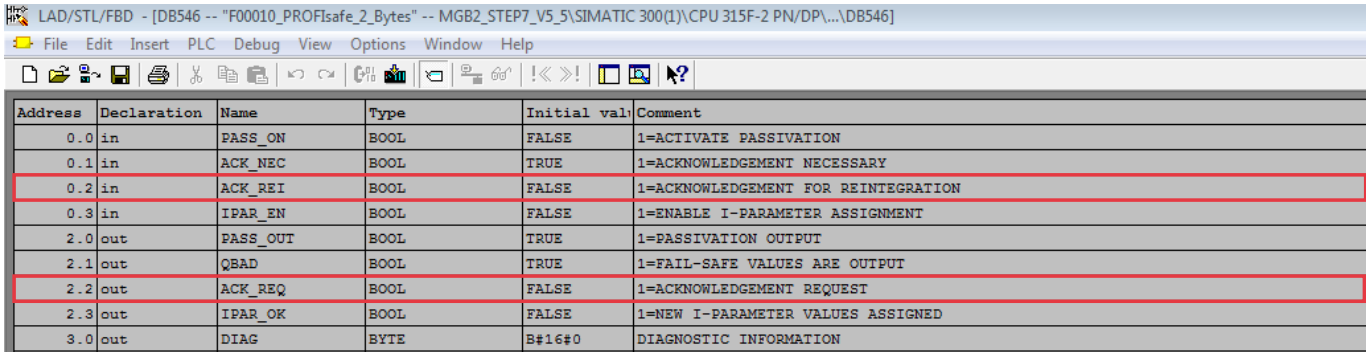
Figure 11: Safety program

10.2. Example for the reintegration of the MBM F-I/O:

In the following example two ways are shown using which the MBM can be consciously reintegrated as an F-I/O if there is a fault.

10.2.1. Reintegration of the MBM F-I/O channel

A related F-I/O DB is created automatically on using the MBM PROFIsafe modules. The name of the DB can vary between configurations because it is generated by STEP 7 depending on the I/Q byte used. If the MBM is passivated, the bit "ACK_REQ" (Acknowledgment Request) of the DB generated is set (=TRUE). For reintegration the bit "ACK_REI" (Acknowledgment for Reintegration) must be set (=TRUE).



Address	Declaration	Name	Type	Initial val	Comment
0.0	in	PASS_ON	BOOL	FALSE	1=ACTIVATE PASSIVATION
0.1	in	ACK_NEC	BOOL	TRUE	1=ACKNOWLEDGEMENT NECESSARY
0.2	in	ACK_REI	BOOL	FALSE	1=ACKNOWLEDGEMENT FOR REINTEGRATION
0.3	in	IPAR_EN	BOOL	FALSE	1=ENABLE I-PARAMETER ASSIGNMENT
2.0	out	PASS_OUT	BOOL	TRUE	1=PASSIVATION OUTPUT
2.1	out	QBAD	BOOL	TRUE	1=FAIL-SAFE VALUES ARE OUTPUT
2.2	out	ACK_REQ	BOOL	FALSE	1=ACKNOWLEDGEMENT REQUEST
2.3	out	IPAR_OK	BOOL	FALSE	1=NEW I-PARAMETER VALUES ASSIGNED
3.0	out	DIAG	BYTE	B#16#0	DIAGNOSTIC INFORMATION

Figure 12: Declaration table, F-I/O DB

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In the following figure, on the occurrence of passivation the MBM is consciously reintegrated using the *SM.I_S2* input. Sequence: if, e.g. a communication error has occurred between the PLC and the MBM, the MBM is passivated. As soon as the error has been rectified, the passivation of the MBM is indicated using the POWER/FC LED (flashes) and the bit *ACK_REQ* is set (=TRUE). With the non-safe input *SM.I_S2 (I25.1)* = TRUE, the condition becomes valid and the MBM is reintegrated using the output ACK_REI.

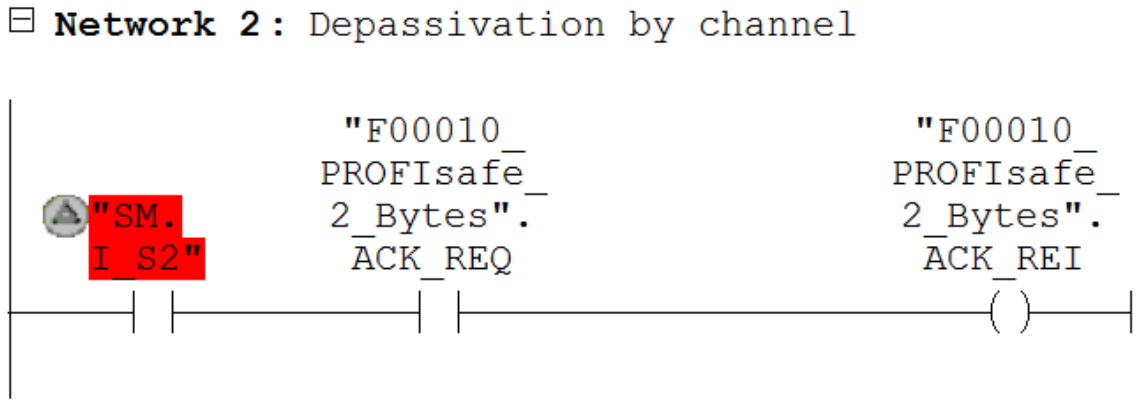

Figure 13: Reintegration for channels

10.2.2. Explanations ACK_REQ and ACK_REI

ACK_REQ:

When the F-system detects a communication error or an F-I/O fault or channel fault for an F-I/O, the relevant F-I/O or individual channels of the F-I/O are passivated. ACK_REQ = 1 signals that user acknowledgment is required for reintegration of the relevant F-I/O or channels of the F-I/O.
The F-system sets ACK_REQ = 1 as soon as the fault has been eliminated and user acknowledgment is possible. For channel-granular passivation, the F-system sets ACK_REQ = 1 as soon as the channel fault is corrected. User acknowledgment is possible for this fault. Once acknowledgment has occurred, the F-system resets ACK_REQ to 0.

Notice:
For F-I/O with outputs, acknowledgment after F-I/O or channel faults may only be possible some minutes after the fault has been eliminated, until the necessary test signal is applied (see F-I/O manuals).

ACK_REI:

When the F-system detects a communication error or an F-I/O fault for an F-I/O, the relevant F-I/O is passivated. If channel faults are detected and channel-granular passivation is configured, the relevant channels are passivated. If passivation of the entire F-I/O is configured, all channels of the relevant F-I/O are passivated. Reintegration of the F-I/O/channels of the F-I/O after elimination of faults requires a user acknowledgment with a positive edge at the ACK_REI tag of the F-I/O DB:

- After every communication error
- After F-I/O or channel faults only with parameter assignment "Channel failure acknowledge = Manually" or ACK_NEC = 1

Reintegration after channel faults reintegrates all channels whose faults were eliminated.
Acknowledgment is not possible until tag ACK_REQ = 1.
In your safety program, you must provide a user acknowledgment by means of the ACK_REI tag for each F-I/O.

⚠ WARNING:

For the user acknowledgment, you must interconnect the ACK_REI tag of the F-I/O DB with a signal generated by an operator input. An interconnection with an automatically generated signal is not permitted. (S011)

Table 2: Source: SIEMENS TIA Portal information system

10.2.3. Global reintegration of all F-I/Os using the SIEMENS instruction "ACK_GL"

If you use the instruction *ACK_GL*, you do not have to provide a user acknowledgment for each F-runtime group via the *ACK_REI* tag of the F-I/O DB. In the following example the global reintegration is consciously undertaken using the input *SM.I_S3 (I25.1)*.

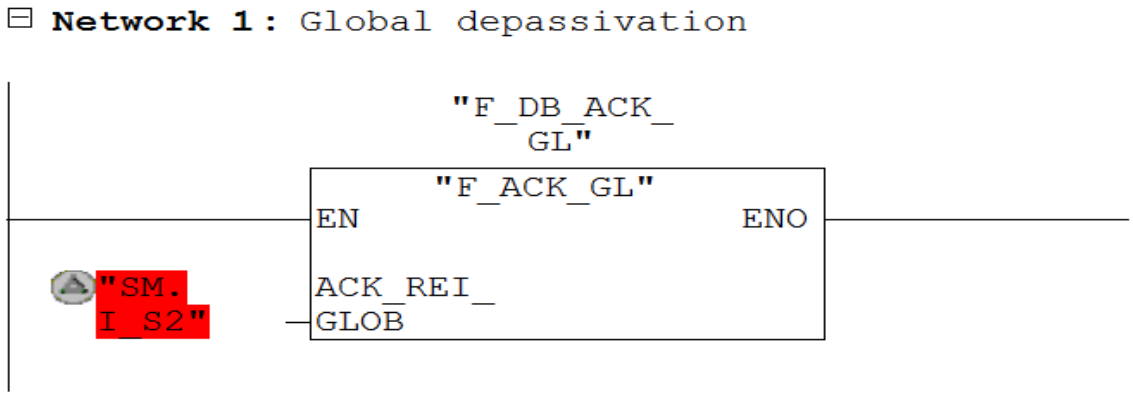

Figure 14: Global reintegration

10.2.4. Explanation ACK_GL

ACK_GL:
This instruction creates an acknowledgment for the simultaneous reintegration of all F-I/O or channels of the F-I/O of an F-runtime group after communication errors, F-I/O errors, or channel faults. A user acknowledgment with a positive edge at input ACK_GLOB is required for reintegration. The acknowledgment occurs analogously to the user acknowledgment via the ACK_REI tag of the F-I/O DB, but it acts simultaneously on all F-I/O of the F-runtime group in which the instruction is called. If you use the instruction ACK_GL, you do not have to provide a user acknowledgment for each F-I/O of the F-runtime group via the ACK_REI tag of the F-I/O DB. Every call of the "Global acknowledgment of all F-I/O of a runtime group" instruction must be assigned a data area in which the instruction data are stored. The "Call options" dialog is automatically opened when the instruction is inserted in the program for this reason. There you can create a data block (single instance) (e.g., ACK_GL_DB_1) or a multi-instance (e.g., ACK_GL_Instance_1) for the "Global acknowledgment of all F-I/O of a runtime group" instruction. Once it is created, you can find the new data block in the project tree in the "STEP 7 Safety" folder under "Program blocks > System blocks" or the multi-instance as a local tag in the "Static" section of the block interface. For more information, refer to the help on STEP 7. Enable input "EN" and enable output "ENO" cannot be connected. The instruction is therefore always executed (regardless of the signal state at enable input "EN").

	NOTICE An acknowledgment via the ACK_GL instruction is only possible if the tag ACK_REI of the F-I/O DB = 0. Accordingly, an acknowledgment via the tag ACK_REI of the F-I/O DB is only possible if the input ACK_GLOB of the instruction = 0. The instruction is only allowed to be called once per F-runtime group.

Table 3: Source: SIEMENS TIA Portal information system

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11. Explanations about the GSD file

EUCHNER provides two different GSD files for the MGB2 *Modular*; these have both been tested and certified by COMDEC.

You will require the corresponding GSD file in the GSDML format to integrate the MGB2 *Modular* into TIA Portal, depending on the version of TIA Portal (TIA V13 or TIA V14). The TIA Portal version is apparent in the name of the GSD file (T13 or T14):

- GSDML-V2.33-EUCHNER-MBM_2512512_T13-YYYYMMDD.xml
- GSDML-V2.33-EUCHNER-MBM_2512512_T14-YYYYMMDD.xml

The GSD file for TIA Portal V13 is suitable for installation in STEP 7 V5.5 SP4.

11.1. GSDML V2.31 and V2.33 differences

The configuration tool STEP7 V5.5 SP4 supports GSD files up to version 2.31.

A GSD file in version 2.31, which does not generate a warning message, can no longer have a COMDEC certificate. The lowest possible version for a GSDML file with COMDEC certificate is V2.32.

The restrictions detected by STEP7 relate to the following attributes in the GSDML file; these attributes are not recognized by STEP7 V5.5 SP4:

Attribute	Explanation
MayIssueProcessAlarm	This attribute is set to TRUE for the MGB2 *Modular*. Process alarms were not yet controlled by GSDML V2.31.
MAUTypeList	The different possible PROFINET connections to the MGB2 *Modular* are described in this list. The MGB2 *Modular* supports only the connection of 100 MB full-duplex connections using copper. The attribute MAUType, missing in V2.33, was stated instead in GSDML V2.31. The connection stated above is, however, specified by default if this attribute is missing. There is no restriction.
AdaptsRealIdentification	This attribute is used for identification during the certification phase and has no effect on the operation of the MGB2 *Modular*.
NumberOfDeviceAccessAR	This attribute regulates the device relationships for shared devices. The MGB2 *Modular* is not designed as a shared device, for this reason this attribute is set to 1 and is not required for the operation of the MGB2 *Modular*.
IM5Supported	I&M 5 data may not be supported by a control system that has been programmed using STEP7 V5.5 SP4. The MGB2 *Modular* will, however, correctly respond to requests from the control system related to these data. The entry in these data is always the same for all MGB2 *Modular*, it contains the firmware version. This information is printed on the rating plate.

In GSDML V2.33 a further attribute is missing that was necessary in GSDML V2.31:

Attribute	Explanation
SupportedMIBS	This attribute regulates the SNMP Management Information Base. The MIB2 service is currently supported. This service is also activated in the MGB2 *Modular* with STEP 7.

12. Important note – please observe carefully!

This document is intended for a design engineer who possesses the requisite knowledge in safety engineering and knows the applicable standards, e.g. through training for qualification as a safety engineer. Only with the appropriate qualification is it possible to integrate the example provided into a complete safety chain.

The example represents only part of a complete safety chain and does not fulfill any safety function on its own. In order to fulfill a safety function, the energy switch-off function for the danger zone and the software within the safety evaluation must also be considered, for example.

The applications provided are only examples for solving certain safety tasks for protecting safety doors. The examples cannot be comprehensive due to the application-dependent and individual protection goals within a machine/installation.

If questions concerning this example remain open, please contact us directly.

According to the Machinery Directive 2006/42/EC, the design engineer of a machine or installation has the obligation to perform a risk assessment and take measures to reduce the risk. While doing this, the engineer must comply with the applicable national and international safety standards. Standards generally represent the current state-of-the-art. Therefore, the design engineer should continuously inform himself about changes in the standards and adapt his considerations to them. Relevant standards include EN ISO 13849 and EN 62061. This application must be regarded only as assistance for the considerations about safety measures.

The design engineer of a machine/installation has the obligation to assess the safety technology him/herself. The examples must not be used for an assessment, because only a small excerpt of a complete safety function was considered in terms of safety engineering here.

In order to be able to use the safety switch applications correctly on safety doors, it is indispensable to observe the standards EN ISO 13849-1, EN ISO 14119 and all relevant C-standards for the respective machine type. Under no circumstances does this document replace the engineer's own risk assessment, and it cannot serve as the basis for a fault assessment.

In particular in relation to a fault exclusion, it must be noted that a fault can only be excluded by the machine's or installation's design engineer and this action requires justification. A general fault exclusion is not possible. More information about fault exclusion can be found in EN ISO 13849-2.

Changes to products or within assemblies from third-party suppliers used in this example can lead to the function no longer being ensured or the safety assessment having to be adapted. In any event, the information in the operating instructions on the part of EUCHNER, as well as on the part of third-party suppliers, must be used as the basis before this application is integrated into an overall safety function. If contradictions should arise between the operating instructions and this document, please contact us directly.

Use of brand names and company names

All brand names and company names stated are the property of the related manufacturer. They are used only for the clear identification of compatible peripheral devices and operating environments in relation to our products.

Euchner GmbH + Co. KG
Kohlhammerstraße 16
D-70771 Leinfelden-Echterdingen
info@euchner.de
www.euchner.com

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