



Lean Managed Switch Release IX4:

Port Security Advanced
PROFINET® Conformance Class A
Configuration of ALM Output

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Table of Contents

1	Notes about this Documentation	4
1.1	Copyright.....	4
1.2	Symbols	4
1.3	Number Notation	6
1.4	Font Conventions	6
1.5	Legal Bases.....	7
1.5.1	Subject to Changes.....	7
1.5.2	Personal Qualifications	7
1.5.3	Limitation of Liability.....	7
2	Port Security Advanced feature	8
2.1	Brief description.....	8
2.2	Using the Port Security Advanced feature	8
2.2.1	Required for the setup:.....	9
2.3	Configuration of the Port Security Advanced feature	9
2.3.1	CLI configuration.....	9
2.3.2	WBM configuration.....	9
2.3.3	Configuration check – CLI	10
2.3.4	Configuration check – WBM.....	11
2.4	Test of the Port Security Advanced feature.....	11
2.4.1	Execution :	11
2.4.2	Test results - CLI.....	12
2.4.3	Test results – WBM.....	13
2.4.4	Test results – SNMP Trap	13
2.4.5	Test results - Unlocking port 6.....	13
2.5	Appendix	14
2.5.1	Command list of the CLI.....	14
2.5.2	Overview of settings in the WBM.....	15
3	Use in simple PROFINET® systems	16
3.1	Configuration of the switch	16
3.2	Additional Ethernet Device in the TIA-Portal.....	17
3.3	Diagnosis with the Web-based Management.....	20
4	Configuration of alarm relay function.....	23

1 Notes about this Documentation

1.1 Copyright

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1.2 Symbols



DANGER

Personal Injury!

Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.



DANGER



Personal Injury Caused by Electric Current!

Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Personal Injury!

Indicates a moderate-risk, potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Personal Injury!

Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Damage to Property!

Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.



NOTICE

Damage to Property Caused by Electrostatic Discharge (ESD)!

Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.



Note

Important Note!

Indicates a potential malfunction which, if not avoided, however, will not result in damage to property.



Information

Additional Information:

Refers to additional information which is not an integral part of this documentation (e.g., the Internet).

1.3 Number Notation

Table 1: Number Notation

Number Code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C notation
Binary	'100' '0110.0100'	In quotation marks, nibble separated with dots (.)

1.4 Font Conventions

Table 2: Font Conventions

Font Type	Indicates
<i>italic</i>	Names of paths and data files are marked in italic-type. e.g.: <i>C:\Program Files\WAGO Software</i>
Menu	Menu items are marked in bold letters. e.g.: Save
>	A greater-than sign between two names means the selection of a menu item from a menu. e.g.: File > New
Input	Designation of input or optional fields are marked in bold letters, e.g.: Start of measurement range
"Value"	Input or selective values are marked in inverted commas. e.g.: Enter the value "4 mA" under Start of measurement range .
[Button]	Pushbuttons in dialog boxes are marked with bold letters in square brackets. e.g.: [Input]
[Key]	Keys are marked with bold letters in square brackets. e.g.: [F5]

1.5 Legal Bases

1.5.1 Subject to Changes

WAGO GmbH & Co. KG reserves the right to provide for any alterations or modifications. WAGO GmbH & Co. KG owns all rights arising from the granting of patents or from the legal protection of utility patents. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

1.5.2 Personal Qualifications

The use of the product described in this document is exclusively geared to specialists having qualifications in PLC programming, electrical specialists or persons instructed by electrical specialists who are also familiar with the appropriate current standards.

Moreover, the persons cited here must also be familiar with all of the products cited in this document, along with the operating instructions. They must also be capable of correctly predicting any hazards which may not arise until the products are combined.

WAGO GmbH & Co. KG assumes no liability resulting from improper action and damage to WAGO products and third-party products due to non-observance of the information contained in this document.

1.5.3 Limitation of Liability

This documentation describes the use of various hardware and software components in specific example applications. The components may represent products or parts of products from different manufacturers. The respective operating instructions from the manufacturers apply exclusively with regard to intended and safe use of the products. The manufacturers of the respective products are solely responsible for the contents of these instructions.

The sample applications described in this documentation represent concepts, that is, technically feasible application. Whether these concepts can actually be implemented depends on various boundary conditions. For example, different versions of the hardware or software components can require different handling than that described here. Therefore, the descriptions contained in this documentation do not form the basis for assertion of a certain product characteristic.

Responsibility for safe use of a specific software or hardware configuration lies with the party that produces or operates the configuration. This also applies when one of the concepts described in this document was used for implementation of the configuration.

WAGO GmbH & Co. KG is not liable for any actual implementation of the concepts.

2 Port Security Advanced feature

2.1 Brief description

The Port Security Advanced feature is an easy-to-use security feature to prevent unauthenticated users from accessing a network. When a connection is lost, a learned port on a Lean Managed Switch is locked and can only be unlocked by the administrator.

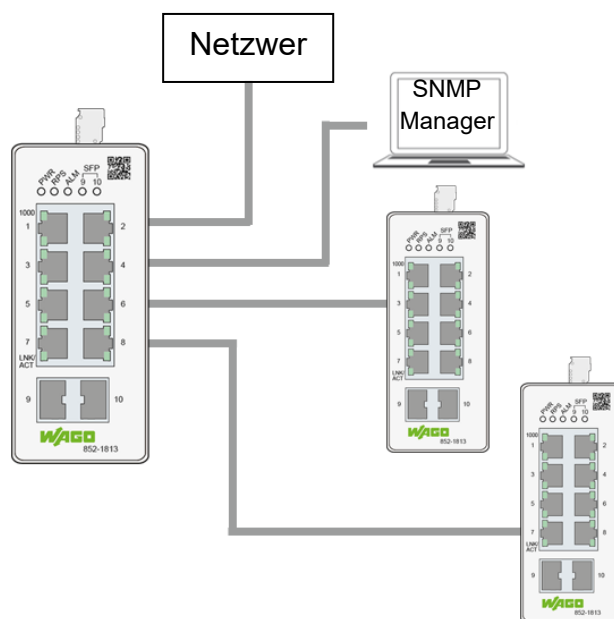
Port Security Advanced helps to secure the network by preventing unknown devices from accessing the network.

Note:

The Port Security Advanced feature increases network security but may reduce system availability. The following instructions must be followed when using Port Security Advanced:

- The Port Security Advanced feature should not be enabled on ports used to establish ring networks with ERPS or RSTP.
- To allow permanent access to the device, the Port Security Advanced feature should not be enabled on uplink ports.
- Blocked ports can only be unblocked by the administrator. For this purpose, a login to the device is required.

2.2 Using the Port Security Advanced feature



2.2.1 Required for the setup:

- PCs x 1
- WAGO switches x 3 (852-1813)
- RJ-45 cables x 4

2.3 Configuration of the Port Security Advanced feature

2.3.1 CLI configuration

L2SWITCH#configure terminal

L2SWITCH(config)#port-security-adv enable

L2SWITCH(config-if)#port-security-adv enable

L2SWITCH(config)#write memory

Note: CLI configuration for port registration:

L2SWITCH#configure terminal

L2SWITCH(config)# port-registration learn

L2SWITCH(config)# port-registration reset

2.3.2 WBM configuration

The screenshot displays the WAGO Web Management Interface (WBM) with the 'Security' tab selected. The left sidebar shows a navigation menu with 'Port Security Advanced' highlighted. The main content area is titled 'Port Security Advanced' and contains a 'Port Security Advanced Settings' form. The form includes a note: 'Note: A linkdown causes a deactivation of a port if this function is enabled.' Below the note, there are three configuration fields: 'Global State' with an unchecked checkbox, 'Port Range' with two dropdown menus both set to '1', and 'Port State' with a dropdown menu set to 'Disable'. A 'Submit' button is located at the bottom right of the form.

Port Security Advanced

Port Security Advanced Settings

Note: A linkdown causes a deactivation of a port if this function is enabled.

Global State

☒

Globally enabled

Port Range

1

~

8

Selecting the port range

Port State

Enable

Enable/Disable on interface range selected

Submit to take effect

Submit

2.3.3 Configuration check – CLI

```
L2SWITCH(config)#port-registration learn
Success!

L2SWITCH(config)#ex
L2SWITCH#show port-security-adv

The port security adv on the Switch is enabled.
```

Port	State	Monitor
1	Enabled	No Use
3	Enabled	No Use
5	Enabled	No Use
7	Enabled	No Use

Port	State	Monitor
2	Enabled	Normal
4	Enabled	Normal
6	Enabled	Normal
8	Enabled	Normal

```
L2SWITCH#
```

Once the port-registration learned after port-security-adv is enable it will devide and display used and no use ports

port-security-adv enabled and used ports in normal state

port-security-adv enabled but no active link so no use ports

2.3.4 Configuration check – WBM

Port Security Advanced Status ^			
Port	State	Monitor	Manual Recovery
1	enabled	No Use	
2	enabled	Normal	
3	enabled	No Use	
4	enabled	Normal	
5	enabled	No Use	
6	enabled	Normal	
7	enabled	No Use	
8	enabled	Normal	
9	disabled	Normal	
10	disabled	Normal	

2.4 Test of the Port Security Advanced feature

2.4.1 Execution :

- Activation of the Port Security Advanced feature (global)
- Activation of the Port Security Advanced feature for the individual ports
- Removing an ETHERNET cable (in this example the cable connected to port 6)
- Reconnect the ETHERNET cable
- Checking the results in the CLI or in the WBM.
 - Expectation:
 - Port 6 should have been locked after link-down.
 - An SNMP trap should have alerted to the locking of port 6.
 - The port should be able to be unlocked by an administrator.

2.4.2 Test results - CLI

```
The port monitor on the Switch is enabled.
```

Port	State	Monitor	Port	State	Monitor
1	Enabled	No Use	2	Enabled	Normal
3	Enabled	No Use	4	Enabled	Normal
5	Enabled	No Use	6	Enabled	Shutdown
7	Enabled	No Use	8	Enabled	Normal
9	Disabled	Normal	10	Disabled	Normal

```
L2SWITCH#con t
L2SWITCH(config)#int 1/0/6
L2SWITCH(config-if)#show
Port Index: 6
Description: gigabitethernet1/0/6
Alias: gigabitethernet1/0/6
Speed: Nway
Status: Disabled by Port Security Adv.
Uptime: 0 days 0:0:0.
Medium mode: Copper
Flow Control: On
Default VLAN ID: 1
Join VLAN: 1
Operating Status: No Connection!
Default QoS priority: 0
Acceptable frame type: all
Administrative Status: Enable
EEE Status : Disable
```

```
<6> 2020 Jan 01 04:19:50 60001:User(admin) Login Succeeded!
<6> 2020 Jan 01 04:21:24 60001:User(admin) Login Succeeded!
<6> 2020 Jan 01 04:22:22 60005:Save configurations to file!
<6> 2020 Jan 01 04:30:47 60001:User(admin) Login Succeeded!
<6> 2020 Jan 01 04:39:54 60001:User(admin) Login Succeeded!
<6> 2020 Jan 01 04:43:00 60005:Save configurations to file!
<6> 2020 Jan 01 04:43:28 60001:User(admin) Login Succeeded!
<4> 2020 Jan 01 04:44:46 40023:Port Security Adv. Link Down! Shutdown port 6.
<6> 2020 Jan 01 04:44:50 60005:Save configurations to file!
<6> 2020 Jan 01 04:48:54 60005:Save configurations to file!

The end of system log.
L2SWITCH#
```

2.4.3 Test results – WBM

Port Security Advanced Status			
Port	State	Monitor	Manual Recovery
1	enabled	No Use	
2	enabled	Normal	
3	enabled	No Use	
4	enabled	Normal	
5	enabled	No Use	
6	enabled	Shutdown	
7	enabled	No Use	
8	enabled	Normal	
9	disabled	Normal	
10	disabled	Normal	

```
<6> 2020 Jan 1 04:21:24 60001:User(admin) Login Succeeded!
<6> 2020 Jan 1 04:22:22 60005:Save configurations to file!
<6> 2020 Jan 1 04:30:47 60001:User(admin) Login Succeeded!
<6> 2020 Jan 1 04:39:54 60001:User(admin) Login Succeeded!
<6> 2020 Jan 1 04:43:00 60005:Save configurations to file!
<6> 2020 Jan 1 04:43:28 60001:User(admin) Login Succeeded!
<4> 2020 Jan 1 04:44:46 40023:Port Security Adv. Link Down! Shutdown port 6.
<6> 2020 Jan 1 04:44:50 60005:Save configurations to file!
<6> 2020 Jan 1 04:48:54 60005:Save configurations to file!
```

2.4.4 Test results – SNMP Trap

Normal	12/09/2020	10:55:28	852-1813	Link 4 Up	SNMP Trap is sent to NMS
Normal	12/09/2020	10:57:15	852-1813	Link 2 Up	
Normal	12/09/2020	14:40:54	852-1813	Link 8 Up	
Minor	12/09/2020	15:38:22	852-1813	enterprises.13576.7.1813.1.5.0.54(1) #index.6 (Integer): 6	
Normal	12/09/2020	15:42:29	852-1813	Link 6 Up	

2.4.5 Test results - Unlocking port 6

To unlock the port of the switch, the administrator must log in to the device and reset the port.

```

L2SWITCH(config)#port-registration reset
Success!

L2SWITCH(config)#ex
L2SWITCH#show interface 1/0/6
Port Index: 6
Description: gigabitethernet1/0/6
Alias: gigabitethernet1/0/6
Speed: Nway
Status: Normally.
Uptime: 0 days 1:31:45.
Medium mode: Copper
Flow Control: On
Default VLAN ID: 1
Join VLAN: 1
Operating Status: 1000M/Full-Duplex/Flow-Control On!
Default QoS priority: 0
Acceptable frame type: all
Administrative Status: Enable
EEE Status : Disable

```

This Command will release the port from blocked state to normal

Functioning Normally after admin reset

2.5 Appendix

2.5.1 Command list of the CLI

Node	Befehl	Beschreibung
Enable	show port-security-adv	This command displays the current configurations of the Port Security Advanced feature.
configure	port-security-adv (disable enable)	This command globally disables/enables the Port Security Advanced feature on the switch.
(config-if)	port-security-adv (disable enable)	This command disables / enables the Port Security Advanced feature on the interface.
(config-if)	port-registration reset	Reset command to activate a locked port for a normal connection.
(config-if)	port-registration learn	The command sets the ports to the extended port security state.

2.5.2 Overview of settings in the WBM

Parameter	Beschreibung
Global State	Globally enable/disable Port Security Advanced feature on the switch.
Port Range	Select the ports on which you want to enable/disable the Port Security Advanced feature.
Port State	Select whether to enable/disable the Port Security Advanced feature on the selected ports.
Submit	Click the "Submit" button to apply the settings.

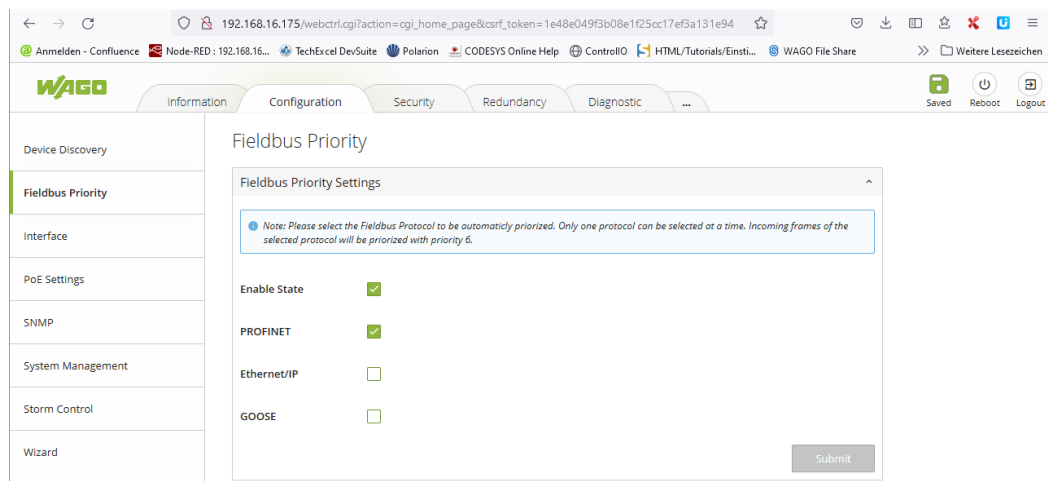
3 Use in simple PROFINET® systems

Lean Managed Switches (from firmware release IX3) prioritize PROFINET® data packets in the network. Prioritization is based on the EtherType=0x8892, which identifies each PROFINET RT data packet. This enables reliable "real-time" data exchange in the PROFINET® system. The switches meet the requirements of Conformance Class A.

Lean Managed Switches do not have a GSDML file and cannot be configured by the TIA Portal or a PROFINET® controller. The WAGO products 852-602, 852-603 and 852-1605 meet these requirements.

3.1 Configuration of the switch

Lean Managed Switches can be configured using a web browser. For example, selected communication protocols can be prioritized.



In the default setting, the prioritization of the PROFINET® data packets are enabled. Ethernet/IP and GOOSE data packets can also be prioritized in this menu.

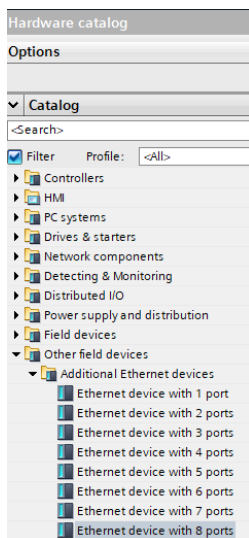
In addition, unused ports can be deactivated in Web-based Management easily. This increases the security in PROFINET® systems, compared to the use of unmanged switches, such as the 852-1111/000-001. On the following page the configuration page is shown. Detailed information about the configuration of the Lean Managed Switches can be found in the product manual.

The screenshot shows the WAGO configuration interface. The left sidebar contains a tree view with categories: Device Discovery, Fieldbus Priority, Interface (highlighted), Loop Detection, Mirror, Port Setup (highlighted), Port Priority, SNMP, System Management, Storm Control, and Wizard. The main area is divided into tabs: Information, Configuration (selected), Security, Redundancy, Diagnostic, and Maintenance. Under the Configuration tab, there are two dropdown menus: 'Speed/Duplex' set to 'Auto' and 'Flow Control' set to 'Off'. A 'Submit' button is located below these menus. Below the configuration area is a 'Port Status' section containing a table with 10 ports.

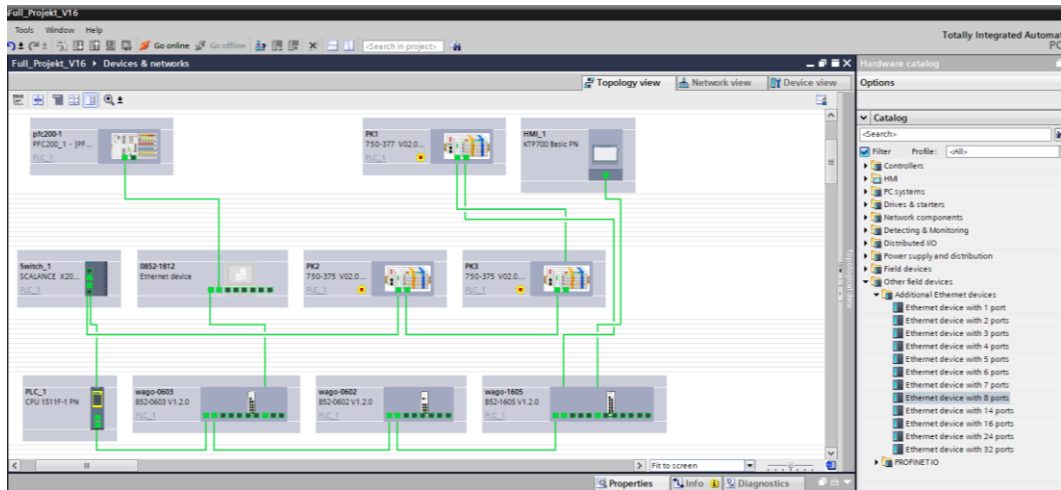
Port	State	Speed/Duplex	Flow Control	Status	Link Status	Edit
1	enabled	Auto	Off	Normally	100M / Full / Off	
2	enabled	Auto	Off	Normally	100M / Full / Off	
3	enabled	Auto	Off	Normally	100M / Full / Off	
4	disabled	Auto	Off	Disabled by Administrator	Link Down	
5	disabled	Auto	Off	Disabled by Administrator	Link Down	
6	disabled	Auto	Off	Disabled by Administrator	Link Down	
7	disabled	Auto	Off	Disabled by Administrator	Link Down	
8	disabled	Auto	Off	Disabled by Administrator	Link Down	
9	disabled	Auto	Off	Disabled by Administrator	Link Down	
10	disabled	Auto	Off	Disabled by Administrator	Link Down	

3.2 Additional Ethernet Device in the TIA-Portal

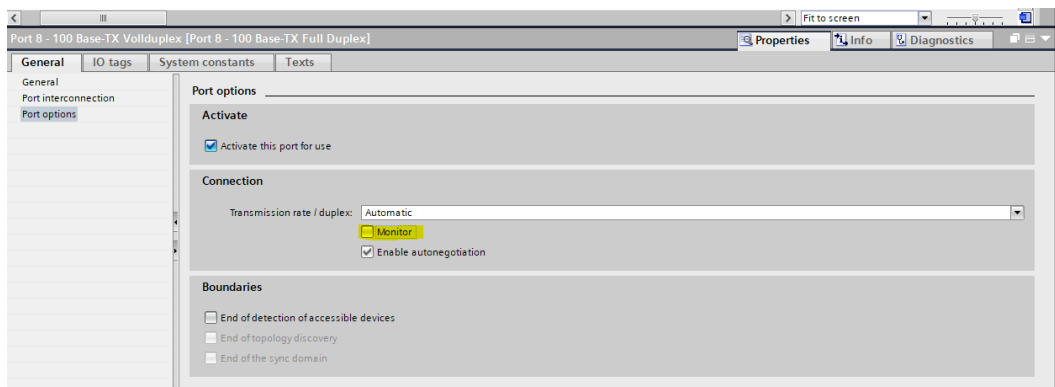
Compared to the unmanaged switch, which meets the requirements of Conformance Class A, the Lean Managed Switch has its own IP address. Due to this feature, the switch can be integrated in the TIA portal as an "Additional Ethernet device" useful.



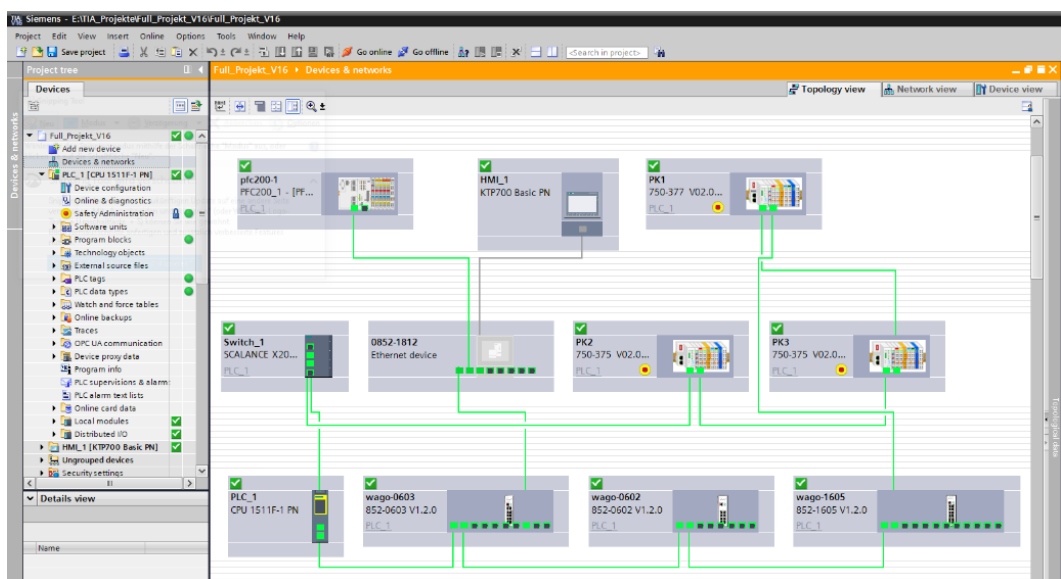
To integrate the product 852-1812 into a PROFINET® project the marked "Ethernet device" from the hardware catalog must be used.



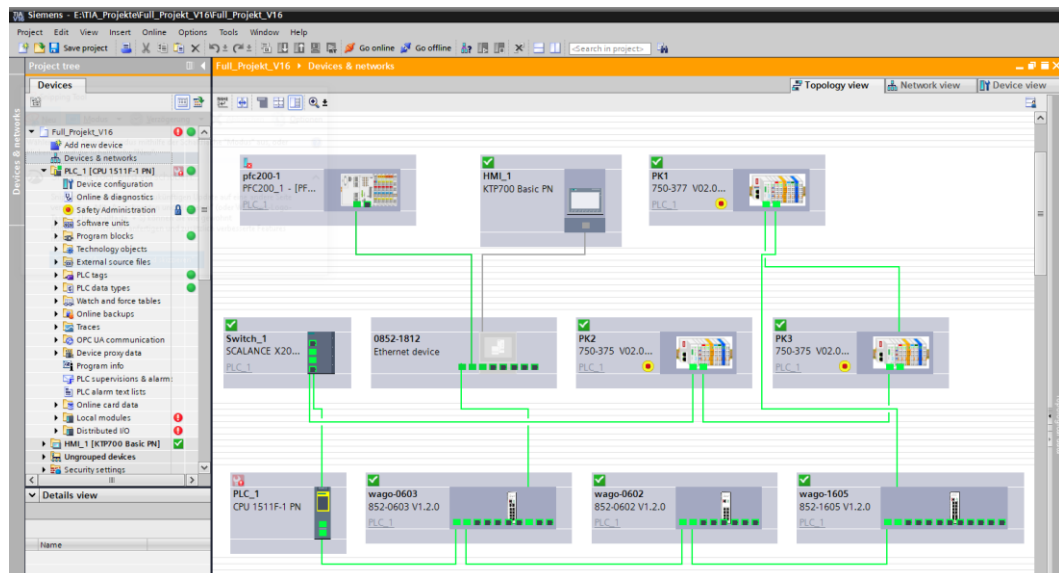
In this example, the Lean Managed Switch with part number 852-1812 was integrated into a test system. To ensure that no errors are displayed in the TIA Portal, monitoring of the ETHERNET connections between the Lean Managed Switch and the other Conformance Class B devices must be deactivated.



The project must be loaded into the PROFINET® system with the monitoring function disabled. The PROFINET® system is active.



Now the ETHERNET connection between the 0852-1812 and the pfc200-1 has been interrupted. A system error can be recognized directly.



The analysis of the diagnostic buffer clarifies the loss of connection of the PROFINET® device pfc200-1. The PROFINET® device pfc200-1 is not reachable.

No.	Date and time	Event
1	8/16/2022 10:39:50.917 A.	IO device failure - IO device not found
2	8/16/2022 10:39:50.916 A.	IO device failure - Watchdog time expired
3	8/16/2022 10:39:47.408 A.	IO device failure - Watchdog time expired
4	8/16/2022 10:35:55.832 A.	Communication initiated request: WARM RESTART - CPU changes from STOP to STARTUP mode
5	8/16/2022 10:35:50.592 A.	Communication initiated request: WARM RESTART - CPU changes from STOP to STARTUP mode
6	8/16/2022 10:35:46.726 A.	Data transfer not possible - Connection error - connection interrupted
7	8/16/2022 10:35:46.714 A.	Error on partner - inconsistency in transmission medium / duplex
8	8/16/2022 10:35:45.886 A.	Communication initiated request: STOP - CPU changes from RUN to STOP mode
9	8/16/2022 10:35:43.986 A.	Session authentication successful

Details on event:

Event ID: 164 02 39CB

Module: pfc200-1

Backslash: Rack --- Slot ---

Description: Error: IO device failure - IO device not found

Help on event: The IO device specified in the detailed information has failed or is not present. Check whether the failure belongs to an intended maintenance intervention. Check whether the failure occurs once or is repeatedly coming going. Check whether there are more device failures and locate the failed device(s) in the IOT system topology. Regard special device types (e.g. I devices, IE-IO).

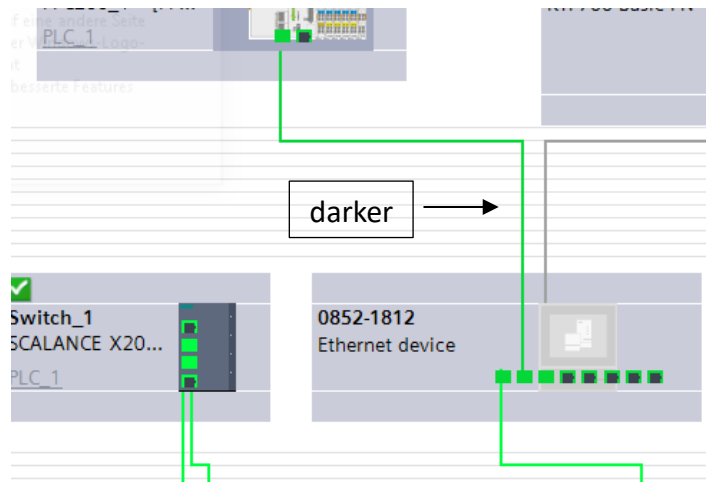
Remedy: Check power supply, network wiring and connectors. The IO device cannot be detected on the network.

Plant designation: --- Location ID: ---

Incoming/outgoing: --- Event type: Error

Open in editor Save as...

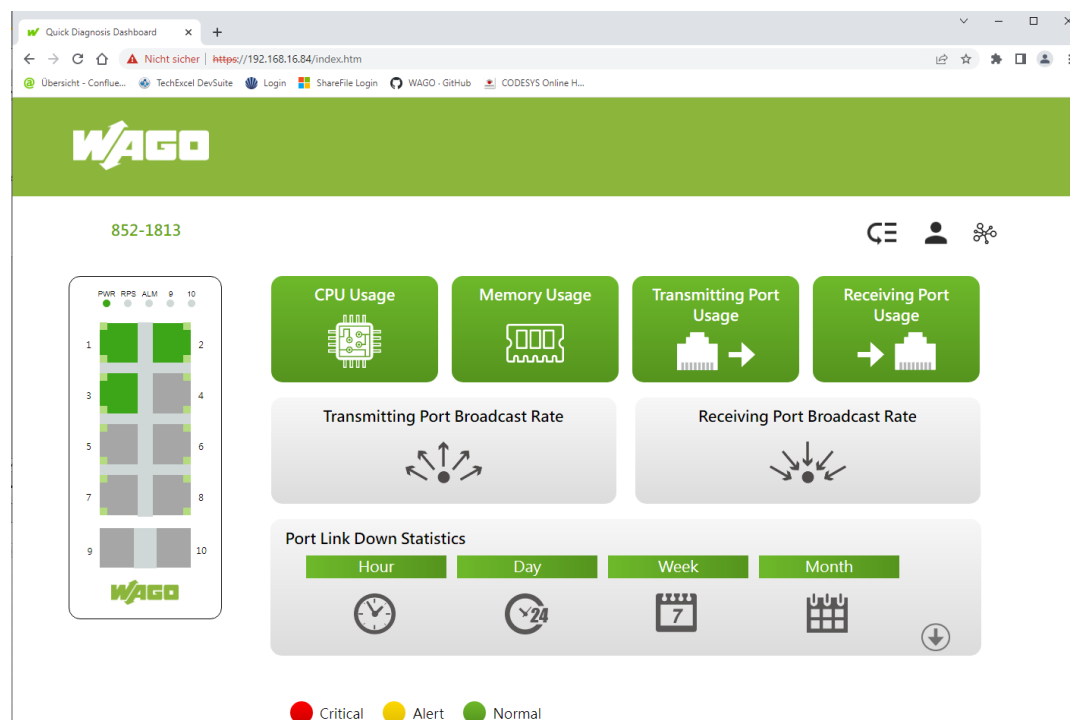
A close look at the connecting line between the 852-1812 and the pfc200-1 can identify a color difference of the green connection.



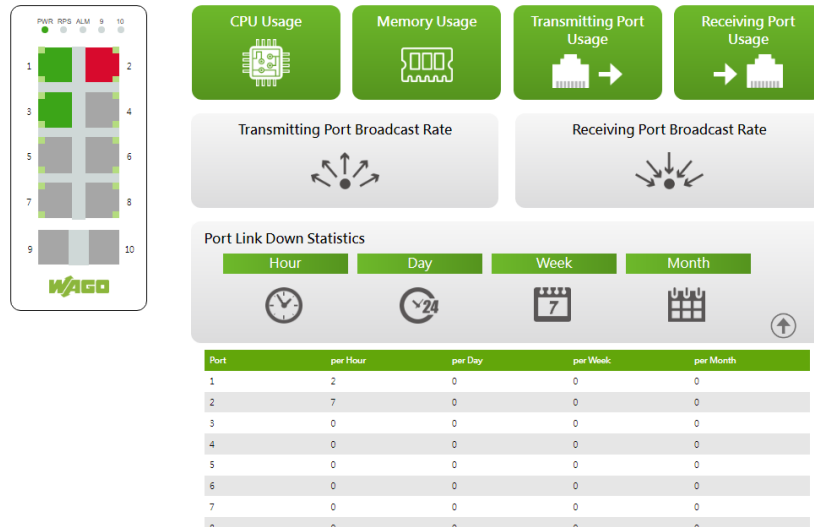
Of course, the diagnostic features of a Managed Switch with Conformance Class B are better. A red color is easily detected.

3.3 Diagnosis with the Web-based Management

The diagnostics dashboard is accessed via the IP address. In this, the system status of the switch is signaled in traffic light colors. This dashboard helps to troubleshoot the system.



A defective cable is detected by a red marking.



It is useful to provide the system operator with a link to this dashboard. This can reduce downtimes.

The Modbus registers in the Lean Managed Switch enable a detailed diagnosis of the switch from the application. For this purpose, the respective Modbus registers must be queried and analyzed from the application.

The Modbus TCP configuration screen shows the 'Modbus TCP Settings' section with a 'Note: The Modbus TCP allows the user to enable and disable in the Switch to communicate with Modbus server.' and an 'Enabled State' checkbox checked. Below is the 'Modbus TCP Information' section with a 'Download' button. The 'Read Input Registers (Function Code 04)' table lists various Modbus registers and their descriptions.

Modbus Address	Length	Interpretation	Description	
Dec	Hex	Word		
System Information				
1001	3e9	1	HEX	Vendor ID
1002	3ea	16	ASCII	Vendor Name
1033	409	16	ASCII	Product Name
1065	429	7	ASCII	Product Serial Number
1081	439	12	ASCII	Firmware Version
1097	449	16	ASCII	Firmware Release Date
1113	459	3	HEX	Ethernet MAC Address
1129	469	1	HEX	Power 1 (PWR) Alarm
1130	46a	1	HEX	Power 2(RPS) Alarm
1145	479	1	HEX	Fault LED Status
Port Information				
1257	4e9	1	HEX	Link Status of Port 1
1258	4ea	1	HEX	Link Status of Port 2
1259	4eb	1	HEX	Link Status of Port 3

The system log of the Lean Managed Switches offers another diagnostic option. Analyzing these entries can also speed up troubleshooting in the system.

WAGO

Information

Configuration

Security

Redundancy

Diagnostics

Maintenance

Alarm

Dashboard Configuration

Modbus TCP

SNMP

Syslog

System Log

Syslog Server Settings

Note: The syslog function records some of system information for debugging purpose. Each log message recorded with one of these levels, Alert/Critical/Error/Warning/Notice/Information.

Server State

☐

Server IP

0.0.0.0

Submit

System Log

Log Level

All

Filter

Delete

Save

<6> 2020 Jan 1 00:00:00 60003: System Cold Start!

<4> 2020 Jan 1 00:00:03 40006: Port 1 Link Up.

<6> 2020 Jan 1 00:05:07 60001: User(admin) Login Succeeded!

<4> 2020 Jan 1 00:06:24 4001d: Update System Firmware Succeeded!

<6> 2020 Jan 1 00:00:02 60004: System Warm Start!

<4> 2020 Jan 1 00:00:03 40006: Port 1 Link Up.

<6> 2020 Jan 1 00:00:45 60001: User(admin) Login Succeeded!

<6> 2020 Jan 1 00:01:08 60001: User(admin) Login Succeeded!

<6> 2020 Jan 1 00:01:14 60005: Save configurations to file!

<6> 2020 Jan 1 00:01:43 60005: Save configurations to file!

4 Configuration of alarm relay function

To use the alarm relay function with Lean Managed Switch, various alarm messages are provided on the website, such as the status of the ERPS ring or the status of the port. In addition, the relay direction can be user-defined. The relay opens or closes when the alarm function is active (Normal open or Normal close).

Note: 852-1816 does not support the full function due to hardware limitations.

The screenshot displays the WAGO web interface for configuring the ALM Output behavior. The top navigation bar includes tabs for Information, Configuration, Security, Redundancy, Diagnostic, and Maintenance. The left sidebar shows the Alarm section with sub-items: Information, ALM Output (selected), DIP Status, Traffic Flooding, and Port Utilization. Below this are links for Dashboard Configuration, Modbus TCP, SNMP, and Syslog. The main content area is titled 'ALM Output behavior' and contains the 'ALM Output Settings' section. This section lists various alarm sources with checkboxes: ERPS, Port 1, Port 2, Port 3, Port 4, Port 5, Port 6, Port 7, and Port 8. At the bottom, the 'Relay Direction' is set to 'Normal Open' via a dropdown menu.

Alarm Source	Enabled
ERPS	<input type="checkbox"/>
Port 1	<input type="checkbox"/>
Port 2	<input type="checkbox"/>
Port 3	<input type="checkbox"/>
Port 4	<input type="checkbox"/>
Port 5	<input type="checkbox"/>
Port 6	<input type="checkbox"/>
Port 7	<input type="checkbox"/>
Port 8	<input type="checkbox"/>

Relay Direction: Normal Open

The port parameter indicates the status of the monitored port (port link up or link down). An alarm will occur if there is a port link up or link down. In this case, the ALM relay changes status. The status of the ERPS rings can also be monitored.

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