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User Guide

aplSwitch Field / aplSwitch Field PA

V1.50-EN/2025-09-23

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Table of Contents

1 About this guide

1.1 Read me first

Please read this User Guide carefully before using the device to ensure safe and proper operation. Softing does not assume any liability for damages due to improper installation or operation of this product.

This User Guide describes how to install, configure and commission the Softing Ethernet-APL switch models **aplSwitch Field** and **aplSwitch Field PA**. Both models operate on the same firmware platform and work identically unless otherwise pointed out in the relevant chapters. The information provided is subject to change without prior notice.

1.2 Target audience

This User Guide is intended for qualified specialists and network professionals responsible for operating and monitoring field devices in an Ethernet-APL network. Any person working with the aplSwitch Field or aplSwitch Field PA must have read and fully understood the safety requirements and working instructions in this guide. This primarily applies to work in the following areas:

- Project engineering
- Installation
- Commissioning
- Automation system and network integration
- Maintenance, repair, cleaning

Anyone responsible for mounting, installing, and operating the switch must have a good working knowledge as required by applicable national standards and regulations. For tasks performed in hazardous areas additional expertise is required!

Softing recommends having a level of knowledge equal to that described in the following standards:

- IEC/EN 60079-14 (Electrical installations design, selection and erection)
- IEC/EN 60079-17 (Inspection and maintenance of electrical installations)
- IEC/EN 60079-19 (Equipment repair, overhaul and reclamation)

1.3 Typographic conventions

The following conventions are used throughout Softing customer documentation:

Keys, buttons, menu items, commands and other elements involving user interaction are set in bold font and menu sequences are separated by an arrow	Open **Start → Control Panel → Programs**
Buttons from the user interface are enclosed in brackets and set to bold typeface	Press **[Start]** to start the application
Coding samples, file extracts and screen output is set in Courier font type	`MaxDlsapAddressSupported=23`
File names and directories are written in italic	Device description files are located in *C:\<Application name>\delivery\software\Device Description files*

HINT

This symbol is used when providing you with helpful user hints.

NOTE

This symbol is used to call attention to notable information that should be followed during installation, use, or servicing of this device.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in damage or injury.

ELECTRONIC DISCHARGE

This symbol is used to warn about the sensitivity of components to electrostatic discharge. It is shown as a safety warning and a handling instruction for to anyone working with the device.

EXPLOSION HAZARD

Explosion hazard in an explosive atmosphere! Non-compliance may result in serious or fatal injuries.

1.4 Document history

Document version	Changes since last version
1.50	first customer release

1.5 Related documentation

See the product website for additional and related product information:

- Datasheet
- Softing product overview on Field Device Connectivity for Digital Plant Asset Management and Control
- Release Notes

1.6 Document feedback

We would like to encourage you to provide feedback and comments to help us improve the documentation. You can write your comments and suggestions to the PDF file using the editing tool in Adobe Reader and email your feedback to support.automation@softing.com.

If you prefer to write your feedback directly as an email, please include the following information with your comments:

- document name
- document version (as shown on cover page)
- page number

2 About the aplSwitch Field / aplSwitch Field PA

This document describes the physical connections, LED functions and basic setup of the aplSwitch Field and aplSwitch Field PA in Zone 2 networks.

The aplSwitch Field has the following connection:

- 1 x ground clamp connection (PA) at the top left
- 2 x power connections (PWR1 / PWR2)
- 2 x 100BASE-TX trunk ports (XT1 and XT2)
- 2 x SFP transceiver slots, 100BASE-FX trunk ports (see Section SFP module and datasheet for details)
- 1 x PT100 connection
- 16 x 10 Mbit/s spur ports supporting Ethernet-APL /PROFIBUS PA (using the PROFIBUS PA Proxy of the aplSwitch Field PA to connect PROFIBUS PA devices)

Note

Only dedicated aplSwitch Field versions support PROFIBUS PA. Ports XT3 and XT4 are SFP slots reserved for defined SFP modules. For supported SFP modules see product website.

aplSwitch Field supporting 12 class A and 4 class B spur ports

aplSwitch Field PA supporting 16 class A spur ports

2.1 Intended use

This product has been designed to be used in compliance with the product specifications, operating instructions and other applicable documents such as the datasheets. Any other use of the device is not considered to be intended use. Detailed information on safety and ambient conditions can be found in the datasheets. The aplSwitch Field is intended for installation in areas with a pollution degree of 2 or 1. Any unauthorized use is considered as misuse and is therefore not warranted.

It is intended for the connection of intrinsically safe 2-WISE Ethernet-APL or FISCO PROFIBUS PA field devices to higher level 4-wire Ethernet networks. The switch can be installed in hazardous areas Zone 2 and in the safe area. The intrinsically safe spurs are suitable for Zone 0, 1, 2 and Zone 20, 21, 22. The Ethernet-APL Field Switches supply the field devices with intrinsically safe power and convert the 4-wire 100Mbit/s Ethernet to a 2-wire Ethernet-APL 10 Mbit/s spurs. The 4-wire Ethernet networks are connected via CAT cables or optional via optical fibre (Zone 2 model).

Note

Installation and operation of the aplSwitch Field must be performed by qualified personnel only.

2.2 Safety

2.2.1 General precautions

Use the device only

- if it is not damaged
- as intended, while remaining aware of safety and dangers
- in accordance with these operating instructions.

CAUTION

During operation, the device's surface may become hot. Avoid direct contact. When servicing, turn off the power supply and wait until surface has cooled down.

ELECTRONIC DISCHARGE

The electronic components of the aplSwitch Field are sensitive to electrostatic discharges. Damages due to electrostatic discharge can lead to premature failure of components or intermittent faults at a later stage. Before installing the aplSwitch Field, divert the electrostatic discharge away from your body and the tools used.

CAUTION

Do not open the housing of the aplSwitch Field. It does not contain any parts that need to be maintained or repaired. In the event of a fault or defect, remove the device and return it to the vendor. Opening the device voids the warranty and immediately invalidates the EX protection.

2.2.2 Residual risks

Despite advance safety design, explosion hazards cannot be entirely eliminated in hazardous areas.

- Always perform all work steps in hazardous areas with the utmost care!
- Transport, store, plan, mount and operate the device exclusively in compliance with the technical data (see Chapter Technical data 16).

Possible hazards (residual risks) can be categorized according to the following causes:

Mechanical damage

The device can be damaged during transport, mounting or commissioning. This kind of damage may, for example, render the device's explosion protection partially or completely ineffective. This may result in explosions causing serious or even fatal injury of people.

- Only transport the device in special transport packaging that reliably protects the device from external influences. Observe the ambient conditions when selecting the transport packaging (see Chapter Technical data 16).
- Do not place any load on the device.
- Check the packaging and the device for damage. Report any damage to Softing immediately. Do not commission a damaged device.
- Store the device in its original packaging in a dry place (with no condensation), and make sure that it is stable and protected against the effects of vibrations and knocks.
- Observe the ambient temperature when storing the device.
- Do not damage the device and other system components during mounting.

Excessive heating or electrostatic charge

An incorrect setup in the enclosure, operation outside of approved conditions or improper cleaning can cause the device to heat up severely or to become electrostatically charged, causing it to produce sparks. This may result in explosions causing serious or even fatal injury of people.

- Operate the device only within the prescribed operating conditions (see the marking on the device and the see Chapter Technical data 16).
- Install and set up the cabinet in such a way that all devices installed within it are always operated within their permissible temperature range.
- Ensure that enough heat is being dissipated continuously, especially when mounting without a mounting plate.
- Clean the device as described in Chapter Caring for your aplSwitch Field 103 .
- The electronic components of the aplSwitch Field are sensitive to electrostatic discharges. Damages due to electrostatic discharge can lead to premature failure of components or intermittent faults at a later stage. Before installing the aplSwitch Field , divert the electrostatic discharge away from your body and the tools used.

Improper mounting, installation, commissioning, maintenance, or cleaning

Basic work such as installation, commissioning, maintenance, or cleaning of the device must be performed only in accordance with the applicable national regulations of the country of use and only by qualified persons. Otherwise, the explosion protection may be rendered ineffective. This may result in explosions causing serious or even fatal injury of people.

- Only have mounting, configuration and commissioning work performed by qualified and authorised persons (see Chapter Target audience 7).
- Prior to commissioning, check the mounting for correctness (see Chapter Mounting and dismounting 22).
- Clean only with damp cloth to avoid electrostatic discharge (see also Chapter Caring for your aplSwitch Field 103)
- The aplSwitch Field may be installed in zone 2 or outside the explosion hazardous areas
- The spring clamp terminals (see accessories) are protected according to IP30 (IEC/EN 60529). If all other non-intrinsically safe circuits inside the enclosure are IP30 protected as well (e.g. via covers), a marking “Warning – Non-intrinsically safe circuits protected by degree of protection IP30!" should be visible on the surrounding enclosure in 2. It is allowed to open the enclosure while energized in explosive atmospheres. aplSwitch Field with screw terminals (see accessories) are protected according to IP20 (IEC/EN 60529). If no additional IP30 protection is used for all non-intrinsically safe circuits inside the enclosure (e.g. via covers), a marking “Warning – Do not open when non-intrinsically safe circuits are energized!" should be visible on the surrounding enclosure in Zone 2. It is only allowed to open the enclosure while energized in absence of explosive atmospheres.
- Carry out all screw fastening processes carefully using the respectively specified screws and tightening torques.
- Sufficiently secure all communication lines against tensile force (e.g. by cable ties and screws).
- Maintain a distance of at least 50 mm for intrinsically safe and non-intrinsically safe circuits.
- Lay fibre optic cables in such a way that mechanical stresses and kinks are excluded. Observe minimum bending radii (observe manufacturer's instructions!) when laying fibre optic cables. A radius > 30 mm is typical.
- Do not remove the dust protection caps until immediately before connecting the plug connectors. Cover unused fibre optic connections and plug connectors with the dust protection caps supplied to prevent soiling.
- During operation, all plug-in terminals and the covers of not connected RJ45 sockets or SFP modules must be fitted.
- Gently clean the device with a damp cloth only – do not use scratching, abrasive or aggressive cleaning agents or solutions.
- Only use the device with original accessories approved by Softing.
- Do not open the housing of the aplSwitch Field. It does not contain any parts that need to be maintained or repaired. In the event of a fault or defect, remove the device and return it to the vendor. Opening the device will void the warranty and the explosion protection!
- All repair work on the device must be performed by Softing.

2.2.3 Specific conditions of use

- The device shall be installed within an enclosure, which has a minimum rating of IP54 in accordance with IEC 60079-0, with a pollution degree of 1 or 2.
- The device shall be installed in an environment with an overvoltage category of II or I.
- The maximum permissible ambient temperature may vary depending on the device type. Please consult the technical data.
- The Ethernet interfaces for data transfer of the aplSwitch Field are data interfaces and the voltages comply with the criteria for safety extra low voltages, no transient overvoltage’s are expected.
- By using a SFP module the maximum ambient temperature for the device is limited to +65 °C.
- By using B-Ports the maximum ambient temperature for the device is limited to +60 °C.

2.3 Supported features

The switch is available in two models supporting the following features:

aplSwitch Field and aplSwitch Field PA

- 10 Mbit/s or 100 Mbit/s full-duplex communication on trunk ports
- 2 x SFP slots
- optional 100BASE-FX support by dedicated SFP-modules (see Accessories and Spare Parts 141)
- 10 Mbit/s full-duplex communication on spur ports
- integrated diagnostics for physical layer and network
- supporting 12 class A spur ports and 4 class B spur ports for APL devices only
- PROFINET Conformance Class B support incl. MRP and high availability (S2 redundancy and dynamic reconfiguration)

aplSwitch Field PA only

- 10 Mbit/s or 100 Mbit/s full-duplex communication on trunk ports
- 2 x SFP slots
- optional 100BASE-FX support by dedicated SFP-modules (see Accessories and Spare Parts 141)
- 10 Mbit/s full-duplex communication on spur ports
- integrated diagnostics for physical layer and network
- PROFINET Conformance Class B support incl. MRP and high availability (S2 redundancy and dynamic reconfiguration)
- PA Proxy function for mixed use of APL and PA devices per spur
- supporting 16 class A spur ports

2.4 System requirements

To install, connect and operate your aplSwitch Field you will need:

- 24VDC - 48VDC power supply
- PC with web browser (Google Chrome, Microsoft Edge, Firefox)
- Ethernet cable
- SFP module (optional)

2.5 Technical data

	aplSwitch Field	aplSwitch Field PA
Explosion Protection		
Installation (Zones)	2, safe area	2, safe area
Ex interface Zone	0, 1, 2, 20, 21, 22	0, 1, 2, 20, 21, 22
IECEx certificate	IECEx TUR 24.0034X	IECEx TUR 24.0034X
IECEx gas explosion protection	Ex ec ic [ia Ga] IIC T4 Gc	Ex ec ic [ia Ga] IIC T4 Gc
IECEx dust explosion protection	[Ex ia Da] IIIC	[Ex ia Da] IIIC
ATEX certificate	TÜV 24 ATEX 9134 X	TÜV 24 ATEX 9134 X
ATEX gas explosion protection	e II 3 (1) G Ex ec ic [ia Ga] IIC T4 Gc	e II 3 (1) G Ex ec ic [ia Ga] IIC T4 Gc
ATEX dust explosion protection	e II (1) D [Ex ia Da] IIIC	e II (1) D [Ex ia Da] IIIC
Safety Data Spurs (S01…16)		
Intrinsic safety concept 1	2-WISE (CLC IEC/TS 60079- 47:2021)	2-WISE (CLC IEC/TS 60079- 47:2021)
Intrinsic safety concept 2	-	FISCO (IEC 60079-11, -25)
Max. output voltage Class A U_o	14.9 V	14.9 V
Max. output current Class A I_o	379 mA	379 mA
Max. output power Class A P_o	998 mW	998 mW
Max. output voltage Class B U_o	17.1 V	-
Max. output current Class B I_o	378 mA	-
Max. output power Class B P_o	1660 mW	-
Max. int. capacitance C_i	110 pF	110 pF
Max. int. inductance L_i	280 nH	280 nH
Max. safety voltage U_m	60 V	60 V
Safety Data Pt100 (SPT)		
Nominal output current I_N	1 mA	1 mA
Safety data according	ib	ib
Max. output voltage U_o	4.94 V	4.94 V
Max. output current I_o	15.6 mA	15.6 mA
Max. output power P_o	52 mW	52 mW
Max. int. capacitance C_i	11 nF	11 nF
Max. int. Inductance L_i	0 nH	0 nH
Electrical Data		
Max. safety voltage U_m	60 V	60 V
Interface 1 version	100BASE-TX	100BASE-TX
Transfer rate interface 1	10/100 MBit/s	10/100 MBit/s
Number of ports interface 1	2 (XT1, XT2)	2 (XT1, XT2)
Connection type interface 1	RJ45 (EIA/ TIA 568B)	RJ45 (EIA/ TIA 568B)
Interface 2 version	100BASE-FX (optional)	100BASE-FX (optional)
Transfer rate interface 2	100 MBit/s	100 MBit/s
Number of ports interface 2	2 (XT3, XT4)	2 (XT3, XT4)
Connection type interface 2	SFP (optional)	SFP (optional)
Auxiliary Power		
Auxiliary power nominal voltage U_N	24 V DC, 48 V DC	-
Auxiliary power voltage range	19.2 ... 57.6 V DC	-
Max. current consumpt. 24 V DC I_N	1.4 A	0.95 A
Max. current consumpt. 48 V DC I_N	0.65 A	0.5 A
Max. power consumption	31.2 W	22.8 W
Max. power dissipation	19 W	13 W

	aplSwitch Field	aplSwitch Field PA
Galvanic Isolation		
Test voltage for galvanic isolation	Acc. to standard EN 60079- 11	Acc. to standard EN 60079- 11
Auxiliary power/spurs/100BASE	≥ 1500 V AC	≥ 1500 V AC
Between spurs	none	none
Field Device Interface		
Spurs version	Ethernet-APL (10BASE-T1L)	Ethernet-APL (10BASE-T1L) PROFIBUS PA
Number of ports spurs	16	16
Characteristic spurs	2-WISE power source	2-WISE power source FISCO
Transfer rate spurs	10 MBit/s full duplex	10 MBit/s full duplex 31.25 kBit/s
Power Class	A, B	A
Max. number of spurs power class A	16	16
Max. number of spurs power class B	4	0
Max. no. spurs PROFIBUS PA	0	16
Output nom. volt. range class A U_N	9.6 … 13.8 V	9.6 … 13.8 V
Output nom. cur. power class A I_N	56 mA	56 mA
Output power power class A P_N	0.54 W	0.54 W
Output nom. volt. range class B U_N	10.1 … 12.6 V	-
Output nom. cur. power class B I_N	115 mA	-
Output power power class B P_N	1.17 W	-
Device Specific Data		
Protocols	PROFINET	PROFINET
Characteristic protocol 1	Device, conformance class B	Device, conformance class B
Availability protocol 1	System redundancy S2, MRP	System redundancy S2, MRP
Functions protocol 1	Dynamic reconfiguration, Network load class III, pruning, rate limiter	Dynamic reconfiguration, Network load class III, pruning, rate limiter
Ethernet functions	SNMP, DHCP	SNMP, DHCP
Cyber security	HTTPS, password mngt, port lock	HTTPS, password mngt, port lock
Diagnostics		
Physical layer 10BASE- T1L	SNR, TDR, shield unbalance	SNR, TDR, Shield unbalance
Communication	Lost packets, LLDP	Lost packets, LLDP
Ambient condition	Temperature, humidity	Temperature, humidity
Display		
Display resolution	256 x 64 pixels	256 x 64 pixels
Display operation	4 operating keys, capacitive	4 operating keys, capacitive
Ambient Conditions		
Ambient temperature	-40 °C ... +70 °C	-40 °C ... +70 °C
Ambient temperature note1	-40 °C ... +65 °C (with SFP module)	-40 °C ... +65 °C (with SFP module)
Ambient temperature note2	-40 °C ... +60 °C (if B-ports are used)	-
Storage temperature	-40 °C ... +80 °C	-40 °C ... +80 °C
Max. relative humidity	95% (without condensation)	95% (without condensation)
Altitude	< 2000 m	< 2000 m
Mechanical Data		
Degree of protection (IEC 60529)	IP20 - with screw terminals) IP30 - with spring clamp terminals)	IP20 - with screw terminals) IP30 - with spring clamp terminals)
Fire resistance (UL 94)	V0	V0
Pollutant class	Acc. to G3 (ISA-71-04-2013)	Acc. to G3 (ISA-71-04-2013)
Enclosure material	Aluminium, painted	Aluminium, painted
Dimensions (L x W x H)	260 x 292 x 52.6 mm	260 x 292 x 52.6 mm
Weight	3.8 kg	3.8 kg
Mounting / Installation		
Mounting orientation	Horizontal, vertical	Horizontal, vertical
Mounting type	On mounting plate	On mounting plate

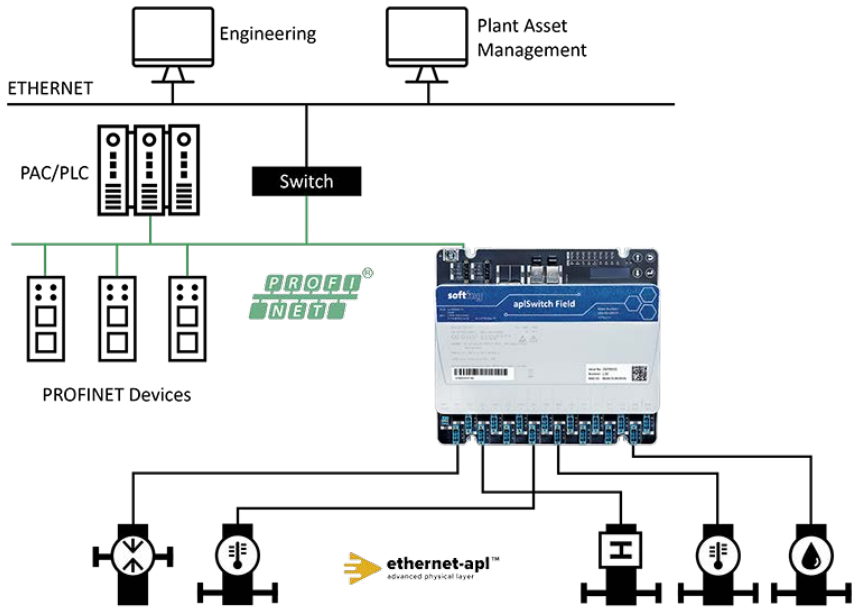
2.6 Network topology

The following topology diagrams present a connection overview for a aplSwitch Field and aplSwitch Field PA network.

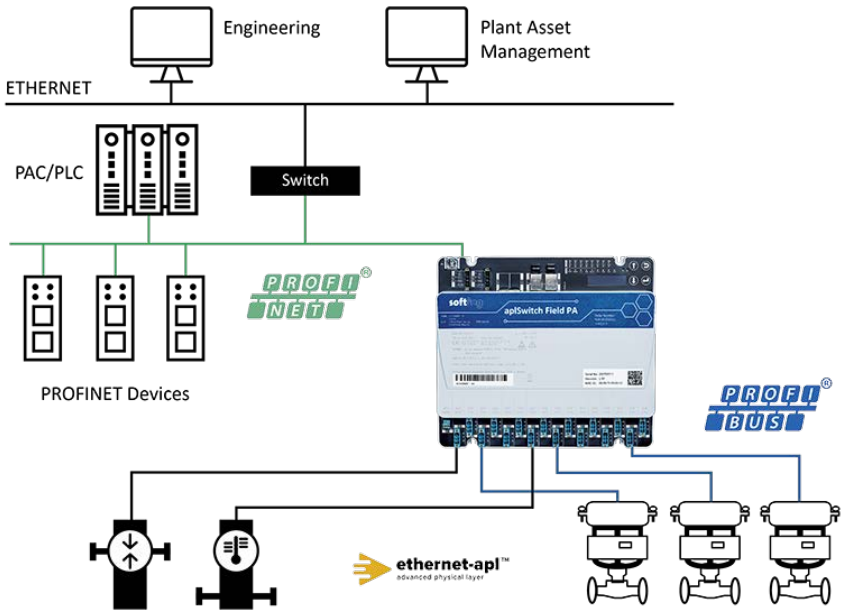
Note

You can visualize your network topology using the Siemens commissioning and diagnostic tool PRONETA, available for download from the Siemens website.

aplSwitch Field network example:

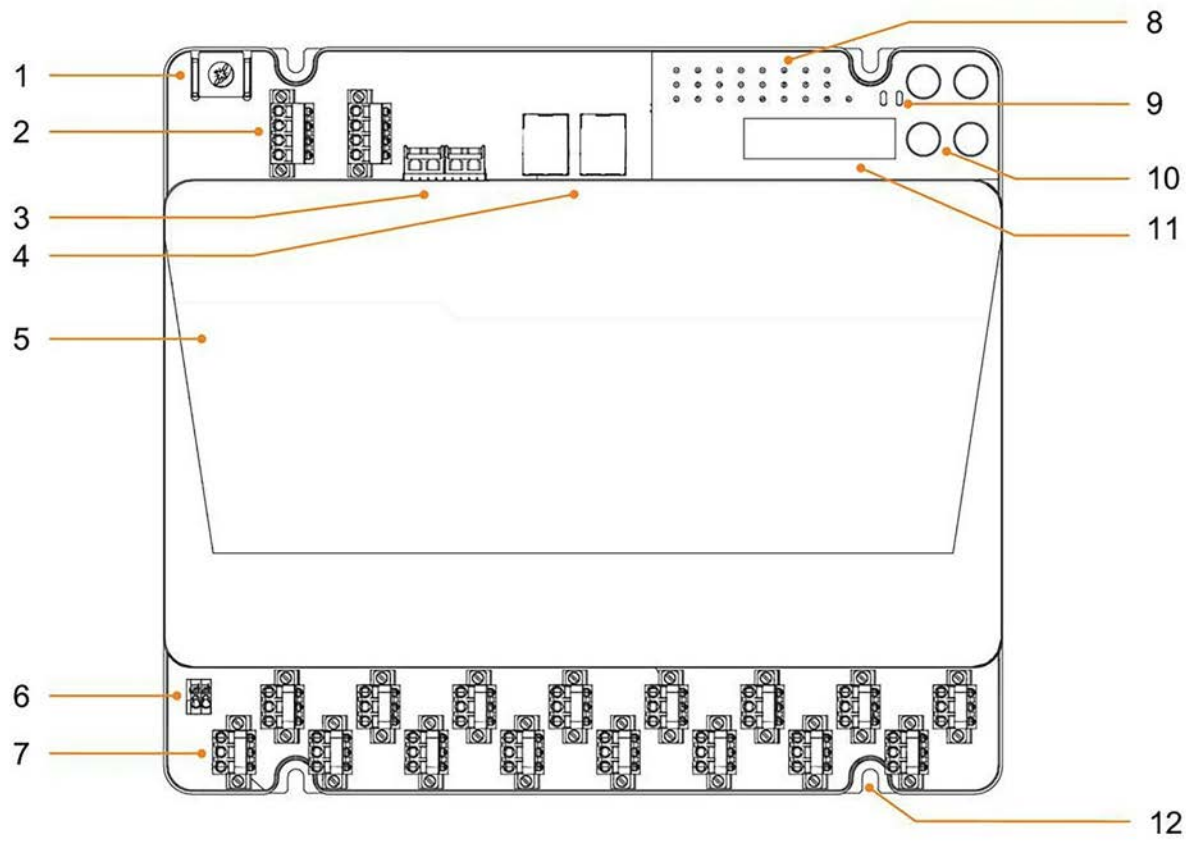


aplSwitch Field PA network example:



2.6.1 Hardware description

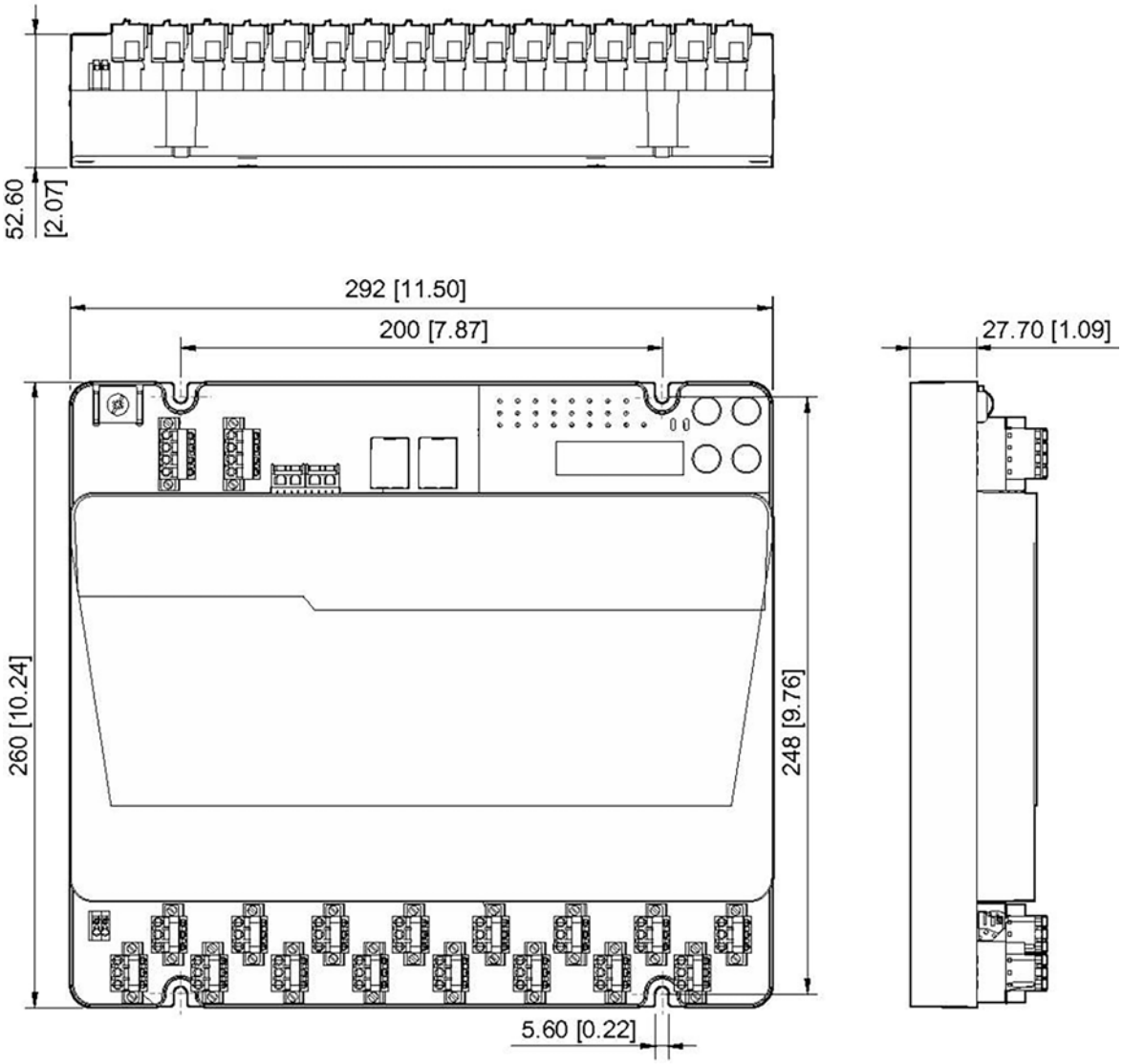
The aplSwitch Field Zone 2 device has the following components.



#	Device elements	Description
1	Connection for PE	Phillips screw for connecting the field switch to the safety potential equalization (PE)
2	Primary and redundant power supply connections	Plug-in terminals PWR1, PWR2 with two locking screws
3	SFP module slots	Optional connections XT3, XT4 for optical fibres via SFP-modules (see Accessories and Spare Parts 141)
4	100BASE-TX connectors	Connection XT1, XT2 for 100BASE-TX Ethernet with RJ45 plugs
5	Labeling area	Device marking, explosion protection and certification labelling, 2-WISE/FISCO label, serial number, date of production
6	Pt100 connector	Spring clamp, 2-pole for intrinsically safe connection of a Pt100 sensor for external temperature measurement
7	Spur connectors	Intrinsically safe connection of up to 16 field devices, Ethernet-APL or PROFIBUS PA. Versions as 3-pole plug-in screw or spring clamp terminals with locking screws.
8	Device status LEDs	Indication of status messages and state of Ethernet links
9	humidity/temperature sensor	Measures both the ambient humidity and temperature
10	OLED operation buttons	Operation of the OLED: up-/down menu, return, back
11	OLED	Status and error messages of the aplSwitch Field and the connected devices
12	Mounting holes	Installation of the field switch on a mounting plate, see Mounting and dismounting 22 .

2.7 Hardware dimensions

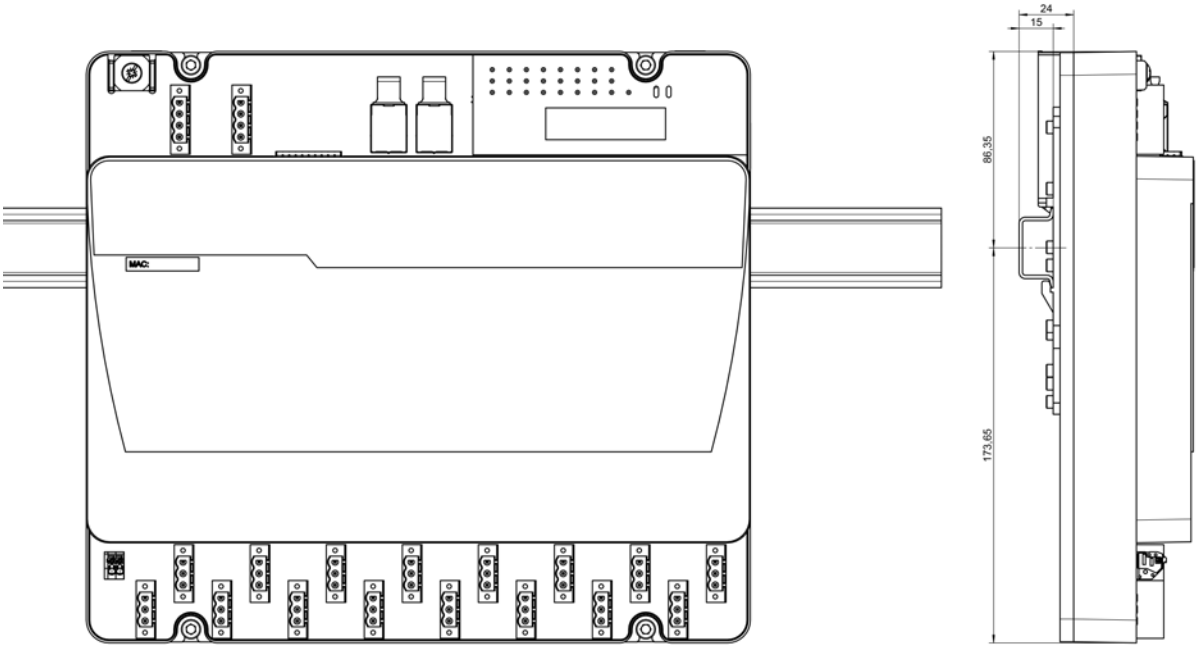
The aplSwitch Field from Softing has the following dimensions (mm and [inches]).



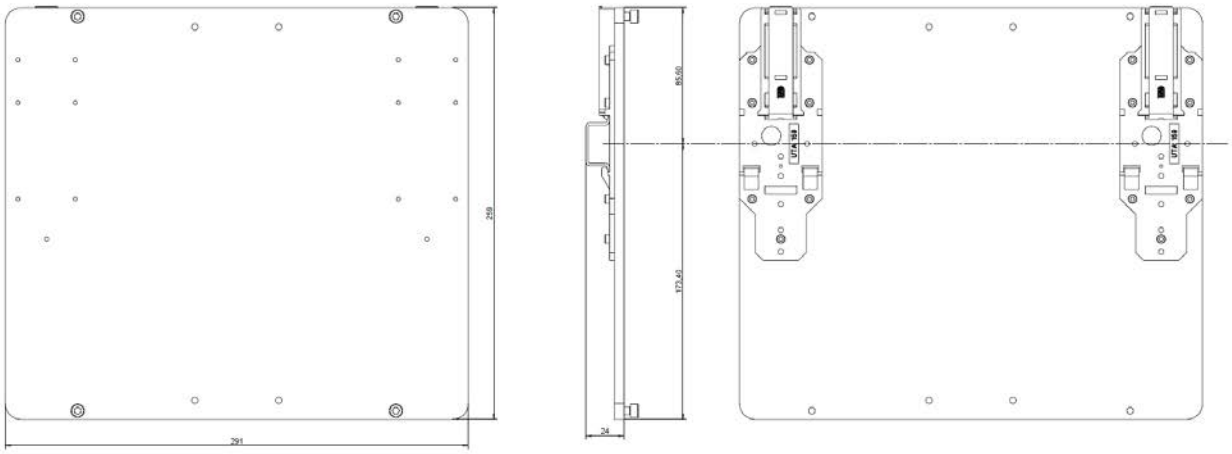
DIN Rail and mounting

NOTE

The DIN rail must be ordered separately. See the datasheet on the product website and the Chapter Accessories and spare parts 141 for details.



Mounting plate with rail clip



3 Installation

3.1 Hardware installation

Note
With an ambient temperature above 55 °C at the place of installation it is very likely that the temperatures of connecting cables will increase if the cables are installed in an unfavourable position. In such cases, measure the temperature to ensure that the service temperature of the cables is not exceeded or use cables sustaining high temperatures of at least 90 °C.

Note
The connections of the aplSwitch Field are listed below. Please note that not all connections are enabled. Any disabled connections are exempt from use.

3.1.1 Mounting and dismounting

The device is shipped without mounting components. The device can be mounted in one of three ways: (A) flat on a mounting plate, (B) secured to two DIN rails (top screws on the upper rail and bottom screws on the lower rail), or (C) attached with rail clips as shown in the drawing below. See the Chapter Accessories 141 or the datasheet for ordering spare parts.

This chapter describes how to mount the aplSwitch Field with M5 screws on a mounting plate or two DIN rails. See Chapter Hardware Dimensions 20 for details. Mount the device carefully and in accordance with the applicable safety instructions (see Chapter Safety) 11 .

CAUTION
The device is relatively heavy. Installation by two people is recommended. Make sure that the mounting location is suitable for the weight.

EXPLOSION HAZARD
Do not connect or disconnect non-intrinsically safe connectors during operation in potentially explosive atmospheres.

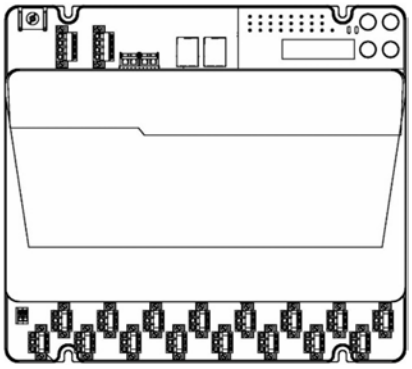
NOTE
Only remove the dust protection cap and protective caps immediately before connection to prevent contamination of the transmitting and receiving elements!

NOTE
If the device is to be operated under difficult circumstances (e.g on board of ships) additional measures have to be taken. For further information contact your Softing sales representative.

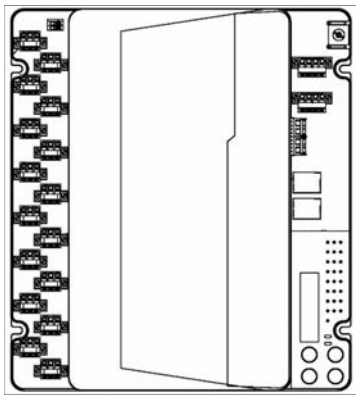
Mounting positions

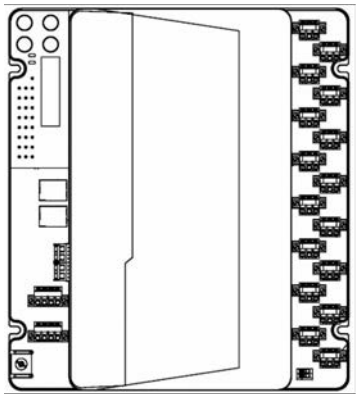
The aplSwitch Field is designed for vertical and horizontal wall and DIN rail mounting.

horizontal position

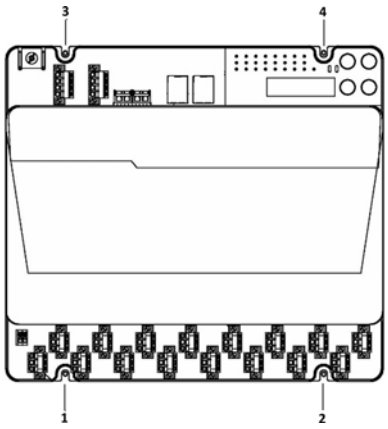


vertical positions





Mounting



1. Mount the aplSwitch Field as shown using four M5 counter-sunk screws. Always start with the bottom screws first (both vertically and horizontally).

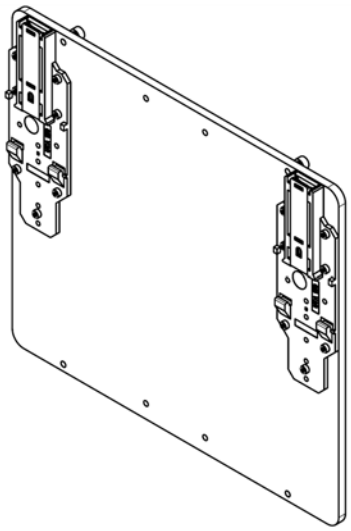
2. If you are using rails clips (mounting option B), hook the device onto the DIN rail.

3. Leverage a screwdriver upwards into the rail clip, pull the locking bar downwards and move the device down towards the rail.

4. Press the plate-mounted device down towards the rail until the clip slides over the lip of the rail.

5. Using the potential equalization clamp marked with the earthing symbol ⏚, connect the device to your network grounding / potential equalization (the cross-section of the cable must be at least 4 mm²).

Dismounting



1. Disconnect the power supply including the protective ground ⏚, Ethernet trunk and all spur terminals.

2. If the device is mounted on a mounting plate (options A) or on two DIN rails (option B) carefully loosen and remove the mounting screws, starting with the top screws 3 and 4 while leaving the aplSwitch Field rest on the bottom screws (1 and 2).

3. If you are using rails clips, slide a screwdriver diagonally into the locking bar of the rail clip.

4. Leverage the screwdriver upwards, pull the locking bar downwards and lift the device off the rail.

Note
Make sure the aplSwitch Field is mounted in such a way that the power supply can be easily disconnected. Depending on the installation position, the maximum ambient operating temperature may differ.

Installation and inspection
Installation and inspection must be carried out by qualified personnel only in accordance with the international standard IEC 60079-17.

3.1.2 Connecting the power supply

WARNING
Do not connect external power to a spur terminal as this will damage the aplSwitch Field beyond repair and will render the Ex approval of the device null an void.

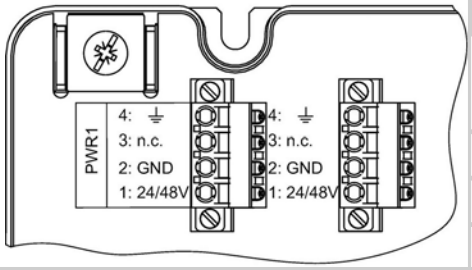
The aplSwitch Field has two power connections (PWR1 and PWR2) for redundant power supply at the top left side. The accepted voltage values are +24 V to +48 V. The same voltage must be set for both connections. Connect the device only to equipment with a maximum internal voltage of Um ≤ 60 V.

Supply Connection	Rated Voltage
PWR1	24…48 VDC
PWR2	24…48 VDC

Note
See the user interface menu Switch 100 → Power 100 for details on the power supply settings.

Note
See also Chapter Power Supply diagnosis 119 in the Appendix for details on the voltage value at PWR1 and PWR2.

Pin assignment of the power supply



Signal	Description
⏚	functional earth (potential equalization)
-	not connected
GND	ground
24/48V	+24/+48 V DC power supply

The aplSwitch Field comes with spring or screw terminal plugs (see Scope of Delivery). Secure the screw plug terminals on the device using a tightening torque of 0.3 Nm. The conductor must have a cross section of 0.2 – 2.5 mm².

CAUTION
When using a screw terminal the IP54 enclosure must either show the warning "Do not open when energized" or the terminal needs to be covered by an IP30 protection.

EXPLOSION HAZARD
The connectors shall not be plugged or unplugged during the device is in operation in a potentially explosive atmosphere..

3.1.3 Connecting Ethernet trunks

Ports XT1 to XT4 are assigned for an uplink traffic to standard 100 Mbits/s Ethernet networks. At least one Ethernet trunk must be activated and connected with the network before the aplSwitch Field is put into operation.

Note

See the PNO PROFINET Assembling Guideline for details on how to connect PROFINET.

aplSwitch Field Zone 2

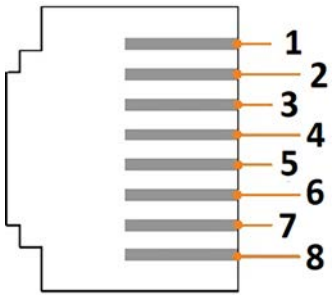
Label	Connector	Network
XT1	RJ45	100BASE-TX
XT2	RJ45	100BASE-TX
XT3	SFP*	100BASE-FX
XT4	SFP*	100BASE-FX

* must be ordered separately (see datasheet for order numbers).

Note

See the PNO PROFINET Assembling Guideline for details on how to connect PROFINET.

Zone 2 Field Switches use standardized RJ45 connectors for XT1 and XT2.

	Pin Pair	Pin No.	Function	Description
	1	4	-	not connected
		5	-	not connected
	2	1	Tc+	Transmit Data+
		2	Tx-	Transmit Data-
	3	3	RX+	Receive Data +
		6	Rx-	Receive Data -
	4	7	-	not connected
		8	-	not connected

Note

Connect the Ethernet cables to the RJ45 sockets of the switch using standard RJ45 plug connectors with latching hooks (to prevent unintentional disconnection of the connection).

SFP module used for fibre optical connection at XT3 / XT4 in Zone 2 (Optional)

1. The SFP modules must not be plugged or unplugged while the device is operated in a potentially explosive atmosphere.
2. Only use SFP modules that have been approved by Softing (see the product website for details).
3. Fibre interfaces: Laser Class 1 approved according to IEC 60825-1. The optical cables may lead either into or through areas requiring equipment of EPL Gb, Gc, Db or Dc.
4. The optionally installed SFP connectors XT3, XT4 can be plugged or unplugged in operation in a potentially explosive atmosphere if Class 1 Laser interfaces according to IEC 60825-1 are used.
5. When using lasers according to optical radiation IEC 60825-1 (Class 1) and IEC 60079-28, the connection can be plugged and unplugged during operation in explosive atmospheres.

6. The SFP modules are sensitive to electrostatic discharges  .
   Damages due to electrostatic discharge can lead to premature failure of components or intermittent faults at a later stage. Before installing the SFP modules, divert the electrostatic discharge away from your body and the tools used.
7. Plug in the SFP modules into the slot XT3 and/or XT4. Make sure, the SFP modules are fully plugged into the slot and latched.
8. Remove the protective caps from the plug and socket.
9. Plug the fibre optic cables onto the LC connector of the SFP module and ensure that the plug snaps into place.
10. Observe the instructions for laying fibre optic cables!

EXPLOSION HAZARD

Do not plug or unplug the trunk connectors while the device is operated in a potentially explosive atmosphere.

EXPLOSION HAZARD

Connect the device only to equipment with a maximum internal voltage of Um ≤ 60 V.

3.1.4 Connecting Ethernet APL and PROFIBUS spur ports

Note

For details on how to connect a PROFINET cable, see the PROFINET Assembling Guideline.

Intrinsically safe interfaces

Ethernet-APL field devices and PROFIBUS PA field devices can be connected at the spur ports. The electrical characteristic corresponds to the power classes of Ethernet-APL or to PROFIBUS PA. The Ethernet-APL power class of the spur port is printed on the aplSwitch Field.

Note

aplSwitch Field is not polarity sensitive! Pin assignments + and – can be swapped. For details on connecting APL devices see the Ethernet-APL Engineering Guidelines and the instruction manuals of your field devices that you intend to connect to the aplSwitch Field.

You can connect your Ethernet APL field devices to the spur ports of the aplSwitch Field. The electrical characteristics correspond to the power classes of Ethernet APL or PROFIBUS PA. The correct Ethernet APL power class of the spur port is printed on the housing of your aplSwitch Field.

Note

Please pay attention to the power class of the aplSwitch Field.

Order number/part number GSA-XX-020101 (16 spur Ethernet-APL model).

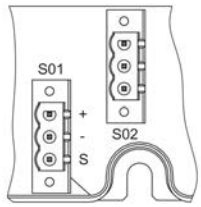
Spur ports	Nominal Values	Power Class[1]
S01...12 APL	9.6 V / 55.6 mA	A
S13...16 APL	10.1 V / 115 mA	A or B[2]

Order number/part number GSA-XX-020111 (16 spur Ethernet-APL/PA model):

Spur ports	Nominal Values	Power Class[1]
S01...16 APL/PA	9.6 V / 55.6 mA	A

[1] The power classes correspond to the Ethernet-APL Port Profile specification of the APL working group.
[2] Power Class B is currently not supported for switches with PA-Proxy function.

Pin assignment of a fieldbus cable type A



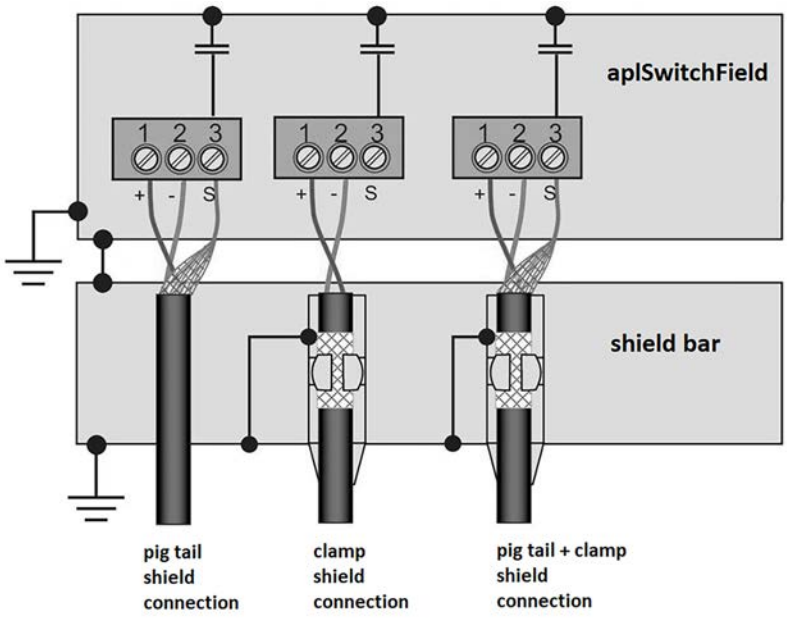
Signal	Sheath Colors	Ethernet APL	PROFIBUS PA
+	red	APL signal +	PA signal +
-	green	APL signal -	PA signal -
S		Shield	Shield

Note

aplSwitch Field is not polarity sensitive! Pin assignments + and – can be swapped. For details on connecting APL devices see the Ethernet-APL Engineering Guidelines.

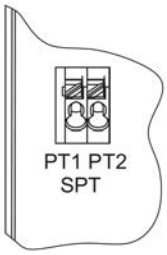
3.1.5 Connecting spur cables

The aplSwitch Field has capacitive shielding connection at the spur terminals. See the figure below for options on how to connect the shielding of the aplSwitch Field spur cables. See also Ethernet-APL Engineering Guideline for more details.



3.1.6 Connecting an external PT100 temperature sensor

To measure the ambient temperature, an intrinsically safe 2-wire connection of an external Pt100 temperature sensor (simple apparatus) can be used. Data and alarms are sent via the diagnostics and communication network. The maximum connectable cable length is 3 m.



3.1.7 Powering up the device

Turn on the power supply. The boot process takes about 20 seconds. Please wait while the green BOOT Status LED is ON. Do not disconnect the power during the boot process. The device is ready when the **BOOT** LED is OFF and at least one green **PWR** LED is ON. For indication of proper operation of an aplSwitch Field refer to LED status indicators 73 .

3.2 Software installation

The aplSwitch Field comes with a pre-installed firmware.

Note

Ensure that the latest firmware is installed on the device. See Chapter Firmware update 82 on where to find and how to install the latest firmware version.

3.3 Resetting the device

Your aplSwitch Field can be reset to restore previous settings or return to the original custom settings known as factory default.

3.3.1 Soft reset

A soft reset is basically a reset of the device through a software restart in the user interface. It allows you to clear your aplSwitch Field of all configuration data, except for the IP address and associated licenses.

Action required:

See Section **Settings → Reset** 84 for details.

3.3.2 Hard reset

This type of reset is recommended if your aplSwitch Field is not responding, is malfunctioning or you simply cannot log on to the device because you have forgotten your login credentials. A hard reset deletes all device settings including the IP address and restores the factory default.

Note

To perform a hard rest of the device, you will need to take it off the rail and mounting plate to access the reset button on the back. This design adds security and helps prevent accidental or unauthorized resets.

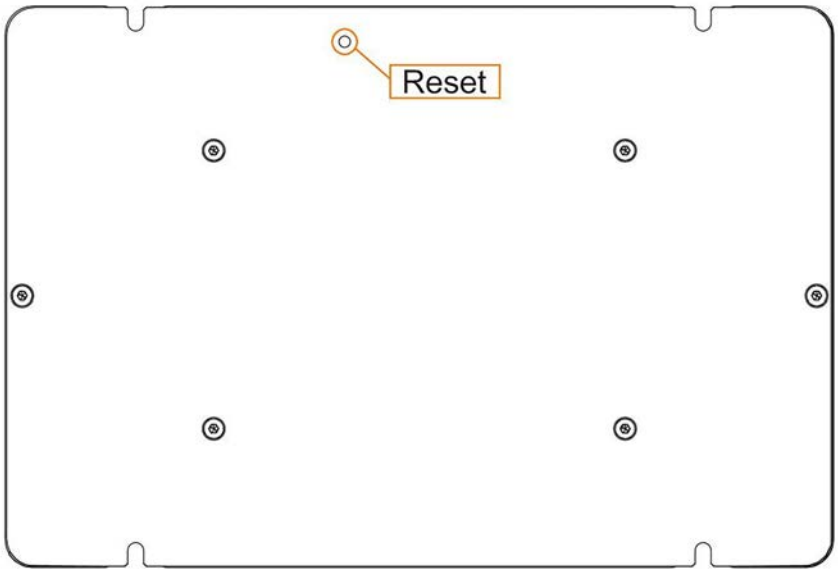
Note

We recommend to press the reset button only if you wish to clear your device of all configurations or if you have attempted all other methods of troubleshooting unsuccessfully. Remember that any type of reset will affect the device settings and all previously configured user data.

Example: You want to decommission a device because your plant is undergoing reconstruction and the network is taken out of service.

Action required:

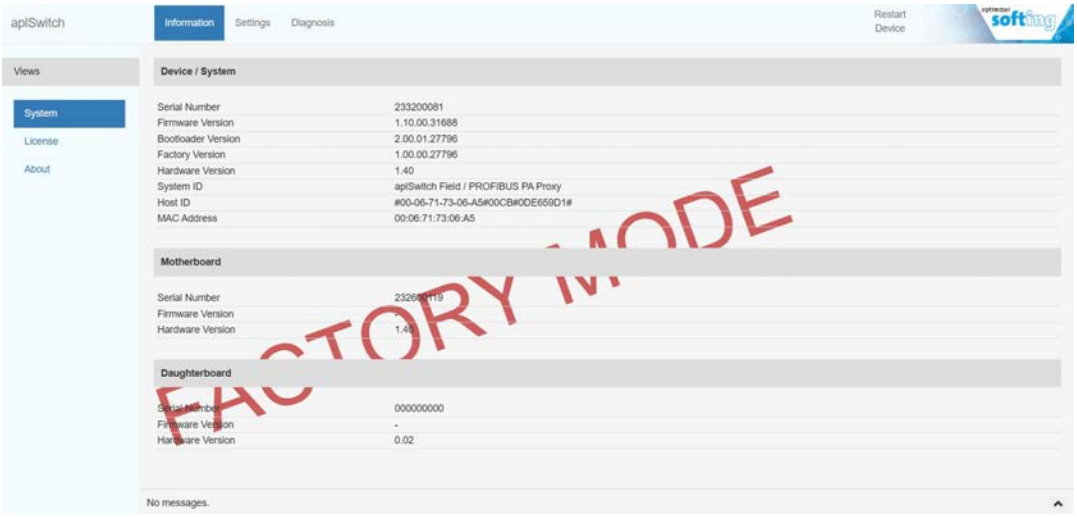
1. Disconnect the power supply of the aplSwitch Field.
2. Insert a thin screwdriver (2-3 mm) into the reset hole in the back of the device. Do not use force.



3. Gently press the reset button while reconnecting and powering up the device. Do not use excessive force to avoid damaging the button.
4. Hold the button for 10 seconds. Only the green BOOT LED turns ON.
5. Release the reset button after **10 seconds**. The aplSwitch Field is now in factory mode.

Note
The green BOOT LED is ON and the device display is turned OFF.

6. Start your Internet browser and enter the last IP address of the device to access the user interface. The user interface shows that the device is now running in factory mode (watermarked diagonally across each menu). Only the menus Information, Setting and Diagnosis are available.



7. Press the reset button again and hold it for **15 to 20 seconds**.
8. Release the reset button.
After **1-2 minutes** the aplSwitch Field is restarting with the **factory default** settings. All LEDs light up briefly and the display turns on again.
When the restart is completed, only the green power LED (**PWR1**) remains on while the yellow LED for the Ethernet connection (XT1) is flashing.

9. Check the IP address settings and the device name in the display of the aplSwitch Field and compare it with settings shown in the network window (Settings → Network[79]) of the user interface. The default settings are shown if the reset was successful.

Note

Remember that the reset you just performed has deleted all previous device settings (including IP address and device name). The aplSwitch Field is now running in factory default. You will need to re-configure your device. See Chapter Configuration and commissioning[74] for details.

Note

It is recommended to check if the device is running the latest firmware. Compare the firmware on your device with the latest firmware version available on the product website and update the firmware if necessary. See Chapter Firmware update[82] for details.

4 Security

IEC 62443 is a cybersecurity standard of the of the International Electrotechnical Commission (IEC) for securing networks and components, including PROFIBUS and PROFINET devices such as the aplSwitch Field. It provides a framework for components, systems, organizations, and processes involved in Industrial Automation and Control Systems (IACS).

IEC 62443 addresses the entire lifecycle of components from design and implementation to operation and maintenance.

4.1 General requirements

To successfully protect your plant, system and components against cyber threats follow the guidance from IEC 62443-3-2 (risk assessment) and 62443-3-3 (system security).

The following minimal requirements are recommended to ensure a secure operation of the device and protect your network from unauthorized access, manipulation, damage, data theft and disruption.

- Carefully monitor sensitive areas of your plant environment to determine, reduce and eliminate risks.
- Grant access to components, networks and systems to trained and authorized personnel only.
- Disable unused communications, services, protocols and ports.

4.2 PROFIBUS/PROFINET recommendations

The standardized PROFIBUS and PROFINET protocols have not been designed to include cyber security features to protect digital systems, networks, and data. Even though IEC 62443 does not recommend specific protocol security features it establishes guidelines and requirements that can be applied to protect PROFIBUS and PROFINET networks from unauthorized access, manipulation, damage, data theft and disruption.

To keep both protocols active in your environment, IEC 62443 recommends the following security measures:

- The aplSwitch Field is integrated in a zone with security level 1 (SL-1).
  SL-1 as defined in the IEC 62443 series of standards according to cyber security protection for industrial automation and control systems (IACS).
- Only authorized persons have access to the cables and components.

4.3 Hardening recommendations

4.3.1 TCP and UDP hardening

To restrict access between the device and upper network layers, it is recommended to use a firewall and only open the necessary TCP/UDP ports.

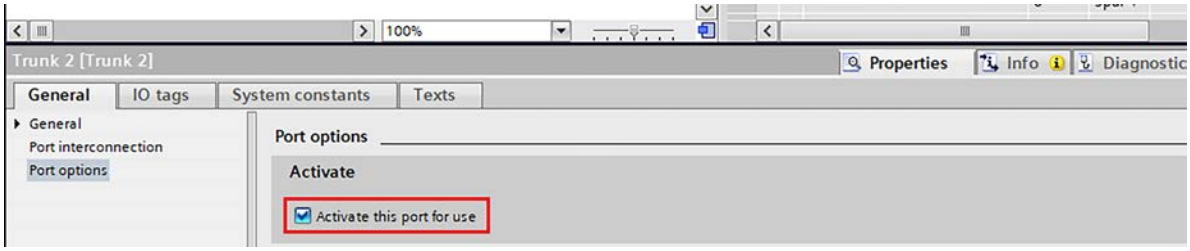
The following TCP/UDP Ports are used by the device.

Port number	Protocol	Functionality
80	TCP	HTTP: webserver
443	TCP	HTTPS: webserver disabled: default enabled: via webserver
123	TCP	SNTP Client disabled: default enabled: via webserver
2357	TCP	Softing specific PROFIBUS remote access protocol
2355	UDP	Softing specific device discovery protocol enabled: default disabled: via webserver
5353	UDP	mDNS discovery protocol enabled: default disabled: via webserver
1900	UDP	SSDP discovery protocol enabled: default disabled: via webserver
34964, 49152 - 65535	UDP	PROFINET EPM, PROFINET communication enabled: default disabled: via webserver
161	UDP	SNMP Agent activated by PROFINET

4.3.2 PROFINET hardening

PROFINET hardening refers to the implementation of security measures to secure PROFINET network from potential cyber threats and unauthorized access. It involves a combination of best practices, configurations, and protective controls to secure PROFINET networks and devices. Using the default network settings of the aplSwitch Field, the hardening measures are implemented in the engineering tool (example: Siemens TIA portal.

1. Start the TIA portal
2. Deactivate any unused Ethernet port.

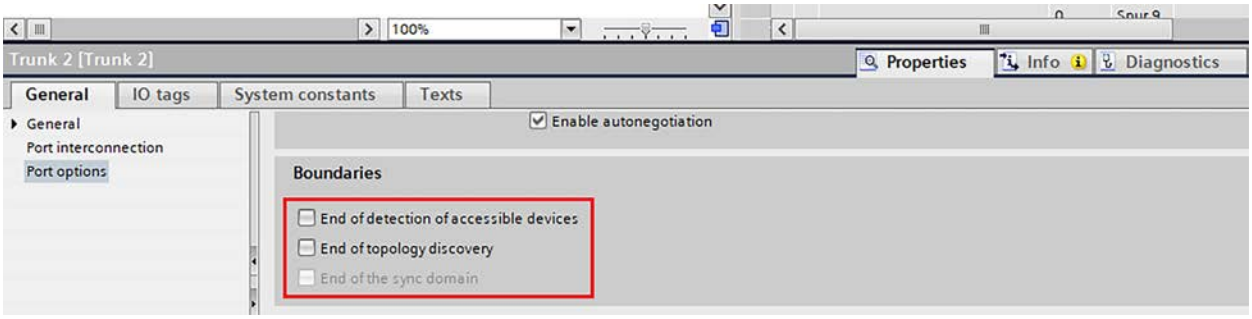


3. De-select **Activate this port for use** in the General tab for any Ethernet port which is currently not used to avoid any connection of unauthorized network devices.

4.3.3 Domain management

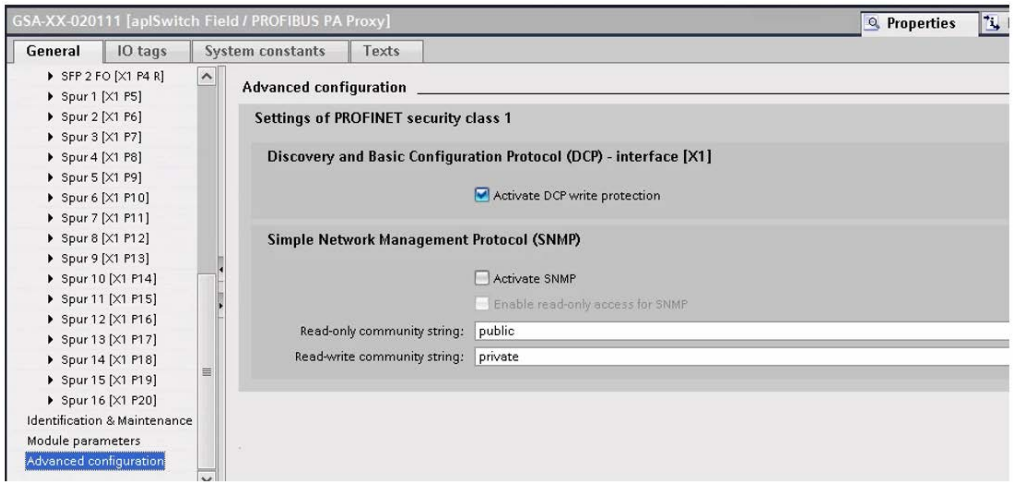
PROFINET provides different protocols to discover information. Keep this information inside the PROFINET domain only.

Select the checkboxes **End of detection of accessible devices**, **End of topology discovery** and **End of the sync domain** (if accessible) on any Ethernet port which is not connected to a PROFINET device and not part of the PROFINET domain.



4.3.4 PROFINET Security Class 1

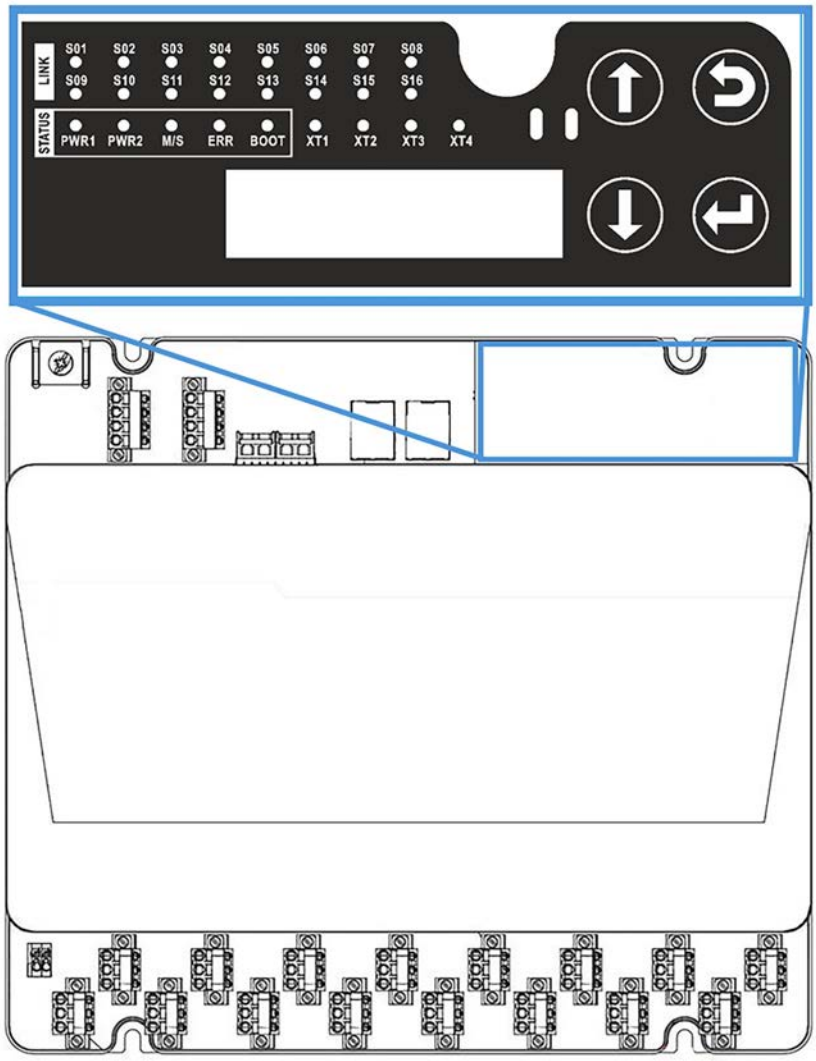
PROFIBUS & PROFINET International (PI) has published the security advisor PISA-001 (PI Security advisories). The aplSwitch Field implements the fixes for this vulnerability via parametrization of the related settings as shown in the image below:



It is recommended to keep the default setting as they provide the highest possible protection for these vulnerabilities. If standard IT applications shall be able to exchange data via SNMP, the community strings for read-only and read-write shall be changed to be unique for each node on the network.

5 Using the display and navigation controls

The aplSwitch Field has an OLED display with navigation buttons and LEDs providing visual feedback about the state, condition, or activity of your aplSwitch Field.



The following chapter describes the structure of the display screens (menu and sub-menus) and outlines how to access and navigate them.

5.1 Display screen

The display screen is divided into five areas showing the following information.

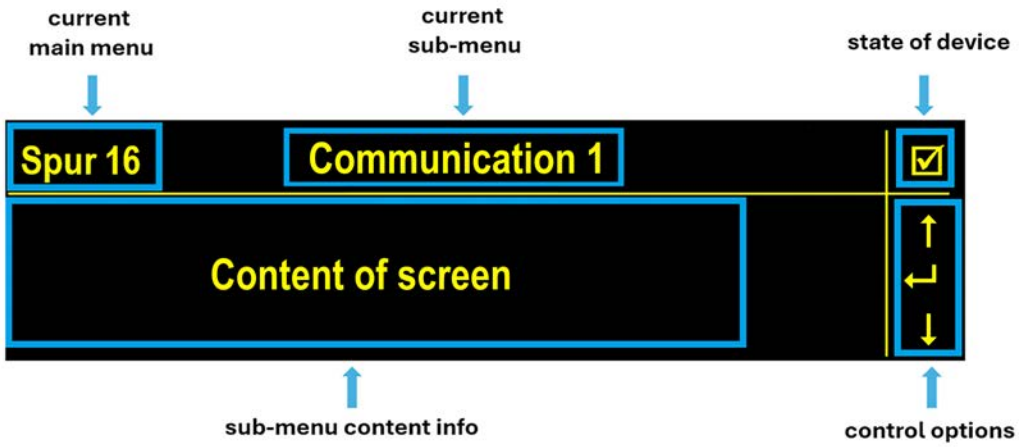
Top left: This area shows the current main menu location

Top center: This area shows a sub-menu of the main menu to the left

Top right: This area shows the general state of the device. If an error is detected, this is indicated by a change of the symbol 39 .

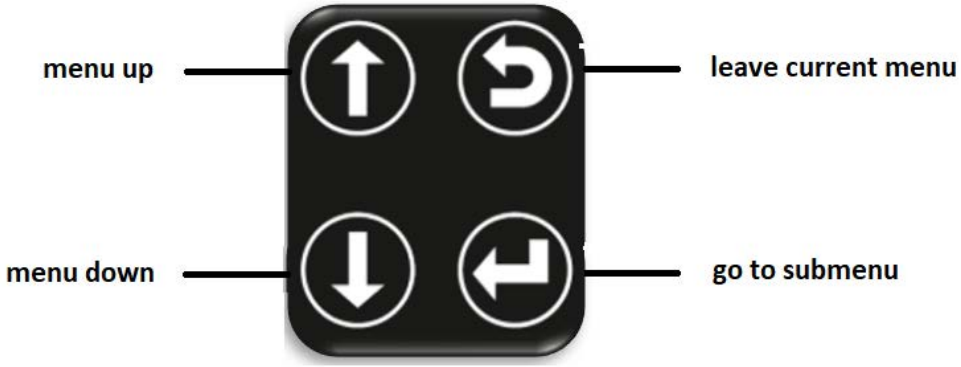
Bottom center: This area displays the sub-menu specific content which varies from screen to screen.

Bottom right: This area shows how you can navigate in the current menu selection.



5.2 Navigation

Navigating through the menu is done using the four keys on the control panel. The following four navigation keys are provided:



Soft keys

The following navigation keys appear in the display menu:

↑	Navigate upwards in the current menu (arrow up = menu up)
↵	Select sub-menu by pressing the **Enter** key
↓	Navigate down in the current menu (arrow down = menu down)

The navigation keys are shown only for as long as you can navigate in the indicated direction. When you have reached the end of a navigation menu, the up or down arrow are no longer visible. When there is no further submenu, the Enter symbol disappears. The ESC key can be used anytime. By pressing this key, the screen always moves back to last main menu level or home screen. Pressing the ESC key in the Home screen has no effect.

The Back key can be used anytime. By pressing this key, the screen always moves back to last main menu level or home screen. Pressing the Back key in home screen has no effect.

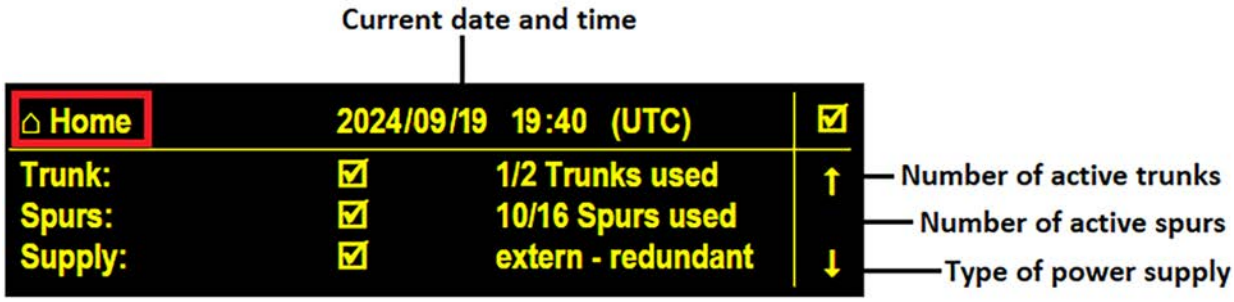
5.3 Symbols

The symbols used in the display have the following meaning.

Symbols	Meaning
☑	Normal operation
?	Out of specification
☒	Error detected / action required
☐	Initialization in progress / no device connected
	maintenance required

5.4 Home screen

The **Home** screen provides an overview of the device status and individual components.



Note

All connected trunks and spurs are counted. This also applies to errors detected on a spur or trunk - even if the spur is switched off due to overcurrent.

Note

Date and time are always displayed in UTC format. In central Europe the standard time difference (winter time) between UTC and real time is +1 hour.

Possible menu transitions:

- ↑ Switch **Module** Level 1
- ↵ Not possible - no menu change *)
- ↓ Switch to **Trunk** Level 1“
- ↵ Not possible - no menu change

*) In the event of a switch error (internally or through external devices), the error status is shown in the display. When acknowledged, the error can be displayed by selecting **Enter** in Home screen. As long as one or more errors are present, the Enter symbol is displayed in Home screen.

5.5 Menu structure

The display is partitioned into a number or menu frames which are described in this chapter.

5.5.1 Main menu - level 1

Menu level 1 (in following text called main menu) is structured according to the following scheme. It can be accessed via the soft keys ↑↓ (up / down).

The main menu displays basic status information about the respective trunk and spur connections and the switch itself. Depending on the hardware variant (with or without external power supply), the main menu item Power Supply is shown or hidden.

In the corresponding main menu, it is possible to enter the respective detail / sub-menu. Menu level 2 (in following text called sub-menu) can be reached via the confirmation / enter key. If you press the ESC key in the main menu, you will always return to the home screen. Depending on the hardware variant, the main menu shows two or four Trunk menu items.

Home	↑↓	Via control key ↑ switch to the module screen Via control key ↓ switch to the following screen

The menu level 2 can be reached via the confirmation / enter key.

Trunk	↑↓	Via control keys (↑↓) switch to the following / previous screen.

The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

↑↓ Via control keys (↑↓) switch to the following / previous screen.

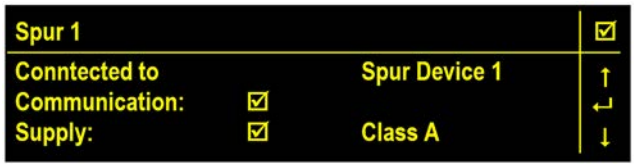
… Continuous for all Trunks

↑↓ Via control keys (↑↓) switch to the following / previous screen.

The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

Spurs	↑↓	Via control keys (↑↓) switch to the following / previous screen.



The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

↑↓

Via control keys (↑↓) switch to the following / previous screen.

The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

↑↓

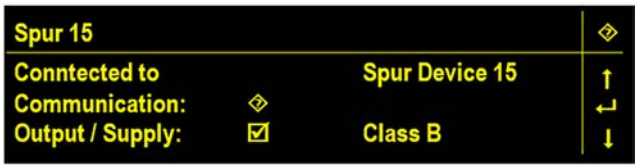
Via control keys (↑↓) switch to the following / previous screen.

…

Continuous for all Spurs

↑↓

Via control keys (↑↓) switch to the following / previous screen.

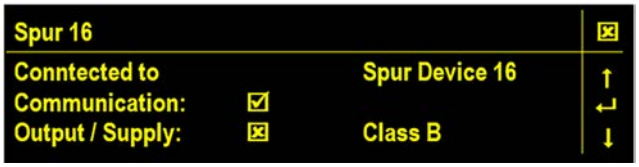


The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

↑↓

Via control keys (↑↓) switch to the following / previous screen.



The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

Supply	↑↓	Via control keys (↑↓) switch to the following / previous screen.

Optional main menu item - only with external supply.

The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

Module	↑↓	Via control keys (↑↓) switch to the following / previous screen.

The menu level 2 can be reached via the confirmation / enter key.

The ESC key is used to switch back to the home screen.

↑↓

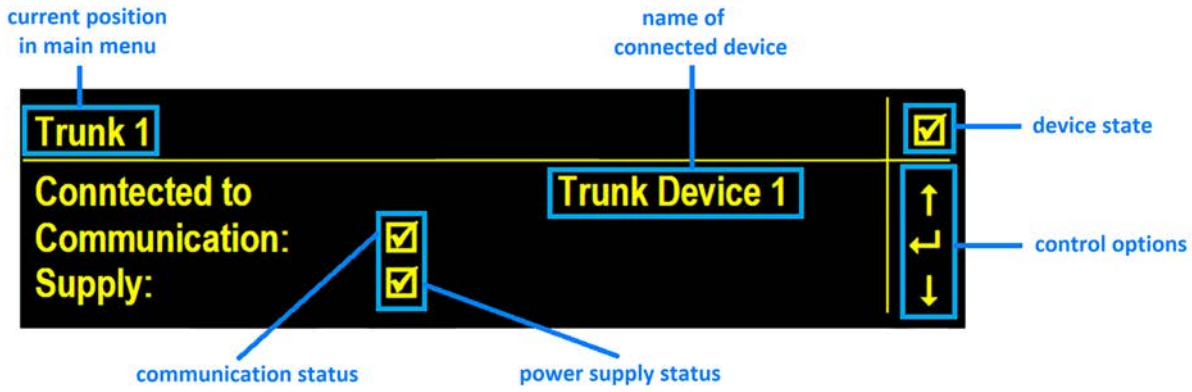
Via control key ↑ switch to the previous screen
Via control key ↓switch to the home screen

Trunk

This main menu option provides basic status information about the specific trunk connection, including:

- The name of the spur-connected device (if information is available).
  If no additional information is available the screen shows **no information avail.**
- Communication status
- Status of the trunk input power supply

This menu ranges from Trunk 1 to Trunk 4. If the device is powered by an external power supply (not via trunk), the Supply symbol changes to ☑. For detailed power supply information select the optional menu option "Power Supply".



Possible menu transitions:

↑ Navigate to Home screen

↵ Navigate to sub-menu: Trunk – Level 2 | Communication 1

↓ Navigate to Spurs – Level 1

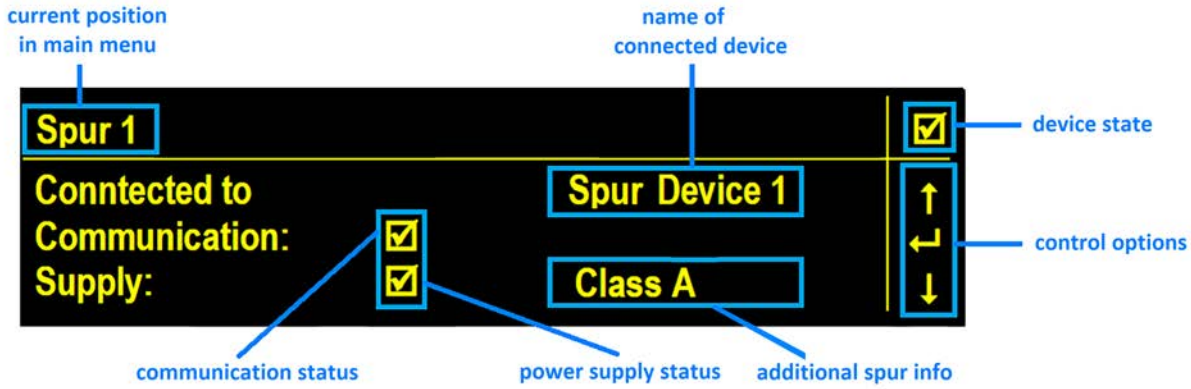
↵ Navigate to Home screen 40

Spurs

This main menu option provides basic status information about the specific spur connection, including:

- The name of the spur-connected device (if information is available).
  If no additional information is available the screen shows **no information avail.**
  If the port is configured as PA the device address is shown.
- Communication status
- Status of the spur output power supply

If no device is connected to the corresponding spur output, ☐ (not available) is returned for communication status and output status.



Symbol	State	Description	Current / voltage Class A (Class B)
☐	Initial	Spur board in initial state	unknown
	Spur turned OFF	Spurs is set to OFF state via configuration	independent
	No device	No device on spur	ISpur ~0mA
☑	Normal operation	Device connected	20 mA < ISpur < 56 mA (110 mA)
☒	Temperature high	Temperature spur board too high	not relevant
	Overcurrent	Device connected, but overcurrent	60 mA < ISpur or USpur < 10.2 V
⚠	Voltage out of range	Voltage spur board out of range	VSpur < 9.6V (10.1V)
	Slight Overcurrent	Device connected but overcurrent (<60mA)	56 mA < ISpur < 60 mA (110 mA)
	Low current	Device connected but low current - from spur board	ISpur < 20 mA

Possible menu transitions:

↑ Navigate to Trunk - Level 1

↵ Navigate to sub-menu: Spurs - Level 2 | Communication 1

↓ If you have come to the last spur (16), the menu will switch to "Power Supply – Level 1". *
Otherwise to the next higher spur number. 1

↵ Navigate to Home screen 40

*) For devices with external power supply. Otherwise "Power Supply – Level 1" will be skipped.

Power supply

This main menu option provides basic status information about the external power supply (not powered trunk).

- Redundancy of external power supplies configured and available
- Voltage of the external power supply within the specified limits
- Current consumption of the external power supply within the specified limits

Note

This menu appears only if an external power supply is configured and available. This menu item is hidden, if switch is trunk powered.

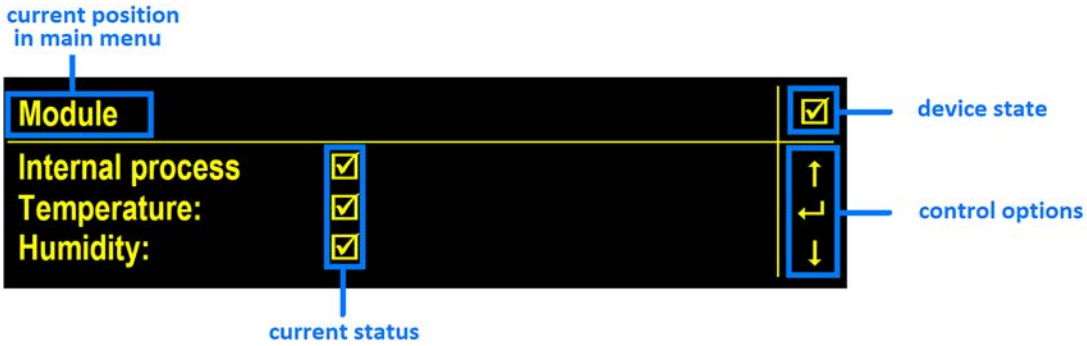
Possible menu transitions:

↑	Navigate to Spurs - Level 1
↵	Navigate to Power Supply - Level 2 | First Power Supply
↓	Navigate to Module - Level 1
↵	Navigate to Home screen 40

Module

This main menu option provides basic status information about the field switch internally. It is displayed:

- Switch internal errors (e.g. sensors, or internal communication paths not reachable)
- Measured temperature values within the specified limits
- Measured humidity value within the specified limits



Symbol	Description	Possible reasons
☑	Normal operation	-
	Fatal error maintenance required device has to be restarted or replaced	Internal Switch SOC controller Temperature too high
		Internal Switch SOC controller Temperature too low
		Internal communication paths disrupted
☒	Internal error detected Device still running – but action required	LED control not possible, or connection disturbed
		LED defect detected
		Switch internal temperature too high (in dependency with “temperature status” on this screen)
		Switch internal humidity too high(in dependency with “humidity status” on this screen)
		External measured temperature too high
		Internal used and generated voltage out of specified limits
		Connection loss between display controller and main SOC controller. No update of display data possible

For every given error, a separate error message / error screen is generated within detailed information.

Possible menu transitions:

↑ Navigate to Power Supply - Level 1 *

↵ Navigate to Module - Level 2 | Communication

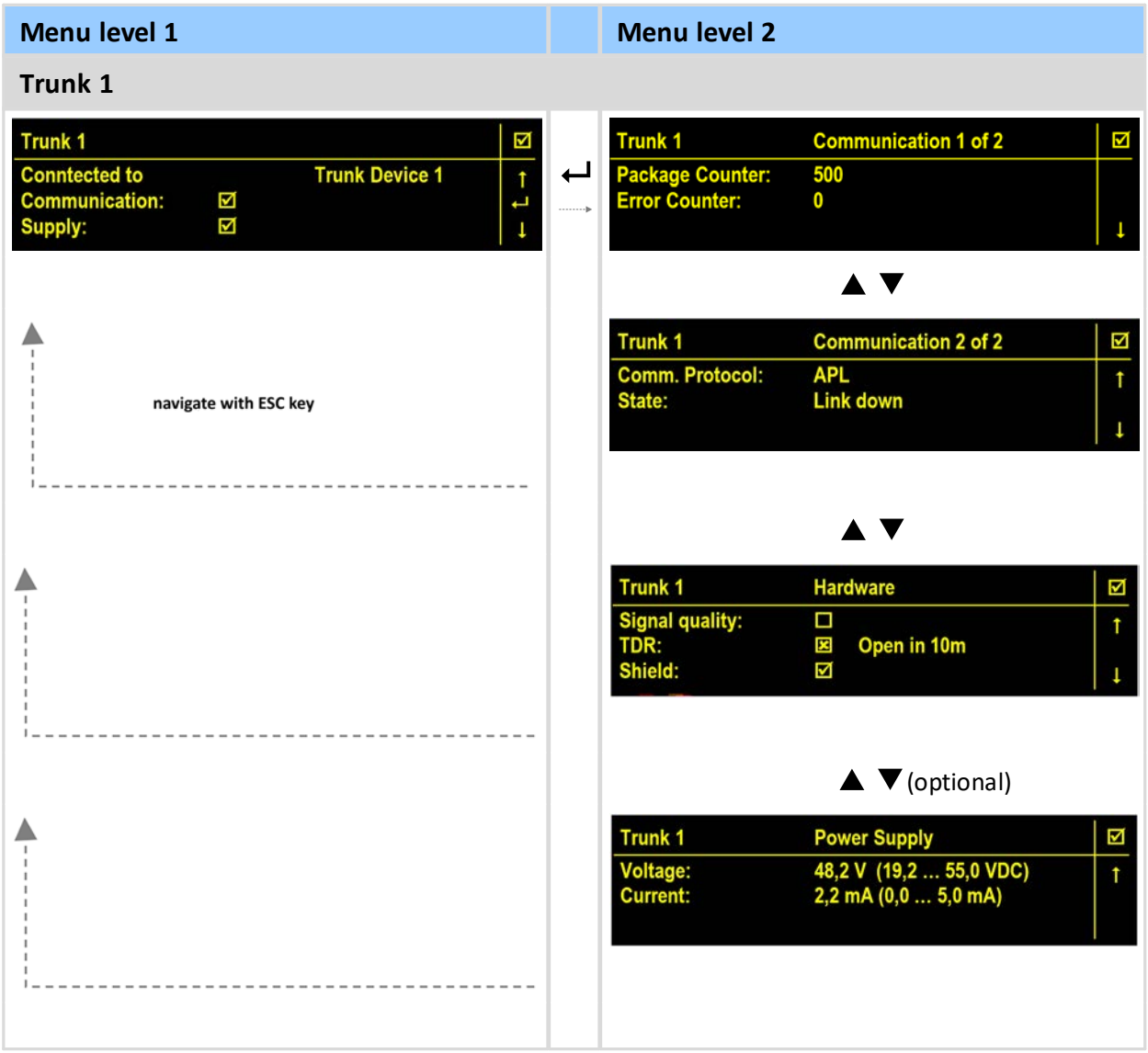
↓ Navigate to Home screen 40

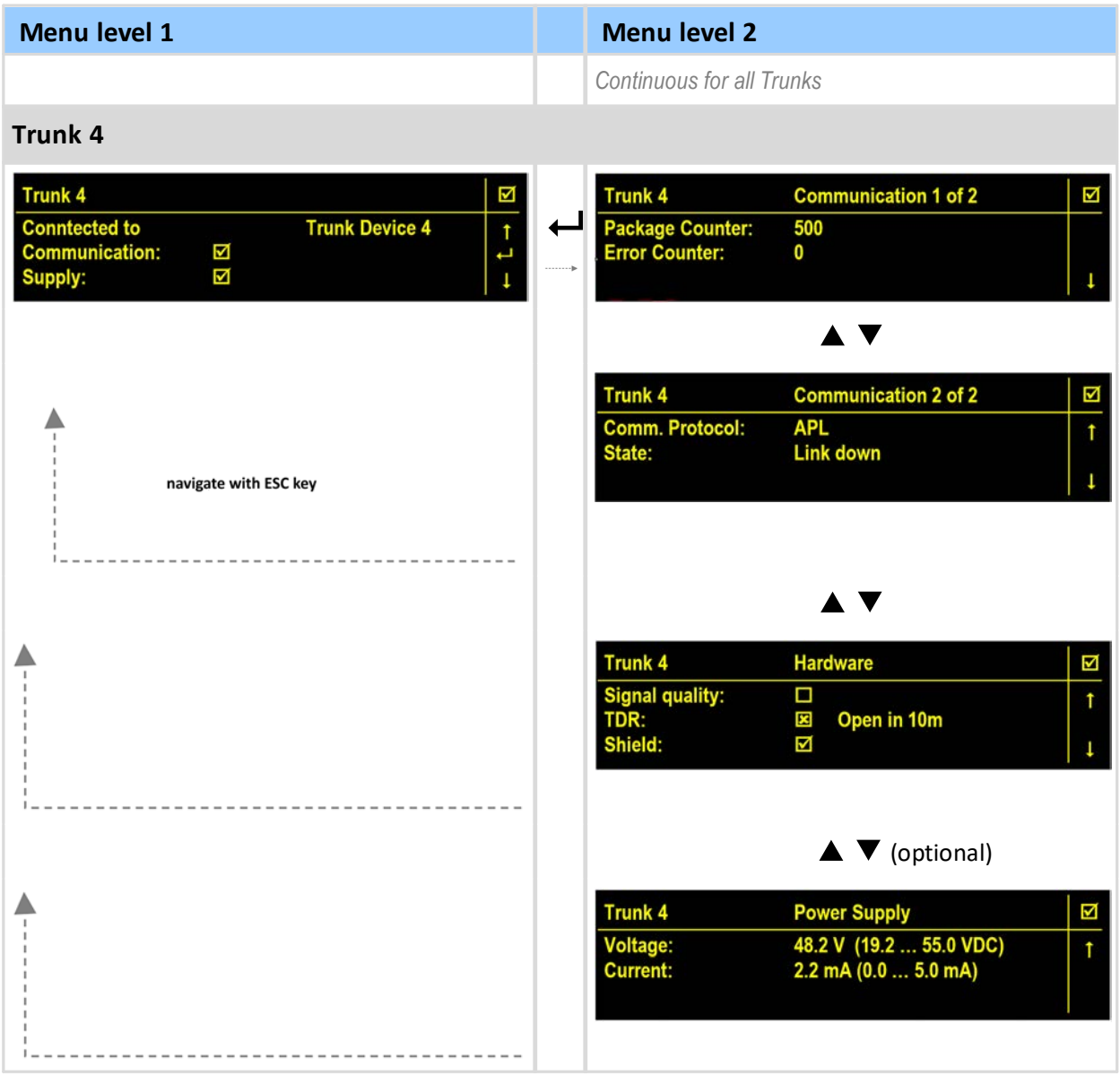
↵ Navigate to Home screen 40

*) For devices with external power supply. Otherwise "Power Supply – Level 1" will be skipped.

5.5.2 Sub-menu - level 2

Trunk



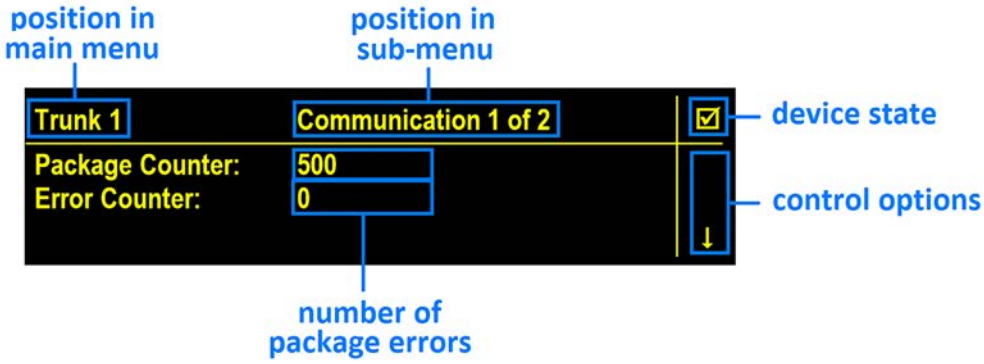


The Power Supply screen is shown only if the trunk powers the device. You can navigate from the sub-menu to the main menu using the ESC key (menu level 1).

Trunk - Level 2 | Communication 1

This sub-menu option provides detailed status information about the specific trunk connection and its communication details.

- Total package counter
- Error package counter



The specified counters apply only to the selected trunk in the main menu. The displayed values are limited to a value range of 32 bits (max. 4.294.967.295). If exceeded, the counter restarts at 0.

Possible menu transitions:

↑ *Not possible - no menu change*

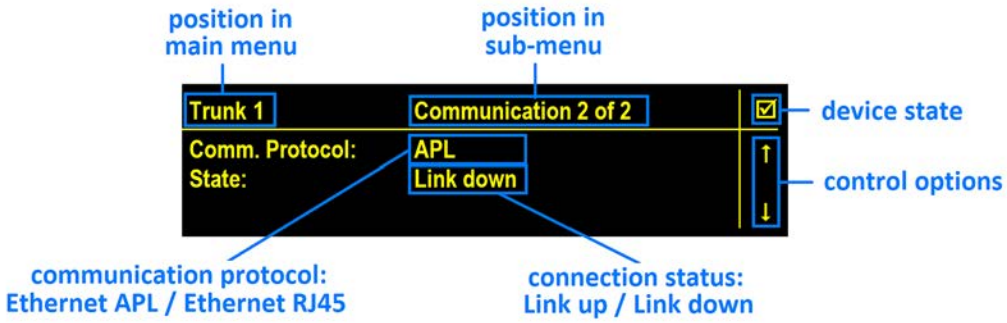
↵ *Not possible - no menu change*

↓ Navigate to Trunk - Level 2 | Communication 2

↵ Navigate to Trunk - Level 1

Trunk – Level 2 | Communication 2

This sub menu option provides detailed status information about the specific trunk connection and its communication details. It displays the currently used communication protocol and the connection status - Link up/down



Possible menu transitions:

↑ Navigate to Trunk - Level 2 | Communication 1

↵ *Not possible - no menu change*

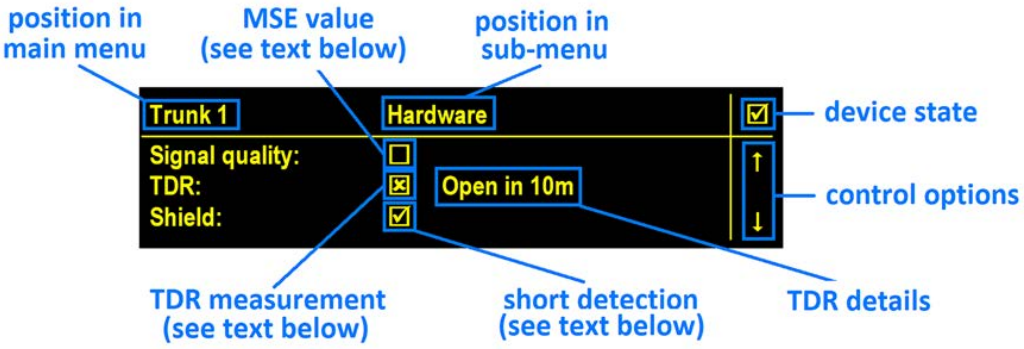
↓ Navigate to Trunk - Level 2 | Hardware

↵ Navigate to Trunk - Level 1

Trunk – Level 2 | Hardware

This sub menu option provides detailed status information about the specific trunk hardware properties of the communication link:

- Signal quality measurement (MSE)
- State of the Time domain reflectometry measurement
- State of the shield short detection



Signal quality - Mean Squared Error (MSE) :
This value can only be calculated and displayed while in 'Link up' state. If trunk is in 'Link down' state, ☐ (not available) is displayed.

☑ MSE value in range (e.g. -30dB to -22dB)
⚠ MSE value deviates from optimum by up to +/- 5dB
☒ MSE value deviates from optimum by more than +/- 5dB
☐ No data available for 'Link down'

Time Domain Reflectometry (TDR) measurement:
A TDR measurement can only be performed in the 'Link down' state. If trunk is in 'Link down' state, ☐ (not available) is displayed.

☑ No open cable or short circuit was detected
☒ An open cable or short circuit was detected
☐ No data available for 'Link up'

In case of an error, 'Short in ...m' and 'Open in ...m' are additionally displayed.

Shield short detection
A shield connection can only be detected for the whole device. By internal processes, or calculations, the shield short can then be logically assigned to the respective trunk or spur.

☑ No error
☒ Shield short detected

Possible menu transitions:

↑ Navigate to Trunk - Level 2 | Communication
↵ *Not possible - no menu change*
↓ Navigate to Trunk - Level 2 | Power Supply *
⮐ Navigate to Trunk - Level 1

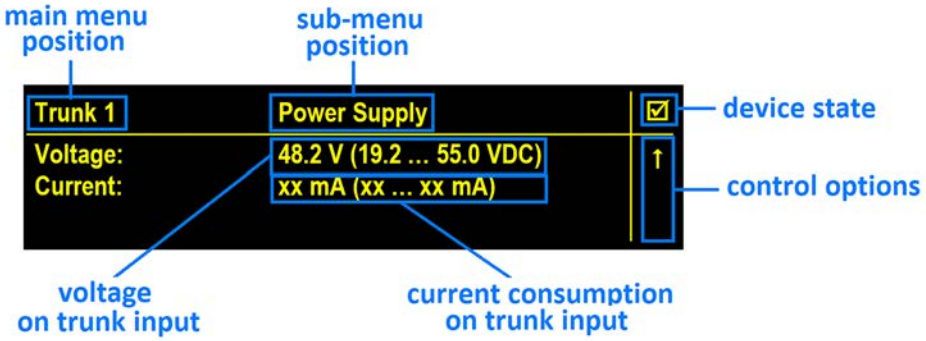
Trunk – Level 2 | Power Supply

This sub-menu option provides detailed status information about the power supply via trunk (APL powered trunk):

- Voltage on APL trunk input
- Current consumption on APL trunk input

Note

This sub-menu is shown only if the device is powered via the trunk.



Current and voltage values are always displayed with the respective valid limit value.

Note

The voltage and current values are acquired collectively for all trunks. The identical values are displayed in the sub-menus of trunks 1 to 4.

Possible menu transitions:

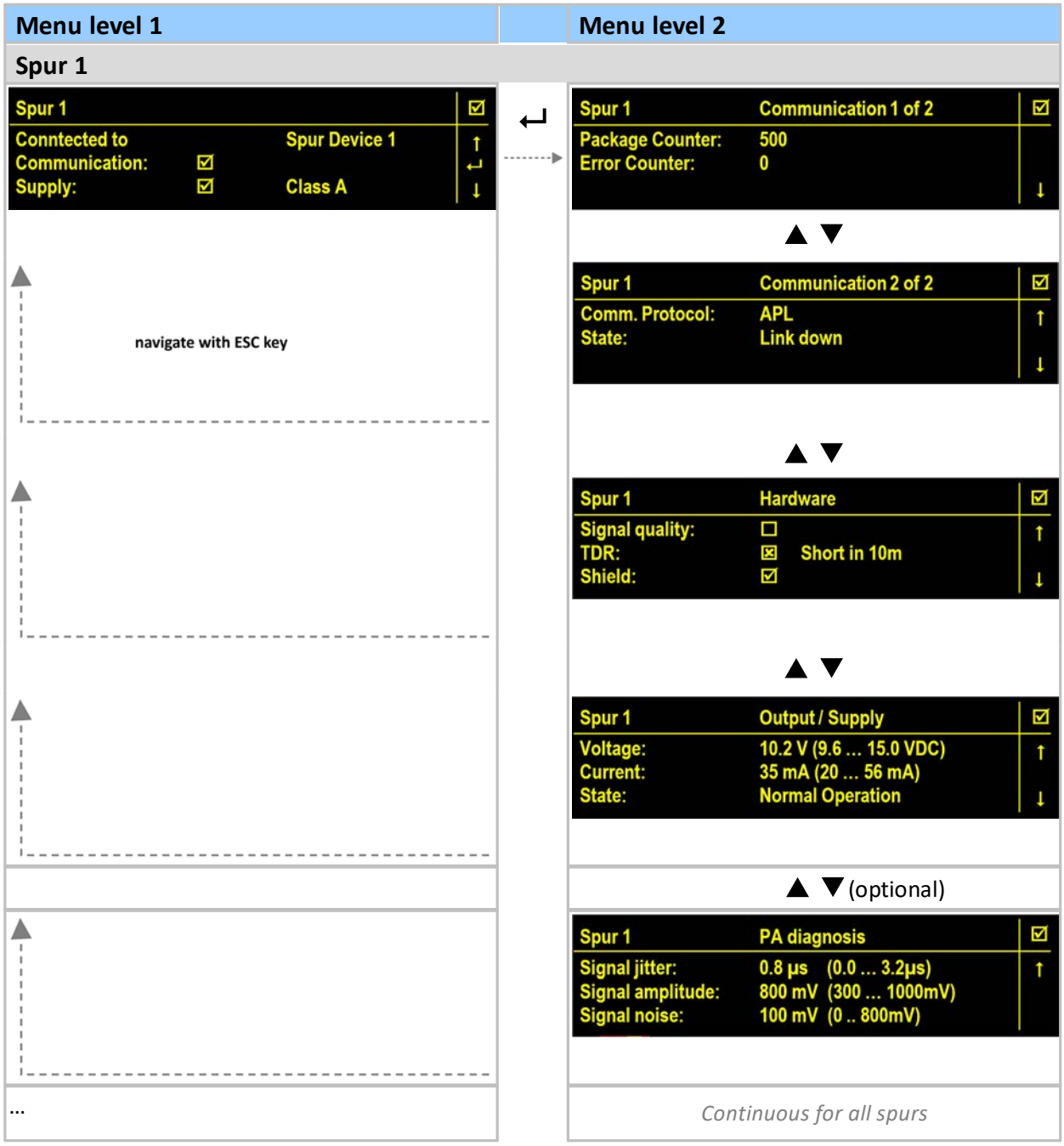
↑ Navigate to Trunk - Level 2 | Hardware

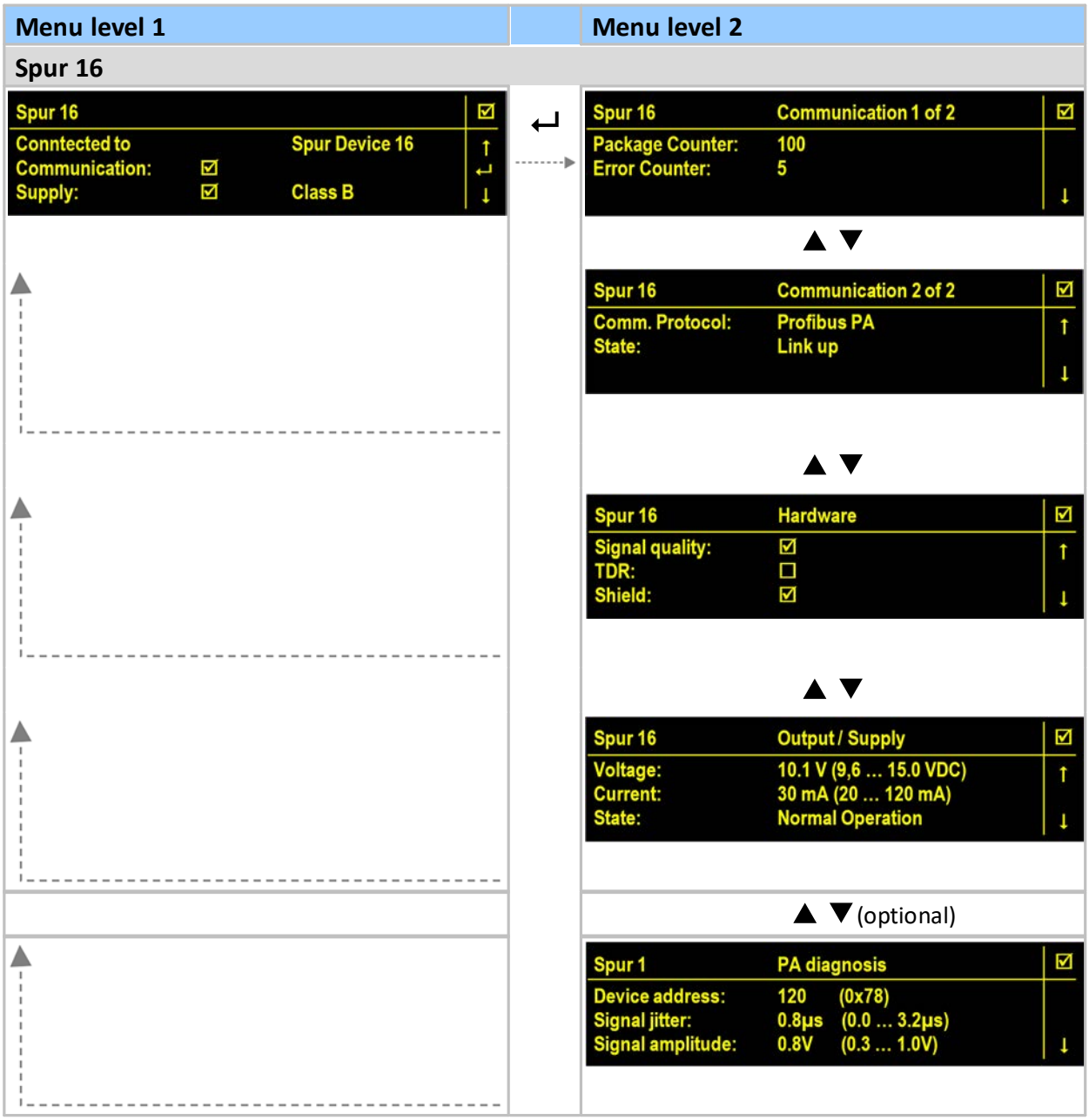
↵ *Not possible - no menu change*

↓ *Not possible - no menu change*

⮐ Navigate to Trunk - Level 1

Spurs

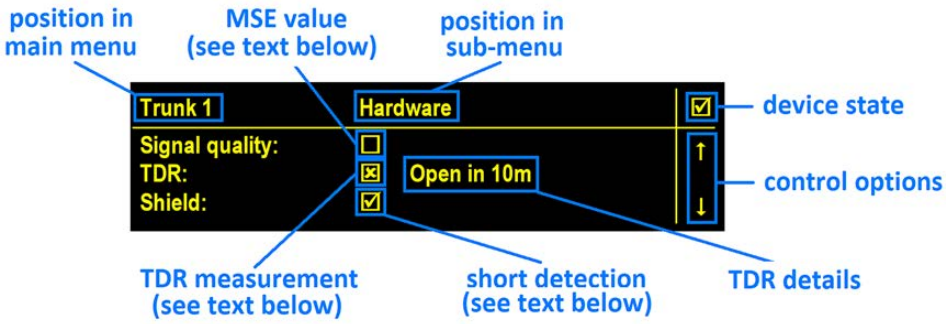

Menu level 1
Menu level 2
Spur 1
Spur 1
Conntected to Spur Device 1
Communication:
Supply: Class A
navigate with ESC key
Spur 1 Communication 1 of 2
Package Counter: 500
Error Counter: 0
Spur 1 Communication 2 of 2
Comm. Protocol: APL
State: Link down
Spur 1 Hardware
Signal quality:
TDR: Short in 10m
Shield:
Spur 1 Output / Supply
Voltage: 10.2 V (9.6 ... 15.0 VDC)
Current: 35 mA (20 ... 56 mA)
State: Normal Operation
(optional)
Spur 1 PA diagnosis
Signal jitter: 0.8 µs (0.0 ... 3.2µs)
Signal amplitude: 800 mV (300 ... 1000mV)
Signal noise: 100 mV (0 .. 800mV)
...
Continuous for all spurs


Menu level 1
Menu level 2
Spur 16
Spur 16
Conntected to
Spur Device 16
Communication:
Supply:
Class B
Spur 16
Communication 1 of 2
Package Counter:
100
Error Counter:
5
Spur 16
Communication 2 of 2
Comm. Protocol:
Profibus PA
State:
Link up
Spur 16
Hardware
Signal quality:
TDR:
Shield:
Spur 16
Output / Supply
Voltage:
10.1 V (9,6 ... 15.0 VDC)
Current:
30 mA (20 ... 120 mA)
State:
Normal Operation
(optional)
Spur 1
PA diagnosis
Device address:
120
(0x78)
Signal jitter:
0.8µs
(0.0 ... 3.2µs)
Signal amplitude:
0.8V
(0.3 ... 1.0V)

Spurs - Level 2 | Communication 1

This sub menu option provides detailed status information about the specific spur connection and its communication details. It is displayed:

- Total package counter
- Error package counter



The specified counters apply only for the selected spur in the main menu (see image of Spur 16). The displayed values are limited to a value range of 32 bits (max. 4.294.967.295). If exceeded, the counter starts from '0' again.

Possible menu transitions:

Not possible - no menu change

Not possible - no menu change

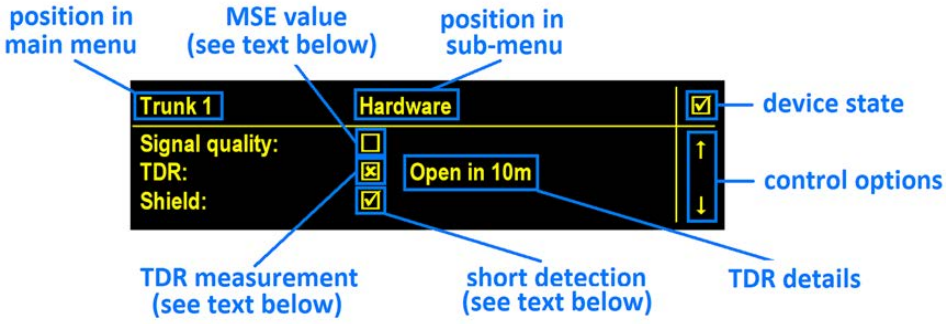
Navigate to Spurs - Level 2 | Communication 2

Navigate to Spurs - Level 1

Spurs - Level 2 | Communication 2

This sub menu option provides detailed status information about the specific spur connection and its communication details. It is displayed:

- Currently used communication protocol
- Connection status - Link up/down



Possible menu transitions:

↑ Navigate to Spurs - Level 2 | Communication 1

↵ *Not possible - no menu change*

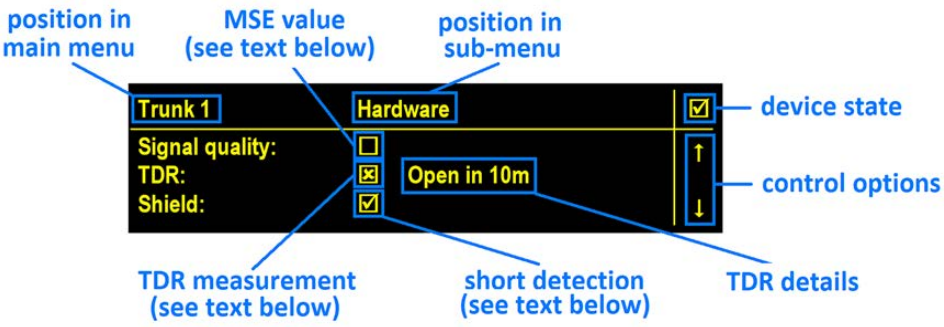
↓ Navigate to Spurs - Level 2 | Hardware

⮐ Navigate to Spurs - Level 1

Spurs - Level 2 | Hardware

This sub menu option provides detailed status information about the specific spur hardware properties of the communication link:

- Signal quality measurement (MSE)
- State of the Time domain reflectometry measurement
- State of the shield short detection



Signal quality - Mean Squared Error (MSE):
This value can only be calculated and displayed while 'Link up' state. If the spur is in 'Link down' state, ☐ (not available) is displayed.

☑ MSE value in range (e.g. -30dB to -22dB)
⚠ MSE value deviates from optimum by up to +/- 5dB
☒ MSE value deviates from optimum by more than +/- 5dB
☐ No data available for 'Link down'

Time Domain Reflectometry (TDR) measurement:
A TDR measurement can only be performed in the 'Link down' state. If the spur is in 'Link down' state, ☐ (not available) is displayed.

☑ No open cable or short circuit was detected
☒ An open cable or short circuit was detected
☐ No data available for 'Link up'

In case of an error, 'Short in ...m' and 'Open in ...m' are additionally displayed.

Shield short detection

A shield connection can only be detected for the whole device. By internal processes, or calculations, the shield short can then be logically assigned to the respective trunk or spur. Additional information is displayed only if an shield error was detected AND if the spur output is set to PA mode.

☑ No error

☒ Shield short detected

Possible menu transitions:

↑ Navigate to Spurs - Level 2 | Communication

↵ *Not possible - no menu change*

↓ Navigate to Spurs - Level 2 | Output / Supply

↵ Navigate to Spurs - Level 1

Spurs - Level 2 | Output / Supply

This sub menu option provides detailed status information about the spur specific output current and output voltage:

- Voltage on spur output
- Output current
- State of dedicated spur

Measure voltage:
When the Spur is turned off, the voltage measurement displays the real measured value (~0.0 V)

Measure current:
When the Spur is turned off, the current measurement displays the real measured value (~0 mA).

Example: If a Spur switches off due to an overcurrent (> 60mA), the current measurement shows the real measured value (~0 mA) and not the last measured overcurrent. The overcurrent is indicated by the 'State' parameter.

State	Description	Current / voltage Class A (Class B)
Initial	Spur Board in Initial State	unknown
Spur turned OFF	Spurs is set to OFF-State via configuration	independent
Temperature high	Temperature Spur-Board too high	not relevant
Voltage out of range	Voltage Spur-Board out of range	ISpur < 9.6V (10.1V)
No device	No device on Spur	ISpur ~0mA
Low device current	Device connected but low current - from Spur-Board	ISpur 20 mA
Normal operation	Device connected	20 mA < ISpur < 56 mA (110 mA)
High current	Device connected, but overcurrent(< 60 mA	56 mA < ISpur < 60 mA (110 mA)
Overcurrent (Spur OFF)	Device connected, but overcurrent	60 mA < ISpur or USpur < 10.2 V

If several states overlap (e.g. the temperature is too high and there is an overcurrent on one of the spurs), the state with the highest priority is set. The priorities are assigned as follows:

1. Initial (highest priority)
2. Spur turned OFF
3. Temperature high
4. No device
5. Low current
6. Overcurrent / High current
7. Voltage out of range
8. Current difference
9. Normal operation (lowest priority)

Possible menu transitions:

↑ Navigate to Spurs - Level 2 | Hardware

↵ *Not possible - no menu change*

↓ Navigate to Spurs - Level 2 | PA diagnosis *

↵ Navigate to Spurs - Level 1

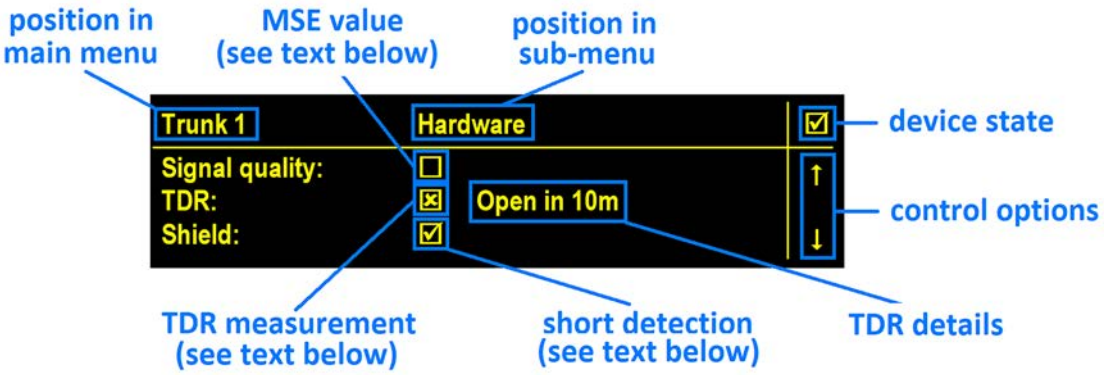
*) Change is possible only if the spur output is configured to PROFIBUS PA. Otherwise, no menu change is performed.

Spurs - Level 2 | PA diagnosis

This sub-menu option provides detailed status information about the 'PA low level diagnosis'.:

- Noise: current measured value with specified limits
- Jitter: current measured value with specified limits
- Signal: current measured value with specified limits

This sub-menu is displayed only if the dedicated spur is set to PA functionality.



PA device address
The display shows 'n.a.' if PA is configured on the dedicated spur yet no device is detected.

Measure jitter and signal value
The current jitter / signal value of the device is displayed. This is measured by the 'PA low level diagnosis' on the dedicated power plugboard.

Possible menu transitions:

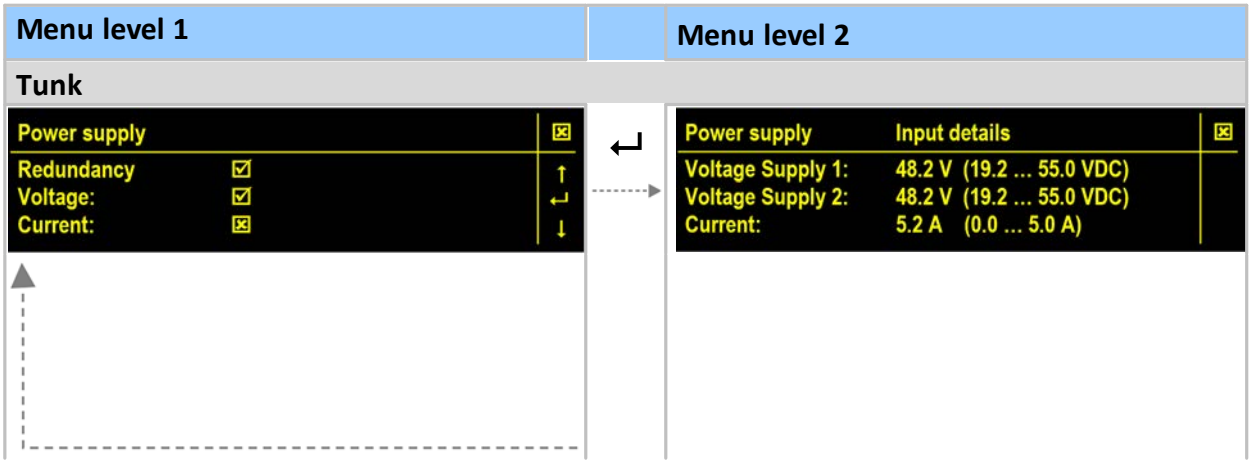
↑ Navigate to Spur - Level 2 | Output /Supply

↵ *Not possible - no menu change*

↓ *Not possible - no menu change*

↵ Navigate to Spur - Level 1

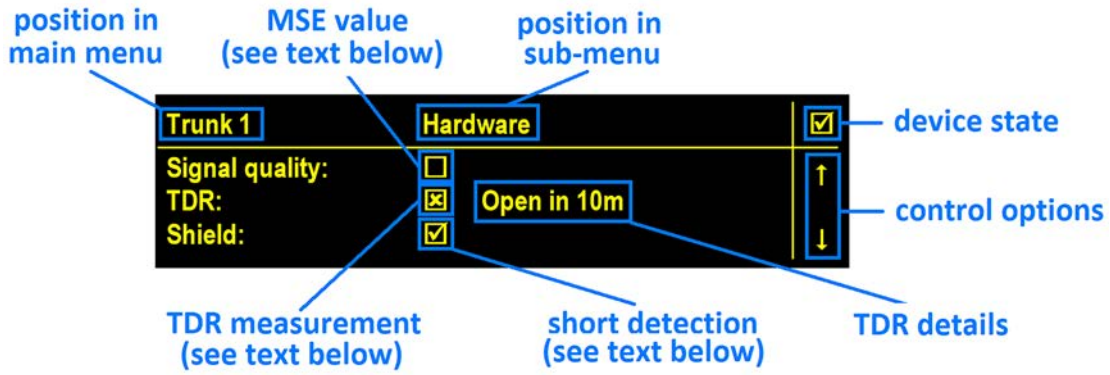
Power supply



The power supply menu (level 1) is only displayed if external supply source is used. In the case of a powered trunk, this menu item is hidden. As result, the sub-menu (level 2) cannot be reached.

You can return to the main menu (menu level 1) using the ESC key.

Power Supply - Level 2 | First power supply



Measure voltages < 10V

Voltages lower than 10V are displayed with the text '< 10V'.

Current consumption

The total current consumption of both supply inputs (in case of redundancy) is displayed.

Possible menu transitions:

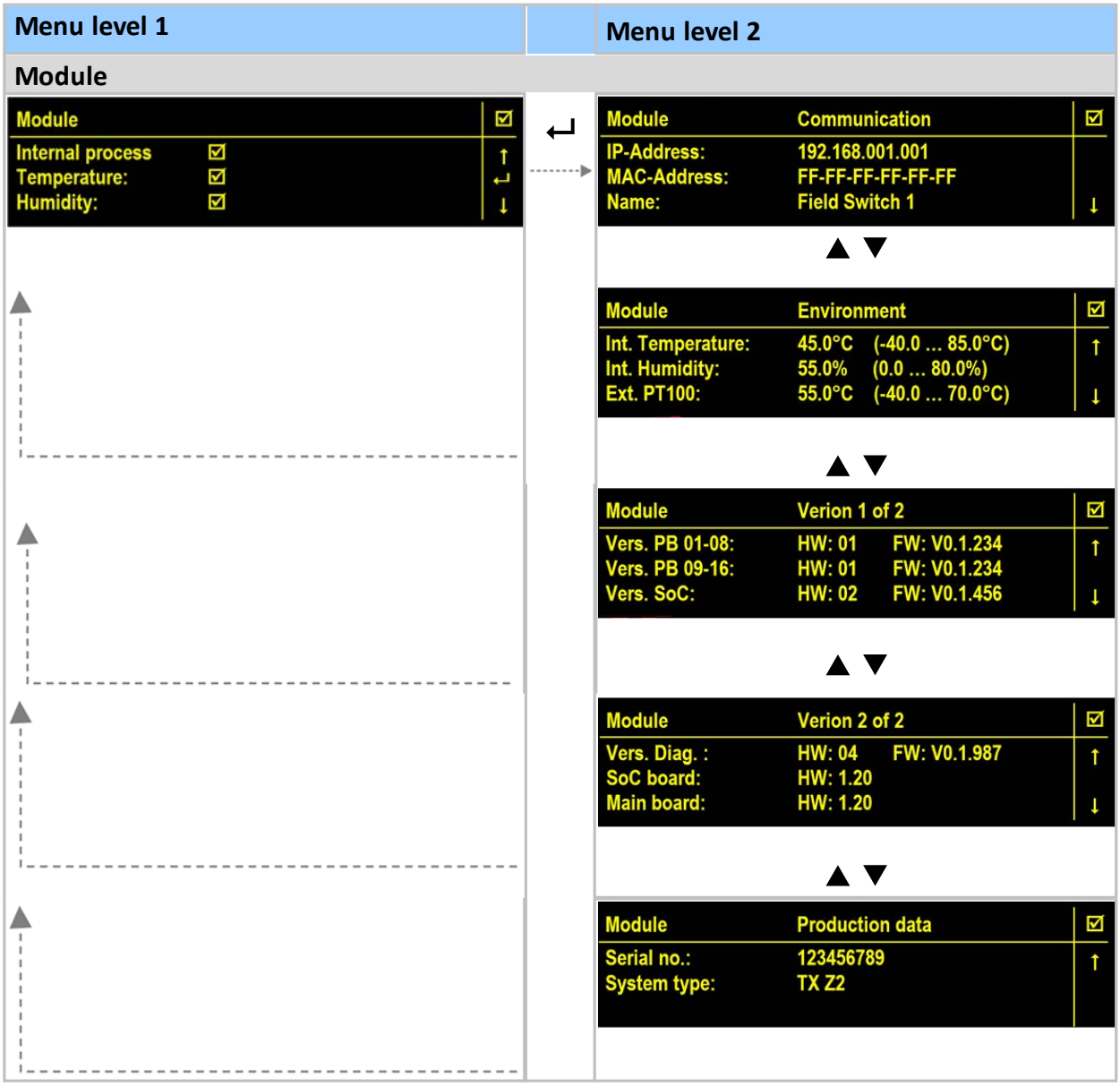
↑ *Not possible - no menu change*

↵ *Not possible - no menu change*

↓ *Not possible - no menu change*

↵ Navigate to Power Supply - Level 1

Module


Menu level 1
Menu level 2
Module
Module
Internal process
Temperature:
Humidity:
Module Communication
IP-Address: 192.168.001.001
MAC-Address: FF-FF-FF-FF-FF-FF
Name: Field Switch 1
Module Environment
Int. Temperature: 45.0°C (-40.0 ... 85.0°C)
Int. Humidity: 55.0% (0.0 ... 80.0%)
Ext. PT100: 55.0°C (-40.0 ... 70.0°C)
Module Verion 1 of 2
Vers. PB 01-08: HW: 01 FW: V0.1.234
Vers. PB 09-16: HW: 01 FW: V0.1.234
Vers. SoC: HW: 02 FW: V0.1.456
Module Verion 2 of 2
Vers. Diag. : HW: 04 FW: V0.1.987
SoC board: HW: 1.20
Main board: HW: 1.20
Module Production data
Serial no.: 123456789
System type: TX Z2

Module - Level 2 | Communication

This sub menu option provides detailed status information about the switch internal network parameters. It is displayed:

- IP address (IPv4) of the switch
- MAC address of the first switch port
- Network name of the switch

The parameters IP Address and Network Name can be adjusted via the respective configuration tools. The web server of the switch can be reached via Ethernet and the given IP address. The parameter for the MAC Address is constant.

Possible menu transitions:

↑ *Not possible - no menu change*

↵ *Not possible - no menu change*

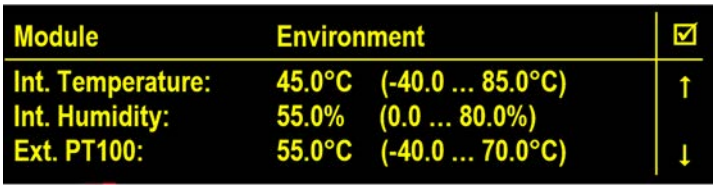
↓ Navigate to Module - Level 2 | Environmental conditions

↵ Navigate to Module - Level 1

Module - Level 2 | Environmental Conditions

This sub-menu option provides detailed status information about the measured environmental conditions.

- Internal measured temperature in °C (limit values included)
- Internal measured humidity in % (limit values included)
- Measured temperature of an external optional PT100-Sensor (limit values included)



The following options can be displayed instead of the PT100 temperature

- PT100 n.a. (not configured)
- PT100 short (short circuit detected)
- PT100 open (open circuit detected)

Possible menu transitions:

↑ Navigate to Module - Level 2 | Communication

↵ *Not possible - no menu change*

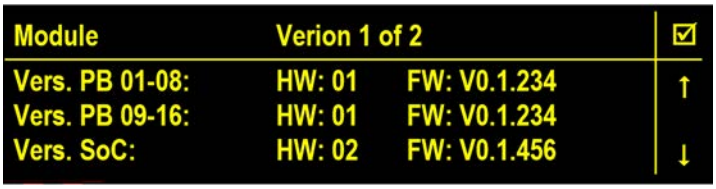
↓ Navigate to Module - Level 2 | Version Control 1

↵ Navigate to Module - Level 1

Module - Level 2 | Version Control 1

This sub-menu option provides detailed status information about the switch internal software and hardware revisions.

- Firmware and hardware revision of the internal power plugboard (Spur 1-8).
- Firmware and hardware revision of the internal power plugboard (Spur 9-16).
- Firmware and hardware revision of the SOC main controller.



Possible menu transitions:

↑ Navigate to Module - Level 2 | Environmental conditions

↵ *Not possible - no menu change*

↓ Navigate to Module - Level 2 | Version Control 2

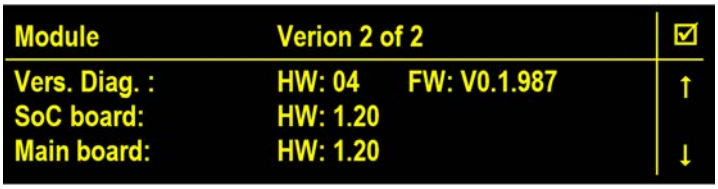
↵ Navigate to Module - Level 1

Module - Level 2 | Version Control 2

This sub-menu option provides detailed status information about the switch internal software and hardware revisions.

It is displayed:

- Firmware and hardware revision of the internal diagnosis controller.
- Additional hardware information.



Possible menu transitions:

↑ Navigate to Module - Level 2 | Version Control 1

↵ *Not possible - no menu change*

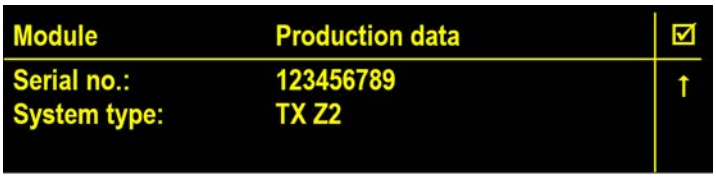
↓ Navigate to Module - Level 2 | Production data

↵ Navigate to Module - Level 1

Module - Level 2 | Production Data

This sub-menu option provides detailed status information about the switch production data.

- Serial number
- System type



Possible menu transitions:

↑ Navigate to Module - Level 2 | Version Control 2

↵ *Not possible - no menu change*

↓ *Not possible - no menu change*

↵ Navigate to Module - Level 1

Module - Level 2 Debug | Lifetime

This menu is only displayed if the debug mode is activated. It shows the results of the lifetime calculations (calculated field switch lifetime and calculated lifetime of the super capacitor)

This sub-menu is only displayed if debug mode is activated.

Possible menu transitions:

↑ Navigate to Module - Level 2 | Environmental conditions

↵ *Not possible - no menu change*

↓ Navigate to Module - Level 2 Debug | Internal 1

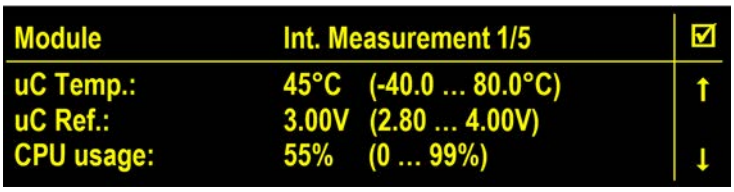
↵ Navigate to Module - Level 1

Module - Level 2 Debug | Internal 1

This sub-menu is only displayed if the debug mode is activated. It provides detailed internal measurements about the display micro-controller.

This sub-menu shows:

- Internal measured temperature in °C (limit values included) of the display micro-controller
- Voltage reference (limit values included) of the display micro-controller
- CPU usage in % (limit values included) of the display micro-controller
- This sub-menu is only displayed if debug mode is activated.



Possible menu transitions:

↑ Navigate to Power Supply – Level 2 | First Power Supply

↵ *Not possible - no menu change*

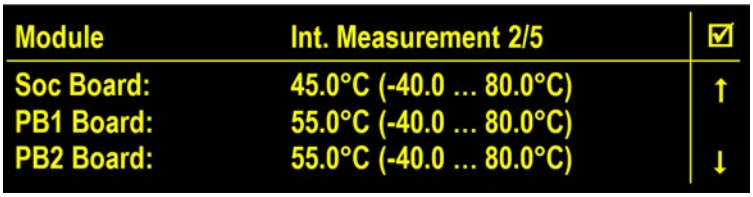
↓ Navigate to Module - Level 2 | Version Control 2

↵ Navigate to Module - Level 1

Module - Level 2 Debug | Internal 2

This sub-menu is only displayed if the debug mode is activated. It shows the internal measured temperature values of the device.

- Internal measured temperature in °C (limit values included) of the SoC board
- Internal measured temperature in °C (limit values included) of the plugboard 1
- Internal measured temperature in °C (limit values included) of the plugboard 2
- This sub-menu is only displayed if debug mode is activated.



Possible menu transitions:

↑ Navigate to Module - Level 2 Debug | Internal 1

↵ *Not possible - no menu change*

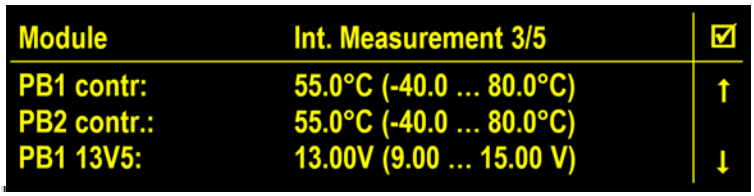
↓ Navigate to Module - Level 2 Debug | Internal 3

↵ Navigate to Module - Level 1

Module - Level 2 Debug | Internal 3

This sub-menu is only displayed if debug mode has been activated. It shows the internal measured temperature values of the plugboard micro-controller.

- Internal measured temperature in °C (limit values included) of the plugboard 1 microcontroller
- Internal measured temperature in °C (limit values included) of the plugboard 2 microcontroller
- Input voltage in V (limit values included) of the power plugboard 1
- This sub-menu is only displayed if debug mode is activated.



Possible menu transitions:

↑ Navigate to Module - Level 2 Debug | Internal 2

↵ *Not possible - no menu change*

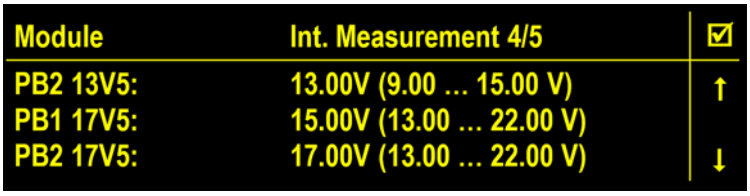
↓ Navigate to Module - Level 2 Debug | Internal 4

↵ Navigate to Module - Level 1

Module - Level 2 Debug | Internal 4

This sub-menu is only displayed if debug mode has been activated. It shows the input voltage of the respective plugboards.

- Input voltage in V (limit values included) of the power plugboard 2
- Input voltage in V (limit values included) of the power plugboard 1
- Input voltage in V (limit values included) of the power plugboard 2
- This sub-menu is only displayed if debug mode is activated.



Possible menu transitions:

↑ Navigate to Module - Level 2 Debug | Internal 3

↵ *Not possible - no menu change*

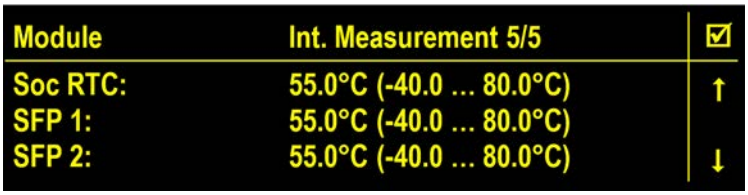
↓ Navigate to Module - Level 2 Debug | Internal 5

↵ Navigate to Module - Level 1

Module - Level 2 Debug | Internal 5

This menu is only displayed if debug mode has been activated. It shows the additional internal measured temperature values.

- Internal measured temperature in °C (limit values included) of the SoC RTC
- Internal measured temperature in °C (limit values included) of the SFP 1 module
- Internal measured temperature in °C (limit values included) of the SFP 2 module
- This submenu is only displayed if debug mode is activated.



Possible menu transitions:

↑ Navigate to Module - Level 2 Debug | Internal 4

↵ *Not possible - no menu change*

↓ Navigate to Module - Level 2 Debug | Version Control 1

↵ Navigate to Module - Level 1

5.5.3 Screen saver

If the device remains idle for 10 minutes, it automatically enters screen saver mode to prevent static image burn-in on the OLED display.

The screen saver features a dynamic logo that gently moves from left to right and back, creating a subtle sense of motion

The display is always on when the switch is running.

Possible menu transitions:

↑ Navigate to Home screen *

↵ Navigate to Home screen *

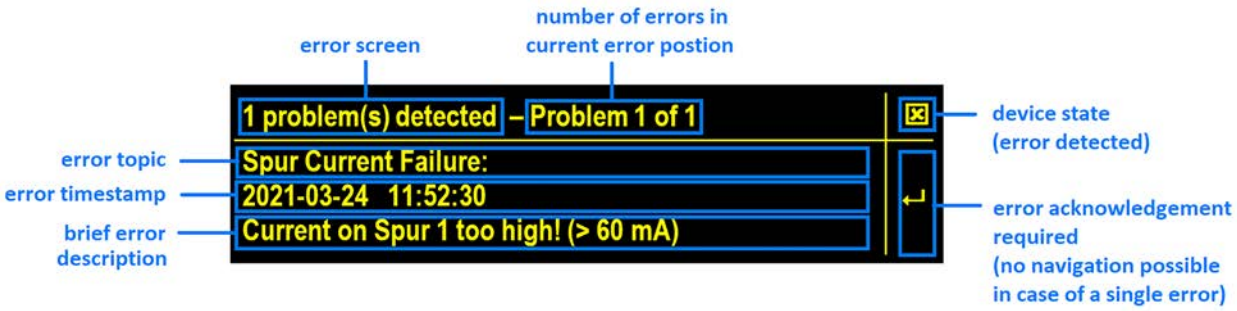
↓ Navigate to Home screen *

↵ Navigate to Home screen *

*) If an error occurs in the screen saver mode, the error status is displayed when you exit this screen view. The Home screen appears only after the error message has been acknowledged.

5.5.4 Error screen

If an error occurs, an error screen is displayed. This screen briefly describes the problem that has occurred.



The error screen overlays the standard home screen and the normal menu structure. The error screen disappears after having been acknowledged with the "Enter" key or the "ESC" key.

After acknowledgement, the system switches back to the last screen view before the error occurred:

- The ESC key and the Enter key have an identical function.

Error is fixed before error screen is acknowledged:

- If the problem is resolved before the error screen is acknowledged, the view disappears again (no acknowledgement required).

Active screen saver in error mode:

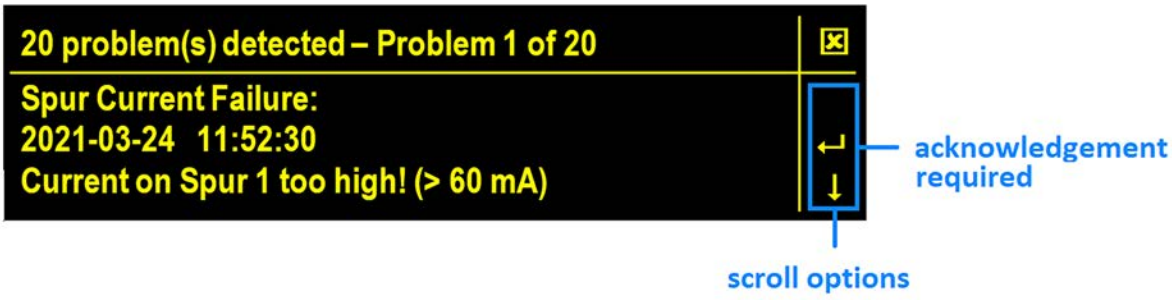
- Screen saver keeps active. The error is only displayed after exiting the screen saver. In this case, the system does not switch directly to the home screen.
- Errors always be displayed by the LEDs immediately (blinking ERR-LED and corresponding device LED)

If the error is acknowledged once, it is only possible to call it up again via the home screen.

- After an error has occurred, the icon ↵ (confirmation / enter) is shown in the home screen.

If several errors occur at the same time individual error messages can be scrolled.

- The number of error messages can be identified from the screen header e.g. : 20 problem(s) detected – Problem 1 of 20
- scrolling is signaled by the up/down arrow (↑↓)
- Acknowledgement occurs only once (not error by error).



5.5.5 Startup screen

This screen is displayed on device startup.

If the device is properly initialized, screen switches automatically to "5 Home screen".

If this screen doesn’t disappear, the device hasn’t started properly.

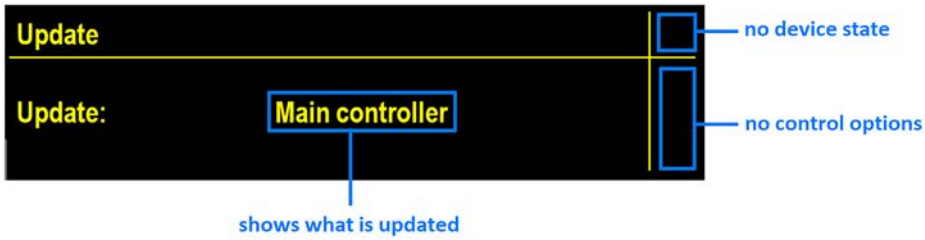
Actions and reasons:

- The device has to be restarted.
- The device has to be updated to the latest valid firmware version.
- The device is defective.

NOTE
No navigation is possible in this screen.

5.5.6 Update screen

This sub-menu option provides information about a running update procedure. If this screen is displayed an update is running.



The update parameter can take the following values:

- Main controller
- Diagnosis controller
- Spur 1 to 8 (--> Power plugboard 1)
- Spur 9 to 16 (--> Power plugboard 2)

Possible menu transitions:

Not possible - no menu change

Not possible - no menu change

Not possible - no menu change

Not possible - no menu change

5.6 LED indicators

	LED	Color	Function	Status	Description
Link	XT1 - XT4	yellow	Link status XT1…XT4	OFF ON FLASH (30Hz)	No link available Link found at XT1…XT4, no communication Link found, communication active
Link	S01 - S16	yellow	Link status S01…S16	OFF ON FLASH (30Hz) FLASH (2 Hz)	No link available Link found at spur S01…S16, no communication Link found at spur S01…S16, communication active Link found at spur S01…S16, failure see “LED M/S” or “ERR”
Status	PWR1	green	Status of Power 1	OFF ON FLASH	No power connected to PWR1 or power supply low Power supply connected at PWR1 Supply voltage out of specification (see also M/S)
Status	PWR2	green	Status of Power 2	OFF ON FLASH	No power connected or power supply too low Power supply connected at PWR2 Supply voltage out of specification (see also M/S)
Status	M/S	blue	Maintenance request	OFF ON FLASH	No maintenance required Maintenance required soon, replacement of device recommended. Maintenance requested by device. Request details can be found in the display or on the webserver. + flashing Link LED : current/voltage of spurs out of specification
Status	ERR	red	Device error	OFF ON FLASH	No error Fatal error, immediate replacement required External error (high temperature, water ingress etc.) Device may get damaged. + flashing Link LED: failure at spurs
Status	BOOT	green	Boot process	OFF ON FLASH	Boot process finished successfully Boot process of device ongoing, wait until finished Boot process interrupted, firmware update required

6 Configuration and commissioning

6.1 Prerequisites

- You have downloaded and installed the latest firmware from the product website.
- The aplSwitch Field has been mounted and installed according to Chapter Hardware Installation22 ..
- The connection cables are secured against tensile force and accidental disconnection.
- The aplSwitch Field is connected to an external power supply. See Chapter Power Supply25 for details.
- The aplSwitch Field is connected on a local network with your PC.
- Your PC runs a standard Internet browser supporting JavaScript.
- You have downloaded a standard DCP tool (Discovery and Configuration Protocol, such as PRONETA) allowing you to re-assign an IP address in case the default IP address of the device is lost after a factory reset.

Note
Do not commission the device until it has been successfully tested.

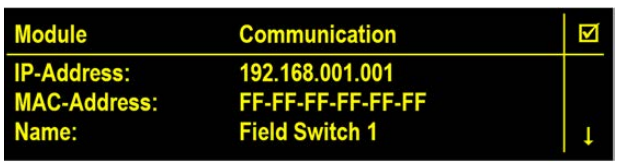
6.2 IP address

Softing ships the aplSwitch Field with the pre-assigned IP address **192.168.0.10**. This makes it easy for the user to access the web server (user interface) without prior connection to a PROFINET host. When the aplSwitch Field is then connected to a PROFINET host such as the Siemens TIA portal, the PROFINET DCP procedure will change the IP address. To access the aplSwitch Field after IP address has been set to 0.0.0.0, a DCP tool is required to change the IP address. The most commonly used DCP tool is PRONETA from Siemens available from Siemens website free of charge. The DCP tool is also required to set the IP address after factory reset30 . You can always check the IP address of the aplSwitch Field in the display on the device.

1. Click the arrow up ↑ in the **Home** menu.

2. Click the return key ↵ in the sub-menu.

3. The current IP address of the aplSwitch Field is shown in the sub-menu **Module Communication**.



6.2.1 Setting the IP address of your PC

Since your aplSwitch Field is using a static default IP address you have to set a static IP address on your PC using the same subnet as the switch.

The following chapter describes how to set a static IP address in Windows 10 or Windows 11.

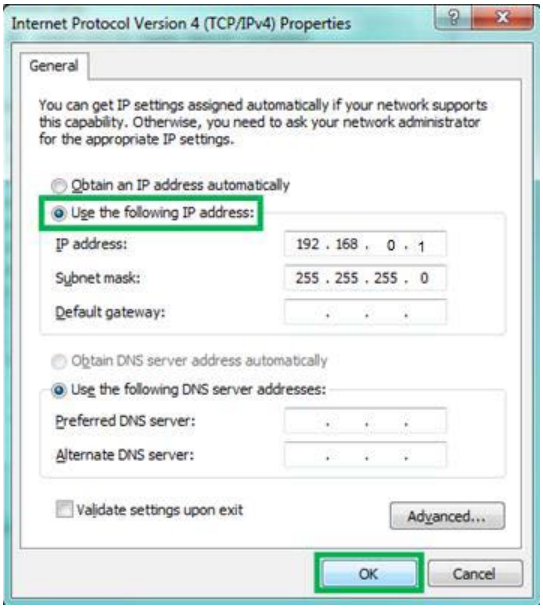
1. Click **Start → Windows System → Control Panel** from your task bar.

2. Select **Network and Internet → Network and Sharing Center**.
   A new window opens where you can view your basic network information.

3. Click on your Internet connection (either Ethernet or wireless) next to Connections under **View your active networks**.
   A new window opens.

4. Click **[Properties]**.

5. Select **Internet Protocol Version 4 (TCP/IPv4)**.
   The following window opens.



6. Select **Use the following IP address** and enter a specific IP address and subnet mask. In our example we use the following settings:
   IP address: 192.168.0.1
   Subnet mask: 255.255.255.0

7. Click **[OK]** to confirm.

6.2.2 Changing the IP address of the aplSwitch Field

To change the IP address of the aplSwitch Field start the user interface and enter the IP address in the menu Settings → Network[79] .

Note

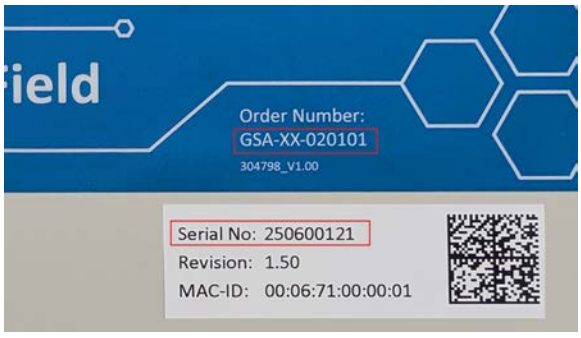
See Section Login to user interface[76] for details.

To access the aplSwitch Field from your PC, you either have to change the default IP address of the integrated web server to an address on your network or change the DHCP address on your PC to a static IP address that matches the network address of your device (192.168.0.10).

6.3 Login to the user interface

1. Open your Internet browser.
2. Enter the default IP address of the integrated web server: **192.168.0.10**
   The login page of your aplSwitch Field is displayed.
3. Enter **administrator** in the User Name field and the default password. The password is a combination of the order number as prefix (example: *GSA-XX-020111*) followed by a 9 digit serial number.
   Example: **GSA-XX-020111233200081**

You will find both printed on the nameplate on the front of your aplSwitch Field.



4. Click **[Login]**.
   The web-based interface opens with the login page.
5. Change the default administrator password during initial commissioning.
   See Chapter User Accounts[81] for password rules.

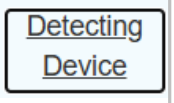
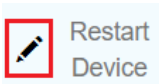
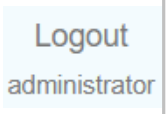
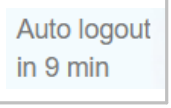
7 Working with the user interface

This chapter describes access, setup options, update and diagnostics of aplSwitch Field. The navigation through the menu structure is complemented by screenshots of the user interface.

In this chapter you will learn how to set up and operate the aplSwitch Field using the graphical user interface. The navigation through the GUI is supported by corresponding screenshots of menus and windows.

7.1 Navigation and banner bar

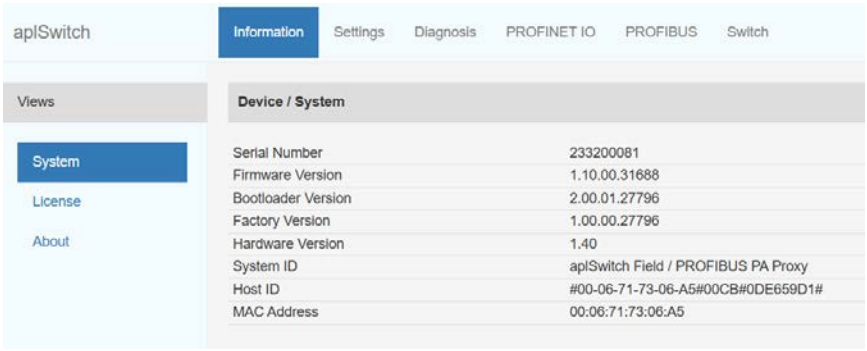
The navigation bar and banner bar are located at the top of the user interface window. While the navigation bar displays the main menu options which launch sub-menus in the sidebar, the banner bar to the right includes the action buttons explained below.

Detect Device	When you select this action button the software scans for the connected aplSwitch Field. The device responds with all LEDs flashing, that action button now reading *Detecting Device* and the message in the OLED display: *I am the device your are looking for*. Click to identify the device in your lab or in the field (mounted on a rack or in cabinet).	
Restart Device	After you have made changed in the Settings and PROFINET IO menus and clicked **[Apply]**, a pencil symbol appears next to **[Restart Device]** indicating that the device must be restarted for the changes to become effective.	
Logout	Click to log yourself out as the current user.	
Auto logout	A security feature indicating the time you remain logged on the user interface if no user activity is monitored by the system. The default logout is predefined to 10 minutes.	

7.2 Information

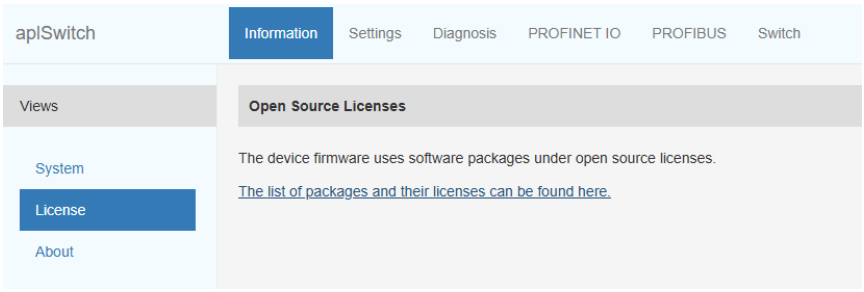
7.2.1 System

Select **Information → System** to view the following system information of your device:



7.2.2 License

Select **Information → License** to view the licenses used by the device firmware under an open source license.



7.2.3 About

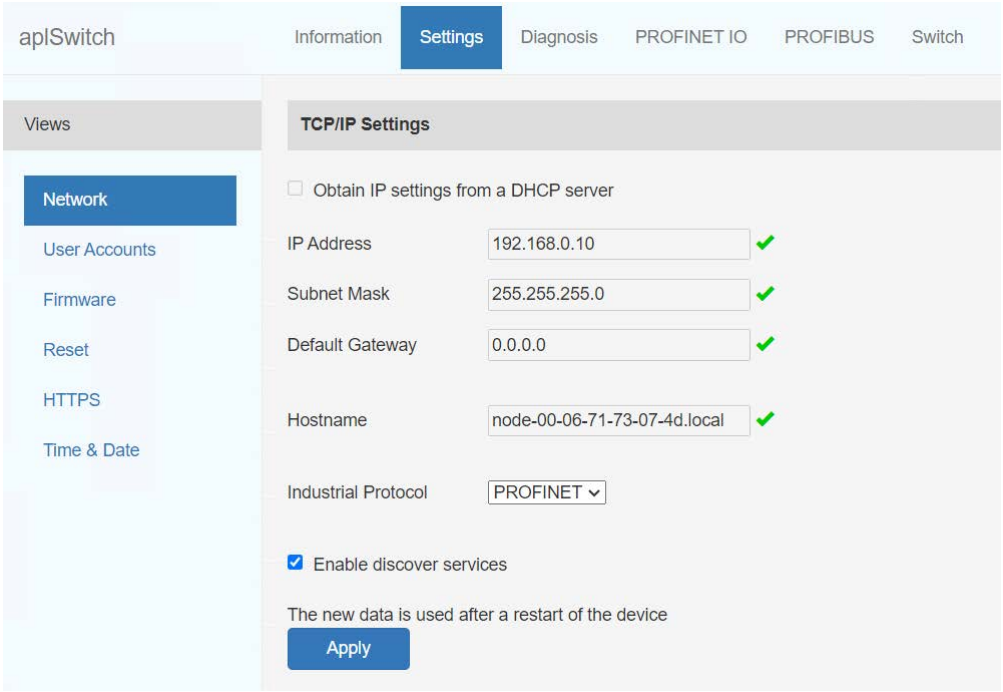
Select **Information → About** to show information about Softing and other useful information.

7.3 Settings

7.3.1 Network

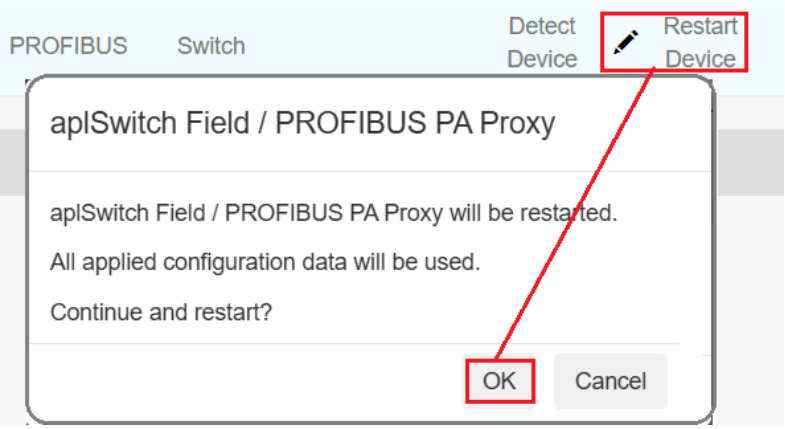
Select **Settings →Network** to view and change the TCP/IP settings (including IP address, subnet mask, gateway and the host name). Additionally you can chose to retrieve the IP settings from a DHCP server by selecting the radio button at the top of the window.

Note
You need to be logged in as **administrator** to change the settings. If you change the settings you must restart the aplSwitch Field.



Parameter	Meaning
Obtain IP address from a DHCP server	The Dynamic Host Configuration Protocol (DHCP) is activated and the IP address is obtained from a DHCP server.
IP Address	Internet Protocol (IP) address of the device used for web access.
Subnet Mask	Subnet mask of the device used for web access.
Default Gateway	Default gateway of the device used for web access.
Hostname	PROFINET name of the device.
Industrial Protocol	When selecting PROFINET the following user interface menu options switch to read-only mode: ▪ Settings →TCP/IP attributes ▪ Switch → Port Settings ▪ Switch → Power When selecting NONE the following user interface menu options switch to read-write mode: ▪ Settings →TCP/IP attributes ▪ Switch → Port Settings ▪ Switch → Power
Enable discover services	Check the box to enable *Simple Service Discovery Protocol* (SSDP) *multicast DNS* (mDNS) and Softing's *SearchAndConfigure* tool.
Apply	Click **[Apply]** to confirm changes made in this window.

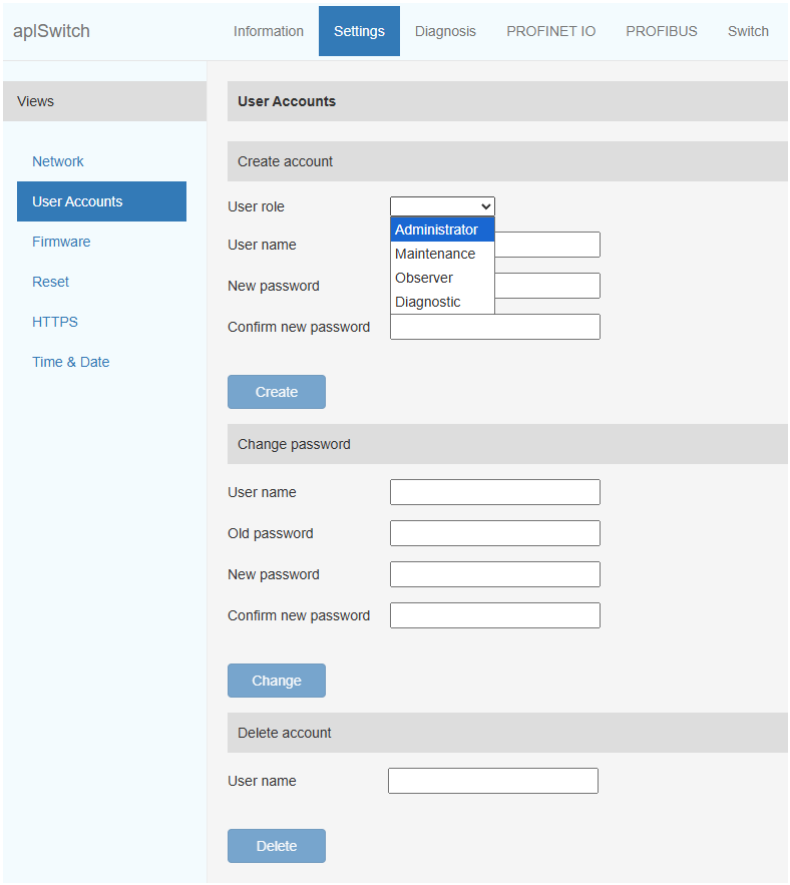
Note
To edit IP Address, Subnet Mask and Default Gateway, first select **none** from the **Industrial Protocol** dropdown list, click **[Apply]** and restart the device. The pencil icon in the banner bar[77] indicates that a restart of the device is required.



7.3.2 User accounts

In this section you will learn how to change accounts and passwords. As **Administrator** you can create and delete user accounts and also change passwords.

1. Select **Settings → User Accounts**.



2. Select a user role in the dropdown menu, assign a user name and enter a **New password** in the corresponding fields according to the password rules.

3. Retype the password in the **Confirm new password** field and click **[Create]** to save the user and password settings.

Password rules

A password must contain between eight and 128 characters, including at least 1 lower case letter, 1 upper case letter, 1 number and 1 special character: !"#$%&'()*+,-./:;<=>?@[\]^_`{|}~

Changing the password

1. Enter the user name of the account for which you want to change the password.

2. Enter the **Old password**.

3. Enter the **New password**.

4. Retype the password in the **Confirm new password** field and click **[Change]** to save the new password settings.

Deleting an account

1. Enter the user name of the account which you want to delete.
2. Click **[Delete]** to erase the account settings and remove the user.

The following table shows the user roles and corresponding permissions:

Permission	Administrator	Diagnostic	Maintenance	Observer
Create and delete accounts	☑	☑		
Change all passwords	☑	☑		
Change own password	☑	☑	☑	☑
Configuring device	☑	☑	☑	
Reading configuration	☑	☑	☑	☑
Reading diagnostics	☑	☑	☑	☑
Updating firmware	☑	☑		
Resetting device	☑	☑		
Installing HTTPS certificates	☑	☑		

Note

The user role *Diagnostic* is not required for daily operations. It is reserved for internal purposes such as troubleshooting. Softing Support may ask you to add a user with this role to obtain more details of your aplSwitch Field.

7.3.3 Firmware

The aplSwitch Field comes with pre-installed firmware which is maintained and updated to continuously enhance the functionality of the device. To ensure that your aplSwitch Field is running the latest firmware version check, the product website for updates. Bear in mind that the aplSwitch Field cannot be downgraded to a previous version.

Note

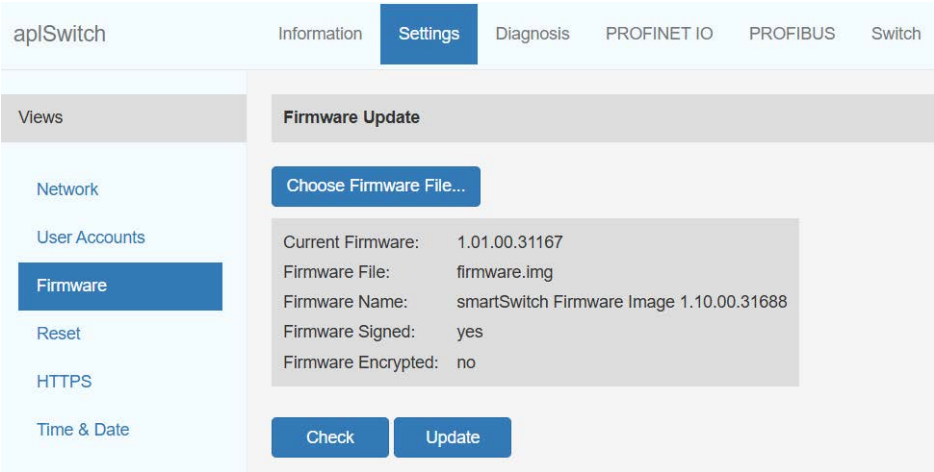
Always update the firmware following the initial installation.

Note

The firmware must be updated over an Ethernet trunk 26 connection. You need to be logged in as **administrator**.

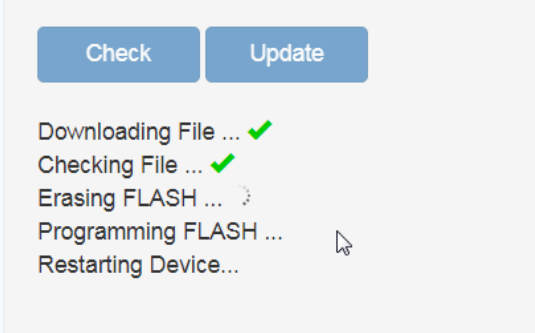
Action required:

1. Go to the the product website and download the firmware update to your computer.
   When you are downloading from this site for the first time you will have to register yourself in a few steps.
2. Log on to the web interface of the switch.
3. Select **Settings → Firmware** in the side bar navigation.
4. Click **[Choose Firmware File...]** and select the file *firmware.img* you downloaded to your PC.

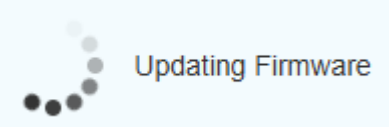


5. Click **[Check]** to verify that the file you have chosen is a valid firmware file

6. Click **[Update]** to install the latest firmware and **[OK]** in the message window to continue and restart.
   The update progress is shown beneath the update button.



The system is updating the firmware as indicated in the bottom left corner of the window. The download starts automatically. When the download is completed the aplSwitch Field will be rebooted.



Note
After the switch has rebooted you are automatically forwarded to the login page. If this fails press F5 to reload the web page.

Note
If something goes wrong during the firmware update simply repeat the update.

When the firmware is updated the new firmware version is shown in the information menu (**Information** → **System**[78]).

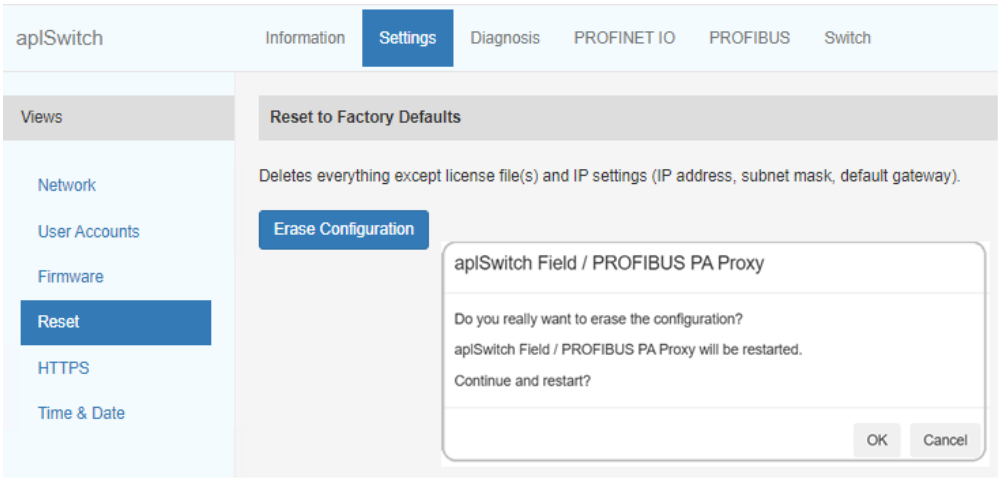
7.3.4 Reset

Unlike the factory reset (hard reset) described in Chapter Resetting the device 30, this soft reset deletes the configuration of your aplSwitch Field and restores the factory settings of your switch.

1. Select **Settings → Reset** in the side bar navigation

2. Select **[Erase Configuration]** to reset your device to default settings.

Note
You need to be logged in as **administrator**.



3. Click **[OK]** to confirm your selection.
Your aplSwitch Field will be restarted with the default settings. IP settings will not be deleted.

Note
The password is reset to the **default password**.

7.3.5 HTTPS

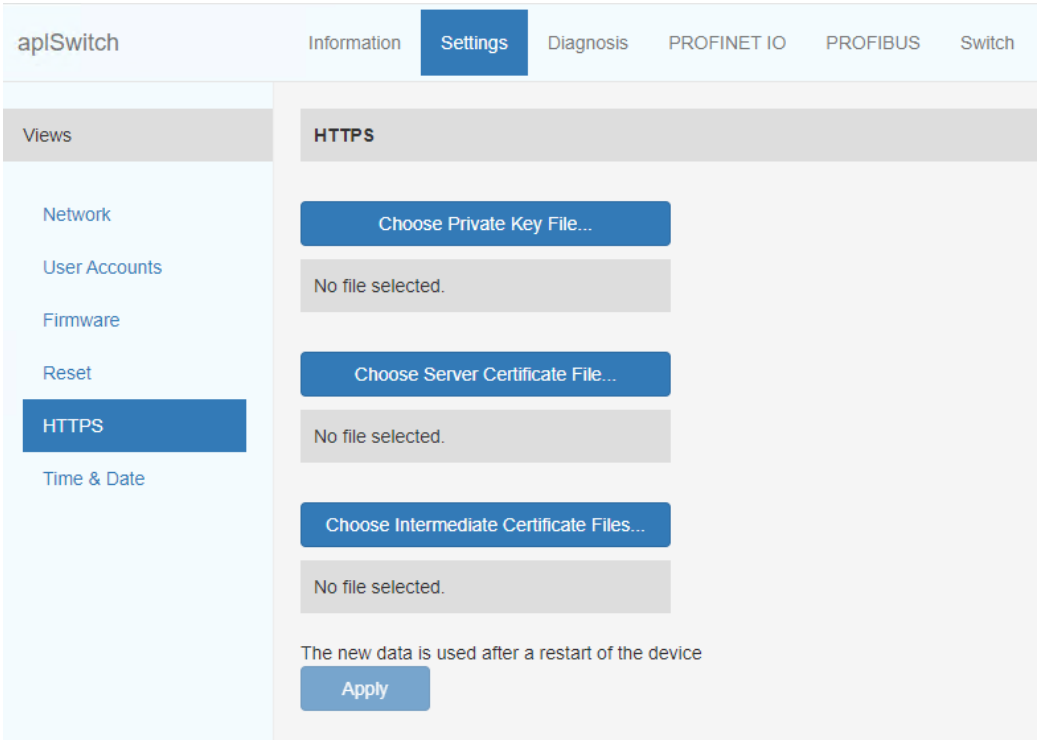
If you access the device on an HTTPS connection, make sure a trusted certificate is used. You can check easily if the IP address of your device is secured by a certificate. Most web browsers typically display a padlock icon in the address bar to indicate that a secured HTTP connection is used. Click on the icon to find out which type of security and certificate is used.

aplSwitch Field uses Open SSL V1.0.2 for TLS 1.2 with a self-signed Softing certificate. If you want to use a different certificate to secure your switch, select **Settings → HTTPS** and choose the upload options to install a private key, server certificate file and intermediate certificate files.

When you configure the HTTPS settings the initially installed self-signed certificate is replaced. You can restore the original certificate by resetting the default gateway configuration (**Settings → Reset → Erase Configuration**).

Note

You need to be logged in as **administrator** to change the HTTPS settings.



Parameter	Meaning
Choose private key file…	Install the private key file, containing the private key, generated simultaneously with the certificate signing request.
Choose server certificate file…	Install the server certificate file.
Choose Intermediate Certificate Files…	Optional for installing necessary intermediate certificate files.
Apply	Click button to activate your settings.

Note

If you change the settings you must restart the device.

Note

If you are experiencing problems with certificates, please update your web browser first with the most recent version before contacting Softing support.

Note

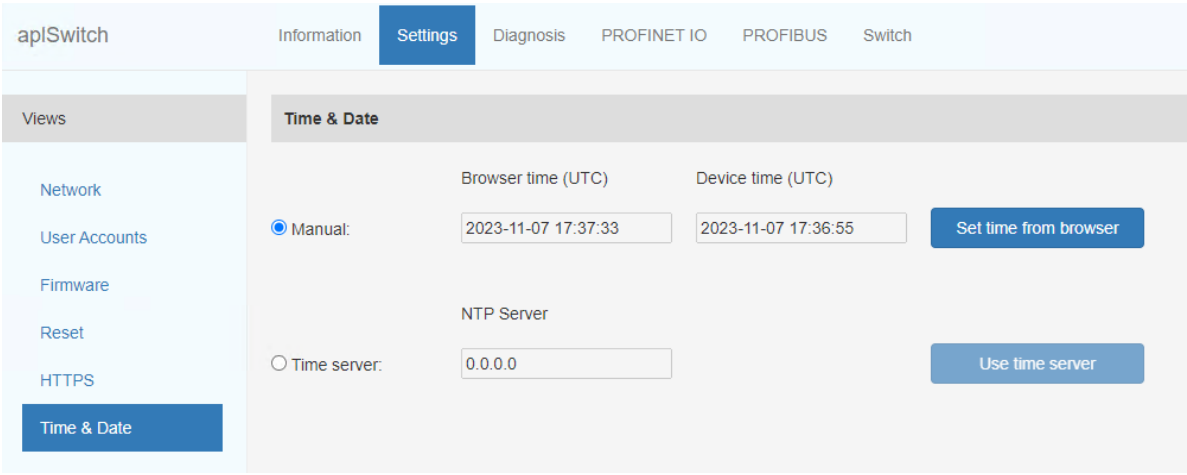
As your web browser might use cached data, please refresh the browser after rebooting the device.

7.3.6 Time & Date

Select **Settings → Time & Date** in the side bar navigation to set the time and date of your aplSwitch Field.

1. Click **[Set time from browser]** to synchronize the aplSwitch Field with the PC date and time manually.

2. Click **[Use time server]** and enter the IP address of your time server to synchronize date and time automatically.



Parameter	Meaning
Browser time (UTC)	The time set on the PC.
Device time (UTC)	The time set on the device when you select **[Set time from browser]**. The device time cannot be set separately.
NTP server	IP address of a Network Time Protocol (NTP) server used for time synchronisation.
Time server	The time can be set either manually or using a time server.

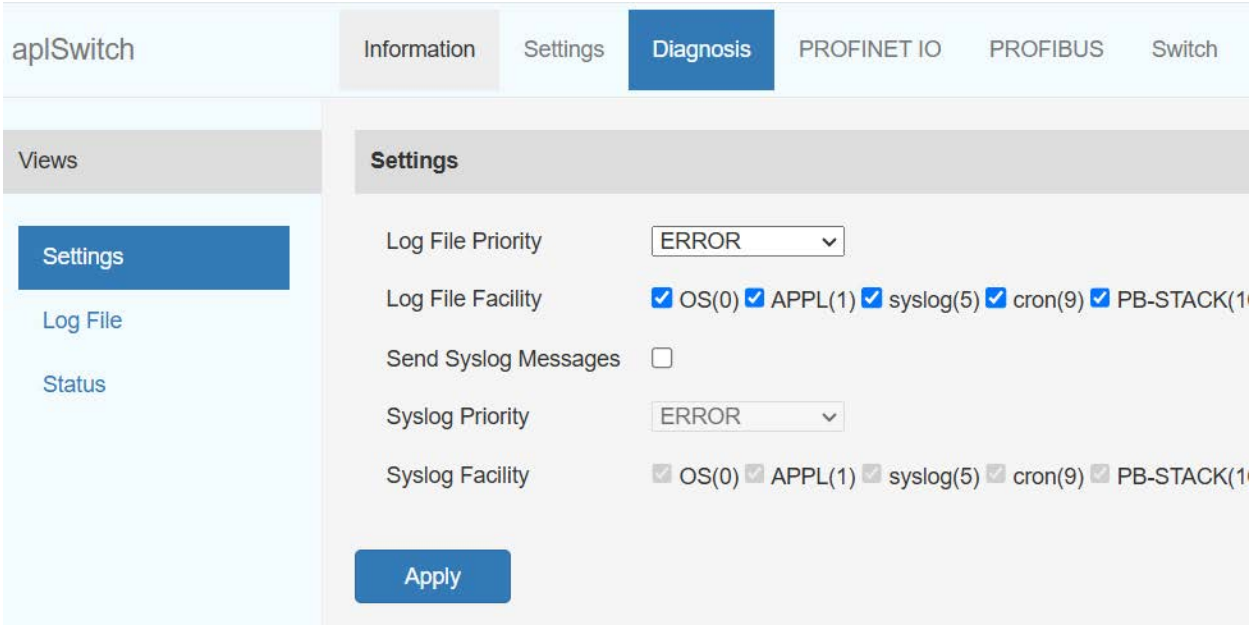
7.4 Diagnosis

Note

The menu **Diagnosis** including all sub-menus **Settings, Log File and Status** is primarily reserved for Softing Support to help Expert users analyze system data.

7.4.1 Settings

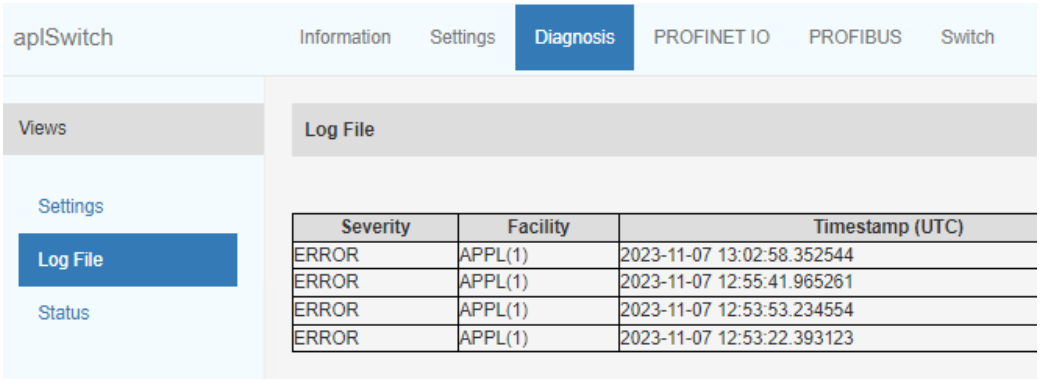
Select **Diagnosis → Settings** to view the diagnosis settings, set the log file priority and choose which files you wish to log. The settings can be viewed in any role. To change the settings you must have administration rights.



Parameter	Meaning
Log File Priority	Available values: Emergency, Alert, Critical, Error, Warning, Notice, Information. All messages with the set priority or higher are logged. The log file is shown under **Diagnosis → Log File**
Log File Facility	Tick the checkbox for the protocol layer you want to write to the log file.
Send Syslog Messages	Activates additional debug logging and sends the information to the network. Can be logged with wireshark, Visual Syslog Server or similar applications.
Syslog Priority	Available values: EMERGENCY, ALERT, CRITICAL, ERROR, WARNING, NOTICE, INFORMATION. All messages with the set priority or higher are logged.
Syslog Facility	Tick the checkbox for the protocol layer you wish to write to the syslog file.
Apply	Click the Apply button to activate your settings. The data is written to the log file.

7.4.2 Log File

Select **Diagnosis → Log File** to view log files and backup file. You can also filter the diagnostic log by ticking and unticking the checkboxes of the different priorities (Emergency, Alert, Critical, Error etc). This only affects the display of the log and not the settings of the log file priority under **Diagnosis → Settings**.



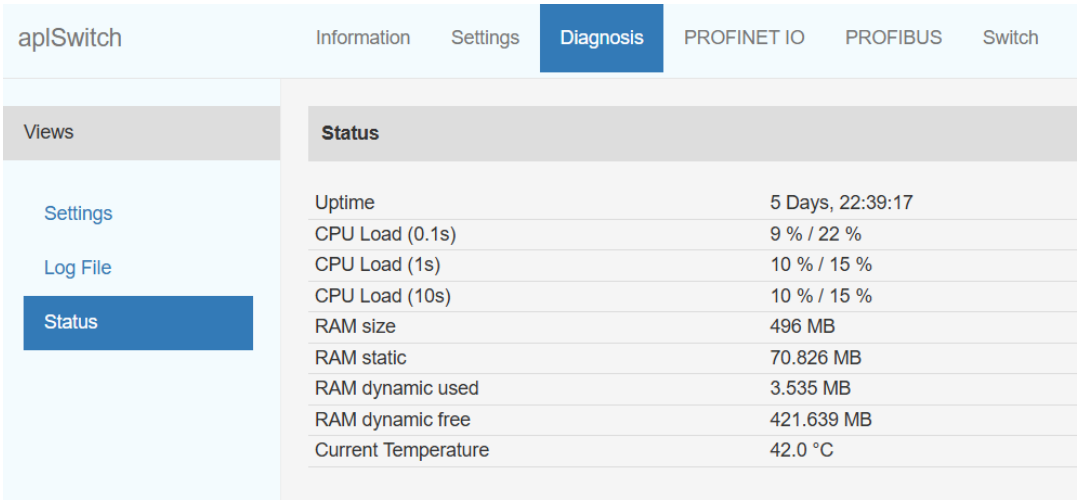
Note

Use the button **[Support Data]** to save connection status data and mapping data to a file. The information contained in this file may provide Softing Support with valuable information to address and fix potential issues.

Parameter	Meaning
Refresh	Click this button to update the message log entries.
Time s	Dropdown to select the automatic refresh interval in seconds (default setting is 10 seconds)
Clear	Click this button to delete the log file entries.
Support Data	Click this button to upload a collection of all available logs for support requests.
EMERGENCY, ALERT, CRITICAL, ERROR, WARNING, NOTICE, INFORMATION	Tick the check boxes to set a display filter.
Severity	Rates the meaning of the the event: EMERGENCY, ALERT, CRITICAL, ERROR, WARNING, NOTICE, INFORMATION
Facility	Defines from which part of the firmware the message is issued
Timestamp UTC	Date and time recorded in the Coordinated Universal Time (UTC) standard
Message	Text describing the issue

7.4.3 Status

This page shows the current processor load and temperature of the switch.



7.5 PROFINET IO

The aplSwitch Field is compliant with Conformance Class B (PA) including S2 redundancy and MRP. The PROFINET GSDML file can be downloaded via the integrated webserver. If PROFIBUS PA devices in manufacturer mode are connected to the aplSwitch Field a separate GSDML must be created (see Chapter GSDML 92).

7.5.1 Prerequisites

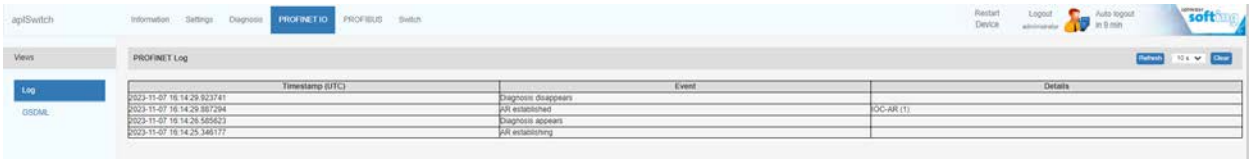
- Your PC and aplSwitch Field are connected over Ethernet.
- The GSDML has been downloaded from the aplSwitch Field.
- The GSDML files of your PROFINET IO devices are available.
- PROFINET devices, aplSwitch Field and a PLC are connected to the PROFINET network.
- APL devices and PROFIBUS PA devices are connected to the spur ports of the aplSwitch Field.
- A PLC programming tool is available to download the program to the PLC.

7.5.2 Log

Select **PROFINET IO → Log** to view the events / states of the aplSwitch Field acting as PROFINET device.

The following events are logged:

- PROFINET connection to the aplSwitch Field
- PROFINET diagnosis state of the aplSwitch Field



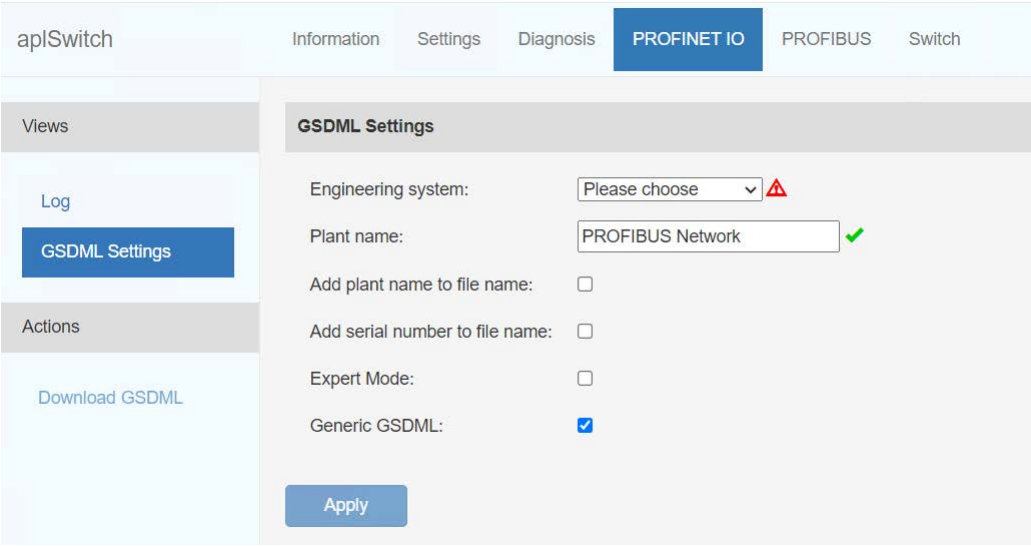
7.5.3 GSDML Settings

1. Select **PROFINET IO → GSDML Settings** to download the GSDML file.

2. Determine for which engineering system and for which installation (plant name) you want to generate a GSDML file. An engineering system needs to be selected before you can download a GSDML file.

Note

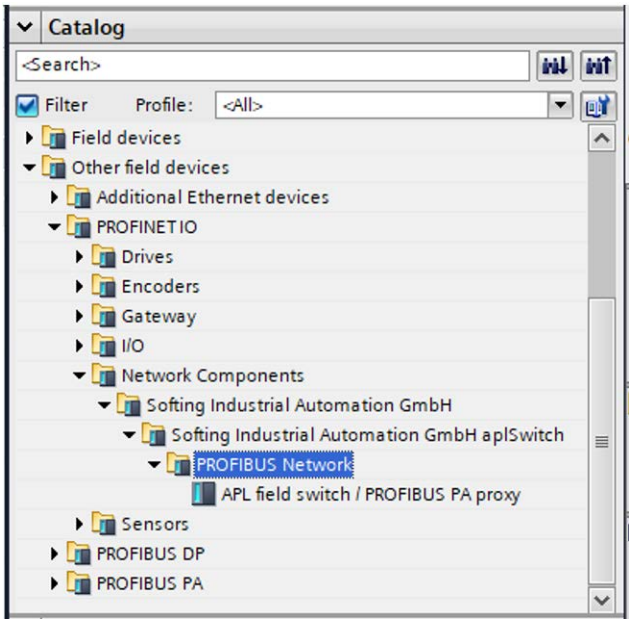
To ensure proper display of your GSDML file, it is recommended that you select your preferred engineering system under **GSDML Settings**.



Parameters	Meaning
Engineering system	The engineering system using the GSDML file. As not every system support all GSDML options for proper operation select the correct system. If your system is not available select *Generic*.
Plant name	Plant name is an additional sorting criterion that can be added to the GSDML. In TIA Portal the plant name appears as a folder in the Device Catalog after importing the GSDML file. In other engineering systems, the plant name may not appear.
Add plant name to file name	The file name of downloaded GSDML contains the configured plant name.
Add serial number to file name	The file name of downloaded GSDML contains the serial number of the aplSwitch Field.
Expert Mode	If checked, a GSDML is generated with PROFIBUS PA bus parameters that can be changed in the PROFINET engineering system. If unchecked, a GSDML is generated with fixed PROFIBUS PA bus parameters that cannot be changed in the PROFINET engineering system.

Generic GSDML	If checked, a GSDML is generated containing all devices and their modules from the device catalog of the PROFIBUS Configuration page. The PA bus configuration has to be done in the PROFINET engineering system. If unchecked, a GSDML is generated specific to the current Segment configuration from the PROFIBUS Configuration page. No configuration in the PROFINET engineering system is needed.

3. Enter a **Plant name**.



4. Optional. Tick **Add plant name to file name** and/or **Add serial number to file name** to add the related information to the GSDML file name.

5. Tick **Expert Mode** to enable write access to bus parameter values via PROFINET engineering. The following default parameters are used.

Parameter	Meaning
Master Address	1
Baudrate	31.25 kBaud
Slot time	320
Min. TSDR	11
Max. TSDR	250
Quiet time	0
Setup time: 32	32
Ttr	20000
Has	126
Retry	3

6. Click **[Apply]** to save the settings.

7. Click **[Download GSDML]** to download the GSDML file.

Note
The GSDML file can now be imported to any PROFINET engineering system.

7.6 PROFIBUS

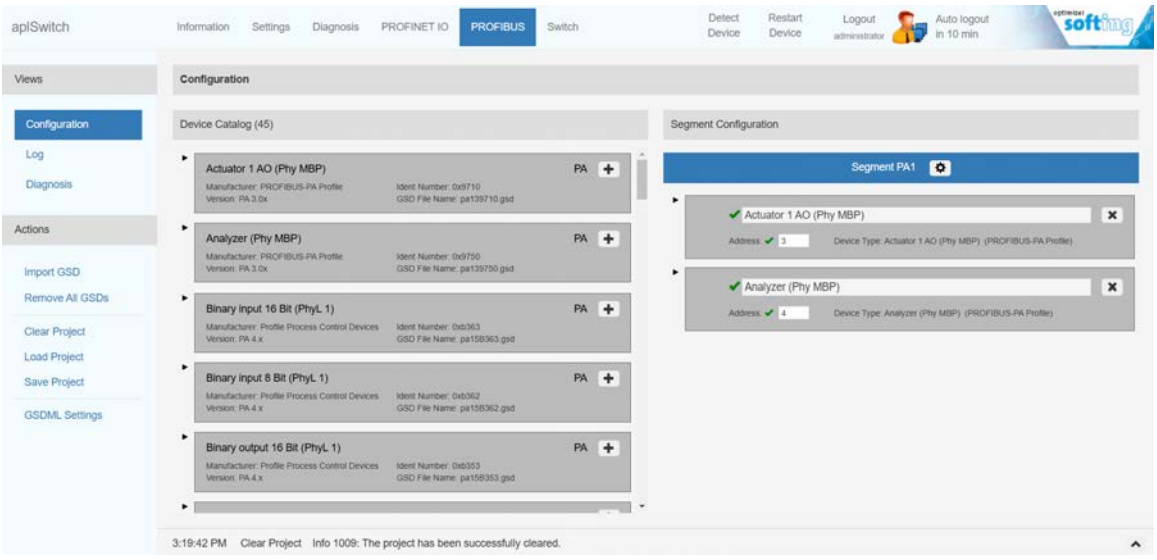
Note

The information in this Chapter applies only to the operation of the model aplSwitch Field PA.

7.6.1 Configuration

This section describes how to configure the aplSwitch Field PA for PROFIBUS communication. You need to be logged in as administrator to configure the aplSwitch Field PA. Set up a PROFIBUS PA segment by building a new project or loading a project file. A project includes the Segment Configuration.

1. Select **PROFIBUS → Configuration**.
   The configuration window opens showing a catalog list of supported PROFIBUS PA GSD files.
2. Select **Import GSD** in the side menu to import the GSD files of your PROFIBUS PA devices to the Device Catalog. For additional information or setup options expand the PROFIBUS PA devices. The PROFIBUS PA Profile GSD files are pre-installed.
3. Click **[+]** in the right top corner of a PA device in the device catalog to add PROFIBUS PA devices to the segment.
   The PROFIBUS PA device appears in the Segment Configuration. If necessary, modify the auto-generated address of the PROFIBUS PA devices. For additional information or setup options expand **[v]** the PROFIBUS PA devices.
4. If needed, click **[x]** at the PROFIBUS PA device below Segment PA1 to delete a device from the PA segment.
5. Select **Remove All GSDs** to remove all previously imported GSDs.
6. Click [⚙] at Segment PA1 to inspect and modify the bus parameter.
7. If necessary, select **Clear Project** to clear the Device Catalog and the Segment Configuration.
8. Select **Load Project** and choose a project file. The Device Catalog and Segment Configuration will be updated with the project data.
9. Select **Save Project** to store the project.
10. Select **GSDML settings** to navigate to **PROFIBUS → GSDML**. Follow the instructions in Chapter GSDML 92 to download the GSDML file.



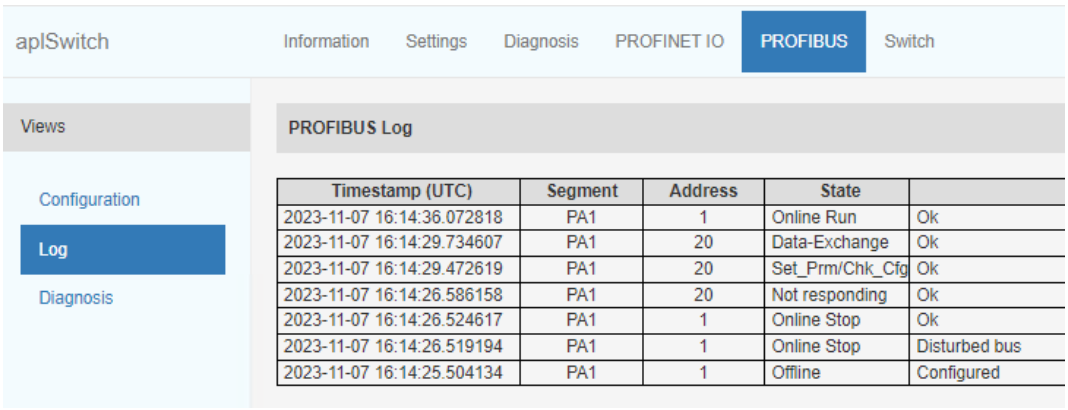
Actions	Meaning
Import GSD	Import GSD device description file to device catalog.
Remove all GSDs	Delete all previously imported GSDs.
Clear Project	Delete all configured devices.
Load Project	Load a previously saved project configuration.
Save Project	Save the project configuration to a file.
GSDML Settings	Navigate to GSDML settings page.

Note
You can adapt the baud rate and retry limits to network characteristics. The default baud rate is set to 1.5 Mbaut and the retry limit to 1.

Terms / Abbreviations	Meaning
Baudrate	The rate at which data is transferred in a PROFIBUS communication segment. "1.5MBaud" means that segment can transfer a maximum of 1.5 megabits per second.
Tsl	Slot Time: This time determines the maximum time the sender waits for a response from the addressed device.
Min Tsdr	Minimum Station Delay Responder: The time that the slave must wait before it may respond to a request from the master. The default value is 11tBit.
Max Tsdr	Maximum Station Delay Responder: The time in which the slave must respond to a request from the master. The value range is set between 60 and 800 tBit.
Ttr	Target Rotation Time: This time is the maximum time available for one Token rotation. In this time span, all DP masters receive the Token once.
Highest Station Address	Indicates the highest valid device address in the PROFIBUS network.
Tset	Setup Time: This is the time that may pass between receiving a data telegram and the respective reaction within a device.
Max Retry limit	The total number of retries.

7.6.2 Log

Select **PROFIBUS** → **Log** to see the PROFIBUS log messages.

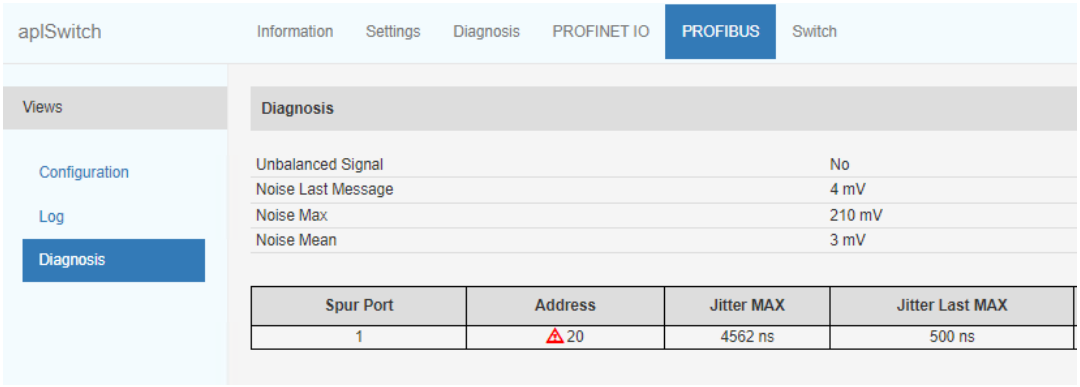


Timestamp (UTC)	Segment	Address	State	
2023-11-07 16:14:36.072818	PA1	1	Online Run	Ok
2023-11-07 16:14:29.734607	PA1	20	Data-Exchange	Ok
2023-11-07 16:14:29.472619	PA1	20	Set_Prm/Chk_Cfg	Ok
2023-11-07 16:14:26.586158	PA1	20	Not responding	Ok
2023-11-07 16:14:26.524617	PA1	1	Online Stop	Ok
2023-11-07 16:14:26.519194	PA1	1	Online Stop	Disturbed bus
2023-11-07 16:14:25.504134	PA1	1	Offline	Configured

Paramters	Meaning
Timestamp (UTC)	Date and time recorded in the Coordinated Universal Time (UTC) standard
Segment	Segment of the aplSwitch Field to which the PROFIBUS device is connected. The switch has one internal bus called PA1
Address	Address of the PROFIBUS device to which the displayed message belongs. The aplSwitch Field has the addresses 1 and 2. PA devices have addresses between 3 and 125.
State	The column shows the current state of the device at this address *Online run*, *Not responding etc.).*
Status	Additional information pertaining to the current state (if there is a diagnosis available on the device etc.)

7.6.3 Diagnosis

Select **PROFIBUIS → Diagnosis** for a list of the PROFIBUS devices connected to the spurs of the aplSwitch Field. The address of the PROFIBUS devices is displayed along with the number of the connected spur and some diagnosis information.

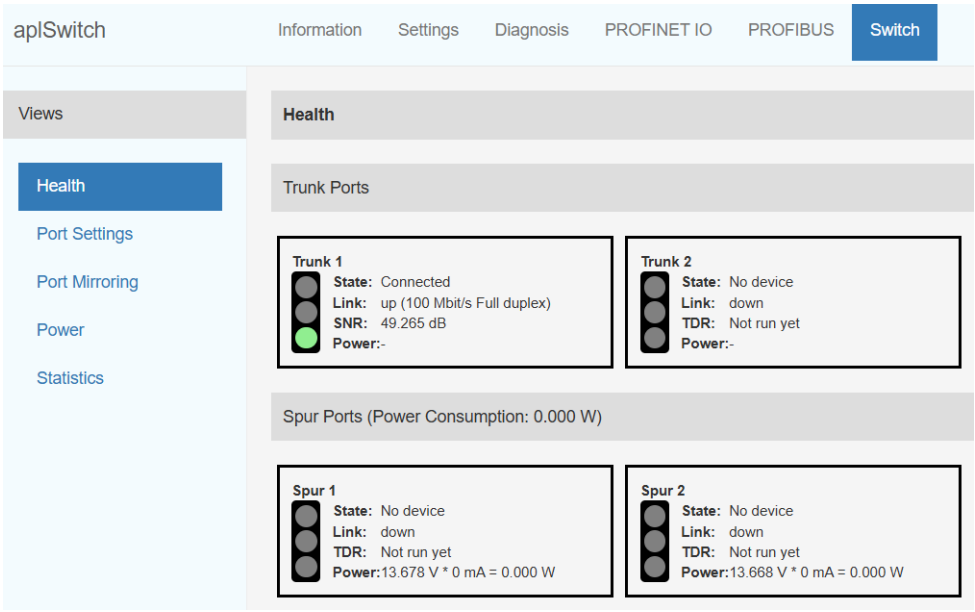


Parameters	Meaning
Spur Port	Number of spur ports connected to PROFIBUS device
Address	Address of the connected PROFIBUS device
Jitter MAX	highest jitter value reached of the connection with that specific PROFIBUS device during a measurement period
Jitter Last MAX	the last local maximum jitter value reached of the connection with that specific PROFIBUS device
Jitter Mean	gives the average variation in the timing of packet arrivals
Signal Ampl MAX	the highest signal amplitude value reached of the connection with that specific PROFIBUS device
Signal Ampl MIN	the lowest signal amplitude value reached of the connection with that specific PROFIBUS device
Signal Ampl Last MAX	the last local maximum signal amplitude value reached of the connection with that specific PROFIBUS device
Signal Ampl Last MIN	the last local minimum signal amplitude value reached of the connection with that specific PROFIBUS device

7.7 Switch

7.7.1 Health

Select **Switch → Health** to monitor the port status of the Ethernet trunks and APL/PA spurs.



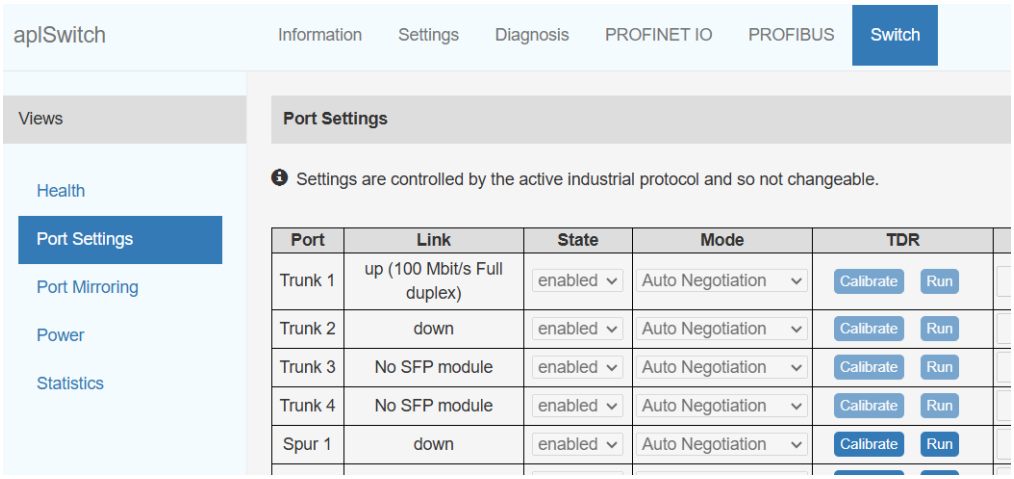
Each trunk and spur port are shown with the following information:

State:	general description of the port status
Link:	link status information
TDR/SNR:	value of the time-domain reflection (TDR) during link-down and value of the signal-to-noise ratio (SNR) during link-up
Power:	current output power (exclusive for spur ports)

Note
The TDR and SNR function are not implemented in the current version of the aplSwitch Field.

7.7.2 Port settings

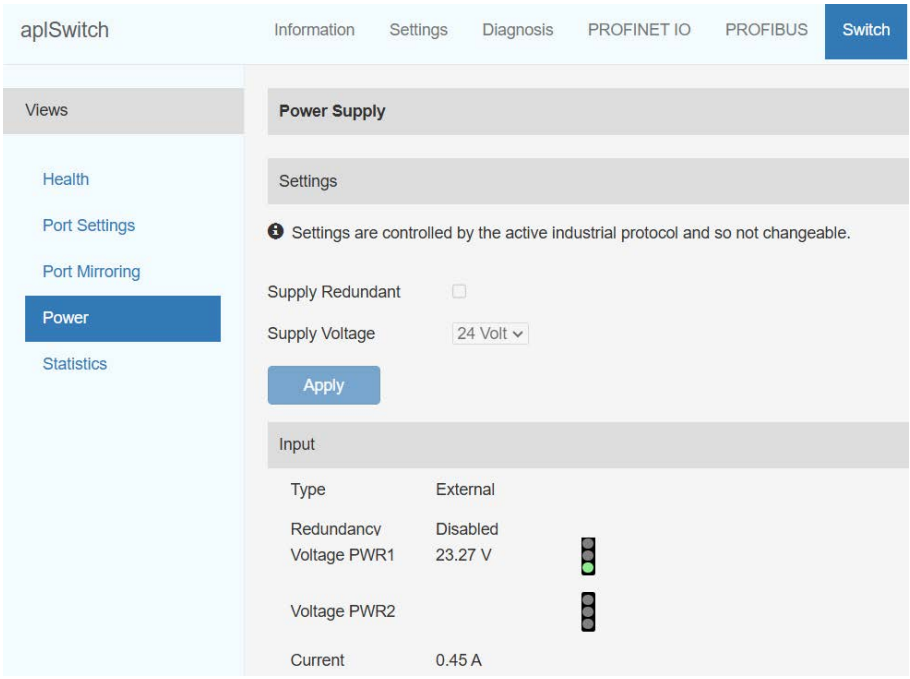
Select **Switch → Port Settings** to see the trunk and spur port settings defined by the industrial protocol of the engineering system. If you would like to set the ports in this window you will first need to disable the industrial protocol in the Network 79 window (set dropdown to *none*).



Parameters	Meaning
Port	Number and function of the port described in the table.
Link	Link *down* if port disconnected, link *up* if port connected. In case of link up, the speed of the connection is reported. In case of the SFP ports, the column shows if SFP modules are connected or not.
State	State shows if the port is enabled or disabled
Mode	Connection mode. Trunk ports: Auto Negotiation / 10 Mbit/s half-duplex / 10 Mbit/s full-duplex / 100 Mbit/s half-duplex / 100 Mbit/s full-duplex. SFP ports: Auto Negotiation. Spur ports: Auto Negotiation / 10 Mbit/s / PROFIBUS PA (only for aplSwitch PA).
TDR	Reserved for TDR in the next version.
Calibrate	Reserved for next version
Run	Reserved for next version
Description	Currently left blank

7.7.3 Power

The external power supply can be monitored in sub-menu **Power.** You can define the supplied voltage in the **Settings** area at the top of the window.



Parameters	Meaning
Supply Redundant	Redundant power supply is enabled and expected if box is checked, otherwise power redundancy is disabled and single power supply is expected
Supply Voltage	The expected supply voltage (24V or 48V).
Voltage PWR1	The actual voltage on power supply 1. The traffic signal shows if the voltage value is good (green) or faulty (yellow/red). If the traffic signal is off, no significant voltage is detected at power supply 1.
Voltage PWR2	The actual voltage on power supply 2. The traffic signal shows if the voltage value is good (green) or faulty (yellow/red). If the traffic signal is off, no significant voltage is detected at power supply 2.
Current	The actual current of the device.

1. Tick the checkbox **Supply Redundant** if the field switch is supplied redundantly via the connections PWR1 and PWR2.
2. Select the supplied voltage from the drop-down menu **Supply Voltage** and choose between 24 VDC and 48 VDC.
3. Click **[Apply]** to confirm your selection.

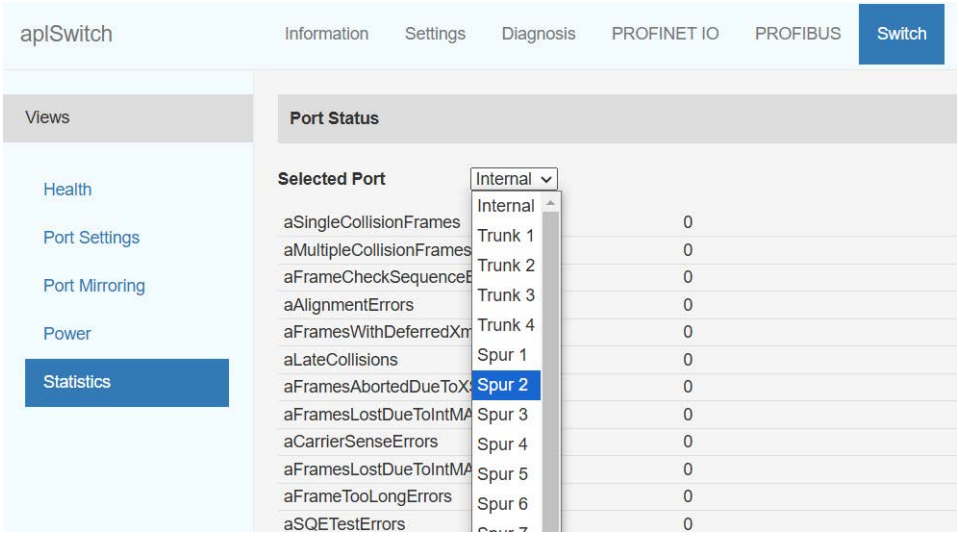
The status of the external power supply is shown under **Input**. The measured clamp voltage at connection P1 and P2 is shown at Voltage P1 and Voltage P2. Also shown is if the voltage meets the specified requirements which are based on the universal voltage range 24 to 48 VDC.

7.7.4 Statistics

Select **Switch → Statistics** to display the traffic statistics at the internal interface and the different ports of the aplSwitch Field. The considered port can be selected with the dropdown at the top of the page.

Note

The port status is shown for Ethernet ports only. PROFIBUS PA devices are not supported in the statistics view.



8 Troubleshooting

This chapter outlines common issues that may confuse the user or may disrupt switch operation, along with possible causes and recommended corrective actions.

Message or Error	Possible Cause	Solution or Required Action
I cannot connect to the switch on the web browser.	You are using an incorrect IP address.	Use the IP address shown in the display of the switch. See chapter IP address 74 for details.
Spur LED is OFF in the display.	The field device is not properly connected or the spur port is idle.	Connect a field device and the LED for the spur port will light up.
The display shows the IP address 0.0.0.0 (no IP address allocated).	The IP address has been lost due to a Hard Reset 30 or there is no connection to the controller.	Set a new IP address using a commissioning tool (PRONETA) or via an engineering project.
Of all LEDs only the BOOT LED is lit in the display.	The switch is rebooting.	Wait for the (re)boot process to finish.
I cannot connect using the IP address shown in the display.	(A) The web browser for the device is disabled in the device settings of your engineering project. (B) The device is not working or not responding.	(A) Enable the web browser settings for the device in the engineering project. (B) Execute a ping command to check if the device can be reached.
I cannot connect change the IP address of the switch in the web browser.	You do not have the user permissions to change the IP address.	You must be logged in with the user role Maintenance and must had selected "none" in the Industrial Protocol dropdown menu.

9 Caring for your aplSwitch Field

9.1 Transport

Transport and store the device carefully and in accordance with the safety notes (see Chapter Safety 11).

- Transport and store the device only in the original packaging.
- Store the device in a dry place (no condensation) and vibration-free.
- Do not drop the device.

9.2 Maintenance

The device does not require regular maintenance. However to ensure a long service life, the following is recommended:

- Protect the from any damage. Endure the device has no cracks or shows other visible signs of damage.
- The permissible temperatures are not exceeded.
- All parts are securely fitted.
- The device is used as intended.

9.3 Cleaning

- Gently clean the device with a damp cloth only. Do not use abrasive or aggressive cleaning agents or solutions.
- Devices located in hazardous areas may only be cleaned with a damp cloth to avoid electrostatic charge.
- Check the device for damage before and after cleaning it. Decommission damaged devices immediately.

9.4 Repair

- Repair work on the device must be performed by Softing Industrial Automation GmbH.

9.5 Returning your aplSwitch Field

Contact your Softing representative or Softing Support prior to packaging and returning a device to Softing Industrial Automation GmbH.

9.6 Disposing of your aplSwitch Field

- Observe national, local and statutory regulations regarding disposal.
- Separate materials for recycling.
- Ensure environmentally friendly disposal of all components according to statutory regulations.

10 Certificates

10.1 ATEX EU type examination certificate

(1) **EU-TYPE EXAMINATION CERTIFICATE**

(2) Equipment and Protective Systems intended for use in Potentially Explosive Atmosphere - **Directive 2014/34/EU**

(3) EU-Type Examination Certificate Number:

TÜV 24 ATEX 9218X Issue: 00

(4) Equipment: **aplSwitch Field, GSA-XX-020101, GSA-XX-020111**

(5) Manufacturer: **Softing Industrial Automation GmbH**

(6) Address: **Richard-Reitzner-Allee 6**
85540 Haar, Germany

(7) This product and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Zertifizierungsstelle für Explosionsschutz of TÜV Rheinland Industrie Service GmbH, Notified Body No. 0035 in accordance with Article 21 of the Council Directive 2014/34/EU of 26th February 2014, certifies this product which has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmosphere, given in Annex II to the Directive.
The examination and test results are recorded in the confidential report 331 / Ex9218.00 / 24.

(9) Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule of this certificate, has been assessed by reference to:

EN IEC 60079-0: 2018 **EN IEC 60079-7:2015/A1:2018**

EN 60079-11: 2012 **IEC 60079-11: 2023** **IEC/TS 60079-47: 2021**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EU-Type Examination Certificate relates only to the design and specification for construction of the equipment or protective system. It does not cover the process for actual manufacture or supply of the equipment or protective system, for which further requirements of the directive are applicable.

(12) The marking of the equipment shall include the following:

II 3 (1) G **Ex ec ic [ia Ga] IIC T4 Gc**
II (1) D **[Ex ia Da] IIIC**

TÜV Rheinland Zertifizierungsstelle für Explosionsschutz Cologne, 2025-07-14

Digital unterschrieben von Christian Mehrhoff

This EU-Type Examination Certificate without signature and stamp shall not be valid and may be circulated only without alteration.
Extracts or alterations are subject to approval by Zertifizierungsstelle für Explosionsschutz of TÜV Rheinland Industrie Service GmbH.
Am Grauen Stein • 51105 Köln • Tel. +49 (0) 221 806-0 • Fax. + 49 (0) 221 806 114

www.tuv.com

DAkkS Deutsche Akkreditierungsstelle D-ZE-11052-03-00

TÜVRheinland® Precisely Right.

(13) Annex to
(14) **EU-Type Examination Certificate**

TÜV 24 ATEX 9218X Issue: 00

(15) Description of Equipment

Equipment and type:

aplSwitch Field, GSA-XX-020101, GSA-XX-020111

General product information:

The aplSwitch Field is designed for integration in powered Ethernet-APL spur-topologies. In this case the uplink functionality of the trunk is realized by copper based standard Ethernet interfaces (10/100Base-TX, 1000Base-TX) or alternatively by fiber based standard Ethernet interfaces (10/100Base-FX, 1000Base-FX).
The powered spurs communicate via Ethernet-APL and match either power class A or B according to the Ethernet-APL port profile. As additional feature power class A spurs can be configured to communication via Profibus PA. The aplSwitch Field is intended to be supplied by an auxiliary power source.

Technical data:

Power Supply (PWR1, PWR2)

Max. safety voltage:	U_m = 60 V
Nominal voltage:	U_N = 24 / 48 V DC
Voltage Range:	19,2 ... 57,6 V DC
Input current:	$I_N \leq$ 1,4 A (at 24 V DC) $I_N \leq$ 0,65 A (at 48 V DC)
Max. power consumption:	≤ 31,2 W
Max. power dissipation:	≤ 19 W

Data Interfaces (XT1, XT2)

RJ45 Plug connector

Max. safety voltage:	U_m = 60 V
Standard:	100BASE-TX
Transfer Rate:	10/100 Mbit/s

Interfaces (XT3, XT4)

SFP-Module for fibre optics
Laser Class 1 approved according to IEC 60825-1
The optical cables may lead either into or through areas requiring equipment of EPL Gb, Gc, Db or Dc.

Max. safety voltage:	U_m = 60 V
Standard:	100BASE-FX
Transfer Rate:	10/100 Mbit/s

(13) Annex to
(14) **EU-Type Examination Certificate**

TÜV 24 ATEX 9218X Issue: 00

PT100 Output (SPT)

Nominal values

Output current (const.) I_N = 1 mA

Max. output voltage: Uo = 4,94 V
Max. output current: Io = 15,6 mA
Max. output power: Po = 52 mW
Max. internal capacitance: Ci = 11 nF
Max. internal inductance: Li = 0 µF

In the following tables the combination of Lo and Co are listed including the line reacatances for the connection in the respective gas group. The internal capacitance of Ci = 11 nF is already considered.
The maximum values for Lo and Co are highlighted in grey.

For IIC:

Lo [mH]	100	10	1	0,1	0,01	0,001
Co [µF]	1,69	3,59	6,49	11,9	32,9	999

For IIB/IIIC:

Lo [mH]	100	10	1	0,1	0,01	0,001
Co [µF]	13,9	21,9	36,9	78,9	209	999

Spur Power Source Ports (S01…S16)

FISCO only applies for type GSA-XX-020111.
The option for Power Class B is only available for type GSA-XX-0202101 and terminals S13…S16.

Electrical characteristics of Power Class A Ports

Nominal values

Voltage range: U_N = 9,6 … 13,8 V DC
Output current (max.): I_N = 56 mA, short circuit protected

According to 2-WISE and FISCO in intrinsic safety type protection ia

Max. output voltage: Uo = 14,9 V
Max. output current: Io = 379 mA
Max. output power: Po = 998 mW
Max. internal capacitance: Ci = 110 pF
Max. internal inductance: Li = 280 nH

The following tables show the Entity values including occurring line reactances for the connection in the respective gas group.
The maximum internal reactances Ci and Li do not exceed 1 % of the determined Co and Lo values and are negligible.

(13) Annex to

(14) **EU-Type Examination Certificate**

TÜV 24 ATEX 9218X Issue: 00

For IIC:	Lo [mH]	0,15
	Co [µF]	0,5

For IIB / IIIC:	Lo [mH]	0,15	0,5	1
	Co [µF]	2	2	1

Electrical characteristics of Power Class B Ports

Nominal values

Voltage range: U_N = 10,1 … 12,6 V DC

Output current (max.): I_N = 115 mA, short circuit protected

According to 2-WISE and FISCO in intrinsic safety type protection ia

Max. output voltage: Uo = 17,1 V

Max. output current: Io = 378 mA

Max. output power: Po = 1,66 W

Max. internal capacitance: Ci = 110 pF

Max. internal capacitance: Li = 280 nF

Environmental data:

By using a SFP module: Ta = - 40°C ... + 65°C

By using a B-Port (option is only available for type GSA-XX-020101): Ta = - 40°C ... + 60°C

All other types: Ta = - 40°C ... + 70°C

List of used equipment and components

Device	Manufacturer	Type	Ex-Marking	Certificate no.
PCB Connector Series Combicon EX	Phoenix Contact GmbH & Co. KG	MSTBV 2,5/ 4-GF-5,08 EX BK FKC 2,5/ 4-STF-5,08 EX BK MSTB 2,5/ 4-STF-5,08 EX BK	Ex eb IIC Gb Operating temperature range -60 °C to +110 °C.	IECEx KEM 10.0093U KEMA 10ATEX0196 U
PCB Connector Series Combicon EX	Phoenix Contact GmbH & Co. KG	MSTBV 2,5/ 5-GF-5,08 EX BK FKC 2,5/ 5-STF-5,08 EX BK MSTB 2,5/ 5-STF-5,08 EX BK	Ex eb IIC Gb Operating temperature range -60 °C to +110 °C	IECEx KEM 10.0093U KEMA 10ATEX0196 U

(16) **Test report No.: 331 / Ex9218.00 / 24**

The device was assessed to meet the requirements of EN IEC 60079-0:2018, EN IEC 60079-7:2015/A1:2018, IEC 60079-11:2023 and CLC IEC/TS 60079-47:2021. The requirements of EN 60079-11:2012 are covered with the newest version of the IEC 60079-11:2023.

(13) Annex to

(14) **EU-Type Examination Certificate**

TÜV 24 ATEX 9218X Issue: 00

(17) Special Conditions for safe use

1. The device shall be installed in an environment with a pollution degree of 1 or 2. When installed in hazardous areas, an enclosure, which has a minimum rating of IP54 and is in accordance with EN IEC 60079-0, shall be used.
2. The device shall be installed in an environment with an overvoltage category of I or II.
3. The Ethernet interfaces for data transfer of the Ethernet- aplSwitch Field must be connected to Ethernet communication partners, which are in accordance with the technical data's. Since these are data interfaces and the voltage complies with the criteria for safety extra low voltages, no transient overvoltage's are expected.
4. By using a SFP module the maximum ambient temperature for the device is limited to +65 °C.

   By using B-Ports (option is only available for type GSA-XX-020101) the maximum ambient temperature for the device is limited to +60 °C.

(18) Essential Health and Safety Requirements

The Essential Health and Safety Requirements are covered by the standards listed at item 9.

TÜV Rheinland Zertifizierungsstelle für Explosionsschutz Cologne, 2025-07-14

Digital unterschrieben von Christian Mehrhoff

10.2 IECEx Certificate of Conformity

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification System for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	**IECEx TUR 24.0096X**	Page 1 of 3	Certificate history:
Status:	**Current**	Issue No: 0	
Date of Issue:	2025-07-14		
Applicant:	**SOFTING Industrial Automation GmbH** Richard-Reitzner-Allee 6 Haar 85540 **Germany**		
Equipment:	**aplSwitch Field, GSA-XX-020101 and GSA-XX-020111**		
Optional accessory:			
Type of Protection:	**increased safety, intrinsic safety**		
Marking:	Ex ec ic [ia Ga] IIC T4 Gc [Ex ia Da] IIIC		

Approved for issue on behalf of the IECEx Certification Body: **Christian Mehrhoff**

Position: **Assigned certifier**

Signature: (for printed version)

Date: (for printed version) 2025-07-14

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting www.iecex.com or use of this QR Code.

Certificate issued by:

TUV Rheinland Industrie Service GmbH
Am Grauen Stein
51105 Cologne
Germany

IECEx Certificate of Conformity

Certificate No.:	**IECEx TUR 24.0096X**	Page 2 of 3
Date of issue:	2025-07-14	Issue No: 0

Manufacturer:
SOFTING Industrial Automation GmbH
Richard-Reitzner-Allee 6
Haar 85540
Germany

Manufacturing locations:
SOFTING Industrial Automation GmbH
Richard-Reitzner-Allee 6
Haar 85540
Germany

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements.This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended

STANDARDS :
The equipment and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards

IEC 60079-0:2017 Edition:7.0	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-11:2023 Edition:7.0	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
IEC 60079-7:2017 Edition:5.1	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
IEC TS 60079-47:2021 Edition:1.0	Explosive atmospheres – Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE)

This Certificate **does not** indicate compliance with safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in:

Test Report:

DE/TUR/ExTR24.0096/00

Quality Assessment Report:

DE/PTB/QAR11.0002/07

IECEx Certificate of Conformity

Certificate No.:	**IECEx TUR 24.0096X**	Page 3 of 3
Date of issue:	2025-07-14	Issue No: 0

EQUIPMENT:
Equipment and systems covered by this Certificate are as follows:

The aplSwitch Field is designed for integration in powered Ethernet-APL spur-topologies. In this case the uplink functionality of the trunk is realized by copper based standard Ethernet interfaces (10/100Base-TX, 1000Base-TX) or alternatively by fiber based standard Ethernet interfaces (10/100Base-FX, 1000Base-FX).

The powered spurs communicate via Ethernet-APL and match either power class A or B according to the Ethernet-APL port profile. As additional feature power class A spurs can be configured to communication via Profibus PA. The aplSwitch Field is intended to be supplied by an auxiliary power source.

SPECIFIC CONDITIONS OF USE: YES as shown below:

1. The device shall be installed in an environment with a pollution degree of 1 or 2. When installed in hazardous areas, an enclosure, which has a minimum rating of IP54 and is in accordance with IEC 60079-0, shall be used.
2. The device shall be installed an environment with an overvoltage category of I or II.
3. The Ethernet interfaces for data transfer of the Ethernet- aplSwitch Field must be connected to Ethernet communication partners, which are in accordance with the technical data's. Since these are data interfaces and the voltage complies with the criteria for safety extra low voltages, no transient overvoltage's are expected.
4. By using a SFP module the maximum ambient temperature for the device is limited to +65 °C.
   By using B-Ports (option is only available for type GSA-XX-020101) the maximum ambient temperature for the device is limited to +60 °C.

Annex:

IECEx TUR 24.0096X _Attachment rev 00.pdf

Attachment to Certificate
IECEx TUR 24.0096X
Revison 0

Device: aplSwitch Field
Type: GSA-XX-020101, GSA-XX-020111

Manufacturer: Softing Industrial Automation GmbH

Address: Richard-Reitzner-Allee 6, 85540 Haar, Germany

Electrical data:

Power Supply (PWR1, PWR2)

Max. safety voltage:	U_m = 60 V
Nominal voltage:	U_N = 24 / 48 V DC
Voltage Range:	19,2 ... 57,6 V DC
Input current:	$I_N \leq$ 1,4 A (at 24 V DC) $I_N \leq$ 0,65 A (at 48 V DC)
Max. power consumption:	≤ 31,2 W
Max. power dissipation:	≤ 19 W

Data Interfaces (XT1, XT2)

RJ45 Plug connector

Max. safety voltage:	U_m = 60 V
Standard:	100BASE-TX
Transfer Rate:	10/100 Mbit/s

Data Interfaces (XT3, XT4)

SFP-Module for fibre optics
Laser Class 1 approved according to IEC 60825-1
The optical cables may lead either into or through areas requiring equipment of EPL Gb, Gc, Db or Dc.

Max. safety voltage:	U_m = 60 V
Standard:	100BASE-FX
Transfer Rate:	10/100 Mbit/s

PT100 Output (SPT)

Nominal values

Output current (const.)	I_N = 1 mA
Max. output voltage:	Uo = 4,94 V
Max. output current:	Io = 15,6 mA
Max. output power:	Po = 52 mW
Max. internal capacitance:	Ci = 11 nF
Max. internal inductance:	Li = 0 µF

In the following tables the combination of Lo and Co are listed including the line reacatances for the connection in the respective gas group. The internal capacitance of Ci = 11 nF is already considered. The maximum values for Lo and Co are highlighted in grey.

TÜV Rheinland Industrie Service GmbH Am Grauen Stein 51105 Cologne
Tel. +49 (0) 221 806-0 Fax. + 49 (0) 221 806 114

Attachment to Certificate
IECEx TUR 24.0096X
Revison 0

TÜVRheinland®
Precisely Right.

For IIC:

Lo [mH]	100	10	1	0,1	0,01	0,001
Co [µF]	1,69	3,59	6,49	11,9	32,9	999

For IIB/IIIC:

Lo [mH]	100	10	1	0,1	0,01	0,001
Co [µF]	13,9	21,9	36,9	78,9	209	999

Spur Power Source Ports (S01…S16)

FISCO only applies for type GSA-XX-020111.

The option for Power Class B is only available for type GSA-XX-0202101 and terminals S13…S16.

Electrical characteristics of Power Class A Ports

Nominal values

Voltage range: U_N = 9,6 … 13,8 V DC

Output current (max.): I_N = 56 mA, short circuit protected

According to 2-WISE and FISCO in intrinsic safety type protection ia

Max. output voltage: Uo = 14,9 V

Max. output current: Io = 379 mA

Max. output power: Po = 998 mW

Max. internal capacitance: Ci = 110 pF

Max. internal inductance: Li = 280 nH

The following tables show the Entity values including occurring line reactances for the connection in the respective gas group.
The maximum internal reactances Ci and Li do not exceed 1 % of the determined Co and Lo values and are negligible.

For IIC:	Lo [mH]	0,15
	Co [µF]	0,5

For IIB / IIIC:	Lo [mH]	0,15	0,5	1
	Co [µF]	2	2	1

Electrical characteristics of Power Class B Ports

Nominal values

Voltage range: U_N = 10,1 … 12,6 V DC

Output current (max.): I_N = 115 mA, short circuit protected

According to 2-WISE and FISCO in intrinsic safety type protection ia

Max. output voltage: Uo = 17,1 V

Max. output current: Io = 378 mA

Max. output power: Po = 1,66 W

Max. internal capacitance: Ci = 110 pF

Max. internal capacitance: Li = 280 nF

Ambient temperature range:

By using a SFP module:	Ta = - 40°C ... + 65°C
By using a B-Port (option is only available for type GSA-XX-020101):	Ta = - 40°C ... + 60°C
All other types:	Ta = - 40°C ... + 70°C

TÜV Rheinland Industrie Service GmbH Am Grauen Stein 51105 Cologne
Tel. +49 (0) 221 806-0 Fax. + 49 (0) 221 806 114

10.3 Declaration of conformity

EU-Konformitätserklärung
EU Declaration of Conformity

Wir
We

Softing Industrial Automation GmbH
Richard-Reitzner-Allee 6
D-85540 Haar

erklären hiermit in alleiniger Verantwortung, dass das Produkt
declare under our sole responsibility that the product

Modell / Typ
Model / Type

aplSwitch Field, GSA-XX-020101
aplSwitch Field PA, GSA-XX-020111

mit den Anforderungen der folgenden Richtlinien übereinstimmt
complies with the requirements of the following directives:

EMV Richtlinie 2014/30/EU
EMC Directive 2014/30/EU

ROHS-Richtlinie 2011/65/EU, ergänzt um Delegierte Richtlinie (EU) 2015/863
ROHS directive 2011/65/EU, amended by commission delegated directive (EU) 2015/863

Niederspannungsrichtlinie 2014/35/EU
Low Voltage Directive 2014/35/EU

ATEX-Richtlinie 2014/34/EU
ATEX Directive 2014/34/EU

Angewandte harmonisierte Normen
Applied harmonized standards:

EN IEC 60079-0 :2018
EN IEC 60079-7 :2015 / A1 :2018
EN 60079-11 :2012
EN 61326-1:2013
EN 61010-1:2010/A1:2019 /AC:2019-04
EN IEC 63000:2018

Kennzeichnung
marking

II 3 (1) G Ex ec ic [ia Ga] IIC T4 Gc CE 0102
II (1) D [Ex ia Da] IIIC

EU-Baumusterprüfbescheinigung
EU Type Examination Certificate:

TÜV 24 ATEX 9218 X

Ergänzende Normen
Supplemental standards:

IEC TS 60079-47:2021 Edition 1.0

Haar, 14.7.2025
Ort, Datum
Place, Date

Geschäftsführer
Managing Director

Dokumentvorlage/Template: EU-Konformitätserklärung_V1.13.docx Version: 1.00
Datei: EU-Konformitätserklärung_aplSwitch_Field-V1.00.docx Datum: 14.07.2025

11 Glossary

Term / Abbreviation	Definition
APL	Advanced Physical Layer. Using APL, Ethernet data can be transmitted on only two wires instead of the standard four twisted pair Ethernet wires (eight wires in total).
CE	Conformité Européenne (engl. European Conformity)
DCP	Discovery and Configuration Protocol. Lets you find PROFINET devices in a network without knowing their IP addresses.
diagnosis controller	Internal hardware unit for display and LED control. A controller that collects, processes, and manages diagnostic information from IO devices
DHCP	Dynamic Host Configuration Protocol
DIN	Deutsches Institut für Normung
DTM	Device Type Manager
ETH	Ethernet
Ex	Explosion protection
FX	Fiber cable connection
FDT	Field Device Tool
GND	Ground
GSD	PROFIBUS General Station Description (a file containing the manufacturer's device data base)
GSDML	PROFINET General Station Description Markup Language (a GSD file written in XML format)
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IEC	International Electrotechnical Commission
LLDP	Link Layer Discovery Protocol
MBP	Manchester Bus Powered. Transmission technology allowing data and field bus power to be fed through the same cable.
mDNS	Multicast Domain Name System
OLED	Organic Light-Emitting Diode
OPC UA	Open Platform Communications Unified Architecture
PA	Process Automation
PA	Potentialausgleich (engl. potential equalization)
PAC	Programmable Automation Controller
PB	PROFIBUS
PDM	Process Device Manager (sometimes aka Plant Device Manager)
PLC	Programmable Logic Controller
Power-Plugboard	Internal hardware unit for spur output current and voltage monitoring
PT	Pressure-Temperature
PT100	Platinum 100 temperature sensor
RDL	Redundancy Link
RIO	Remote Input/Output unit
S	Shield
SFP	Small Form-factor Pluggable
SL	Security Level
SNMP	Simple Network Management Protocol
SNR	Signal Noise Ratio
SoC	System-on-a-Chip

Term / Abbreviation	Definition
SOC controller	Main controller for the switch and the protocol functionality
SPT	Standard Pressure and Temperature
T	Temperature
TCP	Transmission Control Protocol
TDR	Time Domain Reflectometer
TX	Twisted pair cable connection
UTC	Universal Time Coordinated
XT	Trunk connection

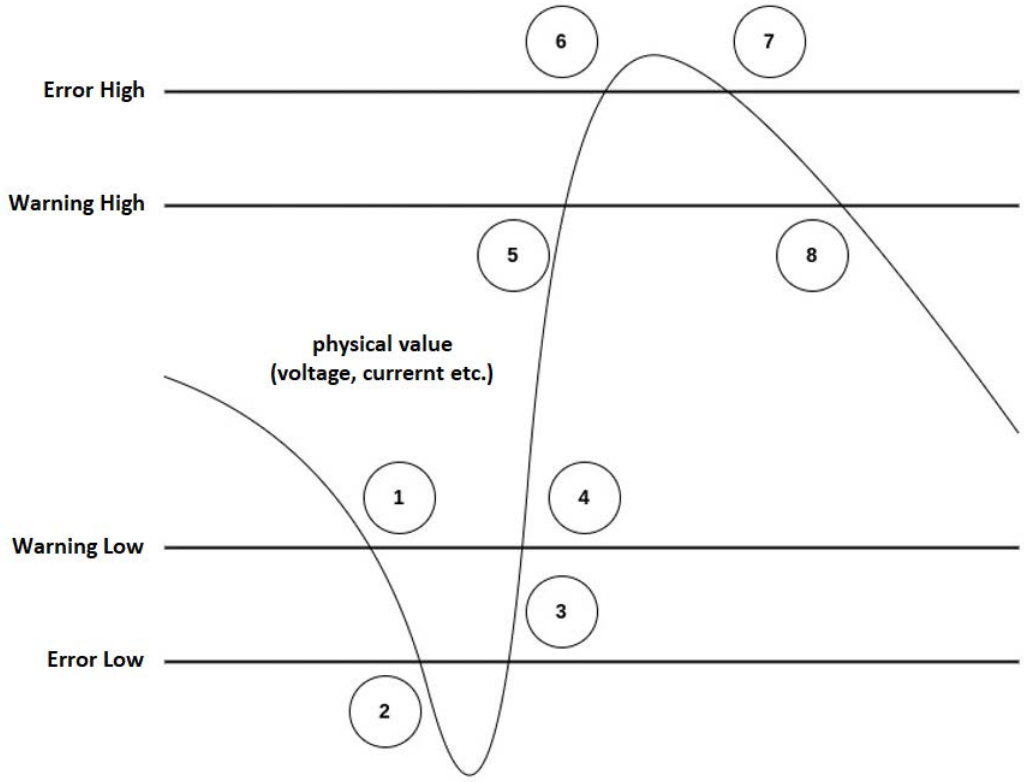
12 Appendix

12.1 Diagnostic behavior

12.1.1 General

The aplSwitch Field can monitor several physical values (e.g. voltage, current) and checks if they are within the expected range (see Sections Power Supply Diagnosis 119 and PA Spur Physical Values 125).

Depending on the monitored value a diagnosis is generated and sent to the PLC. The diagnosis specifies the location of the issue (API, slot, subslot) and may provide additional details using ExtChannelDiagnosis or QualifiedChannelDiagnosis.



The diagnostic behavior shown in the diagram above is the same for limits based on parametrization or device property.

1. Physical value fall below **warning low** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *appear*.

2. Physical value fall below **error low** level
   The aplSwitch generates a **Fault Diagnosis** with severity *fault* and specifier *appear*.
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *disappear*.

3. Physical value exceeds **error low** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded*or *required* and specifier *appear*.
   The aplSwitch generates a **Fault Diagnosis** with severity *fault* and specifier *disappear*.

4. Physical value exceeds **warning low** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *disappear*.

5. Physical value fall exceeds **warning high** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *appear*.

6. Physical value exceeds **error high** level
   The aplSwitch generates a **Fault Diagnosis** with severity *fault* and specifier *required*.
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *disappear*.

7. Physical value fall below **error high** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *appear*.
   The aplSwitch generates a **Fault Diagnosis** with severity *fault* and specifier *disappear*.

8. Physical value fall below **warning high** level
   The aplSwitch generates a **Maintenance Diagnosis** with severity *demanded* or *required* and specifier *disappear.*

12.1.2 Power supply diagnosis

The status of the power supply of the aplSwitch Field can result in fault or maintenance diagnosis if the measured value of the power with which the switch is provided does not respect the tolerance limits around the accepted supply values. The expected voltage value at PWR1 and PWR2 can be set by the user. The accepted voltage values of the power supply are: 24 V,48 V.

The defined limits are:

Expected Voltage	Limit	Value
General	Lower fault limit	10 V
	Lower maintenance limit	18 V
	Upper fault limit / maintenance limit	58 V
24 V	Lower fault limit	19.2 V
	Upper fault limit	28.8 V
	Lower maintenance limit	19.4 V
	Upper maintenance limit	28.5 V
48 V	Lower fault limit	38.4 V
	Upper fault limit	58 V
	Lower maintenance limit	38.6 V
	Upper maintenance limit	57.7 V

The power supply diagnosis is shown only if the the option **Enable Power Supply Diagnosis** is set to Enable. The redundant power supply mode is enabled when the option **Enable Redundant Power Supply** is set to Enable.

Fault messages

In the event of a power supply fault diagnosis, the message **Power supply issue** should appear in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: *Check expected and real power supply settings and connection*.

Power 1 Undervoltage

The diagnosis is created when the voltage value measured at PWR 1 lies below the expected voltage value. This diagnosis is created only if the redundant power supply mode is disabled.

Two types of PWR1 undervoltage diagnoses can be created:

- Maintenance required diagnosis: If the value of the measured voltage lies between the lower maintenance limit and the lower fault limit.
- Fault diagnosis: if the value of the measured voltage lies below the lower fault limit.

The message *Check PWR1 connection (<measured_voltage> mV)* should be displayed in the engineering system or asset management tool: If permitted by the tool, the following help text should be displayed: *Check PWR1 connection (<measured_voltage> mV),* where <measured_voltage> is the measured value of the power supply at PWR1.

Power 1 Overvoltage

The diagnosis is created when the voltage value measured at PWR 1 lies above the expected voltage value. This diagnosis is created only if the redundant power supply mode is disabled.

Two types of PWR1 overvoltage diagnoses can be created:

- Maintenance required diagnosis: If the value of the measured voltage lies between the upper maintenance limit and upper fault limit.
- Fault diagnosis: if the value of the measured voltage lies above upper fault limit.

The message *PWR 1 overvoltage* should be displayed in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: *Check PWR1 connection (<measured_voltage> mV),* where <measured_voltage> is the measured value of the power supply at PWR1.

Power 2 Undervoltage

The diagnosis is created when the voltage value measured at PWR 2 lies below the expected voltage value. This diagnosis is created only if the redundant power supply mode is disabled.

Two types of PWR2 undervoltage diagnoses can be created:

- Maintenance required diagnosis: If the value of the measured voltage lies between the lower maintenance limit and the lower fault limit.
- Fault diagnosis: if the value of the measured voltage lies below the lower fault limit.

The message *PWR 2 undervoltage* should be displayed in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: "*Check PWR2 connection (<measured_voltage> mV), where* <measured_voltage> is the measured value of the power supply at PWR2.

Power 2 Overvoltage

The diagnosis is created when the voltage value measured at PWR 2 lies above the expected voltage value. This diagnosis is created only if the redundant power supply mode is disabled.

Two types of PWR 2 overvoltage diagnoses can be created:

- Maintenance required diagnosis: If the value of the measured voltage lies between the upper maintenance limit and the upper fault limit.
- Fault diagnosis: if the value of the measured voltage lies above the upper fault limit.

The message *PWR 2 overvoltage* should be displayed in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: *Check PWR2 connection (<measured_voltage> mV), where <measured_voltage>* is the measured value of the power supply at PWR 2.

Power 1 Redundant Power Loss

The diagnosis is created when the redundant power supply mode is enabled and there is a power loss at PWR 1. A fault diagnosis is generated.

The message *Redundant power loss* should be displayed in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: *Check PWR1 connection (<measured_voltage> mV)*, where *<measured_voltage>* is the measured value of the power supply at PWR1.

Power 2 Redundant Power Loss

The diagnosis is created when the redundant power supply mode is enabled and there is a power loss at PWR 2. A fault diagnosis is generated.

The message *Redundant power loss* should be displayed in the engineering system or asset management tool. If permitted by the tool, the following help text should also be displayed: *Check PWR2 connection (<measured_voltage> mV)*, where *<measured_voltage>* is the measured value of the power supply at PWR2.

Redundancy Mismatch

The diagnosis is created when the redundant power supply mode is disabled and power is supplied to both PWR 1 and PWR2. A fault diagnosis is generated.

The message should be displayed in the engineering system / asset management tool: *"Redundant power mismatch"*. If permitted by the tool, following help text should also be displayed: *"Check redundant settings at PWR1 and PWR2 connection (<measured_pwr1_voltage> mV - (<measured_pwr2_voltage>),* where *<measured_pwr1_voltage>* is the measured value of the power supply at PWR1 and *<measured_pwr2_voltage>* is the measured value of the power supply at PWR2.

12.1.3 Temperature and humidity sensors

PT100 sensor

The external PT 100 sensor supports all diagnosis states described in section General117 . The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	1	Temperature below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	1	Temperature below parameterized Error level (low)
Maintenance required	8	1	Temperature above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	1	Temperature above parameterized Error level (high)
Failure	21	1	Sampling error, wirebreak of PT100 sensor detected

Combi sensor temperature

The internal Combi sensor supports all diagnosis states described in section General117 . The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	3	Temperature below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	3	Temperature below parameterized Error level (low)
Maintenance required	8	3	Temperature above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	3	Temperature above parameterized Error level (high)
Failure	21	3	Sampling error, no Temperature can be read from sensor

Combi sensor humidity

The internal Combi sensor supports all diagnosis states described in section General117 . The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	2	Humidity below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	2	Humidity below parameterized Error level (low)
Maintenance required	8	2	Humidity above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	2	Humidity above parameterized Error level (high)
Failure	21	2	Sampling error, no Humidity can be read from sensor

12.1.4 Device health

The device health monitoring supports the diagnosis states described in section General 117 . The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	4	Temperature of communication board below specified Warning level (low), but above specified Error level (low)
Failure	7	4	Temperature of communication board below specified Error level (low)
Maintenance required	8	4	Temperature of communication board above specified Warning level (high), but below specified Error level (high)
Failure	8	4	Temperature of communication board above specified Error level (high)
Failure	21	4	Sampling error, no Temperature of communication board can be read from sensor
Maintenance required	7	5	Temperature of base board below specified Warning level (low), but above specified Error level (low)
Failure	7	5	Temperature of base board below specified Error level (low)
Maintenance required	8	5	Temperature of base board above specified Warning level (high), but below specified Error level (high)
Failure	8	5	Temperature of base board above specified Error level (high)
Failure	21	5	Sampling error, no Temperature of base board can be read from sensor
Maintenance required	7	6	Temperature of SFP 1 module below specified Warning level (low), but above specified Error level (low)
Failure	7	6	Temperature of SFP 1 module below specified Error level (low)
Maintenance required	8	6	Temperature of SFP 1 module above specified Warning level (high), but below specified Error level (high)
Failure	8	6	Temperature of SFP 1 module above specified Error level (high)
Failure	21	6	Sampling error, no Temperature of SFP 1 module can be read
Maintenance required	7	7	Temperature of SFP 2 module below specified Warning level (low), but above specified Error level (low)
Failure	7	7	Temperature of SFP 2 module below specified Error level (low)
Maintenance required	8	7	Temperature of SFP 2 module above specified Warning level (high), but below specified Error level (high)
Failure	8	7	Temperature of SFP 2 module above specified Error level (high)
Failure	21	7	Sampling error, no Temperature of SFP 2 module can be read
Maintenance required	22	1	End-of-life of device below 1 year remaining calculated lifetime*
Maintenance demanded	22	1	End-of-life of device reaches 0*
Maintenance required	22	2	End-of-life of internal Super-CAP below 1 year remaining calculated lifetime**
Maintenance demanded	22	2	End-of-life of internal Super-CAP reaches 0**

* It is recommended to replace the device during the next maintenance phase of the plant
** If no time server is configured it is recommended to check in the web interface if the RTC is up-to-date.

12.1.5 APL spur physical values

The monitored physical values of the APL Spurs, except Signal-Noise-Ratio, support all diagnosis states described in section General 117 . Signal-Noise-Ration supports only states 1 to 4 in this chapter. The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	8	Voltage below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	8	Voltage below parameterized Error level (low)
Maintenance required	8	8	Voltage above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	8	Voltage above parameterized Error level (high)
Failure	21	8	Sampling error, Voltage can not measured
Maintenance required	7	9	Current below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	9	Current below parameterized Error level (low)
Maintenance required	8	9	Current above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	9	Current above parameterized Error level (high)
Failure	21	9	Sampling error, Current can not measured
Maintenance required	7	13	Signal-Noise-Ratio below specified Warning level (low), but above specified Error level (low)
Failure	7	13	Signal-Noise-Ratio below specified Error level (low)
Failure	21	13	Sampling error, Signal-Noise-Ratio can not measured

12.1.6 PA segment physical values

The monitored physical values of the PA segment supports only states described in section General 117. The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined by PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	8	11	Noise above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	11	Noise above parameterized Error level (high)
Failure	21	11	Sampling error, Noise can not measured

12.1.7 PA spur physical values

Monitored physical values of the PA spurs, except Jitter, support all diagnosis states described in section General 117. In this section, the jitter supports only states 5 to 8. The diagnosis uses the PROFINET ExtChannelDiag format and ChannelErrors defined in the PROFINET specification.

Severity	Channel Error	ExtChannel Error	Description
Maintenance required	7	8	Voltage below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	8	Voltage below parameterized Error level (low)
Maintenance required	8	8	Voltage above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	8	Voltage above parameterized Error level (high)
Failure	21	8	Sampling error, Voltage can not measured
Maintenance required	7	9	Current below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	9	Current below parameterized Error level (low)
Maintenance required	8	9	Current above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	9	Current above parameterized Error level (high)
Failure	21	9	Sampling error, Current can not measured
Maintenance required	7	10	Amplitude below parameterized Warning level (low), but above parameterized Error level (low)
Failure	7	10	Amplitude below parameterized Error level (low)
Maintenance required	8	10	Amplitude above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	10	Amplitude above parameterized Error level (high)
Failure	21	10	Sampling error, Amplitude can not measured
Maintenance required	8	12	Jitter above parameterized Warning level (high), but below parameterized Error level (high)
Failure	8	12	Jitter above parameterized Error level (high)
Failure	21	12	Sampling error, Jitter can not measured

12.2 Switch parameters

The switch has many parameters that configure the behavior and diagnosis. The parameters can be changed by different means (PROFINET startup parameter, web server, FDI tool, …). This section describes all available parameters. The access ways are described in different chapters.

12.2.1 Device parameters

Startup settings

Name	Unit	Range	Description
Startup Settings	-	None applied, Communication settings applied, Communication + diagnosis settings applied	This parameter select which of all the other parameters are taken over during startup of the industrial protocol. The parameters are grouped in “communication” and “diagnosis” parameters.

Power supply

This parameter belongs to the **Diagnosis Parameter** group.

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for power supply problems.
Redundant Power Supply	-	Disable/Enable	Selects if a redundant power supply is used or not. If the value does not match the real configuration, a diagnosis is generated.
Voltage	V	24, 48	Selects the expected voltage of the used power supply. If the selected voltage does not match the real voltage, a diagnosis is generated

Temperatur and humidity sensors

This parameter belongs to the **Diagnosis Parameter** group.

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for the temperature and humidity values. Use the other parameters in this section to set the limits.
External PT 100 sensor	-	Not used, Installed, Installed + wirebreak monitoring.	Selects if an external PT100 sensor is connected and if so, the function of the sensor shall be supervised.
PT 100 Warning Level (low) PT 100 Warning Level (high	°C	-35 - 70 -30 - 75	The limits of the PT100 temperature for warning. If the temperature is below or above this value a diagnosis is generated. The warning levels must be less strict than the error levels.
PT 100 Error Level (low) PT 100 Error Level (high)	°C	-40 - 65 -25 - 80	The limits of the PT100 temperature for error. If the temperature is below or above this value a diagnosis is generated.
Humidity Warning Level (low) Humidity Warning Level (high)	%	5 - 70 10 - 75	The limits of the humidity for warning. If the humidity is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Humidity Error Level (low) Humidity Error Level (high)	%	0 - 65 15 - 80	The low limit of the humidity for error. If the humidity is below or above this value a diagnosis is generated.
Temperature Warning Level (low) Temperature Warning Level (high)	°C	-35 - 70 -30 - 75	The limits of the temperature for warning. If the temperature is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Temperature Error Level (low) Temperature Error Level (high)	°C	-40 - 65 -25 - 80	The low limit of the temperature for error. If the temperature is below or above this value a diagnosis is generated.

Device health

This parameter belongs to the **Diagnosis Parameter** group.

Name	Unit	Range	Description
Diagnosis	-	Enable	Enables or disables generation of diagnosis for device health. If handling of „diagnosis“ parameter is activated (see Chapter 1.1 Startup parameters), this parameter can not be disabled. Device Health monitors if internal parameters run out of specified range.
Power consumption monitoring	-	Enable	For future use.
Temperature monitoring	-	Enable	For future use.
Shielding monitoring	-	Enable	For future use.
Electronic monitoring	-	Enable	For future use.

12.2.2 APL spur parameters

APL physical values spur X

These parameters are available for every Spur port. The parameter belongs to the **Diagnosis Parameter** group. They are used to configure the physical diagnosis for the port.

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for the physical values of this Spur. Use the other parameters in this section to set the limits.
TDR	-	Disable/Enable	Enables or disables time domain reflection diagnosis for this Spur. TDR can be used to detect short or open cables.
SNR	-	Disable/Enable	Enables or disables Signal Noise Ratio diagnosis for this Spur. The SNR value can be used to detect bad cabling or degradation of cables.
Voltage Warning Level (low) Voltage Warning Level (high)	Volt	9.9 – 14.4 10.2 – 14.7	The limits of the voltage for warning. If the voltage is below or above this value a diagnosis is generated. The warning levels must be less strict than the error levels.
Voltage Error Level (low) Voltage Error Level (high)	Volt	9.6 – 14.1 10.5 – 15.0	The limits of the voltage for error. If the voltage is below or above this value a diagnosis is generated.
Current Warning Level (low) Current Warning Level (high)	mA	25.0 – 51.0 30.0 – 56.0	The limits of the current for warning. If the current is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Current Error Level (low) Current Error Level (high)	mA	20.0 – 47.0 35.0 – 60.0	The low limit of the current for error. If the current is below or above this value a diagnosis is generated.

Traffic control trunk/spur X

These parameters are used to configure the rate limiter feature that the switch supports on every port. The parameters belong to the **Communication Parameter** group. With the rate limiter the device on a port can be protected against heavy network load for different traffic classes. For example, a heavy broadcast load on the Trunk ports (100Mbit) can, without protection, lead to an overload situation on the Spur ports (10 Mbit).

Name	Unit	Range	Description
Ingress Burst Control Broadcast	-	Disable/Enable	Enable unicast burst limiting in the ingress direction for the port. When enabled received bursts are limited to the size selected with the parameter Ingress Burst Limit Broadcast.
Ingress Burst Control Multicast	-	Disable/Enable	Enable multicast burst limiting in the ingress direction for the port. When enabled received bursts are limited to the size selected with the parameter Ingress Burst Limit Multicast.
Ingress Burst Control Multicast Coupling	-	Disable/Enable	Enables coupling of the ingress multicast and broadcast burst limits. This means a multicast burst can use free quanta of the broadcast limit.
Ingress Burst Control Unicast	-	Disable/Enable	Enable unicast burst limiting in the ingress direction for the port. When enabled received bursts are limited to the size selected with the parameter Ingress Burst Limit Unicast.
Ingress Burst Control Unicast Coupling	-	Disable/Enable	Enables coupling of the ingress unicast and multicast burst limits. This means a unicast burst can use free quanta of the multicast limit.
Ingress Burst Control RTA_CLASS_X	-	Disable/Enable	Enable PROFINET RTA burst limiting in the ingress direction for the port. When enabled received bursts are limited to the size selected with the parameter Ingress Burst Limit RTA_CLASS_X.
Ingress Burst Control RT_CLASS_X	-	Disable/Enable	Enable PROFINET RT burst limiting in the ingress direction for the port. When enabled received bursts are limited to the size selected with the parameter Ingress Burst Limit RT_CLASS_X.
Ingress Burst Control RT_CLASS_X Coupling	-	Disable/Enable	Enables coupling of the ingress RTA and RT burst limits. This means a RT burst can use free quanta of the RTA limit.
Ingress Burst Limit Broadcast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for ingress broadcasts bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Ingress Burst Limit Multicast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for ingress multicast bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Ingress Burst Limit Unicast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for ingress unicast bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Ingress Burst Limit RTA_CLASS_X	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for ingress RTA bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Ingress Burst Limit RT_CLASS_X	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for ingress RT bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.

Name	Unit	Range	Description
Ingress Rate Control Broadcast	-	Disable/Enable	Enable broadcast rate limiting in the ingress direction for the port. When enabled received bandwidth for broadcast frames is limited to the value selected with the parameter Ingress Rate Limit Broadcast.
Ingress Rate Control Multicast	-	Disable/Enable	Enable multicast rate limiting in the ingress direction for the port. When enabled received bandwidth for multicast frames is limited to the value selected with the parameter Ingress Rate Limit Multicast.
Ingress Rate Control Multicast Coupling	-	Disable/Enable	Enables coupling of the ingress multicast and broadcast rate limits. This means a multicast frame can use free quanta of the broadcast rate limit.
Ingress Rate Control Unicast	-	Disable/Enable	Enable unicast rate limiting in the ingress direction for the port. When enabled received bandwidth for unicast frames is limited to the value selected with the parameter Ingress Rate Limit Unicast.
Ingress Rate Control Unicast Coupling	-	Disable/Enable	Enables coupling of the ingress unicast and multicast rate limits. This means a unicast frame can use free quanta of the multicast rate limit.
Ingress Rate Control RTA_CLASS_X	-	Disable/Enable	Enable PROFINET RTA rate limiting in the ingress direction for the port. When enabled received rate are limited to the size selected with the parameter Ingress Rate Limit RTA_CLASS_X
Ingress Rate Control RT_CLASS_X	-	Disable/Enable	Enable PROFINET RT rate limiting in the ingress direction for the port. When enabled received rate are limited to the size selected with the parameter Ingress Rate Limit RT_CLASS_X
Ingress Rate Control RT_CLASS_X Coupling	-	Disable/Enable	Enables coupling of the ingress RT and RTA rate limits. This means a RT frame can use free quanta of the RTA rate limit.
Ingress Rate Limit Broadcast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for ingress broadcast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Ingress Rate Limit Multicast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for ingress multicast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Ingress Rate Limit Unicast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for ingress unicast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Ingress Rate Limit RTA_CLASS_X	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for ingress RTA rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Ingress Rate Limit RT_CLASS_X	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for ingress RT rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Egress Burst Control Broadcast	-	Disable/Enable	Enable unicast burst limiting in the egress direction for the port. When enabled received bursts are limited to the size selected with the parameter Egress Burst Limit Broadcast.
Egress Burst Control Multicast	-	Disable/Enable	Enable multicast burst limiting in the egress direction for the port. When enabled received bursts are limited to the size selected with the parameter Egress Burst Limit Multicast.

Name	Unit	Range	Description
Egress Burst Control Multicast Coupling	-	Disable/Enable	Enables coupling of the egress multicast and broadcast burst limits. This means a multicast burst can use free quanta of the broadcast limit.
Egress Burst Control Unicast	-	Disable/Enable	Enable unicast burst limiting in the egress direction for the port. When enabled received bursts are limited to the size selected with the parameter Egress Burst Limit Unicast.
Egress Burst Control Unicast Coupling	-	Disable/Enable	Enables coupling of the egress unicast and multicast burst limits. This means a unicast burst can use free quanta of the multicast limit.
Egress Burst Control RTA_CLASS_X	-	Disable/Enable	Enable PROFINET RTA burst limiting in the egress direction for the port. When enabled received bursts are limited to the size selected with the parameter Egress Burst Limit RTA_CLASS_X.
Egress Burst Control RT_CLASS_X	-	Disable/Enable	Enable PROFINET RT burst limiting in the egress direction for the port. When enabled received bursts are limited to the size selected with the parameter Egress Burst Limit RT_CLASS_X.
Egress Burst Control RT_CLASS_X Coupling	-	Disable/Enable	Enables coupling of the egress RTA and RT burst limits. This means a RT burst can use free quanta of the RTA limit.
Egress Burst Limit Broadcast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for egress broadcasts bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Egress Burst Limit Multicast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for egress multicast bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Egress Burst Limit Unicast	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for egress unicast bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Egress Burst Limit RTA_CLASS_X	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for egress RTA bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Egress Burst Limit RT_CLASS_X	Kbyte	64, 48, 32, 16, 8, 4, 2	Set the limit for egress RT bursts in kbyte. If a longer burst is detected the following frames are dropped until the burst ends with a short silence on the cable.
Egress Rate Control Broadcast	-	Disable/Enable	Enable broadcast rate limiting in the egress direction for the port. When enabled received bandwidth for broadcast frames is limited to the value selected with the parameter Egress Rate Limit Broadcast.
Egress Rate Control Multicast	-	Disable/Enable	Enable multicast rate limiting in the egress direction for the port. When enabled received bandwidth for multicast frames is limited to the value selected with the parameter Egress Rate Limit Multicast.
Egress Rate Control Multicast Coupling	-	Disable/Enable	Enables coupling of the egress multicast and broadcast rate limits. This means a multicast frame can use free quanta of the broadcast rate limit.

Name	Unit	Range	Description
Egress Rate Control Unicast	-	Disable/Enable	Enable unicast rate limiting in the egress direction for the port. When enabled received bandwidth for unicast frames is limited to the value selected with the parameter Egress Rate Limit Unicast.
Egress Rate Control Unicast Coupling	-	Disable/Enable	Enables coupling of the egress unicast and multicast rate limits. This means a unicast frame can use free quanta of the multicast rate limit.
Egress Rate Control RTA_CLASS_X	-	Disable/Enable	Enable PROFINET RTA rate limiting in the egress direction for the port. When enabled received rate are limited to the size selected with the parameter Egress Rate Limit RTA_CLASS_X
Egress Rate Control RT_CLASS_X	-	Disable/Enable	Enable PROFINET RT rate limiting in the egress direction for the port. When enabled received rate are limited to the size selected with the parameter Egress Rate Limit RT_CLASS_X
Egress Rate Control RT_CLASS_X Coupling	-	Disable/Enable	Enables coupling of the egress RT and RTA rate limits. This means a RT frame can use free quanta of the RTA rate limit.
Egress Rate Limit Broadcast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for egress broadcast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Egress Rate Limit Multicast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for egress multicast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Egress Rate Limit Unicast	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for egress unicast rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Egress Rate Limit RTA_CLASS_X	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for egress RTA rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.
Egress Rate Limit RT_CLASS_X	MBit/s	70, 60, 50, 40, 30, 25, 20, 15, 10, 7, 6, 5, 4, 3, 2, 1	Set the limit for egress RT rate in MBit/s. If a higher used bandwidth is detected frames are dropped until the bandwidth is below the limit again.

12.2.3 PA segment parameters

Bus parameters

Name	Unit	Range	Description
Master Address	-	1 - 64	The address of the PROFIBUS master
Baudrate	kbaud	31,25	The baudrate of the PROFIBUS
Slot time	bit	100 - 1000	The slot time is the maximum time the PROFIBUS-DP Master (requester/initiator) must wait to receive the first byte of the response, or a frame from the token receiver after token exchange.
min. TSDR	bit	11 - 1000	The min Tsdr is the minimum time delay to be observed by responders before responding.
max. TSDR	bit	100 - 1000	The max Tsdr is the time after which the sink must have processed a request and responded, if applicable. It determines the waiting time of the master after an unacknowledged request.
Quiet time	bit	0	The quiet time Tqui is the time during which the PROFIBUS control logic has to close its sender and its receiver. Tqui < min Tsdr must be observed.
Setup time	bit	10 - 100	The setup time Tset indicates the latency of the data link layer.
Ttr	bit	10000 - 100000	The target rotation time Ttr is the maximum permissible rotation time of a token in the PROFIBUS network.
HSA	-	Master Address - 125	The Highest Active Address indicates the highest address to be expected for active stations. The GAP cycle is limited to the range up to this address. If there is an active station above the Hsa value, it cannot be included in the token ring.
Retry	-	3 - 5	The maximum number of frame repetitions indicates how often the master repeats a request, after the end of the slot time, before it designates the responder as “not available“.

PROFIBUS PA physical value

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for the physical values of this slave. Use other parameters in this section to set the limits.
Noise Warning Level (high)	V	0.2 – 0.7	The limit of the Noise for warning. If the Noise is above this value a diagnosis is generated. The warning level must be less strict than the error levels.
Noise Error Level (high)	V	0.5 – 0.9	The limit of the Noise for error. If the Noise is above this value a diagnosis is generated.

12.2.4 PA slave parameters

The PRM data is derived from the GSD file of the related PROFIBUS slave.

Slave channel/address assignment

Name	Type	Range	Description
PROFIBUS Channel	-	0	Selects the PROFIBUS Channel used for this slave
Slave Address	-	3-125	The PROFIBUS Address of the slave.
Watchdog Timeout	seconds	1-60	Watchdog time in seconds within which a valid exchange of process data must have taken place.
Read/Write Timeout	Seconds	0-60	timeout monitors the time which may pass between a request of the master and a response of the slave on an acyclic connection. A value of 0 means, that no acyclic communication is supported
Max. data length	Byte	Read only	Maximum length of input + output data
Max. input data length	Byte	Read only	Maximum length of input data
Max. output data length	Byte	Read only	Maximum length of output data
Watchdog base	ms	1, 10, 100	Base clock for the watchdog calculation

PROFIBUS PA physical values

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for the physical values of this slave. Use other parameters in this section to set the limits.
Topology	-	Disable/Enable	Enables or disables topology diagnosis for this slave. Topology means the slave address to spur assignment is checked.
Voltage Warning Level (low) Voltage Warning Level (high)	Volt	9.9 – 14.4 10.2 – 14.7	The limits of the voltage for warning. If the voltage is below or above this value a diagnosis is generated. The warning levels must be less strict than the error levels.
Voltage Error Level (low) Voltage Error Level (high)	Volt	9.6 – 14.1 10.5 – 15.0	The limits of the voltage for error. If the voltage is below or above this value a diagnosis is generated.
Current Warning Level (low) Current Warning Level (high)	mA	9.0 – 41.0 13.0 – 45. 0	The limits of the current for warning. If the current is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Current Error Level (low) Current Error Level (high)	mA	8.0 – 37.0 17.0 – 49.0	The low limit of the current for error. If the current is below or above this value a diagnosis is generated.

Name	Unit	Range	Description
Amplitude Warning Level (low) Amplitude Warning Level (high)	V	0.7 – 1.2 1.0 – 1.5	The limits of the Amplitude for warning. If the Amplitude is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Amplitude Error Level (low) Amplitude Error Level (high)	V	0.5 – 1.0 1.2 – 1.7	The limits of the Amplitude for error. If the Amplitude is below or above this values a diagnosis is generated.
Jitter Warning Level (high)	us	0.2 – 0.7	The limit of the Jitter for warning. If the Jitter is above this value a diagnosis is generated. The warning level must be less strict than the error levels.
Jitter Error Level (high)	us	0.5 – 0.9	The limit of the Jitter for error. If the Jitter is above this value a diagnosis is generated.

Slave channel/address assignment

Name	Type	Range	Description
PROFIBUS Channel	-	0	Selects the PROFIBUS Channel used for this slave
Slave Address	-	3-125	The PROFIBUS Address of the slave.
Watchdog Timeout	seconds	1-60	Watchdog time in seconds within which a valid exchange of process data must have taken place.
Read/Write Timeout	Seconds	0-60	timeout monitors the time which may pass between a request of the master and a response of the slave on an acyclic connection. A value of 0 means, that no acyclic communication is supported
Max. data length	Byte	Read only	Maximum length of input + output data
Max. input data length	Byte	Read only	Maximum length of input data
Max. output data length	Byte	Read only	Maximum length of output data
Watchdog base	ms	1, 10, 100	Base clock for the watchdog calculation

PROFIBUS PA physical values

Name	Unit	Range	Description
Diagnosis	-	Disable/Enable	Enables or disables generation of diagnosis for the physical values of this slave. Use other parameters in this section to set the limits.
Topology	-	Disable/Enable	Enables or disables topology diagnosis for this slave. Topology means the slave address to spur assignment is checked.
Voltage Warning Level (low) Voltage Warning Level (high)	Volt	9.9 – 14.4 10.2 – 14.7	The limits of the voltage for warning. If the voltage is below or above this value a diagnosis is generated. The warning levels must be less strict than the error levels.
Voltage Error Level (low) Voltage Error Level (high)	Volt	9.6 – 14.1 10.5 – 15.0	The limits of the voltage for error. If the voltage is below or above this value a diagnosis is generated.
Current Warning Level (low) Current Warning Level (high)	mA	9.0 – 41.0 13.0 – 45. 0	The limits of the current for warning. If the current is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Current Error Level (low) Current Error Level (high)	mA	8.0 – 37.0 17.0 – 49.0	The low limit of the current for error. If the current is below or above this value a diagnosis is generated.
Amplitude Warning Level (low) Amplitude Warning Level (high)	V	0.7 – 1.2 1.0 – 1.5	The limits of the Amplitude for warning. If the Amplitude is below or above this values a diagnosis is generated. The warning levels must be less strict than the error levels.
Amplitude Error Level (low) Amplitude Error Level (high)	V	0.5 – 1.0 1.2 – 1.7	The limits of the Amplitude for error. If the Amplitude is below or above this values a diagnosis is generated.
Jitter Warning Level (high)	us	0.2 – 0.7	The limit of the Jitter for warning. If the Jitter is above this value a diagnosis is generated. The warning level must be less strict than the error levels.
Jitter Error Level (high)	us	0.5 – 0.9	The limit of the Jitter for error. If the Jitter is above this value a diagnosis is generated.

12.3 Switch diagnostics

The aplSwitch Field has various sensors to keep the temperature and the humidity inside and / or outside of the device under control. If the measured values of the temperature or of the humidity lie above or below a certain limit, a diagnosis is generated. Depending on the type of sensor these limits are fixed or can be set by the user.

The following sensors monitor the internal temperature or the humidity of the aplSwitch:

- SoC Board Temperature Sensor
- Internal Baseboard Temperature Sensor
- Base Board Temperature and Humidity Combi Sensor

For each temperature and humidity value measured by a sensor, an upper and lower error limit and an upper and lower warning limit are defined. If the measured temperature or humidity is lower than the lower error limit or higher than the upper error limit, a fault diagnosis is generated. If the measured temperature or humidity lies between the lower warning limit and the lower error limit, or between the upper warning limit and the upper error limit, a maintenance required diagnosis is generated. The lower, upper error and warning limits of the SoC board temperature sensor and of the internal baseboard temperature sensor are fixed and cannot be set by the user. The diagnoses generated by the values measured at these sensors are always considered as active and cannot be manually enabled or disabled.

The user can define upper and lower errors and warning levels for the temperature and humidity measured by the base board temperature and humidity combi sensor. The diagnoses generated by this sensor can be manually enabled or disabled.

Besides measured temperature or humidity values relative to the internal state of the aplSwitch, the switch can connect to a PT100 temperature sensor. This sensor measures the external temperature of the aplSwitch. If the measured temperature or humidity is lower than the lower error limit or higher than the upper error limit, a fault diagnosis is generated. If the measured temperature or humidity lies between the lower warning limit and the lower error limit, or between the upper warning limit and the upper error limit, a maintenance required diagnosis is generated. For this sensor, upper and lower error and warning limits can be set by the users. The diagnoses generated by this sensor can be manually enabled or disabled. The diagnoses are generated only if the PT100 is installed (see the parameters of the PT100 for details).

12.4 PROFINET features

The spur ports of the aplSwitch Field can connect to APL devices and PROFIBUS PA devices. Regardless of the supported PA profile version, any PROFIBUS PA device can be connected with the aplSwitch Field. By contracts, PROFIBUS PA slaves older than PA profile version 3.02 may not support all features of acyclic communication and may therefore not provide useful Identification and maintenance data. But they can be used in cyclic communication.

The aplSwitch implements the proxy functionality for PROFIBUS PA slaves as defined in the *Fieldbus integration in PROFINET* Guideline V2.1 November 2017, *PROFIBUS Integration in PROFINET* Guideline V2.2 September 2017.

Note

There is one major difference. The implementation does not support the 'slot cluster' concept to avoid issues and incompatibilities with existing PROFINET engineering systems.

Device Parameters

In addition to the standard parameters defined by PROFINET, the switch provides manufacturer-specific device parameters in the parameter set *TempAndHumidityReal PROFINET Index 0x1103* - Version1.0. The index and structure of the parameter set are detailed below:

Name	Data type	Description
VersionHigh	Unsigned8	Major version of the parameter (1)
VersionLow	Unsigned8	Minor version of the parameter (0)
Properties	Unsigned8	Properties for the temperature and humidity sensors. Valid values: 0x10: Diagnose is enabled when bit is set. Temperature and humidity sensors are monitored and results in a diagnosis 0x01: External PT100 sensor is installed, temperature value is available 0x02: External PT100 sensor is installed, wire is monitored
Reserved	Unsigned8	Always read as 0
TempPT100	Integer16	Measure value in one-hundredth of °C
StatePT100	Unsigned16	The state of the PT100 temperature value. Valid values: 0 = Not available: no sensor is available 1 = Error: Determine sensor value failed 2 = Reserved: Currently Unused 3 = Good: Sensor value is good 6 = Error high: sensor value is above high limit 7 = Error low: sensor value is below low limit 8 = Out of spec high: sensor value is above high specification 9 = Out of spec low: sensor value is below low specification
TempCombi	Integer16	Measure value in one-hundredth of °C
StateTempCombi	Unsigned16	The state of the combi temperature value. Valid values see StatePt100 description
HumidityCombi	Unsigned16	Measure value in one-hundredth of %
StateHumidityCombi	Unsigned16	The state of the combi humidity value. Valid values see StatePt100 description

12.5 Power-on behavior

This chapter describes the typical behavior of the IP address and the spur ports after the aplSwitch Field is powered.

12.5.1 IP settings

This section describes what happens to the IP address of the aplSwitch Field in a number of startup scenarios.

Startup after reset to factory settings

The device starts up with the preconfigured IP address 192.168.0.10 a name based on it's MAC address (e.g. "node-00-06-71-xx-yy-zz.local") and enabled PROFINET communication capabilities. It can be accessed by any PROFINET engineering tool which support PROFINET discovery and configuration protocol (PN-DCP). This tool can be used to assign an IP address and/or PROFINET name of station. Assigning an IP address and/or a PROFINET station name is restricted to PROFINET tools as long as PROFINET is enabled. Access is also possible via a browser started from a PC located in network 192.168.0.0/24. You can also determine the device using IT protocols such as UPnP (also known as SSDP), mDNS and the Softing Search and Configuration tool.

Normal startup (PROFINET communication capabilities enabled)

The aplSwitch Field starts with the IP address and the PROFINET name of station as assigned by a PROFINET tool. If there is no permanent IP address assigned, the device can neither be accessed via Browser nor discovered by IT protocols. After assignment of a temporary IP address these services can be used.

Startup with DHCP enabled (PROFINET communication capabilities disabled)

The aplSwitch Field starts and requests an IP address from a DHCP server. If there is no DHCP server available or it does not provide an IP address, the device can neither be accessed with a browser nor discovered by IT protocols.

Startup with no IP address or static IP address 0.0.0.0 (PROFINET communication capabilities disabled)

The aplSwitch Field detects this situation and generates a link local address in network 169.254.0.0/16. Access is possible via a browser started from a PC located in the same network. The device can be discovered by IT protocols.

12.5.2 Spur ports

This section applies to devices that support PROFIBUS PA. The behavior described below is valid only when PROFINET is enabled as the industrial protocol.

With connection to a PLC

In the PROFINET engineering tool of your PLC, you can configure a spur port to operate as an APL port (default) or as a PROFIBUS PA port. To switch a spur port to PA mode, either remove it from the list of Ethernet ports (spur ports are sub-modules of slot 0) or assign a PA device to a spur slot (slot > 1). When you now power on the device, the PLC connects and automatically applies the spur configuration. Reconfiguring the operating mode requires modifying the PLC project; it cannot be changed directly on the device.

Without connection to a PLC

If you do not have a PLC connected, an automatic algorithm is executed to detect if an APL or PROFIBUS PA device is connected to a spur port. This algorithm starts after the device has been power up and it is active until a PLC establishes a PROFINET connection to the switch. It is restarted when the PROFINET connection to the PLC is terminated.

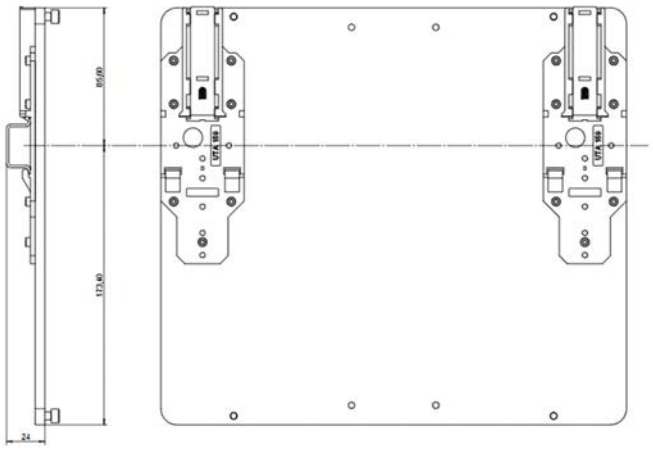
After startup, the device switches the spur ports into APL mode and starts measuring voltage and current on each port. In addition, link detection is enabled. The algorithm monitors the Ethernet link and calculates the power consumption (voltage and current) of each spur port every 30 seconds, The spur port switches to APL mode if a link is detected or if no link and no power flow are detected. However, if no link is detected in two consecutive cycles and the voltage and the current are > 0, the spur port switches to PROFIBUS PA.

Hint
If a PROFIBUS PA device is connected to a spur port it takes typically 2 cycles to switch to PROFIBUS PA Mode (about 60 seconds).
If a PROFIBUS PA device is disconnected from a spur port it takes typically 1 cycle to switch back to APL mode (about 30 seconds).

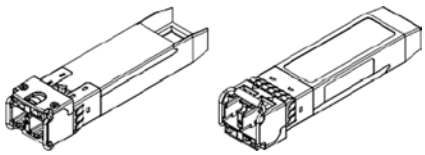
12.6 Accessories and spare parts

The following parts can be ordered separately from Softing Industrial Automation GmbH. See the datasheet for ordering information or contact your Softing representative for details.

- Mounting plate for DIN rail including 4 screws

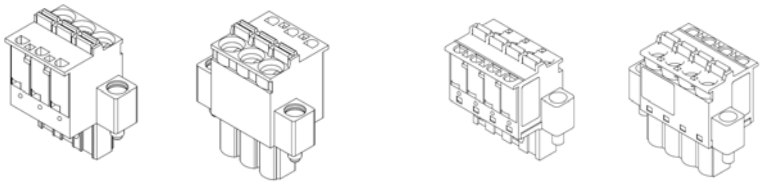


- Multi-mode duplex SFP modules (SFP-Module 100BASE-FX SM LC Z2 and SFP-Module 100BASE-FX MM LC Z2)



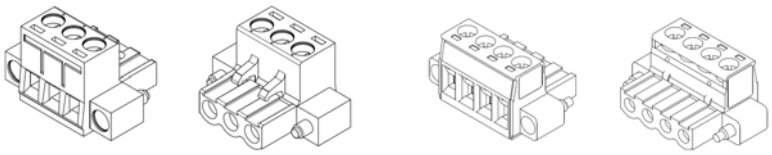
- Screw terminal set, 16 x 3-pin spur, blue; 2 x 4-pin power black
  Order number: ACA-XX-020203

spur terminal power terminal



- Spring clamp terminals, 16 x 3-pin spur ; 2 x 4-pin power, black
  Order number: ACA-XX-020202

spur terminal power terminal



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