

# Profinet

D

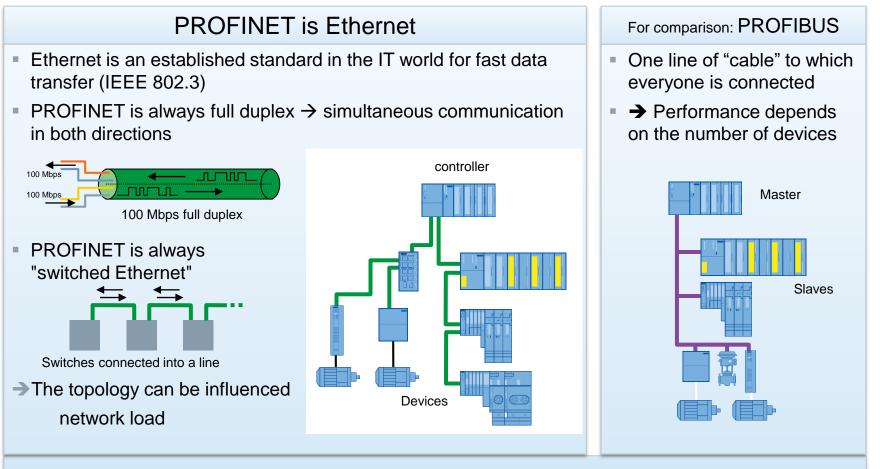
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siemens.com/switches

#### **PROFINET on 100% Ethernet**





PROFINET take full advantage of the possibilities offered by Ethernet

#### **Profinet Vs. Profibus**

Profinet works on the same principle as Profibus. Except :

- Higher carrier frequency100-600MHz (3-20MHz)
- 2-4 twisted pair cable
- Bandwidth 10-1000Mbps (0,184-12Mbps)
- Different cables can be used in the same application
- Maximum length 100m and with flexible cables 80m





# Cable technology – FastConnect (electric/twisted pair) Industrial Ethernet/PROFINET

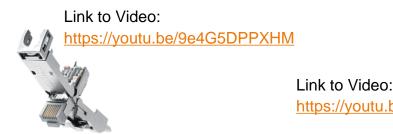


#### Industrial Ethernet/PROFINET:

For quick installation

RJ45 liittimet 2 x 2 and 4 x 2

Stripping Tools!





M12 plugs (using stripping tool)
 IE FC cables: 4 ja 8- wires



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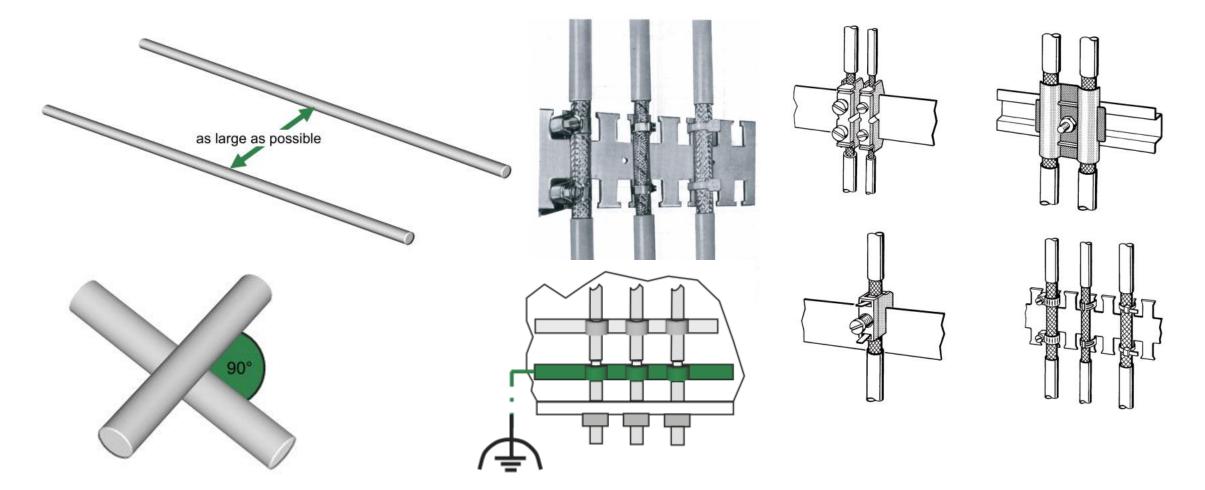
Page 4





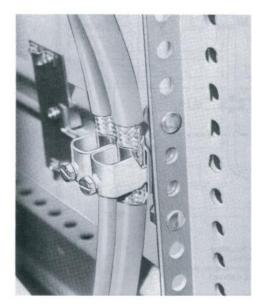
## Installation and grounding

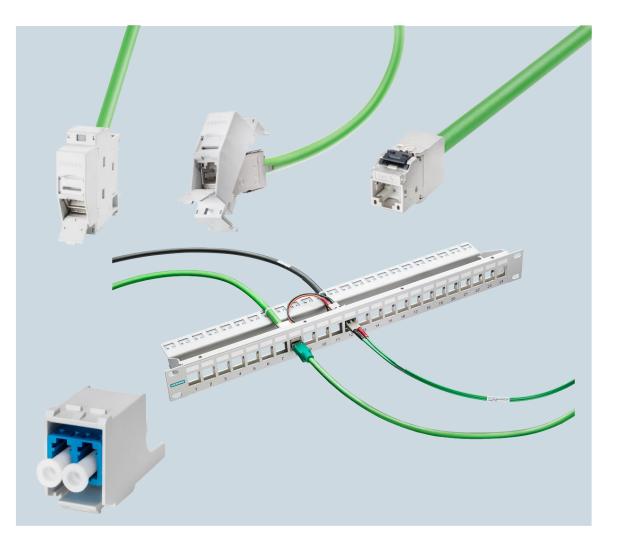




## Installation and grounding







## Profinet telegram – no TCP/IP frame – no roaming



				PROFINET Rea	l-Time-Fra	ame			
Preamble	сэтапт нгагте	Destination- MAC-address	Source- MAC-address	VLAN-Tag (VLAN-ID/VLAN-	Туре	Frame ID	User data	Status	FCS (Frame Check
7 Byte	Delimiter) 1 Byte	6 Byte	6 Byte	Priority) 4 Byte	2 Byte	2 Byte	40 - 1440 Byte	4 Byte	Sequence) 4 Byte
				/LAN-Priority=6	Type=0x8 (Identificat Real-Time	ion PROFI	NET		

### **PROFINET** device configurations and topology in TIA Portal



#### **TIA Portal – PROFINET**

- PROFINET devices (including network products) are configured using the TIA Portal.
- These settings are transferred to the SIMATIC CPU and from there to the PROFINET devices.
- The CPU defines IP addresses and PN names according to the topology made in the TIA Portal. Also for network devices.
- In the topology, all devices must support the Profinet mechanism.

#### **PROFINET TIA in Portal**

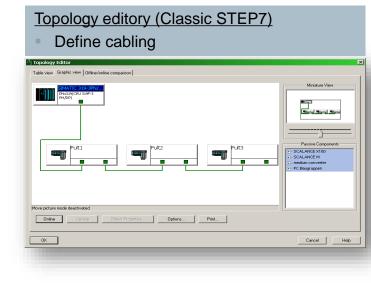
All parameters relevant to PROFINET are defined in the TIA portal and then transferred to the SIMATIC CPU.

			🚰 Topology view	n Ne	etwork view	Device	view
Network	ection 💌 🚾 🖽 🗄	🛄 🔍 ±			Network ov	erview	
				^	2 Device		
						TIC 300(1)	
d-dkp1-et200s	d-dkp1-et200fo	d-dkp1-et200s	x-dkp1-x204-4		+ 0	-dkp1-cpu315-	46-6c
IM 151-3 PN	IM 151-3 PN FO	IM 155-6 PN ST	V5.1		and the second	p1-et200s-61-5	
<u>с-dkp1-сри3</u> 🖲 🛛 📲	c-dkp1-cpu315	<u>c-dkp1-cpu315</u>	c-dkp1-cpu315			-dkp1-et200s-6	
						p1-et200fo-61-	
					▶ d	-dkp1-et200fo-	61-74
					✓ d-dkg	p1-et200sp-ec	-15
				-	▶ d	-dkp1-et200sp	-ec-15
					▼ x-dkp	1-x204-44-b9	
				-	• ×	dkp1-x204-44-	b9
					▼ x-dkp	01-xf208-27-ae	
WLAN_1	x-dkp1-xf208	8-2 x-dkp1-x2	02-2		► x	dkp1-xf208-27	-ae
SCALANCE W76	SCALANCE XF	208 DDDD SCALANCE	x20 🗖 👘	•	🔻 SCAL	ANCE W AP	
<u>c-dkp1-cpu315-</u>	c-dkp1-cpu31	15 C-dkp1-cp	<u>u315-</u>		► W	ILAN_1	
					▼ x-dkp	1-x204-44-b9_	1
					► x•	dkp1-x202-2-4	3-68
					▼ d-dkj	p1-simocode-7	6-5fSta
					▶ d	-dkp1-simocod	le-76-5f
							100000
				~			

### **Topology definition allows automatic configuration**

Teneles ( celles / OTEDZ TIA Dertel)

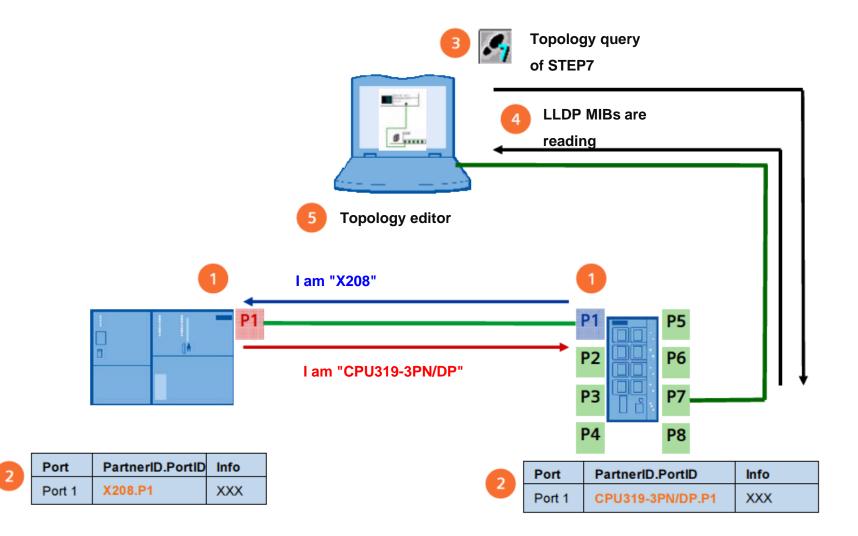




<ul> <li>Define cabling</li> </ul>		
Profinet_Demo → Devices & networks		Topology view 📩 Network view 🕅 Device view
PLC_1 CPU 1511-1	Switch_1 SCALANCE X PLC_1	itch_2         ALANCE X         I         PLC_1
		× > •

#### **Topology detection uses LLDP communication**





#### **Topology Defined - Automatic Configuration**

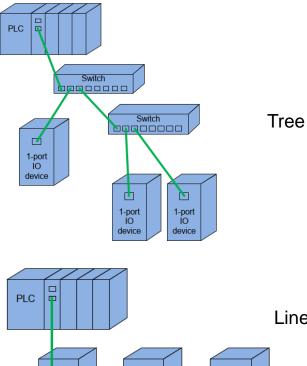


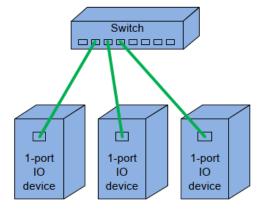
#### WITH PROFINET YOU ALWAYS HAVE USE MANAGERED SWITCHES!

- Automatic configuration saves time and minimizes errors
- With this function, the PROFINET IO controller automatically enters the IP address and device name of the PROFINET IO devices without a programming device (PG).
- The requirements for automatic configuration are :
  - The IO controller and IO devices must support the PROFINET function "Device replacement without exchangeable medium / PG".
  - In STEP7, you must select the option "Replacing the device without removable media" "Device replacement without exchangeable medium"
  - The devices must be reset to factory settings factory reset.
  - Profinet GSDxml device description must be found on all devices including switches!
  - The configured topology must correspond to the actual topology!

#### **Profinet network topologies**

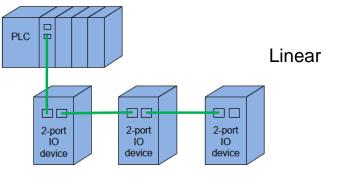




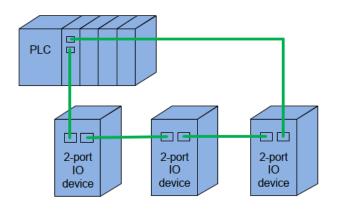


Star

(typically motor centers - Simocode)



Linear topology



**Ring topology** 

**Ring - MRP** 

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## Response time in line topology – 14 stations (1.8 ms) Siemens Profinet IO device with "cut through" switch – Ertec Asics circuit has been used for interface.



Tt = Transmission time of minimum frame = approximately 7

#### μs

Rtb =Run time of bit on the cable at 100 Mbps and 100 m cable between two nodes -> 0,5  $\mu$ s TPTswitch = Throughput time through a switch. For RT\_Class\_1 approximately 10  $\mu$ s (in GSD file)

#### Basic calculation:

Length of minimum frame:	64 bytes including process data
Including preamble and SFD:	08 bytes as header
Idle time:	12 bytes after each Ethernet frame
Total:	84 bytes

RT Minimum/maximun transmission time without wait times

E	Byte	Tt	Nn (asemien määrä	Rtb	TPTswitch		
S	;	[µs]	ketjussa)	[µs]	[µs]	Tt_min [ms]	Tt_max [ms]
	84	6,7	/ 14	1 0 <i>,</i> 5	10	0,154	1,729

TPTswitch [μs]	Tx [μs]	
10	)	153,72

This calculation can only be used with Siemens devices. It has been found that some other manufacturers has used standard "store and forward" switches in device Profinet interface. These do not guarantee a stable response time.

## Response time in line topology – 20 stations (2,6 ms) Siemens Profinet IO device with "cut through" switch – Ertec Asics circuit has been used for interface.



Tt = Transmission time of minimum frame = approximately

#### 7 µs

Rtb =Run time of bit on the cable at 100 Mbps and 100 m cable between two nodes -> 0,5  $\mu$ s TPTswitch = Throughput time through a switch. For RT\_Class\_1 approximately 10  $\mu$ s (in GSD file)

#### Basic calculation:

Length of minimum frame:	64 bytes including process data
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RT Minimum/maximun transmission time without wait times

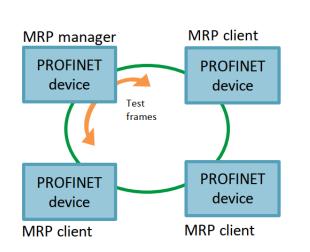
Byte	Tt	Nn (asemien määrä		Rtb	TPTswitch		
S	[µs]	ketjussa)		[µs]	[µs]	Tt_min [ms]	Tt_max [ms]
84	6,	7	20	0,5	10	0,217	2,527

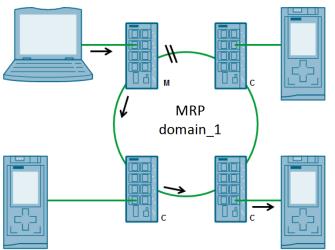
TPTswitch [μs]	Tx [µs]	
10		216,72

This calculation can only be used with Siemens devices. It has been found that some other manufacturers has used standard "store and forward" switches in device Profinet interface. These do not guarantee a stable response time.

# RT: Media Redundancy Protocol (MRP) 1/2

MRP is a ring redundancy method used in Profinet applications. The redundancy manager sends test messages from each of its ring ports as long as the messages arrive at the other ring port. This way the manager knows that the ring is intact. At the same time, it prevents messages from circulating indefinite in the ring, closing one of the ring ports.

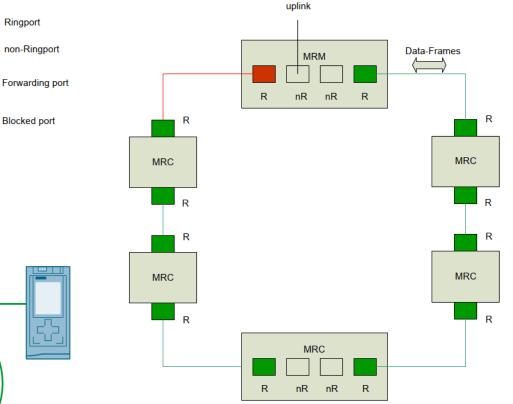




R:

nR:





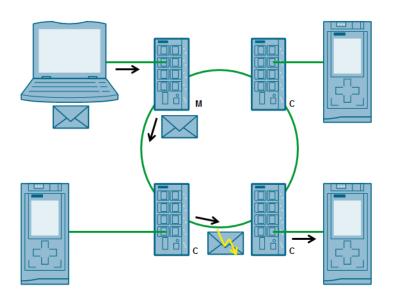
# RT: Media Redundancy Protocol (MRP) 2/2

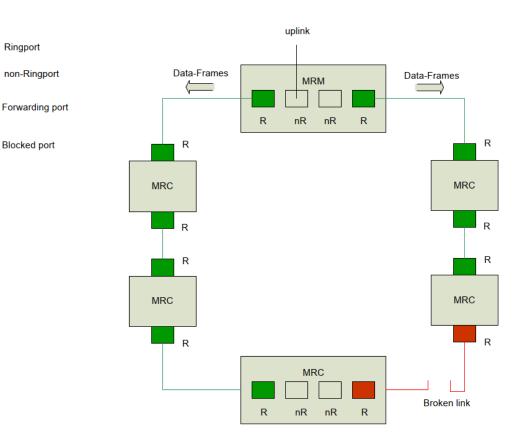
When test messages no longer arrive at another ring port, such as a damaged cable, the manager opens the closed ring port. In this case, post-break subscribers are available.

R:

nR:

Network recovery (reconfiguration) takes up to 200 m (50 subscribers).





#### **IRT: MRPD seamless ring. Max. 32 devices**



Redundancy

Client

Test

frames

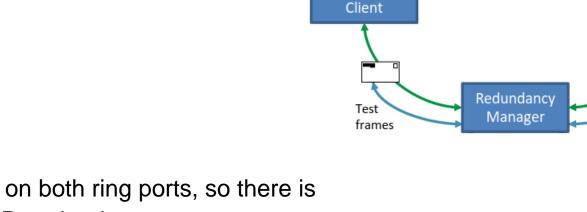
Redundancy

Client

PROFINET

Redundancy

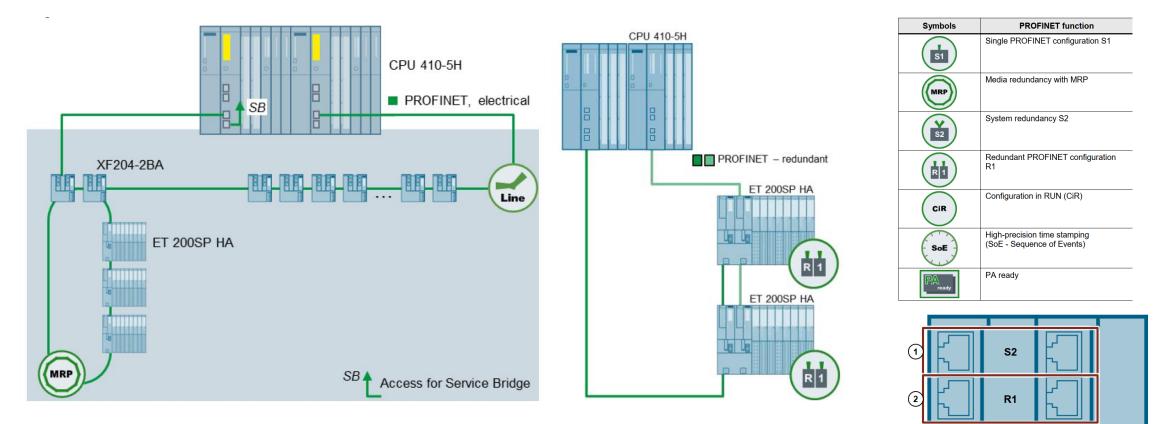
The MRPD mechanism is based on IRT and MRP. A reconfiguration time of 0ms is possible by sending cyclic IRT packets duplicated in both directions on the ring. The recipient receives the same IRT frame twice if there are no errors on the network.



The devices receive this information on both ring ports, so there is no ring remodeling time. As with MRP, redundancy management prevents loops.

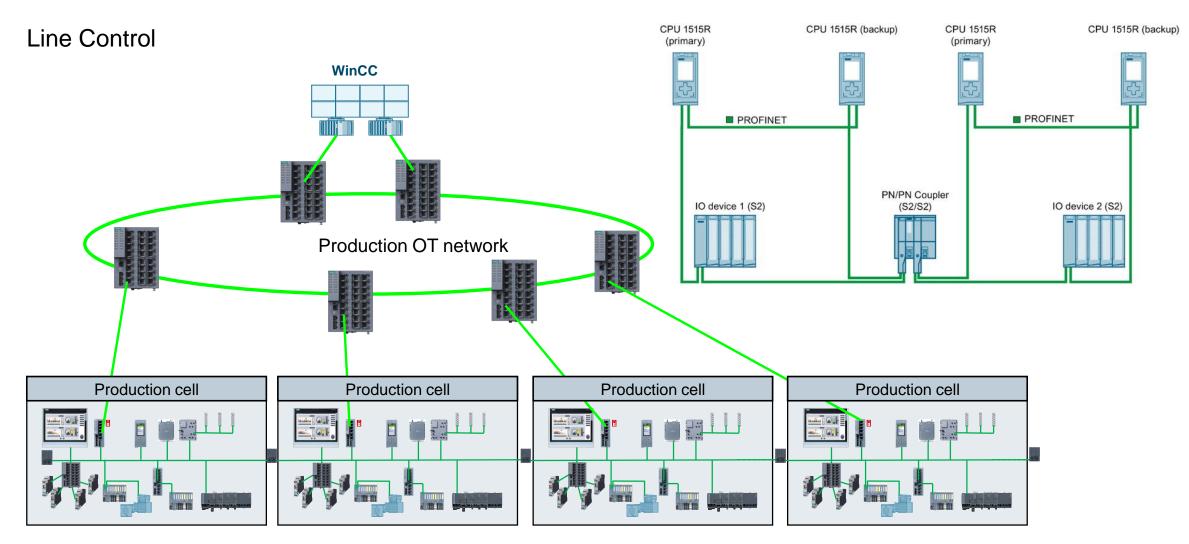


#### **Redundancy example**



### Segmented production network – PN/PN Coupler



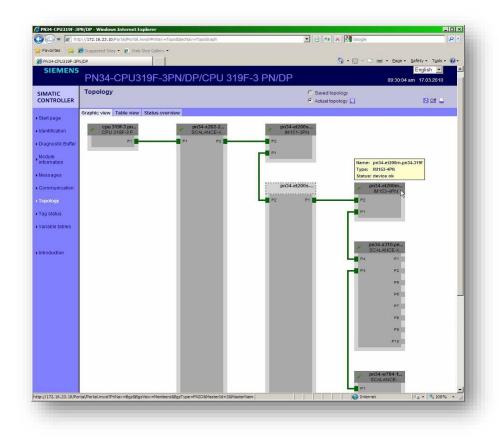


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#### Web extension - Network topology - graphical view





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Address 🙆 http://19	2.168.1.2	21/Portal/Portal.mw	; ?PriNav=Bgz&BgzType=DF	98MasterNar	ne=PROFIBUS(1): DP master s	ystem (1)&Member	Name=IM1 💙 🚦	🗲 Go Links
SIEMENS							E	nglish 🔽
5121112113		PU319/C	PU 319F-3	PN/D	Р		01:36:49 pm	
SIMATIC	Mod	lule informati	on		Slot	~		<u>Filter</u>
CONTROLLER	CPU3	<u> 19</u> - <u>PROFIBUS(1)</u>	: DP master system (1)	- IM151-1 I				💋 <u>Of</u> f 📇
	Slot	Symbol	Name		Order number	I Address	O Address	Comment
▶ Start page	0	×	IM151-1 HF	Details	6ES7 151-1BA02-0AB0	8177		
	1	×	PM-E DC2448V	Details	6ES7 138-4CA50-0AB0	8176		
Identification	2	×	4/8 F-DI DC24V	<u>Details</u>	6ES7 138-4FA03-0AB0	300.0	300.0	
Diagnostic Buffer	3	4	4/8 F-DI DC24V	Details	6ES7 138-4FA03-0AB0	306.0	306.0	
Diagnostic Buller	4	<b>v</b>	4 F-DO DC24V/2A	<u>Details</u>	6ES7 138-4FB02-0AB0	312.0	312.0	
Module	5	×	PM-D F PROFIsafe	<u>Details</u>	3RK1 903-3BA01	10.0	10.0	
information	6	×	F-DS1e-x 0.3-3A HF	<u>Details</u>	3RK1 301-0AB13-0AA4	15.0	4.0	
▶ Messages								
PROFINET								
▶ Topology	Status	Identification						
▶ Tag status	PB si	ave 31 on PB svs	em 1, Slot 3: Module ren	noved Nam	ne: IM151-1			
▶ Variable tables			24V I/O address: 1306					
▶ Introduction								
\$) }							Interne	

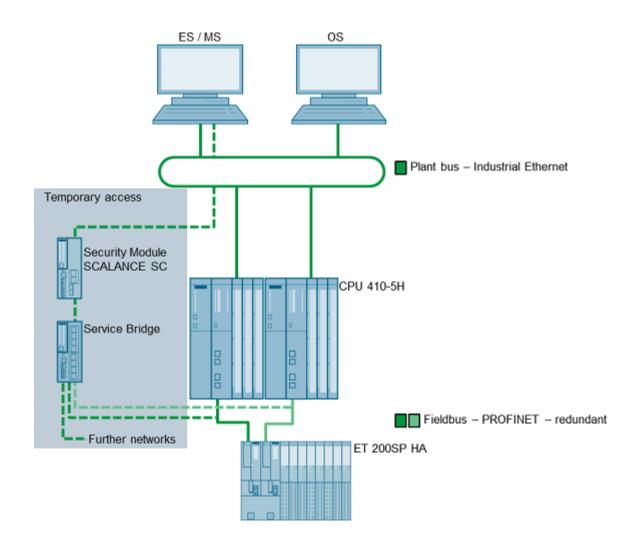
### Online view on the TIA Portal.

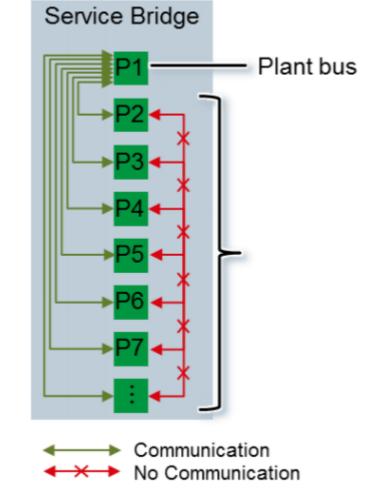


			21		ork view 🛛 Device view
🔜 🔍 ± 88%					Topology overvi
				^	Port interconnection
RA PLC_1 CPU 1516-3	Drive_1 G120C PN PLC_1	KP8_1 KP8 PLC_1	IO device_1 IM 155-6 PN PLC_1	=	<ul> <li>✓ Device / port</li> <li>✓ SCALANCE XM-400</li> <li>✓ Switch_3</li> <li>✓ SCALANCE int RJ45 1000</li> <li>RJ45 1000</li> <li>RJ45 1000</li> <li>RJ45 1000</li> <li>RJ45 1000</li> </ul>
Switch_1 SCALANCE X PLC_1	Switch_2 SCALANCE X	Switch_3 SCALANCE X PLC_1	Switch_4 SCALANCE X PLC_1		RJ45 1000 RJ45 1000 RJ45 1000 RJ45 1000 V Scalance X300 Switch_4 SCALANCE int Port_1
					Port_2 Port_3 Port_4 Port_1 Port_1 Port_2 Port_1
					Port_1 Port_2 ♥ 571500/ET200MPs ♥ PLC_1 ♥ PROFINET inte

#### Service bridge (Scalance XC200 series)





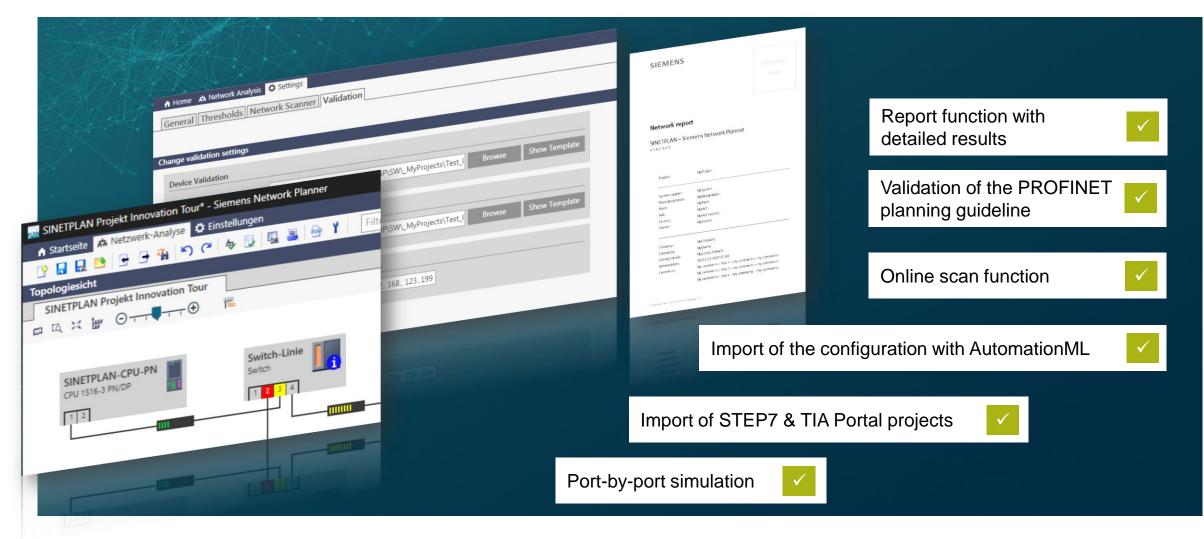


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### Sinetplan – Offline simulation for load in Profinet network



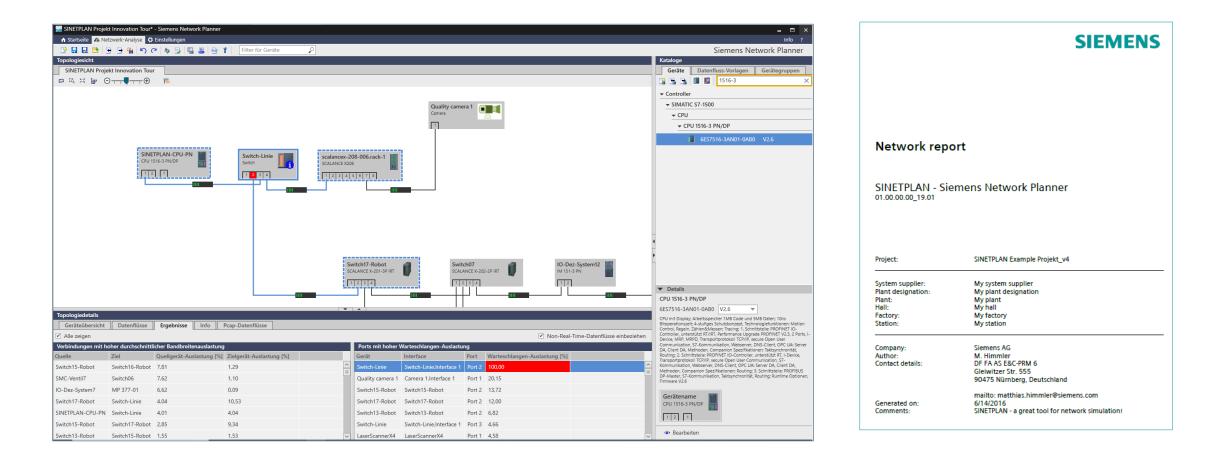


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## SIEMENS Ingenuity for life

#### Sinetplan



#### **Proneta (PROFINET network analyzer - free!)**



#### Requirements

- Easy to set up devices and network without PLC "tools"
- Detects devices and topology automatically
- Address settings
- IO testing

#### Used to

- cabinet manufacture
- Commissioning



• <u>www.siemens.com/proneta</u>



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#### **SINEC PNI Basic – for free**

# SINEC PNI is a program that can be set for a network-specific parameter to SCALANCE and RUGGEDCOM devices

	Device list	Y Settings	Device credentials					
	figure device 🛛 🎘 Flash LED	Ping device Sect devi	ice 💮 Open in Web browser					Start network sca
3	Status 🗘	Device type	PROFINET device name 💲	IP address	MAC address	Article number	Firmware version	Serial number
	T	T	T	T	Ţ	T	T	
1	Ø ок	57-1500 CP	c-dkp2-cp1543-1-03-66	192.168.120.69	00:18:18:A7:03:66			
1	Ø ок	SCALANCE W-700		192.168.120.65	00:18:18:A8:88:9E	6GK5 734-1FX00-0AA0	V6.3.1	VPE8174558
1	Ø ок	\$7-1500	c-dkp2-cpu1511-ab-e2	192.168.120.68	28:63:36:82:AB:E2	6ES7 511-1AK00-0AB0	V1.6.0	
3	Ø ок	ET 200eco PN 8DI	d-dkp1-et200eco-63-41	192.168.120.28	28:63:36:15:63:41	6ES7 141-6BF00-0AB0	V7.0.1	S C-E9TP94042014
1	Ø ок	SCALANCE X-400	r-dkp2-xm408-67-00-msps	192.168.120.64	00:1B:1B:9D:67:00	6GK5 408-8G500-2AM2	V6.2.2	VPE4141830
1	Ø ок	SCALANCE 5-600	ricky615	192.168.120.221	00:1B:1B:8B:41:98			
1	Ø ок	SCALANCE X-200	x-dkp2-xf208-28-23-vx	192.168.120.63	00:18:18:A8:28:23	6GK5 208-0BA00-2AF2	V5.2.3	VPE8137684
	Ø ок	SIMATIC-PC	h-dkp1-ipc427d	192.168.120.40	00:1B:1B:42:91:2B			
1	Ø ок	SCALANCE X-200	x-dkp1-x204-44-b9	192.168.120.27	00:18:18:A8:44:89	6GK5 204-0BA00-2BA3	V5.4.1	SVPE8169267
	Ø ок	ET200SP	d-dkp1-et200sp-ec-15	192.168.120.24	28:63:36:13:EC:15	6ES7 155-6AU00-0BN0	V1.1.1	S C-EBVW23142014
	Ø ок	SCALANCE W-700	ap3	192.168.120.61	00:1B:1B:A5:5C:10	6GK5 774-1FX00-0AA0	V6.3.1	VPE6177863
	Ø ок	Motor Mgmt. System	d-dkp1-simacode-76-5f	192.168.120.31	00:0E:8C:E6:76:5F	3UF7 011-1AB00-0	V1.2.2	
	Ø ок	SCALANCE XB-200	x-dkp2-xb208-a4-df-msps	192.168.120.52	20:87:56:64:A4:DF			
	Ø ок	SCALANCE XF-200	8888888	192.168.120.72	20:87:56:5C:92:1E	6GK5 204-2AA00-2GF2	V4.1	VPJN130163
3	Ø ок	KP8 PN 8KEYS 8DI/O DC24V	h-dkp2-kp8-ce-d4	192.168.120.70	28:63:36:14:EC:D4	6AV3 688-3AY36-0AX0	V1.0.1	S C-E9A308162014
	Ø ок	SCALANCE X-200	x-dkp1-x202-43-68	192.168.120.26	00:1B:1B:AB:43:68	6GK5 202-2BH00-2BA3	V5.4.1	SVPE8138662
1	Ø ок	\$7-300	c-dkp1-cpu315-46-6c	192.168.120.21	28:63:36:14:46:6C	6ES7 315-2FJ14-0AB0	V3.2.16	
	Ø ок	IM151-3	d-dkp1-et200s-61-5e	192.168.120.22	28:63:36:14:61:5E	6ES7 151-3BA23-0AB0	V7.0.5	S C-E8WB42142014
1	⊗ ок	SCALANCE X-200	x-dkp1-xf208-27-ae	192.168.120.30	00:18:18:A8:27:AE	6GK5 208-0BA00-2AF2	V5.2.3	VPE8137671
	Ø ок	IM151-3	d-dkp1-et200fo-61-74	192.168.120.23	28:63:36:0F:61:74	6ES7 151-38B23-0AB0	V7.0.5	S C-E7UC87762014

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The configuration can be performed simultaneously for multiple devices.

- Network Scanning of all PROFINET and RUGGEDCOM devices
- Initialization by setting the following parameters for the devices :
  - address, subnet and gateway
  - Initial password change (Scalance ja Ruggedcom)
  - name (PROFINET)
  - I&M information to identify the device (PROFINET)
  - SysName, sysContact and sysLocation
- Activate DHCP-client
- Resets to factory settings
- Resets to the default PROFINET settings
- ping
- Flashes LEDs
- Open Web Based Management

## SINEC PNI Product editions



	No licence	Only one License per copy	
	SINEC PNI Basic (02/2020)	SINEC PNI Advanced (11/2020)	SINEC PNI Professional (03/2021)
Features	<ul> <li>Step 1</li> <li>Scan network</li> <li>Set IP, subnet, gateway</li> <li>Set DHCP Client</li> <li>Set PROFINET / System name</li> <li>Set I&amp;M Data</li> <li>Reset to factory</li> <li>Change Default Password</li> <li>Flash LED</li> <li>Ping</li> </ul> Step 2 <ul> <li>Firmware Update</li> <li>Diagnostic Downloads (logs with config)</li> <li>Configuration copy (up/down)</li> <li>Set SNMP (V1, V2C, V3)</li> </ul>	<ul> <li>+ Set Time</li> <li>+ Set DNS Proxy</li> <li>+ Set Syslog-Client</li> <li>+ Set NTP-Client</li> <li>+ Set RADIUS-Client</li> <li>+ Configure DHCP Server</li> <li>+ Set SSID</li> <li>+ Set SSID</li> <li>+ Set WLAN Mode</li> <li>+ Set Country</li> <li>+ Set Channel</li> <li>+ Set frequency</li> <li>+ Set SSID Security</li> <li>+ Set static VLANs</li> <li>+ Set VLAN IP addresses</li> </ul>	<ul> <li>+ Generate SSL and SSH Keys</li> <li>+ Set Hardening profile</li> <li>+ Set NAT/ NAPT</li> <li>+ Set Firewall / ACLs</li> <li>+ Set SINEMA RC Client</li> <li>+ Password protection</li> </ul>
Price	Free of charge	xxx €	xxx €

### **SINEMA Server V14**



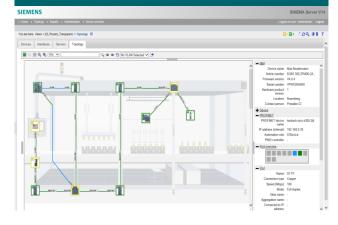
		Но	me s	screei	n	
SIEMEN	S					SINEMA Server V14
- Home Do	pology > Reports >	Administration      Server overview	_	_	Logged-or	user: Administrator Logout
You are here: Ho	ene 18				2	¤⊠ାଯୟା@¶?
2 <b>4</b> (22		System status				
Overall statu     Overall statu     Overall statu     Overall     Overall	·	System operational, nu Status: OK	ming since 2017-06-07 10 3	5.26.731		
All device     All device     P ade     PROF     Grouped	tress INET device name	Total monitored devi Up Down	ces	12 12 0		
<ul> <li>○ Ot</li> <li>○ PNO syster</li> <li>○ PNO syster</li> <li>○ testrack</li> </ul>	vid davice (1) bar (1) C. (1) subter (2) witch (8) x bar (1) emens AG (11) at 2. 56.0.016 (2) 2. 560.0.024 (11) 2. 560.0.024 (11) 2. 560.0.024 (11) end end end end end end end end	Everts snapshot (last 24 hours)	Event class NetReation Info Warning Error Tota		Ever ci Natification Weine Weine Error	
1 1 2 3	. 📧 🗷	C	· 7			
] Noted	Event status	Event	Event class	Time stamp 😜	Event details	IP address - affected
No	Pending	LAN: interface inactive and does n Error		2017-06-07 11:07:24:201		192.168.0.31
No	Pending	LAN: interface inactive and does n Error		2017-06-07 11:07:23.484		192.168.0.30
No	Resolved autom	al Redundancy status: redundant co Warn	ng	2017-06-07 11:07:23:265		192.168.0.30
No	Pending	Redundancy status: redundant co Warn	ng	2017-06-07 11:07:23.265		192.168.0.30
No	Resolving	Interface connection: connection r info		2017-06-07 11:06:32:534	192 168 0 30 X1 P6-192 168 0 31	

#### Reports

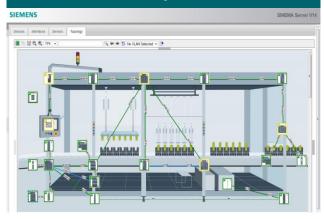
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1235		C	• 7			
Noted	Event status	Event	Event class	Time stamp 🖕	Event details	IP address - affected
No	Pending	Interface connection: no match with	Warning	2017-06-07 11:07:32.625	192 168 0 30 X1 P6-192 168 0 31	192,168,0.30
No	Pending	Interface connection: no match wit	Warning	2017-06-07 11:07:32.625	192 168 0 31 X1 P2-192 168 0 30	192.168.0.31
No	Pending	LAN: interface inactive and does n	Error	2017-06-07 11:07:24:201		192.168.0.31
No	Pending	LAN: interface inactive and does n	Error	2017-06-07 11:07:23.484		192.168.0.30
No	Resolved autom	a Redundancy status: redundant co	Warning	2017-06-07 11:07:23.265		192.168.0.30
NO NO	Pending	Redundancy status: redundant co	Warning	2017-06-07 11:07:23.265		192.168.0.30
No	Resolving	Interface connection: connection r	info	2017-06-07 11:06:32:534	192.168.0.30.X1 P6-192.168.0.3	192.168.0.30
No	Resolving	Interface connection: connection r	info	2017-06-07 11:06:32:519	192.168.0.31:X1 P2-192.168.0.30	192.168.0.31
No	Resolving	LAN: interface is active and match	info	2017-06-07 11:06:24:344		192.168.0.31
No	Resolving	LAN: interface is active and match	info	2017-06-07 11:06:23.455		192.168.0.30
No No	Resolving	Redundancy status: redundant co	info	2017-06-07 11:06:23.159		192.168.0.30
No	Resolving	Redundancy status: redundant co	info	2017-06-07 11:06:23 159		192.168.0.30
NO NO		User: log-in detected	Notification	2017-06-07 11:03:12.885	Administrator is logged in from 17	172.16.1.10
No No	Resolving	Interfaces: normal rate of discarde	info	2017-06-07 11:00:23:328	0	192.168.0.30
No		User: log-in detected	Notification	2017-06-07 10:49:42:214	Administrator is logged in from 17	172.16.1.10
No No	Resolved autom	ar Interface connection: no match wit	Warning	2017-06-07 10:46:30.661	192.168.0.30:X1 P6-192.168.0.3	192.168.0.30
NO NO		na Interface connection: no match wit		2017-06-07 10:46:30.630	192.168.0.31:X1 P2-192.168.0.30	
No		na LAN: interface inactive and does n		2017-06-07 10:46:24.250		192.168.0.31
No No	Resolved autom	alLAN: interface inactive and does n	Error	2017-06-07 10:46:23:501		192.168.0.30
No No	Resolved autom	ial Redundancy status: redundant co	Warning	2017-06-07 10:46:23:251		192.168.0.30
No	Resolved autom	na Redundancy status: redundant co	Warning	2017-06-07 10:46:23:251		192.168.0.30
No		User: log-in detected	Notification	2017-06-07 10:39:49.070	Administrator is logged in from 17	
No		nat Interfaces: critical rate of discarde		2017-06-07 10:35:23:214	10	192.168.0.30
NO NO	Resolving	Redundancy status: redundant co	into	2017-06-07 10:26:27:338		192.168.0.30
No	Resolving	Redundancy status: redundant co	info	2017-06-07 10:26:27:338		192.168.0.30
🗈 No	Resolving	Redundancy status: normal ring m	info	2017-06-07 10:26:27.338		192.168.0.30

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Topology



#### **Customer-specific view**

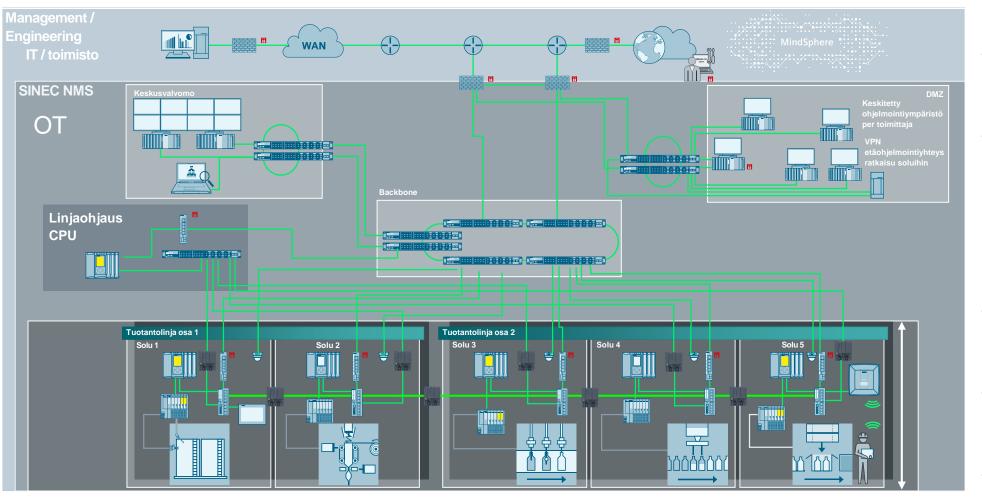


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<ul> <li>Performan are here: Reports &gt; Perfo</li> </ul>			reports					<b>2</b> • <b>2</b>	
AN - Interface utilization	LAN - Interface er	rror rate WLA	N - Interface error rate	WLAN - Interfa	ace data rate	WLAN	Signal strength	WLAN - Number of ci	ients
Viscarded packets F	OF power margin								
24 hours 7 days		a (*	•	• 7					
IP address	Device name	Device type	Media type	Name	FD Av. tran	nsm. util	FD Av. recv. util. as	HD Ax. utilization as	Speed in Mbps
192.168.1.10	sysName Not Set	SCALANCE X308	I-2N Copper	S0/X1 P1		0.373	0.354		100 _
192.168.1.14	testrack-nico-cpu15	CPU 1511-1 PN (	1AF Copper	X1 P1R		0.355	0.338	-	100
192.168.1.13	testrack-nico-et200	s ET 2005P IM155	-6 F Copper	X1 P1		0.354	0.373	-	100
192.168.1.10	syshame Not Set	SCALANCE X308	I-2N Copper	S0/X1 P4		0.337	0.354	-	100
192.168.0.31	testrack-nico-x204ir	t SCALANCE X204	IRT Copper	X1 P1		0.043	0.043	-	100 _
192.168.0.1	sysName Not Set	SCALANCE XM4	18-ECopper	S1/X1 P6		0.042	0.043	-	100
192.168.0.31	testrack-nico-x204ir	R SCALANCE X204	IRTUnknown	X1 P2		0.041	0.041		10
192.168.0.30	sysName Not Set	SCALANCE X308	I-2L Copper	X1 P6		0.041	0.041		100
192.168.1.11	sysName Not Set	SCALANCE X200	-2F Fiber optics	X1 P3		0.039	0.035		100
192.168.1.11	sysName Not Set	SCALANCE X202	-2F Fiber optics	X1 P4		0.039	0.039	-	100
192.168.0.1	sysName Not Set	SCALANCE XM4	18-ECopper	S1/X1 P2		0.037	0.036	-	100
192.168.0.30	syshame Not Set	SCALANCE X308	I-2L Copper	X1 P7		0.036	0.037		100
192.168.0.20	Maschine2	SCALANCE S62	8 (0 Copper	S0/X1 P1		0.006	0.006	i -	100
192.168.0.10	Maschine1	SCALANCE S612	2 (0 Copper	S0/X1 P1		0.006	0.006	-	100
192.168.0.1	sysName Not Set	SCALANCE XM4	18-ECopper	S1/X1 P1		0.006	0.006	- i	100
192.168.0.1	sysName Not Set	SCALANCE XM4	18-{Copper	\$1/X1 P5		0.006	0.006	-	100
192.168.0.1	sysName Not Set	SCALANCE XM4		\$1/X1 P8		0.006	0.006		1000

#### Server overview



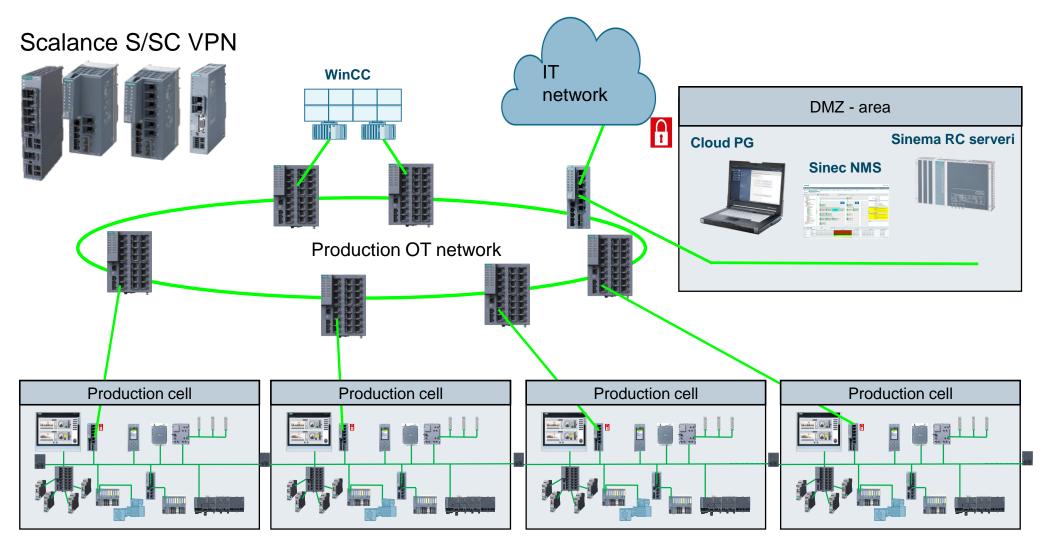
The automation network is connected to the OT network, not directly to the IT network. ADVANTAGE: A more secure data transfer to the entire production line is achieved.



- The production cells are connected to each other with PN / PN Couplers
- Each cell is connected to the OT network with its own Firewall / VPN module
- VPN modules can be used to build a horizontal remote connection within the production line -> network monitoring and maintenance of the entire production line and, if necessary, a-cyclic data transfer between cells
- The devices on the OT network are managed and controlled centrally by Sinec NMS.
- Production network
   protected from IT network
   vulnerabilities -> trouble free production
- The line control CPU is connected to an OT network or a separate network

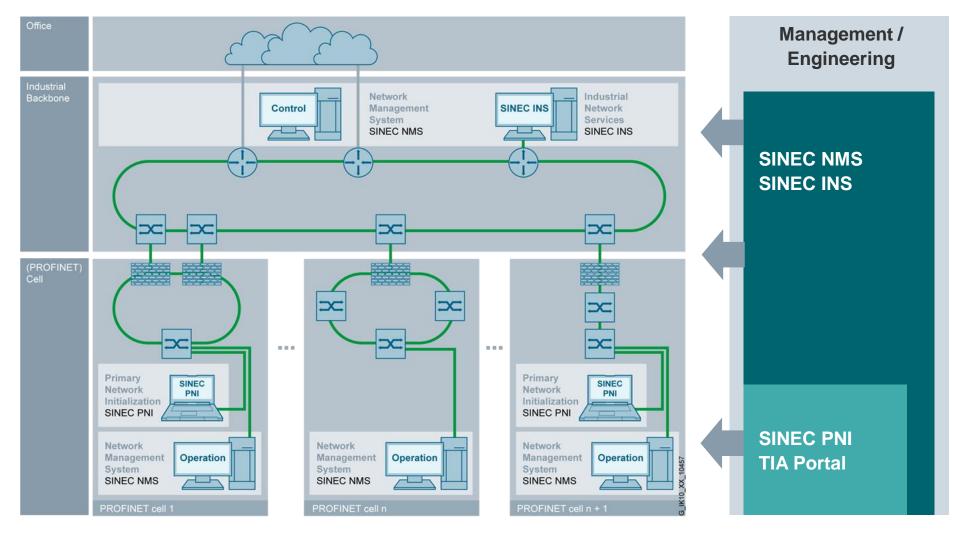
#### Segmented production network (IEC62443)





## SINEC software family (NMS, PNI & INS) Network levels (OT) – Factory automation





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Page 31

### Sinec NMS <u>https://siemens.com/sinec-NMS</u>



Diagnostics details Close



peration - OpProduction (192.16					Photifications	
Home O Network monito		🔅 System monitoring 🗸 🖺	System administration 🐱 🥔 Control			
Home >> Network monitoring	>> Topology	<b>A A A D A</b>	÷			
Overall status  Overall status  Overall  Anternal  Ante			192.184.122.101 0018.65.900.042 spm3-2727-		Status: Down Monitoring setting: Down Statistics: false	
Error (1)     Devices     All devices (18)     Paddress     PROFilest device name     Grouped	102.164.100.03 Contentioner.27	DKP2 10 540 (384) 40 46 (383)	DKP3 102140.038 102140.038 102140.038	- Res	undancy information Protocol: MRP Port status: not connected Role: Ring manager Ring status: Maintenance dema	anded
	102106.2004 10210000000000000000000000000000000000	Table State	122.166.100.2 122.16	- Per	ding event (most negative) Time stamp: 2018-08-23 07:48: Overall status: 2 Event: Redundancy status: Event details: -	28,404
Router (4)     Switch (7)     WLAN client (1)     WLAN client (1)     Other (1)     Simmers AG (17)     Subnet	1923464.2024 202376.401250 2023776.401250 20237777777777777777777777777777777777		122-146.30281 00.16.19.07.44/9 weg8=v700	28 - Per	ding events (newest 5) Time stamp: 2018-08-23 07:48: Overall status: [2] Event: Redundancy status Event details:	
192.168.120.0/24 (17)     192.168.130.0/24 (1)     PNIO systems     Unassigned devices (11)     Views		idgandd.	30000 + 60y300022	- Not	£	
1 <u>2 3 3</u> 2 2 2		· 🔻 0		1		
No Resolving	Event Wireless interface quality: critical high signal strength Wireless interface quality: normal signal strength to th Wireless interface quality: critical high signal strength	e connecturite	Time stamp ↓ 2018-08-26 19:25:57.595 2018-08-26 19:20:57.431 2018-08-26 19:15:57.544	Event MAC address: 00:1b:1b:37:a4:f MAC address: 00:1b:1b:37:a4:f MAC address: 00:1b:1b:37:a4:f	9 , value: -34 192.168.120. 9 , value: -43 192.168.120.	0.82 0.82
	Wireless interface quality: normal signal strength to th Wireless interface quality: risky high signal strength to		2018-08-26 19:10:57.505 2018-08-26 19:05:57.608	MAC address: 00:1b:1b:37:a4:f MAC address: 00:1b:1b:37:a4:f		

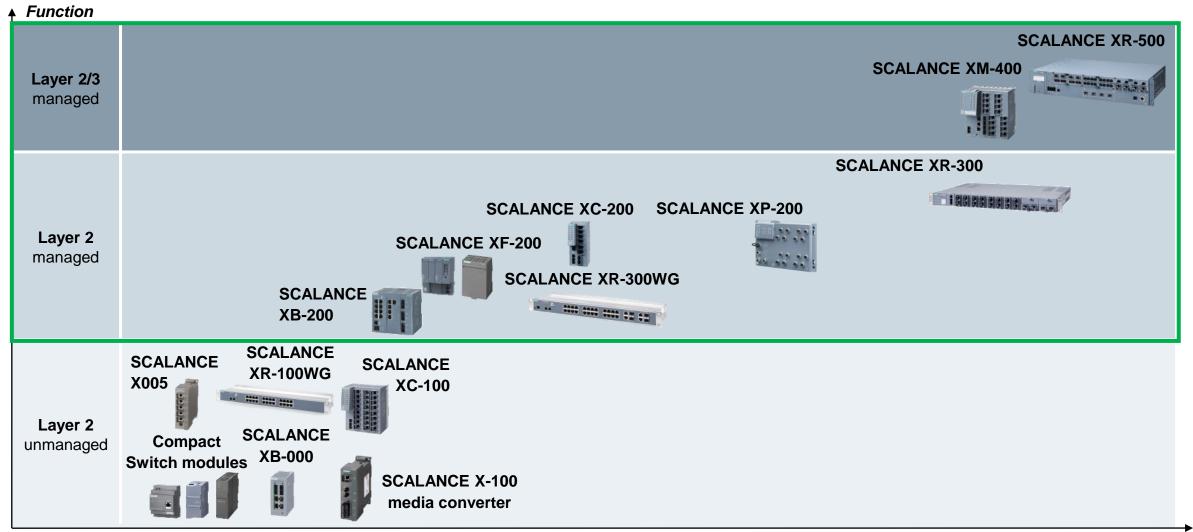
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• 50	septimonitating w													
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tiers														0 -
5345		Paddene B	Device type #	Category #	MAC Address #	Hilder. #	Article number #	Setal number -	Firmages varion #	Herburn version #	Configuration access #	Managa	Operation #	
	ok.	192.566170.204	SCALANCE SEGME CHE	huter	25.87.54.72.28.20	2 Digri Age	6545 646 25000 Jacz	1042132714	20.1		Atom	Multimet	SNELDE	
	04	190.166.100.73.04	SCALANCE NF204 284 (	6480	254754.5012.15	1 Dept age	1045 254-24A00-2072	0101120160	41.0		Aturnel	Monitored	SNECH	
	95	192 148 200 32 24	SCALANCE (C206-2 SPR	34325	20475646-0845	20001490	6685 205-26500 JMC2	100160680	41.0		Allowed	Modured	SNECCE	
	04	192.148.120.1.04	SCALARCE SETS (DARE	kuter	0818(19731028	10erap	VERT BYS-ORADO-DRAD	1014122089	61.1	3	Build	Montaned	SNEGRE	
	OK .	192 NBL230 1/24	SCALANCE SETS (DAAE.,	Bauter	001010202584	2 Daylago	6585 815-04420-2442	1995128224	61.)		About	Motiment	SNECCO	
	0K	100.108.100.02104	SCALANCESSES FORAL.	Record	001010.0041.60	1 Dec apo	6045415-04435-0442	1011142206	6.1.1		Almost	Moderat	\$140 Cont	
•	OK .	192.168.120.65/24	SCALANCE W734 1 RM.	RUN Clark	011012-0180	3 Days ago	6685 734-17000-0440	107081714558	6.5.1	2	Aboved	Mariaged	SNECON	
•	OK .	192,108 120,65:24	SCALANCE IN SOR USA	Suite N	001010462923	3 Depiago	4045258-084052472	VPS8137664	3.2.3	.4	Attend.	Meriaged	\$160.01	
•	0K	192.186.120.33(24	SCALARCE OF XX8 (UBA	Select	1013/1840/2740	1000495	8645208-08408-2472	9968137671	5.2,3	+	Altread	Managed	SHELDER	
•	OK .	192.198.120.61/24	SCALANZ W774 T ISA.	Assessment	001010455010	2 Deju apo	69/5774-11005-5440	1006177863	631	1	Allered	Managad	SNECH	
•	95	192.188.120.69/24	C7 1545-1 (7 ANOL-DREID	8.007	0110154103.00	1 Dept Apr	6647 545 TANDO CHER	1005148821	5.5.88	V2.0.0	Alread	Messand	SNECH	
•	ox	192.198.120.64.04	SCALARIZ HARRINGS REL.	hate	101515404740	3 Dept ept	664343596303-3442	main results	8.2.2		Arrest	Menapet	SNEDER	
•	OK .	192.568.120.27(2)	SCALARCE ADDREET COL.	Subh	10.10.19.45.41.09	3 Deciser	1045231-084052943	50703169287	5.41		Allocat	Manajard	SNECOV	
•	oc.	192.168.720.24:24	SCALANCE \$252-29-81	3+9.9	ID1010AD4D4E	3 Dayt apr	6043332-28400-2843	50703155662	5.6.1		River	Meager	SNECH	
•	04	192.166.120.73/24	APR PROTEIN-DATE	PCH68	28433674,8024	3 Decision	6402 88634936-0682	SCENADE162214	5.0.1	1	Bulet	Meritand	SNEOLA	
•		192.148.100.22.04	(72006.04151-3.PK.W	Int Dates	284036764258	3.Decise-	6857157-36423-0400	10.699/042140814	7.0.5	*	Allered	Managert	SNELH	
•	OC .	102.168.120.21.04	CRU 2197-2 Histor UNIT	RC	28403875/646C	1 Decase	6507215-2974-0480	SCAMMONTATION .	3.2.16	4	Altered	Managed	SNEGH	

Name* Time specin cell 1       Description       Al NTPSNAMPSSMATIC capable devices to Time Server       Fiewall rates       0       Fiag       Version       1.0         Communication Relation Chain       Communication Relation Chain       Fiewall group       Communication Relation Chain       Fiewall group       Communication Relation Chain         Chained devices in Cell 1       V1.0       Fiewall group       Commany Status       Description       PROFINET       Commany Status       Description       Fiewall Area 1         V1.0       Simmeter       V1.0       Simmeter       Fiewall rate       Fiewall Area 1       Fiewall Area 1       Fiewall Area 1       Fiewall Cell 1       Fiewall Area 1	Communication Relation Chains Firewall Area 1 Firewall Area	Communication Plation Oxin  Communication Plation Plat
Firewall groups     Communication Partner 2*       Object group     Communication Partner 2*       Time devices in Cell 1       V1.0     5     5       V1.0     5     5       Terewall Area 1     V1.0     5       V1.0     5     5       Terewall Area 1     V1.0     5       V1.0     5     5       Terewall Area 1     V1.0     5       Terewall Area 1     V1.0     5       Terewall Area 1     Firewall Area 1     Firewall Area 1       V1.0     5     5       Terewall Area 1     Firewall Area 1     Firewall Area 1       V1.0     5     5       Terewall Area 1     Firewall Area 1     Firewall Area 1       V1.0     5     6       Terewall Area 1     Firewall Area 1     Firewall Area 1       PROFINET I Cleantification     PROFINET I Cleantification     Firewall Area 1       PROFINET I Cleantification     Firewall Area 1     Firewall Area 1       Nat     Nat     Nat     Firewall Neather 1       Object I point     Time Standard Glagoottics     Firewall Glagoottics       Digital Input     Time standard Standard Glagoottics     Firewall Neather 1	Operations       Freeval group       Communication Partner 2*         Operating on the devices in Cell 1       Freeval Cell to Area 1       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1       V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et200ps)         Freeval Cell to Area 1         V1.0       Sommary Satus       Device details (192):166.40.13 / since-rack-et2002p       Freeval Cell to Area 1       Freeval Cell to Area 1         Nat       V1.0       Up to V1.1       Nat       Freeval Cell to Area 1       Freeval Cell to Area 1         Up to V1.1       Up to V1.1       Up to V1.1       Station 1       Freeval Cell to Ar	Firewall group     Communication Partner 2*       Object group     Firewall group     Firewall group     Communication Partner 2*       Time devices in Cell 1     Time davices in Cell 1     Time davices in Cell 1     Time davices in Cell 1       Y1.0     Summary     Satus Description     POFINET Config. LAN ports Events Expert       Time davices in Cell 1     Y1.0     Summary     Satus Description     POFINET Config. LAN ports Events Expert       Common capabilitie     Common capabilitie       Firewall No       No     POFINET Identification
Object group     Common capabilities     Firewall Real     Firewall agroup     Common capabilities       V1.0     5 member       Firewall with the second of the s	Object group       O       Frewail group       O         Time devices in Cell 1       V1.0       5 mmmber         V1.0       5 mmmber       V1.0       5 mmmber         Internal       6 mmon capabilities       Frewail Na       6 mmon capabilities         Frewail with 1       V1.0       5 mmmber       6 mmon capabilities         Frewail with 1       Na       Na       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 name       980 FINET 10 name         PROFINET 10 name       980 FINET 10 name       980 FINET 10 n	Object group       Image: Control of the
Time devices in Cell 1     Fiewall Cell to Area 1     Device details (192,168,40.13 / since rack-et200ap)       V1.0     5 mmbr     Fiewall Cell To Area 1     V1.0       V1.0     5 mmbr     V1.0     5 mmbr       Exemal •     Exemal •     Fiewall Cell To Area 1     V1.0       Exemal •     Exemal •     Fiewall Cell To Area 1     PROFINET Cenfig. LAN ports Exents Expert       Fiewall •     Common capabilitie     Fiewall •     PROFINET Cenfig. Canfig. LAN ports Exemts Expert       NAT     VA.1     NaT     VI.0       Optical input     •     PROFINET Identification	Time devices in Cell 1     Firewall Cell to Area 1       V1.0     5 mmmbro     10 mmor capabilities     10 mmor capabilities     10 device	Time devices in Cell 1     Firewall Cell to Area 1     Firewall Area 1     Firewall Area 1     Firewall Area 1       V1.0     5 mmbro     1     5 mmbro     1     5 mmbro       Marco 4     5 mmbro     1     5 mmbro     1     1       Marco 4     1     1     1     1     1        Marco 4     1     1     1     1     1     1       Marco 4     1     1     1     1     1     1       Marco 4     1     1     1     1     1     1       Marco 4     1     1     1     1     1 <tr< td=""></tr<>
Time devices in Cell 1     Fiewall Cell to Area 1     Fiewall Area 1     Fiewall Area 1     Fiewall Area 1       VL0     3 membre     VL0     5 membre     VL0     Summary Status Description     PROFINET Config.     LAN ports Events Expert       Internal     External     External     Common capabilities     PROFINET Identification     PROFINET Config.     LAN ports Events Expert       NAT     VAN     NAT     V     NAT     VI     PROFINET diagnostics       Digital Input     w     Digital Input     Time stang +     Stot     Time stang +	Time devices in Cell 1     Frewall Cell to Ares 1       V1.0     13 membre     V1.0     5 membre     V1.0     5 membre       Description     Frewall Cell to Ares 1     V1.0     5 membre       Description     Frewall Cell to Ares 1     V1.0     5 membre       Description     Frewall Cell to Ares 1     V1.0     5 membre       Description     Frewall Cell to Ares 1     V1.0     5 membre       Description     Frewall Cell to Ares 1     Frewall Cell to Ares 1     Frewall Cell to Ares 1       Nat     VL0     Common capabilities     Frewall N     Nat Vell to Area 1       Nat     VL0     VL0     Nat Vell to Area 1     Frewall N       Digital Input     Nat     VL0     Ung level     PROFINET diagnostics       PROFINET standard diagnostics     Time stamp 2     Stott     Subdot     Text       2019-09-12 15/45/20     2     -     Module missing     2019-09-12 15/45/20     2	Time devices in Cell 1     Freevall Cell to Area 1     Freevall Area 1       VL0     3 membre     V1.0     S membre       VL0     3 membre     V1.0     S membre       Internal     Common capabilities     Internal •       Freevall Cell to Area 1     Common capabilities     Common capabilities       NAT     VL0     NAT       Log level     Log level       Digital leput     Digital leput
VLO     VLO       Internal     External       Internal     External       Common capabilities     Common capabilities       Firewall     No       NAT     VLAN       Nat     VLAN       Oglical Input     Oligital Input   PROFINET Information PROFINET I	Visit       Internal       External       Internal       In	Internal     Enternal     Internal       Internal     Enternal       Internal     Enternal       Filewall     No       NAT     VLN 1       NAT     VLN 1       No     NAT       VLN 1     Log lowel       Digital logut     Digital logut
Common capubilities     Common capubilities     PROFINET 10 name     gines/rack et2000;p       Frewall     No     Frewall     N     Automation role     IO device       NAT     VAT     V     Automation role     Io device       log level     VAT     V     PROFINET diagnostics       Digital Input     +     Digital Input     Stot     Subslot	Common capabilities     Filewall     No     Common capabilities     Filewall     No       Filewall     Nat     V     Nat     V       Nat     VAN1     V       Log level     Digital input	Common rapubilities     Common capabilities     Common capabilities     PROFINET ID name     Sines-rask-e12003p       Firewall     No     Firewall     N     Automation role     10 device       NAT     VAN 1     NAT     M     M       log level     Cog level     Log level     Firewall       Digital leput     Time stamp $\downarrow$ Slot     Subslot     Text
Common capabilities     Common capabilities     PROFINIET for name     ginec-rack et2000;p       Frevail     No     Frevail     N     Automation role     IO device       NAT     VLN1     VLN1     V     V     PROFINIET for name     ginec-rack et200;p       Digital input     v     Log level     Frevail     N     PROFINET standard diagnostics-       Digital input     v     Digital input     Stot     Subslot     Text	Commen capabilities     Common capabilities       Firewall     Notion       NAT     VLN1       Log level     NAT       Ogital leput     VI	Common capabilities     Common capabilities     PROFINET IO name     proc-rack-et200pp       Frevail     No     Frevail     N     Automation role     Io device       NAT     VAN 1 ••     VAN 1 ••     Vanition role     Io device       Log leval     •     No leval     Vanition role     Io device       Digrial leput     •     •     PROFINET diagnostics
No     Vitik     No     No     No     No     No <td>National Note     National Note     Nati</td> <td>Commerce Capacity     Commerce Capacity       Freevall     N       Freevall     N       Natt     VAN1 +       Natt     Natt       Log level     Cognitial Paper       Bright Ingut     +     Digital Ingut       Object Ingut     +     Digital Ingut</td>	National Note     Nati	Commerce Capacity     Commerce Capacity       Freevall     N       Freevall     N       Natt     VAN1 +       Natt     Natt       Log level     Cognitial Paper       Bright Ingut     +     Digital Ingut       Object Ingut     +     Digital Ingut
Nervoil     No     Fervoil     N       NAT     VLAN 1     -     NAT     V       Assigned controllers     pmec-rack-cpu       Ing level     -     Log level       Digital input     -     Digital input         PROFINET standard diagnostics         Time stamp ÷     Stot     Subslot	Hermania     No     Hermania     N       NAT     VLAN 1     NAT     VL       Log loval     *     Log loval     VL       Drigital Imput     *     Drigital Imput     PROFINET diagnostics       Illowed Services*     *     State     Subalot	Net     VIAN 1     NAT     V       Assigned controllers     jinne-rack-cpu       Log lowal
NAT     VLAN 1     VLAN 2     NAT     VLAN 2       Ing level     -     Log level     -       Digital input     -     Digital input     -   PROFINET standard diagnostics- Time stamp ÷ Subto Subslot Text	NAT     VLAN 1     NAT     VL       Log lovel     *     Log lovel     Log lovel       Digital houst     *     Digital houst     PROFINET diagnostics   Rough Services*       Named Services*     Slot     Sublot     Text   Module missing       2019-09-12 15/45/20     2     Module missing	NAT     VLAN 1     NAT     V I       Log lovel
Log level	Log loval     Log loval       Digital input     Digital input       Unewed Services*     Stat         Module missing       2019-09-12 15/45-20     2       Module missing	Log level   Log level  Digital leput  Digital leput
Digital Input	Image: Services*         Slot         Subslot         Text           Nowed Services*         Slot         Slot         Slot         Module missing	Digital Input
CENTER CONTRACTOR CON	Intersteining         Subset         Subset         Text           100-90-12 15/45-20         2         -         Module missing           2019-90-12 15/45-20         2         -         Module missing	interstanp → Sioc Subsoc Pext
	Moveed Services* 2019-09-12 15/45/20 2 · Module missing	
llowed Services* 2019-09-12 15:45:20 2 - Module missing		2019-09-12 15:45:20 2 - Module missing

# **SCALANCE X** managered switches

Layer 2 applications (Profinet)





#### Thank you for your interest!





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