



TBEN-Lx-EN1 and FEN20-EN1 Spanner User Manual

555T00007 v1.1

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Introduction

Purpose

The purpose of this document is to guide customers in installing and commissioning the TBEN-Lx-EN1 and FEN20-EN1 Ethernet spanners.

All respective Safety measures and accident protection guidelines must be considered carefully and without exception.

NFPA 79, State and Local code governing the installation of electrical devices and components take precedence over any circuit presented in this manual – circuits presented in this manual are for demonstrative purpose only.

Products Covered

TBEN-L4-EN1 TBEN-L5-EN1 FEN20-EN1

General Technical Information

Safety

At the moment TURCK does not offer Ethernet Spanners for Safety applications.

Web Server Security

In the web server, a default-password is assigned in the TBEN-L-module for the administrator access (see also Change Admin Password (page 16)).

In order to make misuse by third parties more difficult, it can be necessary to change the password. This should be done in the context of the network security concept for the complete facility in which the modules are placed.

In order to disconnect a logged in user/PC with administrator rights from the web server, a logout is necessary. If the web browser is closed while the admin is logged in, the last active access is reactivated when opening the web server again from the same PC, which means, possibly with all administrator rights.

Ethernet Spanner General Information

- The Ethernet Spanner has 2 Ethernet ports that can be addressed individually.
- Data is exchanged via a 240 WORD (480 byte) data table.
- Spanner Port 1 supports Ethernet/IP and MODBUS/TCP, Spanner Port 2 supports Ethernet/IP and MODBUS/TCP and PROFINET.
- Direct connection of up to 16 digital inputs to the field bus
- Channel-related short-circuit diagnosis of inputs
- Ethernet-connection with two 4-pole, d-coded M12 x 1 connectors
- Rotary switch position settings only apply to port 1
- ACD is disabled on both ports
- LLDP is enabled on Port 2 only
- Port 2 IP address can only be setup via the web server
- Upgrades can only be performed via port 1



TBEN-Lx-EN1 General Technical Information

Supply Voltage TBEN-Lx-EN1

V1 (incl. electronics supply)	24 V DC
Permissible range	18 30 V DC
V2	24 V DC
Permissible range	18 30 V DC
Electrical isolation	galvanic isolation between V1 and V2
Connectors	
Ethernet	2 x M12-female (OUT), 4-pole, D-coded
PROFIBUS	1 x M12-male (IN), 5-pole, B-coded 1 x M12-female (OUT), 5-pole, B-coded
Power supply	7/8" connector, 4-/5-pole
Inputs	M12-connector, 5-pole
Isolation voltages	
V1 to V2	≥ 500 V AC
V1/V2 to field bus	≥ 500 V AC
Protocol properties	
Modbus TCP	
Address assignment	Static IP (rotary coding switch), BOOTP, DHCP
Supported Function Codes	FC3, FC4, FC16, FC23
Number of connections	8
EtherNet/IP™	
address assignment	according to EtherNet/IP [™] standard
Quick Connect (QC)	< 150 ms
Number of connections	3
PROFINET	
Address assignment	DCP
MinCycleTime	1 ms

Diagnosis	according to PROFINET Alarm Handling
Topology detection	supported
Automatic address assignment	supported
Housing	Fibre-glass reinforced Polyamide (PA6-GF30)
Size	$60.4 \times 230.4 \times 24$ mm (B × L × H)
Window material	Lexan
Screw material	303 Stainless Steel
halogen-free	yes
Mounting	via 2 through-holes, Ø 6.3 mm
Mounting distance station to station	 ≥ 50 mm Valid for operation in the ambient temperatures mentioned below, with sufficient ventilation as well as maximum load (horizontal mounting). In case of low simultaneity factors and low ambient temperatures, mounting distances of < 50 mm may be possible.
Protection class	IP65/IP67/IP69K
Tests	
Vibration test	according to EN 60068-2-6/ IEC 68-2-47 Acceleration up to 20 g
Drop and topple	according to IEC 60068-2-31/ IEC 60068-2-32 1
Shock test	according to EN 60068-2-27
EMC	according to EN 61131-2
Temperature range	
– Operating temperature	- 40 °C to + 70 °C (- 40 °F to + 158 °F)
– Storage temperature	- 40 °C to + 70 °C (- 40 °F to + 158 °F)

TBEN-Lx-EN1 Dimensioned Drawing





FEN20-EN1 General Technical Information

FEN20	-EN1
-------	------

Number of channels	0					
Operating / load voltage	12 30 VDC					
Operating current	100 mA					
Electrical isolation	500V Calvanic I/O to Ethomat					
Supply voltage						
Supply voltage						
Voltage supply connection	≤ 2.4 VV					
voltage supply connection	Screw terminals					
Inputs						
Number of channels	8					
Input voltage	24 VDC					
Supply current	700 mA					
Switching threshold	7V / 1.65mA					
Low level signal voltage	< 7 VDC					
High level signal voltage	730 VDC					
Low level signal current	< 1.5 mA					
High level signal current	> 2 mA					
Input delay	2.5 ms					
Max. input current	6 mA					
System data						
Transmission rate	10/100 Mbps; Full/Half Duplex; Auto Negotiation;					
	Auto Crossing					
Addressing modes Ethernet:	via Software					
Connection technology Ethernet	2 x RJ45 Sockets					
Protocol detection	automatic					
Web server	192.168.1.254 (Default)					
Service Interface	Ethernet					
Device Reset	via Push-button					
Modbus TCP						
Addressing	Static IP, BOOTP, DHCP					
Supported function codes	FC1, FC2, FC3, FC4, FC5, FC6, FC15, FC16, FC23					
Number of TCP connections	6					
Input Data Size	max. 240 register					
Input register start address	12288 (HEX 0x3000)					
Output Data Size	max. 240 register					
Output register start address	13312 (HEX 0x3400)					
	· · · · · · · · · · · · · · · · · · ·					

EtherNet/IP™	
Addressing	acc. to EtherNet/IP™ specification
Quick Connect (QC)	< 150 ms
Number of CIP connections	6
PROFINET	
Addressing	DCP
Conformance class	B (RT)
MinCycleTime	1 ms
Diagnostics	acc. to PROFINET alarm handling
Topology detection	supported
Automatic addressing	supported
Dimensions (W x L x H)	55 x 62.5 x 30mm
Housing material	Fiber-glass reinforced Polyamide (PA6-GF30)
Operating temperature	-4070 °C
Storage temperature	-4085 °C
Protection class	IP20
Approvals	CE, cULus

FEN20EN1 Dimensioned Drawing





TBEN-Lx-EN1 Connection Options

Connection to Ethernet

The connection to Ethernet is realized via the integrated auto-crossing switch is done using two 4-pole, D-coded M12 x 1-Ethernet-connectors.

Ethernet M12 x 1



ETH1 (P1)

ETH2 (P2)



Supply voltage 7/8", 5-pole





X1= voltage IN X2 = voltage OUT for supplying the next node V1 = supply voltage 1 (incl. supply of electronics)

_

V2 = supply voltage 2

Supply voltage 7/8", 4-pole





- X1= voltage IN X2 = voltage OUT for supplying the next node
- V1 = supply voltage 1 (incl. supply of electronics) V2 = supply voltage 2

Inputs/outputs

The connection of sensors is realized via 8 M12 x 1-connectors.

Inputs/outputs M12 x 1





-C C0...C7 Input Pin assignments

Grounding the Station (FE)

Metal clamp and metal ring are connected.

The mounting screw (3) through the station's mounting hole connects the shield of the fieldbus lines to the FE of power supply and sensors/actuators and the installation's reference potential.

If a common reference potential is not desirable, remove the metal clamp for decoupling and/or mounting the station by using a plastic screw.

Dismounting the metal clamp

> Use a slim slotted screwdriver in order to lift up and remove the metal clamp.



Mounting the metal clamp

> Place the metal clamp between the fieldbus connectors by using a screwdriver in such way that the clamp contacts the metal housing of the connectors.

→ The shielding of the fieldbus lines is now again connected to the metal clamp.





FEN20-EN1 Connection Options

Terminal assignment

Ethernet 1 = TX + 2 = TX - 3 = RX + 4 = n.c. 5 = n.c. 6 = RX - 7 = n.c. . $8 = n.c.$
Power Supply $ \begin{array}{c} 1 = \textcircled{0} \\ 2 = V1 - \\ 3 = V1 + \end{array} $
Input Channels $ \begin{array}{c} 1 = V1 - 6 = 14 \\ 2 = 10 7 = 15 \\ 3 = 11 8 = 16 \\ 4 = 12 9 = 17 \\ 5 = 13 10 = V_{OUT}1 + \end{array} $ Pin 10 (VOUT1+) is powered by V+, Pin 1 V1- is common to V 3-wire $ \begin{array}{c} 1 = 2 3 4 5 6 7 8 9 10 \\ \hline 0 0 0 0 0 0 0 0 0 0 0 \\ \hline 1 / 0 0 + \end{array} $ 2-wire $ \begin{array}{c} 1 = 2 3 4 5 6 7 8 9 10 \\ \hline 0 0 0 0 0 0 0 0 0 0 0 \\ \hline 1 / 0 0 + \end{array} $

Spanner Setup and Addressing

TBEN-Lx-EN1 Address Mode Assignment

Setting the address mode is dome through 3 rotary coding-switches on the gateway.



000: 192.168.1.254 1 - 254: static rotary 300: BootP 400: DHCP 500: PGM 600: PGM-DHCP 900: F_Reset



ATTENTION!

Protective cover opened

Protection class IP65/IP67/IP69K not warranted

- Screw the protective cover over the rotary coding-switches firmly
- Check if seal of the protective cover is correctly placed



NOTE

After every change of the address-mode, a voltage reset must be done.

Mode: Static rotary

switch position: 001 - 254

When using the rotary-mode, the last byte of the station's IP address can be set via the rotary coding switches.

Addresses in the range from 0 to 255 can be allocated, whereas 1 is normally reserved for the defaultgateway and 0 and 255 for broadcast messages in the subnet.

In TURCK devices, 0 is used to reset the device to the default IP address



NOTE

We therefore recommend addresses in the range of 2-254.

Mode: BootP (300)

switch position: 300

Address setting is carried out by a BootP-server in the network after the start-up of the gateway.



NOTE

The IP address, as well as the default subnet mask assigned to the station by the BootP-server, are stored permanently in the station's EEPROM.

In case of switching the device to rotary- or PGM-mode, the settings carried out via BootP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

PROFINET

Please assure, that in PROFINET-applications, the address assigned via a BootP-server corresponds to the address, which is assigned in the configuration tool.



Mode: DHCP (400)

switch position: 400

Address setting is carried out by a DHCP-server in the network after the start-up of the gateway.



NOTE

The IP address, as well as the default subnet mask assigned to the station by the DHCP-server, are stored permanently in the station's EEPROM.

In case of switching the device to rotary- or PGM-mode, the settings carried out via DHCP (IP address, subnet mask, etc) will be taken from the module's EEPROM.

DHCP supports three mechanisms for IP address allocation:

- In "automatic allocation", the DHCP-server assigns a permanent IP address to a client.
- In "dynamic allocation", DHCP assigns an IP address to a client for a limited period of time. After this time, or until the client explicitly relinquishes the address, the address can be re-assigned.
- In "manual allocation", a client's IP address is assigned by the network administrator, and DHCP is used simply to convey the assigned address to the client.

PROFINET

Please assure, that in PROFINET-applications, the address assigned via a BootP-server corresponds to the address, which is assigned in the configuration tool.

Mode: PGM (500)

switch position: 500

The PGM-mode enables access of the software I/O-ASSISTANT to the module's network settings.



In the PGM-mode, all network settings (IP address, subnet mask, etc.) are send to the module's internal EEPROM and stored permanently.

Mode: PGM-DHCP (600)

NOTE

switch position: 600

The device sends DHCP-requests until a IP address is assigned (DHCP-server, PROFINET-controller).

The assigned IP-address is stored to the device and the DHCP-client is stopped.

Even after a restart of the device, the device sends no further DHCP-requests.

PROFINET

This mode assures a PROFINET-compliant operation of the modules.

If a DHCP-server is used within the network, problems may occur during IP-assignment. In this case, both, the DHCP-server as well as the PROFINET-controller (via DCP), try an IPaddress-assignment.

Resetting the IP address, switch position '000'

NOTE

With this setting the rotary coding-switches to "000" followed by a voltage reset, the module is set to the address 192.168.1.254 for IP-based services (seeDefault setting of the gateway (page 6-5)).



Setting "000" is no operation mode! Please set the device to another mode after having reset the IP address to the default values.

Default setting of the gateway

The stations' default-settings are as follows:

IP address	192.168.1.254
Subnet mask	255.255.255.0
default gateway	192.168.1.1



NOTE

The stations can be reset by the user to these default settings at any time. To reset the module, set the 3 coding-switches on the gateway to "000" followed by a poweron reset.

!

ATTENTION!

Protective cover opened

Protection class IP65/IP67/IP69K not warranted

- Screw the protective cover over the rotary coding-switches firmly
- Check if seal of the protective cover is correctly placed

Factory Rest (F_Reset), switch position '900'

F_Reset (Reset to factory setting)

switch position: 900

This mode sets all device-settings back to the default values and deletes all data in the device's internal flash.



NOTE

Setting 900 is no operation mode! Please set the device to another mode after having reset the IP address to the default values.



ATTENTION!

Protective cover opened

Protection class IP65/IP67/IP69K not warranted

- Screw the protective cover over the rotary coding-switches firmly
- Check if seal of the protective cover is correctly placed

Set Button

The set button is placed to the left of the rotary coding switches under the cover on the device. Pushing this button causes a device re-start.





FEN20-EN1 Address Mode Assignment

The FEN20-EN1 has no rotary switches and is permanently set to mode PGM-DHCP. A factory reset (F_Restet) can be performed by pressing the 'Reset' button that is recessed into the front of the device.

Assign the IP Address with Turck IP Address Tool (Port 1 only)

The Turck IP Address tool can be used to set the IP address of either the TBEN-Lx-EN1 or the FEN20-EN1 in rotary switch mode PGM (500) or PGM_DHCP (600). The tool can also be used to change the first 3 octets of the IP address as well as netmask and gateway in other rotary switch modes.

Note: For the TBEN-Lx-EN1 and the FEN20-EN1 Ethernet Spanners the Ethernet cable MUST be plugged into Port 1 for the Turck IP Address Tool to work correctly. The address of Port 2 CNANOT be set with Turck Address Tool, for users that need to assign IP addresses to ports 1 and 2 the Webserver is recommended and discussed in the following section.

Open the Turck IP Address tool and hit Search:

💳 Tur	ck IP Address Tool, Ve	ers. 2.0.0.0								
Search	Search Change Wink Reset Factory reset Clipboard Language Help Close					TURC BC				
No.	MAC address	Device na	IP address	Netmask	Gateway	Mode	Device type	Version	Adapter	
777 1	00:07:46:25:81:D7		192.168.1.25	255.255.255.0	192.168.1.1	PGM_DHCP	FEN20-EN1	3.1.21.0	192.168.1.200	
2	00:07:46:08:22:7F		<u>192.168.1.100</u>	255.255.255.0	192.168.1.1	PGM_DHCP	TBEN-L5-EN1	3.1.22.0	192.168.1.200	
Found	2 Devices.			1	1					.::

Click on the device you want to address, click Change and the IP Configuration. You should see the following window:

	Change device IP configuration	
Turck IP Address Tool, Vers. 2.0.0.0	IP configuration	
Search Change Wink Reset Factory reset Clipboa	MAC address IP address 00:07:46:25:81:D7 192.168.1.60	THEICK Industral Advancedon
No. MAC address Device na IP address Ne	Netmask Gateway	e Version Adapter
7 1 00:07:46:25:81:D7 <u>192.168.1.25</u> 25	255.255.255.0 192.168.1.1	1 3.1.21.0 192.168.1.200
2 00:07:46:08:22:7F <u>192.168.1.100</u> 25	Set IP configuration temporarily	N1 3.1.22.0 192.168.1.200
Found 2 Devices.	Write to device Cancel	
	:	

Type your IP address, netmask and gateway into the Change device IP configuration dialogue and hit Write to Device:

- Tur	ck IP Address Tool, Ve	ers. 2.0.0.0					-			
Search	Change Wink	Reset Fac	tory reset Clipt	board Languag	ge Help	Close				Industrial Automation
No.	MAC address	Device na	IP address	Netmask	Gateway	Mode	Device type	Version	Adapter	
- 1	00:07:46:25:81:D7		<u>192.168.1.60</u>	255.255.255.0	192.168.1.1	PGM_DHCP	FEN20-EN1	3.1.21.0	192.168.1.200	
2	00:07:46:08:22:7F		<u>192.168.1.100</u>	255.255.255.0	192.168.1.1	PGM_DHCP	TBEN-L5-EN1	3.1.22.0	192.168.1.200	
Found	2 Devices.									.::

The IP address is now set. You can close the Turck IP Address Tool.

Assign the IP Address with the Webserver (Port 1 & 2)

The Webserver of the TBEN-Lx-EN1 and the FEN20-EN1 can be used to set the IP address for Port 1 and 2 of the Ethernet Spanner, other functionalities of the webserver will be discussed in sections to follow.

Type the IP address of the device into your web browser, if the device is out of the box or has been reset to factory defaults the IP Address of both Port 1 and Port 2 is 192.168.1.254:

Station Information X			
\leftarrow \rightarrow C \bigtriangleup $(192.168.1.254)$	nfo.html	⊕ ☆ 🕄	О Ф С Т :
🗰 Apps 🚼 iGoogle 🖓 TURCK Conne	et 🝷 TURCK USA - Capaciti 🝷 TURCK – Your Global		» Other bookmarks
FEN20-EN1 Embedded Website of FEN20-Small	Block I/O Module		TURCK
	Password	[Login]	Industrial Automation
Station Information >			
Station Information Station Diagnostics Event Log	Station Information		
Ethernet Statistics	Туре	F	EN20-EN1
Ethernet/IP Memory Map Modbus/TCP Memory Map	Identification Number	6	931305
Links	Firmware Revision	V	3.1.21.0
8DIP	Bootloader Revision	V	8.0.0.0
	EtherNet/IP Revision	V	2.7.0.0

Log into the clock with the default Admin password – password. The password can be reset by performing a factory reset on the device.

T Station Information ×								
← → C ☆ ③ 192.168.1.254	/info.html	@ 🛧 🕒 🗖 🗘 🖬 Т :						
👯 Apps 👌 iGoogle 🖵 TURCK Conr	🏥 Apps 🔧 iGoogle 🖓 TURCK Connect 💌 TURCK USA - Capaciti 💌 TURCK – Your Global / 💦 👋 📙 Other bookmarks							
FEN20-EN1 Embedded Website of FEN20-Small Block I/O Module								
	admin@192.168.1.20	0 [Logout] Industrial Automation						
Station Information >	-							
Station Information Station Diagnostics	Station Information							
Ethernet Statistics	Туре	FEN20-EN1						
Ethernet/IP Memory Map Modbus/TCP Memory Map	Identification Number	6931305						
Links	ks Firmware Revision V3.1.21.0							
Station Configuration Network Configuration	Bootloader Revision	V8.0.0.0						
Change Admin Password	EtherNet/IP Revision	V2.7.0.0						
8DIP	PROFINET Revision	V1.3.12.0						



Use the hyperlinks on the left hand pane of the screen to go to the **Network Configuration** screen of the device. Here you can program the IP Address for Port 1 and Port 2.

Hit the *Submit* button to save the changes to the block:

T Network Configuration							
	stwark config html						
TUNCK USA - Capaciti TUNCK – Your Global »							
FEN20-EN1 Embedded Website of FEN20-Small L	Embedded Website of FEN20-Small Block I/O Module						
admin@192.168.1.200 [Logout] Industrial Automation							
Network Configuration >							
Station Information Station Diagnostics	Network Settings						
Ethernet Statistics	Ethernet Port 1 setup	Autonegotiate 🔻					
Ethernet/IP Memory Map	Ethernet Port 2 setup	Autonegotiate 🔻					
Links	IP Address Port 1 (External Network)	192.168.1.60					
Station Configuration	IP Address Port 2 (Internal Network)	192.168.1.103					
Change Admin Password	Netmask Port 1 (External Network)	255.255.255.0					
8DIP	Default Gateway Port 1 (External Network)	192.168.1.1					
	MAC Address	00:07:46:25:81:d7					
	LLDP MAC Address 1	00:07:46:25:81:d8					
	LLDP MAC Address 2	00:07:46:25:81:d9					
	NAT 1:1 Mapping 1 External IP	0.0.0.0					
	NAT 1:1 Mapping 1 Internal IP	0.0.0.0					
	NAT 1:1 Mapping 2 External IP	0.0.0.0					
	NAT 1:1 Mapping 2 Internal IP	0.0.0.0					
	NAT 1:1 Mapping 3 External IP	0.0.0.0					
	NAT 1:1 Mapping 3 Internal IP	0.0.0.0					
	NAT 1:1 Mapping 4 External IP	0.0.0.0					
	NAT 1:1 Mapping 4 Internal IP	0.0.0.0					
	NAT 1:1 Mapping 5 External IP	0.0.0.0					
	NAT 1:1 Mapping 5 Internal IP	0.0.0.0					
	Submit Reset	-					

The IP Addresses for Ports 1 and 2 are now changed:

Station Information			3					
$\epsilon \rightarrow C \Delta$ (i) 192.168.1.60/	/info.html	☆ S C Ç ⊑ T	-					
👖 Apps 🔮 iGoogle 🖵 TURCK Conr	nect 🝷 TURCK USA - Capaciti 🝷 TURCK – Your Globa	al 🧼 🔛 Other bookmark	s					
FEN20-EN1 Embedded Website of FEN20-Small Block I/O Module								
	admin@192	.168.1.200 [Logout] Industrial Automation						
Station Information >								
Station Information Station Diagnostics	Station Information							
Ethernet Statistics	Туре	FEN20-EN1						
Ethernet/IP Memory Map	Identification Number	6931305						
Modbus/TCP Memory Map Links	Firmware Revision	V3.1.21.0	Ш					
Station Configuration	Bootloader Revision	V8.0.0.0						
Network Configuration	EtherNet/IP Revision	V2.7.0.0						
	PROFINET Revision	V1.3.12.0						
8DIP	Modbus TCP Revision	V1.3.0.0						
	Rotary Switch Mode	PGM DHCP						
	PROFINET Station Name							
	Network Settings							
	Ethernet Port 1 setup	Autonegotiate						
	Ethernet Port 2 setup	Autonegotiate						
	IP Address Port 1 (External Network)	192.168.1.60						
	IP Address Port 2 (Internal Network)	192.168.1.103						
	Netmask Port 1 (External Network)	255.255.255.0						
	Default Gateway Port 1 (External Network)	192.168.1.1						
	MAC Address	00:07:46:25:81:d7						
	LLDP MAC Address 1	00:07:46:25:81:d8						
	LLDP MAC Address 2	00:07:46:25:81:d9						
	NAT 1:1 Mapping 1 External IP	0.0.0.0						
	NAT 1:1 Mapping 1 Internal IP	0.0.0.0						
	NAT 1:1 Mapping 2 External IP	0.0.0.0	-					
•		• • •						



The Webserver and Spanner Data Mapping

Spanner Data Mapping

The data map of the spanner can be seen on the **Station Information** page of the Webserver under the **Spanner Status** heading.

The data map consists of 240, 16-bit words. The status table for Port 1 shows the value of each word that is being written by the device that is mapped to Port 1, the status table for Port 2 shows the value of each word that is being written by the device that is mapped to Port 2.

Data from each port is loaded into the web page every time it is refreshed.

Port 1 spanner data	Offset (d)	00	01	02	03	04	05	06	07	08	09
	0	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0x0000
	10	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	20	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×000
	30	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	40	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x000
	50	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×000
	60	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×000
	70	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	80	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	90	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0001
	100	0×0000	0x0000	0x0000	0×0000	0x0000	0×0000	0×0000	0×0000	0x0000	0×000
	110	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	120	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x000x0
	130	0x0000	0×0000	0×0000	0x0000	0×0000	0×0000	0x0000	0+0000	0x0000	0x000
	140	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×000
	150	0×0000	0x0000	0x0000	0+0000	0×0000	0x0000	0x0000	0×0000	0×0000	0×000
	160	0×0000	0×0000	0x0000	0×0000	0×0000	0x0000	0x0000	0×0000	0×0000	0x000
	170	0x0000	0x0000	0x0000	0x0000	0×0000	0×0000	0x0000	0×0000	0×0000	0x000
	180	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	0×0000	0x0000	0×000
	190	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0×0000	0×0000	0×0000	0×000
	200	0x0000	0×0000	0x0000	0x0000	0×0000	0×0000	0x0000	0×0000	0x0000	0×000
	210	0x0000	0×0000	0x0000	0+0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×000
	220	0×0000	0×0000	0x0000	0+0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×000
	230	0×0000	0×0000	0x0000	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0001
spanner data	Offset (d)	00	01	02	03	04	05	06	07	08	09
	0	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x000
	10	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000
	20	0×0000	0×0000	0×0000	0+0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000
	30	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000
	40	0.0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000
		0+0000	0.0000	0.000	0,0000	0.0000	0×0000	0,0000	0×0000	0x0000	0×0000
	50			0,00000							
	50	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×000
	50 60 70	0×0000	0×0000	0×0000 0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×000
	50 60 70 80	0×0000 0×0000	0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000	0×0000 0×0000	0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000
	50 60 70 80 90	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000
	50 60 70 80 90	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000
	50 60 70 80 90 100	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 110	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000
	50 60 70 80 90 100 110 120 130	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120 130 130	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120 130 140 150	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120 130 140 150 160	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120 130 140 150 160 170	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000
	50 60 70 80 90 100 110 120 130 140 150 150 160 170	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000
	50 60 70 80 90 100 110 120 130 140 150 150 160 170 180 190	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001 0×0001
	50 60 70 80 90 100 110 120 130 140 150 150 160 170 180 190 200	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	
	50 60 70 80 90 100 110 120 130 140 150 150 160 170 180 190 200 210	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000 0+0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000 0×0000	

Data mapping of the Status and Input bits of the EN1 Spanner vary from protocol to protocol. The following mappings are for Ethernet/IP and Modbus/TCP, the same information can be added to a PROFINET project via GSDML file.

Modbus/TCP Status and Input mapping

SDIP (Input Data Mapping)						
Description	Register	Bit Offset	Bit Length			
Channel 0 - Input value	0x0000 (0)	0	1			
Channel 1 - Input value	0x0000 (0)	1	1			
Channel 2 - Input value	0x0000 (0)	2	1			
Channel 3 - Input value	0x0000 (0)	3	1			
Channel 4 - Input value	0x0000 (0)	4	1			
Channel 5 - Input value	0x0000 (0)	5	1			
Channel 6 - Input value	0x0000 (0)	6	1			
Channel 7 - Input value	0x0000 (0)	7	1			
Station Status Word (Input Data Mapping)						
Description	Register	Bit Offset	Bit Length			
Module Diagnostics Available	0x0001 (1)	0	1			
Station Configuration Changed	0x0001 (1)	3	1			
Overcurrent Isys	0x0001 (1)	5	1			
Overvoltage Field Supply UI	0x0001 (1)	6	1			
Undervoltage Field Supply Ul	0x0001 (1)	7	1			
Overvoltage Field Supply Usys	0x0001 (1)	8	1			
Undervoltage Field Supply Usys	0x0001 (1)	9	1			
Modulebus Communication Lost	0x0001 (1)	10	1			
Modulebus Configuration Error	0x0001 (1)	11	1			
INFO: Spanner connection established on Port 1	0x0001 (1)	12	1			
INFO: Spanner connection established on Port 2	0x0001 (1)	13	1			
Force Mode Enabled	0x0001 (1)	14	1			

Ethernet/IP Status and Input Mapping

Station Status Word (Input Data Mapping)			
Description	Word Offset	Bit Offset	Bit Length
Module Diagnostics Available	0	0	1
Station Configuration Changed	0	3	1
Overcurrent Isys	0	5	1
Overvoltage Field Supply UI	0	6	1
Undervoltage Field Supply UI	0	7	1
Overvoltage Field Supply Usys	0	8	1
Undervoltage Field Supply Usys	0	9	1
Modulebus Communication Lost	0	10	1
Modulebus Configuration Error	0	11	1
INFO: Spanner connection established on Port 1	0	12	1
INFO: Spanner connection established on Port 2	0	13	1
Force Mode Enabled	0	14	1
8DIP (Input Data Mapping)			
Description	Word Offset	Bit Offset	Bit Length
Channel 0 - Input value	1	0	1
Channel 1 - Input value	1	1	1
Channel 2 - Input value	1	2	1
Channel 3 - Input value	1	3	1
Channel 4 - Input value	1	4	1
Channel 5 - Input value	1	5	1
Channel 6 - Input value	1	6	1
Channel 7 - Input value	1	7	1



MODBUS/TCP General Description (Port 1 and/or Port 2)

Common Modbus description

	1	2			
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NOTE

The following description of the Modbus protocol is taken from the Modbus Application Protocol Specification V1.1 of Modbus-IDA.



TECHNICAL BASICS

Modbus is an application layer messaging protocol, positioned at level 7 of the OSI model, that provides client/server communication between devices connected on different types of buses or networks.

The industry's serial de facto standard since 1979, Modbus continues to enable millions of automation devices to communicate. Today, support for the simple and elegant structure of Modbus continues to grow.

The Internet community can access Modbus at a reserved system port 502 on the TCP/IP stack.

Modbus is a request/reply protocol and offers services specified by function codes. Modbus function codes are elements of Modbus request/reply PDUs (Protocol Data Unit).

It is currently implemented using:

- TCP/IP over Ethernet. (that is used for the TBEN-L modules and described in the following)
- Asynchronous serial transmission over a variety of media (wire: RS232, RS422, RS485, optical: fiber, radio, etc.)
- Modbus PLUS, a high speed token passing network.

Schematic representation of the Modbus Communication Stack (according to Modbus Application Protocol Specification V1.1 of Modbus-IDA):



Protocol description



TECHNICAL BASICS

The Modbus protocol defines a simple protocol data unit (PDU) independent of the underlying communication layers.

The mapping of Modbus protocol on specific buses or network can introduce some additional fields on the application data unit (ADU).

The Modbus application data unit is built by the client that initiates a Modbus transaction. The function code indicates to the server what kind of action to perform.

The Modbus application protocol establishes the format of a request initiated by a client. The field function code of a Modbus data unit is coded in one byte. Valid codes are in the range of 1... 255 decimal (128 – 255 reserved for exception responses).

When a message is sent from a Client to a Server device the function code field tells the server what kind of action to perform. Function code "0" is not valid.

Sub-function codes are added to some function codes to define multiple actions.



The data field of messages sent from a client to server devices contains additional information that the server uses to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the data field.

The data field may be non-existent (= 0) in certain kinds of requests, in this case the server does not require any additional information. The function code alone specifies the action. If no error occurs related to the Modbus function requested in a properly received Modbus ADU the data field of a response from a server to a client contains the data requested.





If an error related to the Modbus function requested occurs, the field contains an exception code that the server application can use to determine the next action to be taken.



Data model

The data model distinguishes four basic data types:

Data Type	Object type	Access	Comment
Discrete Inputs	bit	Read	This type of data can be provided by an I/O system.
Coils	bit	Read-Write	This type of data can be alterable by an application pro- gram.
Input Registers	16 bit, (word)	Read	This type of data can be provided by an I/O system.
Holding Registers	16 bit, (word)	Read-Write	This type of data can be alterable by an application pro- gram.



TECHNICAL BASICS

For each of these basic data types, the protocol allows individual selection of 65536 data items, and the operations of read or write of those items are designed to span multiple consecutive data items up to a data size limit which is dependent on the transaction function code.

It's obvious that all the data handled via Modbus (bits, registers) must be located in device application memory.

Access to these data is done via defined access-addresses (see Modbus-registers (page 6-18)).

Implemented MODBUS Functions

The TBEN-Lx-EN1 and the FEN20-EN1 support the following functions for accessing process data, parameters, diagnostics and other services.

Functio	n codes
No.	Function
	Description
3	Read Holding Registers
	Serves for reading multiple output registers.
4	Read Input Registers
	Serves for reading multiple input registers.
6	Write Single Register
	Serves for writing a single output register.
16	Write Multiple Registers
	Serves for writing multiple output registers.
23	Read/Write Multiple Registers
	Reading and writing of multiple registers.

MODBUS/TCP EN1 Process Data Map – HEX (Decimal)

8DIP (Input Data Mapping)				
	Description	Register	Bit Offset	Bit Length
Channel 0 - Input value		0×0000 (0)	0	1
Channel 1 - Input value		0×0000 (0)	1	1
Channel 2 - Input value		0x0000 (0)	2	1
Channel 3 - Input value		0x0000 (0)	3	1
Channel 4 - Input value		0×0000 (0)	4	1
Channel 5 - Input value		0x0000 (0)	5	1
Channel 6 - Input value		0x0000 (0)	6	1
Channel 7 - Input value		0×0000 (0)	7	1
Station Status Word (Input Data Mapping)				
	Description	Register	Bit Offset	Bit Length
Module Diagnostics Available		0x0001(1)	0	1
Station Configuration Changed		0x0001(1)	3	1
Overcurrent Isys		0x0001(1)	5	1
Overvoltage Field Supply UI		0x0001(1)	6	1
Undervoltage Field Supply UI		0x0001(1)	7	1
Overvoltage Field Supply Usys		0x0001(1)	8	1
Undervoltage Field Supply Usys		0x0001(1)	9	1
Modulebus Communication Lost		0x0001(1)	10	1
Modulebus Configuration Error		0x0001(1)	11	1
INFO: Spanner connection established on Port 1		0x0001(1)	12	1
INFO: Spanner connection established on Port 2		0x0001(1)	13	1
Force Mode Enabled		0x0001(1)	14	1
Spanner Data				
	Description	Register	Bit Offset	Bit Length
Spanner Data		0x3000 (12288)	0	up to 240 registers

Modbus/TCP Output Data Mapping

Spanner Data			
Description	Register	Bit Offset	Bit Length
Spanner Data	0x3400 (13312)	0	up to 240 registers



MODBUS/TCP All Registers

Address (hex.)	Access A	Description
0x0000 to 0x0000	ro	8 DIP - Input Data Mapping
0x0001 to 0x0001	ro	Station Status Word
0x3000 to 0x30EF	ro	packed process data of inputs (process data length of the modules
0x3400 to 0x34EF	rw	packed process data of outputs (process data length of the modules
0x1000 to 0x1006	ro	Station Identifier
0x100C	ro	Station status
0x1012	ro	process image length in bit for the intelligent output modules
0x1013	ro	process image length in bit for the intelligent input mod- ules
0x1017	ro	Register-mapping-revision (always 1, if not, mapping is incompatible with this description)
0x1020	ro	watchdog, actual time [ms]
0x1120	rw	watchdog predefined time [ms] (default: 0),
0x1130	rw	Modbus connection mode register
0x1131	rw	Modbus connection timeout in sec. (Def.: 0 = never),
0x113C to 0x113D	rw	Modbus parameter restore (reset of parameters to default values)
0x113E to 0x113F	rw	Modbus parameter save (permanent storing of parameters)

Register 1130h: "Modbus-Connection-Mode"

This register defines the behavior of the Modbus connections:

Bit	Name
	– Description
15 to 2	reserved
1	MB_ImmediateWritePermission
	 - 0: With the first write access, a write authorization for the respective Modbus-connection is requested. If this request fails, an exception response with exception-code 01h is generated. If the request is accepted, the write access is executed and the write authorization remains active until the connection is closed. - 1: The write authorization for the respective Modbus-connection is already opened during the establishment of the connection. The first Modbus-connection thus receives the write authorization, all following connections don't (only if bit 0 = 1).
0	MB_OnlyOneWritePermission
	 - 0: all Modbus-connections receive the write authorization - 1: only one Modbus-connection can receive the write permission. A write permission is opened until a Disconnect. After the Disconnect the next connection which requests a write access receives the write authorization.

Register 1131h: "Modbus-Connection-Timeout"

This register defines after which time of inactivity a Modbus-connection is closed through a Disconnect.

Behavior of the BUS LED

In case of a Connection Timeout the BUS LED's behavior is as follows:

Connection- Timeout	BUS LED
Time elapsed	green, flashing

Register 0x113C and 0x113D: "Restore Modbus-Connection-Parameters"

Register 0x113C and 0x113D are used to reset the parameter-register 0x1120 and 0x1130 to 0x113B to default.

For this purpose, write 0x6C6F to register 0×113E. To activate the reset of the registers, write 0×6164 ("load") within 30 seconds in register 0×113D.

Both registers can also be written with one single request using the function codes FC16 and FC23.

The service resets the parameters without saving them. This can be achieved by using a following "save" service.



Register 0x113E and 0x113F: "Save Modbus-Connection-Parameters"

Registers 0x113E and 0x113F are used for permanent storing the parameters in registers 0x1120 and 0x1130 to 0x113B.

For this purpose, write 0x7361 to register $0\times113E$. To activate the saving of the registers, write 0×7665 ("save") within 30 seconds in register $0\times113F$.

Both registers can also be written with one single request using the function codes FC16 and FC23.

Error behavior (watchdog)

Behavior of outputs

In case of a failure of the Modbus communication, the outputs' behavior is as follows, depending on the defined time for the Watchdog (register 0x1120

- watchdog = 0 ms (default)
 - → outputs hold the momentary value
- watchdog > 0 ms
 - → outputs switch to 0 after the watchdog time has expired (setting in register 0×1120).



NOTE

Setting the outputs to predefined substitute values is not possible in Modbus TCP. Eventually parameterized substitute values will not be used.

Mapping the FEN20-EN1 Spanner into a CoDeSys V3 Project via MODBUS/TCP

The FEN20-EN1 Spanner is addressed as follows via the Webserver

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The Station Information X								
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Embedded Website of FEN20-Small Bi	IOCK I/O MODUIE					_		
Station Information >			Password	[Login]		Automa	tion	
Station Information								-
Station Diagnostics	Station Information							
Event Log Ethernet Statistics	Туре	FEN20-EN1						
Ethernet/IP Memory Map	Identification Number	6931305						
Modbus/TCP Memory Map	Firmware Revision	V3.1.21.0						
	Bootloader Revision	V8.0.0.0						
SDIP	EtherNet/IP Revision	V2.7.0.0						
	PROFINET Revision	V1.3.12.0						
	Modbus TCP Revision	V1.3.0.0						
	Rotary Switch Mode	PGM DHCP						
	PROFINET Station Name							
	Network Settings							
	Ethernet Port 1 setup	Autonegotiate						
	Ethernet Port 2 setup	Autonegotiate						
	IP Address Port 1 (External Network)	192.168.1.60						
	IP Address Port 2 (Internal Network)	192.168.1.103						
	Netmask Port 1 (External Network)	255.255.255.0						
	Default Gateway Port 1 (External Network)	192.168.1.1						
	MAC Address	00:07:46:25:81:d7						
	LLDP MAC Address 1	00:07:46:25:81:d8						
	LLDP MAC Address 2	00:07:46:25:81:d9						
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Create a TX507 Portrait Project in CODESYS V3.5 (CODESYS V3.5 SP 8 Patch 1)

Scan the TX507 HMI into the CODESYS Project. For detailed instructions see the document BLxx-PG-EN-V3 MODBUS-TCP Master Start Up Guide v1.0.pdf





Right Click the *Device* and add an *Ethernet Adapter* Card (TURCK v3.5.7.20 or newer).

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Double click on the *Ethernet Adapter* card. Click the Ellipsis to load the Ethernet IP Address information from the HMI. Click *OK*.



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Right click the Ethernet Card, click Add Device... and add a Modbus TCP Master

Once the *Modbus_TCP_Master* is added, double click on it and check the *Auto-reconnect* box

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Add Device Close			Add Device Close

Right click the Modbus_TCP_Master, click Add Device... and add a Modbus TCP Slave





Double click on the *ModbusTCP_Slave*, in the *General* tab enter the parameters below to map Port 1 of the FEN20-EN1 Spanner at IP Address 192.168.1.60

FEN20-EN1_User_Manual.project* - CODESYS				
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In the *Modbus Slave Channel* tab enter the parameters below to use all of the 240 I/O words in the FEN20-EN1.

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FEN20-EN1_User_Manual			1
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In the *Modbus Slave Channel* tab enter the parameters below to use all of the 240 I/O words in the FEN20-EN1.

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In the *Modbus Slave Channel* tab enter the parameters below to use all of the 240 I/O words in the FEN20-EN1.

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	Modbus Slave Channel	Spanner_Inputs_0 Spanner_Inputs_1	Read Holding Registers (Function Code 03) Read Holding Registers (Function Code 03)	Cyclic, t#100ms Cyclic, t#100ms	16#3000 16#3077	120 120	Set to ZERO Set to ZERO			
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VISU_TASK	Status	Access Type	Write Multiple Registers (Supption Code 16)	_						
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In the Modbus Slave Channel tab enter the parameters below to use all of the 240 I/O words in the FEN20-EN1.

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The following Modbus Slave Channels should be set



Under the *ModbusTCPSIave I/O Mapping* tab change the value of the *Always Update Variables* drop down box to *Enabled 2 (Always in Bus Cycle)*

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FEN20-EN1_User_Manual	Count	Channels						
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Application	Modbus Slave Channel		mapping	Engener Insuite 0	AUGIESS 9/ TWED	ADDAX [0, 110] OF WODD	Default value	Dead Helding Degisters
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NOTE: The Modbus/TCP PLC may need to use "read/write multiple registers" (FC23) service code to read/write entire memory area starting with the first address of that area. It is up to the user to decide how many registers to read and write, but the read/write access may need to start with the beginning of the segment in order to achieve data transfer consistency between PLCs. It is up to the user to test data transfer consistency when multiple blocks of I/O data are read from and written to a single Spanner port.

Click Online -> Login and download the program to the TX507. Follow the prompts.

CODESYS	
?	Application 'Application' does not exist on device 'Device'. Do you want to create it and proceed with download?
	Yes No Details



Click the Start button

Image: Set gen project geld gene gelds grek geld gene gelds geld gene gelds grek geld gene gelds geld	FEN20-EN1_User_Manual.project* - CODESYS		state in the state of the local	State of the local division of the local div						. • • × •		
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With the TX507 in run mode Port 1 of the Spanner is now being scanned

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Writing values to the outputs (QWs) will be reflected in the Port 1 Spanner Data map in the Webserver. These values can also be read in as inputs by a device hooked to Port 2 of the Spanner.



Corresponding Port 1 Spanner data reflected in the Web Server.

T Station Information ×											<u></u>		3
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		60	0x0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
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		120	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	1
		130	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	1
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TURCK

Input values (IWs) will be reflected in the Port 2 Spanner Data map in the Webserver. These values need to be written by a device connected to Port 2. Connecting the MODBUS Server Tester to Port 1 (192.168.1.103) and writing inputs 0-9 generates the following data words on Port 2 of the Spanner.

🕞 Define Data (16 bits register)	🔁 Modbus Server Tester
Cursor position : register Binary Decimal 0000 F0F0 0001 FFFF ABCD 1010 FF00 00FF F56A	File View Tests Help Image: Sent
Automatic initialization since the position 1 to 9 with the value Validate	N° Date(ms) Type Frame
	1 0.00 Req 00 01 00 00 00 19 FF 10 34 00 00 09 12 00 0
Cancel < Back Next> Finish	F0 00 01 FF FF AB CD 10 10 FF 00 00 FF F5 6A 2 4.45 Resp 00 01 00 00 00 06 FF 10 34 00 00 09

In the Webserver Port 2 Spanner Data

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			210	0x0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000		*
			220	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0×0000	0x0000	0x0000		
			230	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000		
	Port 2 spanner data	ſ	Offset (d)	00	01	02	03	04	05	06	07	08	09	j	
		L	0	0x0000	0×f0f0	0×0001	0×ffff	0xabcd	0×1010	0xff00	0x00ff	0xf56a	02000		
			10	0x0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000		
			20	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000		
			30	0x0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x0000	0x0000	0x0000		
			40	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000		

This data is now reflected in the Input words (IWs) of the TX507 CODESYS V3 HMI.

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evices 👻 🗸 🛪 🗙	Modbus_TCP_Slave X									
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Connected] (TX507-P3CV01)	General	Channels				_				
E I PLC Logic		Variable	Mapping	Channel	Address	Туре	Default Value	Current Value	Prepared Value	Unit 4
= O Application [run]	Modbus Slave Channel	- *		Spanner_Inputs_0	%IW50	ARRAY [0119] OF WORD				-
ImagePool	Madhua Clava Init	🕮 - 🦄		Spanner_Inputs_0[0]	%IW50	WORD		0		
Library Manager	Hodbus Slave Inc	1 - 1		Spanner_Inputs_0[1]	%IW51	WORD		61680		
PLC_PRG (PRG)	ModbusTCPSlave Parameters	😟 - 🧤		Spanner_Inputs_0[2]	%IW52	WORD		1		
🗏 🔛 Task Configuration	histobaster slave talaliteters	- *		Spanner_Inputs_0[3]	%IW53	WORD		65535		
🗏 🥩 MainTask	ModbusTCPSlave I/O Mapping	😟 - 🧤		Spanner_Inputs_0[4]	%IW54	WORD		43981		
- ④ PLC_PRG 응 양 VISU_TASK - ④ VisuLems.Visu_Prg		😐 🧤		Spanner_Inputs_0[5]	%IW55	WORD		4112		
	Status	10 - No		Spanner_Inputs_0[6]	%IW56	WORD		65280		
		1 - X		Spanner_Inputs_0[7]	%IW57	WORD		255		
	Information	10 - Ng		Spanner_Inputs_0[8]	%IW58	WORD		62826		
🗄 🔂 Visualization Manager		iii*≱		Spanner_Inputs_0[9]	%IW59	WORD		0		
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Ethernet/IP General Description (Port 1 and/or Port 2)

EtherNet/IP Communication Protocol



TECHNICAL BASICS

EtherNet/IP[™] is based on a connection-oriented communication model. This means that it is only possible to exchange data via specified connections assigned to the devices. Communication between the nodes in the EtherNet/IP[™] network can be carried out either via I/O Messages or Explicit Messages.

I/O Messages

I/O Messages serve to exchange high priority process and application data over the network. Communication between the slaves in the EtherNet/IP[™] network is carried out according to the Server/Client Model,

which means a producing application transmits data to another or a number of consuming applications. It is quite possible that information is passed to a number of Application Objects in a single device.

Explicit Messages

Explicit Messages are used to transmit low-priority configuration data, general management data or diagnostic data between two specific devices. This is a point-to-point connection in a Server/Client System that requires a request from a client always to be confirmed by a response from the server.

- Message Router Request

Consists of a service code, path size value, a message router path and service data. An EPATH is used in the message router path to indicate the target object.

Message Router Response

Consists of a service field with the most significant bit set. This is an echo of the service code in the request message with the most significant bit set. A reserved byte follows the service code, which is followed by the General Status code.

Communication Profile for Ethernet/IP Spanner

The following EtherNet/IP[™] communications types are supported:

- Unicast
- Multicast
- Cyclic Connection
- Unconnected (UCMM) Explicit Messaging
- Connected Explicit Messaging



TECHNICAL BASICS

A point-to-point connection that exists between two nodes only.

Multicast

A packet with a special destination address, which multiple nodes on the network may be willing to receive.

COS I/O Connection

COS (Change Of State) I/O Connections establish event-controlled connections. This means that the EtherNet/IP™ devices generate messages as soon as a change of status occurs.

Cyclic I/O Connection

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

UCMM

The EtherNet/IP[™] gateway offers the option of establishing explicit messaging via the UCMM port (Unconnected Message Manager Port).

UCMM-based explicit messaging is normally used for random, non-periodic requests. It is not recommended for frequent messaging because the UCMM input queue in a product is typically limited to just a few messages. Once this limit is reached, subsequent requests are ignored and must be retried.

Connected Explicit Messaging

CIP is a connection-based system. For most communications between nodes, a connection is used.

A connection is a path or a virtual circuit between two or more end points in a system. The purpose is to transfer data in the most efficient manner possible.

The Connection ID is a number that is associated with a communication relationship. Receiving nodes decode this key to know whether they must accept the data or not.

Ethernet/IP Standard Classes

Class Code	Object name
01 (0x01)	Identity Object (0x01)
04 (0x04)	Assembly Object (0x04)
06 (0x06)	Connection Manager Object (0x06)
245 (0xF5)	TCP/IP Interface Object (0xF5)
246 (0xF6)	Ethernet Link Object (0xF6)

Ethernet/IP EN1 Process Data Map

Connection	Assembly Instance	Size (in words)
Input	103	244
Output	104	244

Ethernet/IP Input Data Mapping

Station Status Word (Input Data Mapping)				
	Description	Word Offset	Bit Offset	Bit Length
Module Diagnostics Available		0	0	1
Station Configuration Changed		0	3	1
Overcurrent Isys		0	5	1
Overvoltage Field Supply UI		0	6	1
Undervoltage Field Supply UI		0	7	1
Overvoltage Field Supply Usys		0	8	1
Undervoltage Field Supply Usys		0	9	1
Modulebus Communication Lost		0	10	1
Modulebus Configuration Error		0	11	1
INFO: Spanner connection established on Port 1		0	12	1
INFO: Spanner connection established on Port 2		0	13	1
Force Mode Enabled		0	14	1
8DIP (Input Data Mapping)				
	Description	Word Offset	Bit Offset	Bit Length
Channel 0 - Input value		1	0	1
Channel 1 - Input value		1	1	1
Channel 2 - Input value		1	2	1
Channel 3 - Input value		1	3	1
Channel 4 - Input value		1	4	1
Channel 5 - Input value		1	5	1
Channel 6 - Input value		1	6	1
Channel 7 - Input value		1	7	1
Spanner Data				
	Description	Word Offset	Bit Offset	Bit Length
Spanner Data		4	0	up to 240 words

Note – The Spanner data starts at word offset 4 for both the Input and Output I/O Data Map.



Mapping the FEN20-EN1 Spanner into a SoftLogix v19 project via Ethernet/IP w/ Generic Device

The FEN20-EN1 Spanner is addressed as follows via the Webserver

Station Information	_						X
					_		-
$\langle \cdot \rangle \rightarrow \mathbf{C} \bigtriangleup$ (i) 192.168.1.6	0/info.html			\$		С) с	T :
👖 Apps 🔮 iGoogle 🖓 TURCK Co	onnect 🔄 TURCK USA - Capaciti 🚽 TURCK – Your Globa	I / 🔫 Home - Product News	5 Home - TUSA Teams		**	Other boo	okmarks
FEN20-EN1 Embedded Website of FEN20-Small	Block I/O Module					TURC	ik î
			Descurad	[Login]		Industrial	-
Station Information >			Password	[Lugin]		Automation	-
Station Information Station Diagnostics	Station Information						
Event Log Ethernet Statistics	Туре	FEN20-EN1					- 1
Ethernet/IP Memory Map	Identification Number	6931305					- 1
Modbus/TCP Memory Map Links	Firmware Revision	V3.1.21.0					- 1
	Bootloader Revision	V8.0.0.0					- 1
ODIP	EtherNet/IP Revision	V2.7.0.0					
	PROFINET Revision	V1.3.12.0					
	Modbus TCP Revision	V1.3.0.0					
	Rotary Switch Mode	PGM DHCP					
	PROFINET Station Name						
	Network Settings						
	Ethernet Port 1 setup	Autonegotiate					
	Ethernet Port 2 setup	Autonegotiate					
	IP Address Port 1 (External Network)	192.168.1.60					
	IP Address Port 2 (Internal Network)	192.168.1.103					
	Netmask Port 1 (External Network)	255.255.255.0					
	Default Gateway Port 1 (External Network)	192.168.1.1					
	MAC Address	00:07:46:25:81:d7					
	LLDP MAC Address 1	00:07:46:25:81:d8					
	LLDP MAC Address 2	00:07:46:25:81:d9					
	NAT 1:1 Mapping 1 External IP	0.0.0.0					
	NAT 1:1 Mapping 1 Internal IP	0.0.0.0					
	NAT 1:1 Mapping 2 External IP	0.0.0.0					
4	· ·						

Create a SoftLogix v19 project and all your PLC. Right click on the Ethernet card and select New Module ...





Select Generic Ethernet Module and hit OK



Name the Spanner in the **Name** field. For **Comm Format** select Data – INT. Enter the desired IP Address under **IP Address** (here we will map Ethernet/IP to Port 2 of the spanner). Enter the **Connection parameters** as pictured below and click OK.

🔀 RSLogix 5000 - SLX_R5232 in EIP_Spanner_User_Manual./	CD [1789-L60 19.11]
File Edit View Search Logic Communications Tools Window	Help
Offline RUN No Forces DK Bat	Image: Constraint of the state of
	H Harl Harl H H H H () () () () Favorites & Add-On & Safety & Alarms & Bit & Timer/Counter & Input/Output & Compare & Compute/Math & Move/Logical & File/Misc. & File/Shift & Segu
Controller Organizer Controller SLX_RS232 Controller Tags Con	Vew Maddle Image: Consection Parameters Type: EIF Verd: EIF Name: FIN20_Spanner Description: Image: Connection Parameters Image: Tell Parameters Configuration: 1 Image: Tell Parameters Image: Tell Parameters Image: Tell Parameters Tell Parameters

Set the desired RPI and check the Use Unicast Connection over Ethernet/IP check box. Click OK.

Module Properties: EIP (ETHERNET-MODULE 1.1)							
General Connection Module Info							
General Connection Module Info Requested Packet Interval (RPI): 10.0 + Inhibit Module + ms (1.0 - 3200.0 ms) Major Fault On Controller If Connection Fails While in Run Mode Vise Unicast Connection over EtherNet/IP Module Fault Module Fault							
Module Fault							
Status: Offline OK Cancel Apply Help							



Go Online and download the project. Put the PLC into Run mode.



Writing values to the output data tags of the FEN20_Spanner module will be reflected in the Port 2 Spanner Data map in the Webserver. These values can also be read in as inputs by a device hooked to Port 1 of the Spanner.



Note – Spanner Output data is offset by 4 words in the Ethernet/IP data mapping.

49

Port 2 Spanner data reflected in the Web Server.

	T Station	Informa	ation	×		nal to the next 2	lare bea	-	the address		-	-	-	-	-	-	and a design of	2		X
•	\leftrightarrow \rightarrow C		(i) 1	192.168.1.6	50/info.	html											۲ S	D ¢	G	т :
	Apps 👌	iGoog	le <mark>5</mark>	UTURCK C	onnect	TURCK USA - Capaciti	TURCK – You	ur Global /	🔫 Home -	Product N	ews 🚺	Home - T	USA Team	s 🖸 Lo	ig in to yo	ur Concu		» 📃	Other bo	okmarks
									220	0×0000	0×0000	0x0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	
									-230	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	
						Port 2 spanner data			Offset (d)	00	01	02	03	04	05	06	07	08	09	j
									0	0×000f	0x0000	0x00ff	0x0000	0x0fff	0x0000	0×ffff	0x0000	0x0000	0x0000	
÷									10	0.0000	0.0000	0.0000	0.0000	0×0000	0,0000	0.0000	0x0000	0x0000	0x0000	
									20	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0×0000	0x0000	0x0000	1
									30	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	0x0000	
									40	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	1

Input tag values will be reflected in the Port 1 Spanner Data map in the Webserver. These values need to be written by a device connected to Port 1. Connecting the MODBUS Server Tester to Port 1 (192.168.1.60) and writing inputs 0-9 generates the following data words on Port 1 of the Spanner.

🔯 Define Data (16 bits register)	Modbus Server Tester
	File View Tests Help
	🚰 🔛 😂 ⊣6 🎘 174 🖳 ▶ = 🎒 🦞 Exchange Control
F564	Sent 1 Exception 1 Invalid 0
Wizard Data Entry	Received 1 Error 0 No response 0
Automatic initialization since the position 1 to 9 with the value Validate	N° Date(ms) Type Frame
	1 0.00 Req 00 01 00 00 00 19 FF 10 34 00 00 09 12 00 0
Cancel < Back Next> Finish	F0 00 01 FF FF AB CD 10 10 FF 00 00 FF F5 6A
	2 4.45 Resp 00 01 00 00 00 06 FF 10 34 00 00 09

In the Webserver Port 1 Spanner Data

T Station Information												L		
← → C ☆ 🛈 192.168.1.60/in	nfo.html									٦	ት 🕄	00) G	т:
🗰 Apps 🔮 iGoogle 🖓 TURCK Conne	ct 🔽 TURCK USA - Capaciti	TURCK – Your Global	🔫 Home -	Product N	ews 🚺	Home - Tl	JSA Team	s 🖸 Lo	g in to yo	ur Concur		» 📙	Other bo	okmarks
	Port 1 spanner data	٢	Offset (d)	00	01	02	03	04	05	06	07	08	(9	1
		L	0	0×0000	0×f0f0	0×0001	0×ffff	0xabcd	0×1010	0xff00	0x00ff	0xf56a	0×0000	
			10	0x0000	0x0000	0x0000	00000	00000	00000	0x0000	000000	0x0000	0x0000	
			20	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
			30	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
			40	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0×0000	0x0000	1
														1



This data is now reflected in the Input tags of the Ethernet/IP PLC

R5Logix 5000 - SLX_R5232 in EIP_Spanner_User_Manual.ACD [1789-L60 19.11] ⁴	4			
File Edit View Search Logic Communications Tools Window Help				
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Controller Organizer - 🗸 🗸 🚺	Controller Tags - SLX_RS232(controller)			
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Power-Up Handler		{} {} Decimal	INT[240]	<u></u> =1
E Tasks	+ FEN20 Spanner:I.Data[0]	12288 Decimal	INT	
🗄 🙀 Main Bik		0 Decimal	INT	
Unscheduled Programs / Phases		0 Decimal	INT	
🖻 😁 Motion Groups	+-FEN20_Spanner:I.Data[3]	0 Decimal	INT	
Ungrouped Axes		0 Decimal	INT	
in-Ga CIP BL Serial	■ FEN20_Spanner:I.Data[5]	-3856 Decimal	INT	
🕀 😁 Data Types	FEN20_Spanner:I.Data[6]	1 Decimal	INT	
User-Defined	-FEN20_Spanner:I.Data[7]	-1 Decimal	INT	
E- Strings	FEN20_Spanner:I.Data[8]	-21555 Decimal	INT	
H	FEN20_Spanner:I.Data[9]	4112 Decimal	INT	
Module-Defined		-256 Decimal	INT	
- Trends		255 Decimal	INT	
E I/O Configuration		-2710 Decimal	INT	
Backplane, 1789-A17/A Virtual Chassis	FEN20_Spanner:I.Data[13]	0 Decimal	INT	
		0 Decimal	INT	
Ethernet	FEN20_Spanner:I.Data[15]	0 Decimal	INT	
EtherNet/IP EIP	+-FEN20_Spanner:I.Data[16]	0 Decimal	INT	
ETHERNET-MODULE FEN20_Spanner	+-FEN20_Spanner:I.Data[17]	0 Decimal	INT	
	++FEN2U_Spanner:I.Data[18]	0 Decimal	INI	
	+FEN2U_Spanner:I.Data[19]	0 Decimal	INI	
	+FEN20_Spanner:I.Data[20]	0 Decimal	INI	
	FEN20_Spanner:I.Data[21]	U Decimal	INI	
	+FEN20_Spanner:I.Data[22]	U Decimal	INI	
	FEN20_Spanner:I.Data[23]	U Decimai	INI	
	EEN20_Spanner(LData[24]	U Decimal	INT	
	LEEN20_SpannerI.Data[25]	0 Decimal	INIT	
	FEN20_spanneril.bata[27]	0 Decimal	INIT	
	EINZU_opannet.t.Data[27] EI-EEN20_Spanner!Data[28]	0 Decimal	INIT	
	Monitor Tags / Edit Tags /			▶
				<u> </u>

Mapping the FEN20-EN1 Spanner into a SoftLogix v20 and above project via Ethernet/IP w/ EDS File

With the project open, select New Module





Select the FEN20-EN1

1 RSLogix 5000 - EIP_Spanner_EDS_Test [1769-L16ER-BB1B 20.11]	
File Edit View Search Logic Communications Tools Window Help	
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Offline 🛛 🗸 🗖 RUN 👘 🙀 Path: RUN	
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Controller Organizer	
Cont Catalog Module Discovery Favorites	
Clear Filters Show Filters ≥	
Caladig winder Desciption Vendor Calegory	
- 🖬 Add-On	
Data Typ	
- Add-	
e - Cee, Prede	
Burger Strends	
Point Contraction of the second sec	
Add to Favorites	
i de la sector de	
Bus Size	
Ready	

Create a name. Select the number of 16 bit words to use with the Spanner, the recommended data size is INT. Add the IP address and click *OK*.





The Spanner can now be used as in the sample above.

B RSLogix 5000 - EIP_Spanner_EDS_Test [1769-L16ER-BB1B 20.11]*		
File Edit View Search Logic Communications Tools W	indow Help	
	🗸 👫 🖏 强 🔃 📝 🕾 🔍 Select a Language	• 📎
Offline 📴 🗖 BUN	x <none></none>	
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No Edits		
	avorites 🖌 Add-On 👗 Safety 👗 Alarms 👗 Bit 👗 Timer/C	
Controller Organizer - 4 X	Controller Tage - FID Spanner EDS Test(controller)	
🔐 🕞 🗁 Controller EIP_Spanner_EDS_Test		
😳 🦾 Controller Tags	Scope: 😰 EIP_Spanner_EI 👻 Show: All Tags 🔹 👻	Enter Name Filter
Controller Fault Handler	Name =∎ △ Value ← Force Ma:	sk 🗲 Style 🔺 🚕
Power-Up Handler	- FEN20_EN1_Spanner:0.Data {}	{} Decimal
E	FEN20_EN1_Spanner:0.Data[0] 0	Decimal 2 3
📄 🤕 Main Lask	+ FEN20_EN1_Spanner:0.Data[1] 0	Decimal
Harahadulad Daamaa	+ FEN20_EN1_Spanner:0.Data[2] 0	Decimal
Unscheduled Programs	+ FEN20_EN1_Spanner:0.Data[3] 0	Decimal
	+ FEN20_EN1_Spanner:0.Data[4] 0	Decimal
Add-On Instructions	+ FEN20_EN1_Spanner:0.Data[5] 0	Decimal
	+ FEN20_EN1_Spanner:0.Data[6] 0	Decimal
User-Defined	+ FEN20_EN1_Spanner:0.Data[7] 0	Decimal
Strings	+ FEN20_EN1_Spanner:0.Data[8] 0	Decimal
Add-On-Defined	+ FEN20 EN1 Spanner:0.Data[9] 0	Decimal
🕀 🎰 Predefined	+ FEN20 EN1 Spanner:0.Data[10] 0	Decimal
💮 🙀 Module-Defined	+ FEN20 EN1_Spanner:0.Data[11] 0	Decimal
Trends	+ FEN20_EN1_Spanner:0.Data[12] 0	Decimal
🚊 🔄 I/O Configuration	+ FEN20 EN1 Spanner:0.Data[13] 0	Decimal
🚊 📼 PointIO	+ FEN20 EN1 Spanner:0.Data[14] 0	Decimal
	+ FEN20 EN1 Spanner:0.Data[15] 0	Decimal
Embedded I/O	FEN20 EN1 Spanner:0.Data[16] 0	Decimal
[1] Embedded Discrete_IO	+ FEN20 EN1 Spanner:0.Data[17] 0	Decimal
Expansion I/O, 0 Modules	+ FEN20 EN1 Spanner:0.Data[18] 0	Decimal
in the second s	+ FEN20 EN1 Spanner:0.Data[19] 0	Decimal
1769-L16ER-BB1B EIP_Spanner_EDS_Test		T
6931305 FEN20_EN1_Spanner		
۲ III ا		
		.11

TECHNICAL BASICS

PROFINET is the innovative open standard for the implementation of end-to-end integrated automation solutions based on Industrial Ethernet. With PROFINET, simple distributed I/O and time-critical applications can be integrated into Ethernet communication just as well as distributed automation system on an automation component basis.

Distributed I/O with PROFINET IO

Distributed I/O is connected into communication through PROFINET IO. Here, the familiar I/O view of PROFIBUS is retained, in which the peripheral data from the field devices are periodically transmitted into the process model of the control system.

Device Model

PROFINET IO describes a device model oriented to the PROFIBUS framework, consisting of places of insertion (slots) and groups of I/O channels (sub slots). The technical characteristics of the field devices are described by the so-called GSD (General Station Description) on an XML basis.

Field bus integration

PROFINET offers a model for integration of existing field buses like PROFIBUS, AS-Interface, and INTERBUS.

This allows the construction of arbitrarily mixed systems consisting of fieldbus- and Ethernetbased segments. Thus a smooth technology transition is possible from fieldbus-based systems to PROFINET. The large number of fieldbus systems makes it necessary to support their simple integration into PROFINET for reasons of investment protection.

The integration is done with so-called "proxies". A proxy is a device which connects an underlying fieldbus with PROFINET. The proxy concept allows the device manufacturer, the plant and machine builder as well as the end user a high degree of investment protection.

Communications in PROFINET

Communications in PROFINET contain different levels of performance:

The non-time-critical transmission of parameters, configuration data, and switching information occurs in PROFINET in the standard channel based on UDP and IP. This establishes the basis for the connection of the automation level with other networks (MES, ERP).

For the transmission of time critical process data within the production facility, there is a Real-Time channel (RT) available.

For particularly challenging tasks, the hardware based communication channel lsochronous



UDP/IP communication

For non-time-critical processes, PROFINET uses communications with the standard Ethernet mechanisms over UDP/IP which follow the international standard IEEE 802.3. Similar to standard Ethernet, PROFINET field devices are addressed using a MAC and an IP address. In UDP/IP communications, different networks are recognized based on the IP address. Within a network, the MAC address is a unique criterion for the addressing of the target device. PROFINET field devices can be connected to the IT world without limitations. A prerequisite for this is that the corresponding services, for instance file transfer, must be implemented in the field device involved. This can differ from manufacturer to manufacturer.

Real-time communication (RT)

A data communication over the UDP/IP channel is provided with a certain amount of administrative and control information for addressing and flow control, all of which slows data traffic.

To enable Real-Time capability for cyclical data exchange, PROFINET abandons partially IP addressing and flow control over UDP for RT communications. The communication mechanisms of the Ethernet (Layer 2 of the ISO/OSI model) are very suitable for this. RT communications can always run in parallel with NRT communications.

The services of PROFINET IO

- Cyclic data exchange

For the cyclic exchange of process signals and high-priority alarms, PROFINET IO uses the RT channel.

- Acyclic data exchange (record data)

The reading and writing of information (read/write services) can be performed acyclically by the user. The following services run acyclically in PROFINET IO:

- parameterization of individual submodules during system boot
- reading of diagnostic information
- reading of identification information according to the "Identification and Maintenance (I&M) functions"
- reading of I/O data

Address assignment

In IP-based communications, all field devices are addressed by an IP address. PROFINET uses the Discovery and Configuration Protocol (DCP) for IP assignment. In the delivery state each device amongst others has a MAC address. This information is enough to assign each field device a unique name (appropriate to the installation). Address assignment is performed in two steps:

- Assignment of a unique plant specific name to the field device.

 Assignment of the IP address by the IO-Controller before system boot based on the plant specific (unique) name.

PROFINET EN1 Process Data Map

The PROFINET process data map is defined in the PROFINET project by the GSDML file. Please download and install the appropriate GSDML file for the Spanner and PROFINT PLC you plan to use. GSDML files can be found at www.turck.com

Use of the GSDML file is demonstrated in the following section.

Mapping the TBEN-L5-EN1 Spanner into a TIA Portal v13 Project via PORFINET

The TBEN-L5-EN1 Spanner is addressed as follows via the Webserver

Station Information ×	Dr Radious II have have a subscript have	at samples samples Addition of	ALC: NAME	A REAL PROPERTY AND INCOME.
← → C ☆ ③ 192.168.1.100/in	nfo.html		⊕ ☆ 😒	О Ф С Т :
🔢 Apps 🚼 iGoogle 🖓 TURCK Connec	tt 🝷 TURCK USA - Capaciti 💌 🛨 TURCK – Your Global / 🔫 Hor	me - Product News 🚺 Home - TUSA Teams		» 📙 Other bookmarks
TBEN-L5-EN1 Embedded Website of TBEN Block I/	'O Module			TURCK
		Password	[Login]	Industrial Automation
Station Information >				
Station Diagnostics	Station Information			
Event Log				
Ethernet Statistics Ethernet/IP Memory Map	l ype	IBEN-L5-EN1		
Modbus/TCP Memory Map	Identification Number	6814035		
Links	Firmware Revision	V3.1.22.0		
16DIP	Bootloader Revision	V8.0.1.0		
	EtherNet/IP Revision	V2.7.1.0		
	PROFINET Revision	V1.3.12.0		
	Modbus TCP Revision	V1.3.0.0		
	Rotary Switch Mode	PGM DHCP		
	PROFINET Station Name	tben-en1		
	Network Settings			
	Ethernet Port 1 setup	Autonegotiate		
	Ethernet Port 2 setup	Autonegotiate		
	IP Address Port 1 (External Network)	192.168.1.100		
	IP Address Port 2 (Internal Network)	192.168.1.90		
	Netmask Port 1 (External Network)	255.255.255.0		
	Default Gateway Port 1 (External Network)	192.168.1.1		
	MAC Address	00:07:46:08:22:7f		
	LLDP MAC Address 1	00:07:46:08:22:80		
	LLDP MAC Address 2	00:07:46:08:22:81		
	NAT 1:1 Mapping 1 External IP	0.0.0.0		
	NAT 1:1 Mapping 1 Internal IP	0.0.0.0		-
4	··· -			•



Create a project in TIA Portal



Use the Hardware Catalog to add a PLC to the project

M Siemens - C:\Users\Turck User\Documer	ts\Automation\TBEN_L5_EN1_User_Manual\TBEN_L5_EN1_User_Manual		- 6	×
Project Edit View Insert Online Opti	ons Tools Window Help 🔊 🛨 (🗥 🖞 🖥 🗓 🕼 🖳 🌌 Go online 🖉 Go offline 🏭 🌆 👫 🚽 🛄	Totally Integrated Automati PO	ion RTAL	
Project tree 🛛 🔳 🖣	TBEN_L5_EN1_User_Manual → Devices & networks	K Hardware catalog		
Devices	🛃 Topology view 🔒 Network view 🕅 Device view	Options		
				H
		u Catalan		rdv
TREN 15 EN1 licer Manual		✓ Catalog		are
Add new device	E	<search></search>		8
😤 🚠 Devices & networks	PLC_1	Filter		
PLC_1 [CPU 1211C DC/DC/DC]	CPU 1211C	✓ ☐ Controllers	^	ĕ
🧕 🕨 🙀 Common data		▼ SIMATIC \$7-1200		
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Languages & resources		CPU 1211C AC/DC/Rly	_	9
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		6557 211-1AE31-0AB0		slo
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		CPU 1214C AC/DC/Rly		
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		CPU 1215C AC/DC/Rly		ra
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		CPU 1215C DC/DC/Rly		
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	S7-1200 station_1 [S7-1200 Station] 📃 Properties 🚺 Info 😮 💟 Diagnostics 📰 🖃 🦷	CPU 1214FC DC/DC/DC		
	General IO tage System constants Tayte	CPU 1214FC DC/DC/Rly		
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		Unspecified CPU 1200	- 11	
	Project information	Communications modules	- 11	
		SIMATIC S7-1500	- 11	
✓ Details view	Name: S7-1200 station 1		- 11	
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Use the Properties -> PrROFINET Interface tab to assign the IP address and PROFINET device Name to the PLC

PLC_1 [CPU 1211C DC/DC/	DC]		🖸 Properties 🚺 Info 🖳 Diagnostics 💷 🗉	-
General IO tags	Syste	em constants Texts		
▼ General	^		Add new subnet	~
Project information				
Catalog information		IP protocol		
▼ PROFINET interface				
General			 Set IP address in the project 	
Ethernet addresses			IP address: 192 168 1 50	
 Advanced options 				
Interface options			Subhet mask: 255.255.0	
Real time settings			Use router	
Port [X1 P1]	=		Router address: 0 . 0 . 0 . 0	
Time synchronization	4		O IP address is set directly at the device	
Hardware identifier			о́ ,	
DI 6/DQ 4	-	PROFINET		
Al 2		PROFINET		
 High speed counters (HSC) 			PROFINET device name is set directly at the device	
 Pulse generators (PTO/PWM) 				
Startup			Generate PROFINE I device name automatically	
Cycle		PROFINET device name	plc_1	
Communication load		Converted name:	plcxb1d0ed	
System and clock memory		Device number:		
Web server	~	Device number.		
<				~



Use the Hardware	Catalog to add a	a spanner to	the project
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PLC_1 [CPU 1211C DC/DC/DC]		Controllers
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Name		✓ Information
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Portal view Overview	Devices & ne	() Scanning for devices completed for int

Use the **Properties** -> **PROFINET Interface tab** to assign the Spanner Port 2 IP address and PROFINET device Name to the Spanner



Note – PROFINET is supported on Port 2 only. If the PROFINET cable is hooked to Port 1 the Spanner will not respond to the PROFINET PLC.



In the Device View use the Hardware Catalog to assign the number of I/O words used in the Spanner.

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Common data				0 3	3					module status	ī
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Languages & resources	>									Spanner 1 Word Input and Output	
Online access	<u>Ki</u>									Spanner 112 Words Input and Output	
Card Reader/USB memory	<u> </u>									Spanner 128 Words Input and Output	
	6									Spanner 144 Words Input and Output	
										Spanner 16 Words Input and Output	=
										Spanner 160 Words Input and Output	
										Spanner 176 Words Input and Output	
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Note - the Spanner defaults to Spanner 4 Words Input and Output. This will have to be deleted to add a different amount of I/O Words.

The module now has 240 Words of Spanner I/O as well as the Module Status bits added.





In the *Project Tree*, open the *Online Access* Tab. Double click *Update accessible devices* and verify that the IP addresses and PROFINET names match in the connected devices.

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PC internal [Local]					noutnames					
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PLCSIM \$7-1200/\$7-1500 [PN/IE]		IP address	MAC address	Device typ	e PROFINET d	evice name	Status			
USB [S7USB]										
TeleService [Automatic protocol]										
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Above you can see the PROFINET name of the TBEN-L5-EN1 does not match the name we programmed into the project, TBEN-EN1

Re-assign the PROFINET name. In the *Project Tree* under the IP address 192.168.1.90 click *Online and Diagnostics*. Go to the *General tab -> Functions -> Assign Name* and assign the correct PROFINET name to the Spanner.

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In the **Project Tree**, double click on **Update accessible devices** and verify that the PROFINET name of the Spanner was changed.



In the *Network View* make the network connection from the PLC to the Spanner.

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Click Online -> Download to Device. Select the correct PLC and click Load.

xtended dow	nload to	device Configured access not	des of "PLC_1"					
		Device	Device type	Slot	Туре	Address	Subne	t
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		Compatible devices in	target subnet:	Type		Show all compat	ible devices	vice
		PLC 1	CPU 1211C DC/D	PN/IE		192 168 1 50	PLC 1	vice
F		-	_	PN/IE	,	Access address	-	
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1 Scan com	pleted. 1 co	ompatible devices of 2 a	accessible devices fou	ind.				^
☆? Retrieving ✓ Scan and i	device info information	rmation retrieval completed.						~
Display on	ly error me	ssages						
						Loa	d g	<u>C</u> ancel



Follow all Load prompts. Once the Load Results window is loaded check the Start All radio button and click Finish.

Load re	sults			×
:	Status	and actions after download	ding to device	
Status	1	Target	Message	Action
1		▼ PLC_1	Downloading to device completed without error.	
	1	Start modules	Start modules after downloading to device.	🛃 Start all
<			1111	>
			Finish	Load Cancel

Click Go Online. The module is now connected to the PLC and the PLC is running.

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Card Reader/USB memory			

In the *Project Tree, under Watch and Force tables*, select *Add New Watch Table*. Add I/O to the watch table. Click the *Monitor All* Icon to monitor the selected I/O

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			Connecte	d to PLC_1, address IP=192	2.168.1.50.				11	/21/2016 4:43:3	37 PM	=	
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	Portal view Overview		turck-tben-I5.	😸 Watch table_1						Connected	to PLC_1, address IP=1	92.1	

Note – Spanner I/O mapping can be found by selecting the Spanner from the *Network* view and going to the *Device Data* tab.

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		^		}	Module	Rack	Slot	I address	Q address	Туре	Article no.	Firmware
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		=	_	1	PN-IO	0	0 X1			turck-tben-l5-en1		
			_	1	16DIP_1	0	1	12		16DIP		
				1	Spanner 240 Words Input an	0	2	256735	256735	Spanner 240 Words		
				1	module status_1	0	3	34		module status		



Writing values to the outputs (QWs) will be reflected in the Port 2 Spanner Data map in the Webserver. These values can also be read in as inputs by a device hooked to Port 1 of the Spanner.

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Ιă	PLC_1 [CPU 1211C DC/DC/DC]	~	4		%IW262	Hex	16#0000					15 D	0
L L	Device configuration		5		%IW264	Hex	16#0000					8	ò
	😨 Online & diagnostics		6		%IW266	Hex	16#0000					-	
	Program blocks		7		%IW268	Hex	16#0000					4	4
	Technology objects		8		%IW270	Hex	16#0000					10	Ŧ
	External source files		9		%IW272	Hex	16#0000					an	ġ.
	PLC tags		10		%IW274	Hex	16#0000					es	5
	PLC data types		11		%QW256	Hex	16#000F	16#000F		1			
	Watch and force tables		12		%QW258	Hex	16#0000						
	Add new watch table		13		%QW260	Hex	16#00FF	16#00FF		1			
	Force table		14		%QW262	Hex	16#0000						
	Watch table_1		15		%QW264	Hex	16#0FFF	16#0FFF		A			
	Online backups		16		%QW266	Hex	16#0000						
	Program info		17		%QW268	Hex	16#FFFF	16#FFFF					
	Device proxy data		18		%QW270	Hex	16#0000						
	Text lists		19		%QW272	Hex	16#0000						
	Local modules	\checkmark	20		%QW274	Hex	16#0000						
	Distributed I/O	\checkmark	21		<add new=""></add>								
	🕨 🙀 Common data												
	N (200 particular and a station of the station o												

Corresponding Port 2 Spanner data reflected in the Web Server.

											x		
Station Information ×													
← → ⊂ ∆	③ 192.168.1.100/info.html							0	2 ☆ (3	¢ G	т	:
👯 Apps 🚼 iGo	ogle 🔚 TURCK Connect 🝷 TURCK USA - Capaciti 🝷 TURCK –	Your Global / 🔫	Home - P	roduct Ne	ws 🚯 H	lome - TU	SA Teams			>>	Other	bookmar	ks
		200	00000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	-
		210	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	-
		220	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0x0000	4
		230	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0x0000	1
	Port 2 spanner data	Offset (d)	00	01	02	03	04	05	06	07	08	09	1
		0	0x000f	0×0000	0x00ff	0×0000	0×0fff	0×0000	0xffff	0×0000	0x0000	0×0000	1
		10	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	1
		20	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x0000	1
		30	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0×0000	0×0000	
		40	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0×0000	0×0000)
		50	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	
		60	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	
		70	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0×0000	j
		80	0x0000	0×0000	0×0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x0000	j
		90	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0×0000	j
		100	0x0000	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	,
		110	0x0000	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0x0000	5
		120	0x0000	0×0000	0×0000	0×0000	0×0000	0x0000	0x0000	0x0000	0x0000	0×0000	5
		130	0x0000	0x0000	0x0000	0×0000	0x0000	0x0000	0x0000	0×0000	0x0000	0×0000	5
		140	0x0000	0x0000	0×0000	0×0000	0×0000	0x0000	0x0000	0×0000	0x0000	0×0000	5
		150	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0×0000	0x0000	0x0000	5
		160	0x0000	0x0000	0x0000	0×0000	0×0000	0×0000	0x0000	0×0000	0x0000	0x0000	
		170	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	
		100	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	0×0000	-
		180	0,0000	0,0000	0,0000	0,0000	0,0000	00000	0,0000	00000	00000	0,0000	"

Input vales (IWs) will be reflected in the Port 1 Spanner Data map in the Webserver. These values need to be written by a device connected to Port 1. Connecting the MODBUS Server Tester to Port 1 (192.168.1.100) and writing inputs 0-9 generates the following data words on Port 1 of the Spanner.

🕞 Define Data (16 bits register)	Modbus Server Tester
Cursor position : register Binary Decimal Decimal 0000 F0F0 0001 FFFF ABCD 1010 FF00 00FF F56A Wizard Data Entry	File View Tests Help Image: Sent Image: Sent <t< th=""></t<>
Automatic initialization since the position 1 to 9 with the value Validate	N° Date(ms) Type Frame
	1 0.00 Reg 00 01 00 00 19 FF 10 34 00 00 09 12 00 0
Cancel < Back Next> Finish	F0 00 01 FF FF AB CD 10 10 FF 00 00 FF F5 6A 2 4.45 Resp 00 01 00 00 00 6 FF 10 34 00 00 09

In the Webserver Port 1 Spanner Data

T Station Information										1		
C O 192.168.1.100/info.	html							G	14	3 0	0 0	т
🗄 Apps 🔮 iSoogle 🖓 TURCK Connect 💧	🔫 TURCK USA - Capacit 🛛 💌 TURCK	- Your Global 🧮	Home - F	roduct Ne		lome - TU	SA Teams			39	Other	bookmar
Port 1 spanner	data	Offset (d)	00	01	02	03	04	05	06	07	08	09
		0	0x0000	0xf0f0	0x0001	0xffff	0xabcd	0×1010	0xff00	0x00ff	0xf56a	0x0000
		10	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0×0000	0x000
		20	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0x000
		30	0x0000	0x0000	0x0000	0x0000	0x0000	0x0000	0×0000	0x0000	0x0000	0x000

This data is now reflected in the Input words (IWs) of the PROFINET PLC

🕷 Siemens - C:Users\Turck User\Documents\Automation\TBEN_L5_EN1_User_Manual\TBEN_L5_EN1_User_Manual 💶 🖡 🗙											
Project Edit View Insert Online Options Tools Window Help Totally Integrated Automation											
Project tree 🛛 📢 TBEN_L5_EN1_User_Manual > PLC_1 [CPU 1211C DC/DC/DC] > Watch and force tables > Watch table_1 🗕 🖬 🖷											
Devices											
	1 Name	Rubbes	Usplay format	16#0000	would value		comment	ē			
Add pow doviso	2	94114/258	Hey	16#5050							
Add new device	3	%IW260	Hex	16#0001							
	2 4	%IW262	Hex	16#FFFF				Tas			
Proce reconfiguration	5	%IW264	Hex	16#ABCD				ks			
Q Online & diagnostics	6	%IW266	Hex	16#1010							
Program blocks	7	%IW268	Hex	16#FF00							
Technology objects	8	%IW270	Hex	16#00FF							
External source files	9	%IW272	Hex	16#F56A				ra-			
PLC tags	10	%IW274	Hex	16#0000				les			
PLC data types	11	%QW256	Hex	16#000F	16#000F	🗹 🔺					
 Watch and force tables 	12	%QW258	Hex	16#0000							
Add new watch table	13	%QW260	Hex	16#00FF	16#00FF	🗹 🔺					
Force table	14	%QW262	Hex	16#0000							
Watch table_1	15	%QW264	Hex	16#0FFF	16#0FFF	🛛 🗹 🔺					
Online backups	16	%QW266	Hex	16#0000							
Program info	17	%QW268	Hex	16#FFFF	16#FFFF	🛛 🗹 🔔					
Device proxy data	18	%QW270	Hex	16#0000							
Text lists	19	%QW272	Hex	▼ 16#0000							
🕨 🚺 Local modules	20	%QW274	Hex	16#0000							
Distributed I/O	21	<add new=""></add>									
Common data											
Documentation settings											


Spanner Use Cases

Spanner Mode

The spanner has multiple applications for spanning different networks. One application allows the user to view devices on a different network where under normal operations one would have conflicting IP address issues.



A second application for the spanner allows identical PLCs to exchange information.



A third application allows the user to connect two PLCs (with different subnets) without a router.



Setting the spanner to any of these configurations has been discussed by protocol in the preceding sections.

1:1 NAT Mode

In the 1:1 NAT Router a certain range of IP addresses of the internal network (Port 2) are mapped to a range of IP addresses on the external network (Port 1). This way we provide complete network isolation of the in-machine network and yet we allow a number of devices to be accessible outside of the machine (e.g PLC). The NAT device is protocol independent – it just moves IP frames between 2 networks modifying the IP header in some frames.





Configure the Spanner for 1:1 NAT Router Mode

Set up the IP Addresses for Port 1, Port 2 and the default gateway in the Spanner.

T Station Information ×			
← → C ☆ ③ 192.168.1.	60/info.html	☆ 🕒	Ф 🛛 Т :
👖 Apps 👌 iGoogle 🖵 TURCK C	Connect 🛛 🖛 TURCK USA - Capaciti 🛛 💌 TURCK – Your Glob	al J 📅 Home - Product News 🛛 »	, Other bookmarks
FEN20-EN1 Embedded Website of FEN20-Smal	l Block I/O Module	1	TURCK
	adn	nin@192.168.1.200 [Logout]	Industrial Automation
Station Information > Station Information Station Diagnostics	Station Information		
Ethernet Statistics	Туре	FEN20-EN1	
Ethernet/IP Memory Map	Identification Number	6931305	
Links	Firmware Revision	V3.1.21.0	
Station Configuration	Bootloader Revision	V8.0.0.0	
Network Configuration Change Admin Password 8DIP	EtherNet/IP Revision	V2.7.0.0	
	PROFINET Revision	V1.3.12.0	
	Modbus TCP Revision	V1.3.0.0	
	Rotary Switch Mode	PGM DHCP	
	PROFINET Station Name		
	Network Settings		
	Ethernet Port 1 setup	Autonegotiate	
	Ethernet Port 2 setup	Autonegotiate	
	IP Address Port 1 (External Network)	192.168.1.60	
	IP Address Port 2 (Internal Network)	10.10.10.10	
	Netmask Port 1 (External Network)	255.255.255.0	
	Default Gateway Port 1 (External Network)	192.168.1.1	
	MAC Address	00.07.40.23.81.d7	
	LLDP MAC Address 1	00:07:46:25:81:d8	
	LLDP MAC Address 2	00:07:46:25:81:d9	-
•			Þ
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The following 4 I/O blocks will be mapped to the Spanner internal network. Note the default gateway of each device MSUT be the IP address of Port 2 (the internal port) of the Spanner.

🧮 Turck IP Address Tool, Vers. 2.0.0.0										
Search Change Wink Reset Factory reset Clipboard Language Help Close										
No.	MAC address	Device name	IP address	Netmask	Gateway	Mode	Device type	Version	Adapter	
1	00:07:46:25:81:D7		<u>192.168.1.60</u>	255.255.255.0	192.168.1.1	PGM_DHCP	FEN20-EN1	3.1.21.0	192.168.1.200	
2	00:07:46:02:66:7D	tben	10.10.10.20	255.255.255.0	10.10.10.10	PGM_DHCP	TBEN-L1-16DXP	3.1.2.0	192.168.1.200	
7 3	00:07:46:02:66:83	tben-16dxp	10.10.10.30	255.255.255.0	10.10.10.10	PGM_DHCP	TBEN-L1-16DXP	3.2.7.5	192.168.1.200	
	00:07:46:02:B0:DA		10.10.10.40	255.255.255.0	10.10.10.10	PGM_DHCP	BL20-E-GW-EN	3.2.9.0	192.168.1.200	
= 5	00:07:46:25:33:E6		10.10.10.50	255.255.255.0	10.10.10.10	PGM	BLCEN-1M12MT-1CNT-ENC	3.2.7.3	192.168.1.200	
Found 5 Devices.										



In the Spanner webpage, the blocks on the internal network are mapped to IP addresses on the external network. This is done by logging in as the admin and entering the mappings under **Network Configuration**.

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$\boldsymbol{\leftarrow}$ \rightarrow \boldsymbol{C} $\boldsymbol{\bigtriangleup}$ $(192.168.1.6)$	50/info.html	☆ S	ОФСТ:
🗰 Apps 👌 iGoogle 🖓 TURCK Co	onnect 🝷 TURCK USA - Capaciti 🝷 TURCK – Your Globa	🗁 🔫 Home - Product News	» 📙 Other bookmarks
FEN20-EN1	Plack I/O Madula		TURCK
Embedded Website of FEN20-Smail	BIOCK I/O MODULE		interest of
Station Information >	adm	in@192.168.1.200 [Logout]	Automation
Station Information			
Station Diagnostics	Station Information		
Event Log Ethernet Statistics	Туре	FEN20-EN1	
Ethernet/IP Memory Map	Identification Number	6931305	
Modbus/TCP Memory Map	Firmware Revision	V3.1.21.0	
Station Configuration	Bootloader Revision	V8.0.0.0	
Network Configuration	EtherNet/IP Revision	V2.7.0.0	
Change Admin Password	PROFINET Revision	V1.3.12.0	
8DIP	Modbus TCP Revision	V1.3.0.0	
	Rotary Switch Mode	PGM DHCP	
	PROFINET Station Name		
	Notwork Sottings		
	Ethernet Port 1 setup	Autonegotiate	
	Ethernet Port 2 setup	Autonegotiate	
	IP Address Port 1 (External Network)	192.168.1.60	
	IP Address Port 2 (Internal Network)	10.10.10.10	
	Netmask Port 1 (External Network)	255.255.255.0	
	Default Gateway Port 1 (External Network)	192.168.1.1	
	MAC Address	00:07:46:25:81:d7	
	LLDP MAC Address 1	00:07:46:25:81:d8	
	LLDP MAC Address 2	00:07:46:25:81:d9	
	NAT 1:1 Mapping 1 External IP	192.168.1.12	
	NAT 1:1 Mapping 1 Internal IP	10.10.10.20	
	NAT 1:1 Mapping 2 External IP	192.168.1.13	
	NAT 1:1 Mapping 2 Internal IP	10.10.10.30	
	NAT 1:1 Mapping 3 External IP	192.168.1.14	
	NAT 1:1 Mapping 3 Internal IP	10.10.10.40	
	NAT 1:1 Mapping 4 External IP	192.168.1.15	
	NAT 1:1 Mapping 4 Internal IP	10.10.10.50	
	NAT 1:1 Mapping 5 External IP	0.0.0.0	
	NAT 1:1 Mapping 5 Internal IP	0.0.0.0	-
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The stations now respond to requests from the external network. These stations can now be mapped into a PLC or SCADA on the external network

X Administrator: C:\Windows\system32\cmd.exe Microsoft Windows [Version 6.1.7601] Copyright (c) 2009 Microsoft Corporation. ٨ All rights reserved. C:\Users\kyhall>ping 192.168.1.12 Pinging 192.168.1.12 with 32 bytes of data: Reply from 192.168.1.12: bytes=32 time=4ms TTL=128 Reply from 192.168.1.12: bytes=32 time=2ms TTL=128 Reply from 192.168.1.12: bytes=32 time=2ms TTL=128 Reply from 192.168.1.12: bytes=32 time=2ms TTL=128 Ξ Ping statistics for 192.168.1.12: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 4ms, Average = 2ms C:\Users\kyhall>ping 192.168.1.13 Pinging 192.168.1.13 with 32 bytes of data: Reply from 192.168.1.13: bytes=32 time=4ms TTL=128 Reply from 192.168.1.13: bytes=32 time=2ms TTL=128 Reply from 192.168.1.13: bytes=32 time=2ms TTL=128 Reply from 192.168.1.13: bytes=32 time=2ms TTL=128 Ping statistics for 192.168.1.13: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 4ms, Average = 2ms C:\Users\kyhall>ping 192.168.1.14 Pinging 192.168.1.14 with 32 bytes of data: Reply from 192.168.1.14: bytes=32 time=4ms TTL=128 Reply from 192.168.1.14: bytes=32 time=2ms TTL=128 Reply from 192.168.1.14: bytes=32 time=2ms TTL=128 Reply from 192.168.1.14: bytes=32 time=2ms TTL=128 Ping statistics for 192.168.1.14: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 4ms, Average = 2ms C:\Users\kyhall>ping 192.168.1.15 Pinging 192.168.1.15 with 32 bytes of data: Reply from 192.168.1.15: bytes=32 time=4ms TTL=128 Reply from 192.168.1.15: bytes=32 time=2ms TTL=128 Reply from 192.168.1.15: bytes=32 time=2ms TTL=128 Reply from 192.168.1.15: bytes=32 time=2ms TTL=128 Ping statistics for 192.168.1.15: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 4ms, Average = 2ms C:\Users\kyhall>_