



User Manual
NXIO 100-RE Board
Configuration and Hardware Description

Hilscher Gesellschaft für Systemautomation mbH

www.hilscher.com

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1 Introduction

1.1 About the User Manual

This User Manual contains a description about the configuration of the NXIO 100-RE board and a description of the hardware.

1.1.1 List of Revisions

Index	Date	Chapter	Revisions
1	2006-11-06	all	created
2	2011-06-07	1 5 6	Chapter "Introduction" revised, Chapter "Device Drawings and Connections" revised, Note about IO Pins added Chapter "LED" revised.

Table 1: List of Revisions

1.1.2 Conventions in this Manual

Operating Instructions, a result of an operation step or notes are marked as follows:

Operating Instructions:

➤ <instruction>

or

1. <instruction>

2. <instruction>

Results:

↻ <result>

Notes:



Note: <note>



Further information: <note, were to find further information>

1.2 Reference to Hardware and Firmware

Device	Revision
NXIO 100-RE Board	3

Table 2: Reference on Hardware

Firmware

Firmware	Firmware Version
NETX.ROM (EtherCAT Slave)	2.2.4.0
NETX.ROM (EtherNet/IP Adapter)	2.1.17.0
NETX.ROM (Open Modbus/TCP)	
NETX.ROM (POWERLINK Controlled Node)	2.1.18.0
NETX.ROM (PROFINET IO Device)	3.3.5.0
NETX.ROM (SERCOS III Slave)	3.0.18.0

Table 3: Reference on Firmware

1.3 Contents of the Product CD

The product CD contains:

- Documentation: User Manual (this document)
- Schematic
- Device Description Files (GSDML, XML, EDS)
- NXIO 100-RE

1.4 Legal Notes

1.4.1 Copyright

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1.4.2 Important Notes

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We reserve the right to change our products and their specification as well as related user manuals, accompanying texts and documentation at all times and without advance notice, without obligation to report the change. Changes will be included in future manuals and do not constitute any obligations. There is no entitlement to revisions of delivered documents. The manual delivered with the product applies.

Hilscher Gesellschaft für Systemautomation mbH is not liable under any circumstances for direct, indirect, incidental or follow-on damage or loss of earnings resulting from the use of the information contained in this publication.

1.4.3 Exclusion of Liability

The software was produced and tested with utmost care by Hilscher Gesellschaft für Systemautomation mbH and is made available as is. No warranty can be assumed for the performance and flawlessness of the software for all usage conditions and cases and for the results produced when utilized by the user. Liability for any damages that may result from the use of the hardware or software or related documents, is limited to cases of intent or grossly negligent violation of significant contractual obligations. Indemnity claims for the violation of significant contractual obligations are limited to damages that are foreseeable and typical for this type of contract.

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- for the design, construction, maintenance or operation of nuclear facilities;
- in air traffic control systems, air traffic or air traffic communication systems;
- in life support systems;
- in systems in which failures in the software could lead to personal injury or injuries leading to death.

We inform you that the software was not developed for use in dangerous environments requiring fail-proof control mechanisms. Use of the software in such an environment occurs at your own risk. No liability is assumed for damages or losses due to unauthorized use.

1.4.4 Warranty

Although the hardware and software was developed with utmost care and tested intensively, Hilscher Gesellschaft für Systemautomation mbH does not guarantee its suitability for any purpose not confirmed in writing. It cannot be guaranteed that the hardware and software will meet your requirements, that the use of the software operates without interruption and that the software is free of errors. No guarantee is made regarding infringements, violations of patents, rights of ownership or the freedom from interference by third parties. No additional guarantees or assurances are made regarding marketability, freedom of defect of title, integration or usability for certain purposes unless they are required in accordance with the law and cannot be limited. Warranty claims are limited to the right to claim rectification.

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The delivered product (including the technical data) is subject to export or import laws as well as the associated regulations of different countries, in particular those of Germany and the USA. The software may not be exported to countries where this is prohibited by the United States Export Administration Act and its additional provisions. You are obligated to comply with the regulations at your personal responsibility. We wish to inform you that you may require permission from state authorities to export, re-export or import the product.

2 Safety

2.1 Intended Use

The NXIO 100-RE Boards described in this user manual are small modules for real-time Ethernet communication.

Depending on the loaded firmware via MMC card, the NXIO 100-RE uses the communication protocol of one of the following real time Ethernet systems:

- EtherCAT Slave
- EtherNet/IP Adapter (Slave)
- Open Modbus/TCP Server
- Ethernet Powerlink Controlled Node (Slave)
- PROFINET IO-Device
- SERCOS III Slave



Note: The NXIO 100-RE is in no way optimized in terms of EMC compatibility. This product is intended to be used for evaluation and development purposes in lab environments only and is not suitable for production use!

2.2 Labeling of Safety Instructions

The safety instructions are pinpointed particularly. The instructions are highlighted with a specific safety symbol, a warning triangle and a signal word according to the degree of endangerment. Inside the note the danger is exactly named. Instructions to a property damage message do not contain a warning triangle.


Symbol	Sort of Warning or Principle
	Warning of damages by electrostatic discharge

Table 4: Safety Symbols and Sort of Warning or Principle

2.2.1.1 Signal Words

Signal Word	Meaning
DANGER	indicates an direct hazard with high risk, which will have as consequence death or grievous bodily harm if it isn't avoided. The use of this signal word shall be restricted to extremely hazard. Remark: The signal word may not be used in case of danger of pure property damages.
WARNING	indicates a possible hazard with medium risk, which will have as consequence death or (grievous) bodily harm if it isn't avoided. Remark: The signal word may not be used in case of danger of pure property damages.
CAUTION	indicates a minor hazard with medium risk, which could have as consequence simple battery if it isn't avoided.
Note	Indicates an important note in the manual.

Table 5: Signal Words

2.2.1.2 Signal Words USA

Signal Word	Meaning
DANGER	Indicates a Hazardous Situation Which, if not Avoided, will Result in Death or Serious Injury.
WARNING	Indicates a Hazardous Situation Which, if not Avoided, could Result in Death or Serious Injury.
CAUTION	Indicates a Hazardous Situation Which, if not Avoided, may Result in Minor or Moderate Injury.
NOTICE	Indicates a Property Damage Message.
Note	Indicates an Important Note in the Manual.

Table 6: Signal Words according to ANSI

2.3 Safety Instructions

This manual contains instructions which must be observed to ensure your own personal safety and to avoid damage to devices.

2.3.1 Electrostatic Discharge

Adhere to the necessary safety precautions for components that are vulnerable with electrostatic discharge (EN 61340-5-1 und EN 61340-5-2 as well as IEC 61340-5-1 und IEC 61340-5-2).



CAUTION!

Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which cause internal damage and affect normal operation. Follow guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch connectors or pins on component boards.
 - Do not touch circuit components inside the equipment.
 - If available, use a static-safe workstation.
 - When not in use, store the equipment in appropriate static-safe packaging.
-

2.4 Safety Instructions USA

This manual contains instructions which must be observed to ensure your own personal safety and to avoid damage to devices.

2.4.1 Electrostatic Discharge

Adhere to the necessary safety precautions for components that are vulnerable with electrostatic discharge (EN 61340-5-1 und EN 61340-5-2 as well as IEC 61340-5-1 und IEC 61340-5-2).



NOTICE

Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which cause internal damage and affect normal operation. Follow guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch connectors or pins on component boards.
 - Do not touch circuit components inside the equipment.
 - If available, use a static-safe workstation.
 - When not in use, store the equipment in appropriate static-safe packaging.
-

The data switch interconnects the ARM CPU, communication and Host controllers, memory blocks and peripheral units via five data paths. This allows the controllers to transmit their data in parallel, contrary to the traditional sequential architecture with only one common data bus and additional bus arbitration cycles.

The controllers of the four communication channels are structured on two levels and are identical to each other. They consist of dedicated Alas and special logic units that receive their protocol functions via microcode, combining the performance of dedicated (single-) protocol controllers with the flexibility of a CPU. Two of these channels can further be linked to integrated PHs for Ethernet communication.

The Medium-Access-Controller xMAC sends or receives the serial data stream according to the respective bus access process and encrypts or converts these into Bytes.

The Protocol Execution Controller xPEC compiles these into data packets and controls the telegram traffic, accomplished by DMA transfers. In addition, every channel has a dual-port-memory available for status information or as local data image.

By its intelligent communication ALUs, the netX can implement the most varied protocols and protocol combinations and can synchronize them independently of the CPU response time – an absolutely new feature in industrial communication technology.

3.1.2 NXIO 100-RE Board

The NXIO 100-RE Board described in this user manual is a small module for real-time Ethernet communication system.

The netX handles the data exchange between the connected Ethernet networks and the on-board LEDs and switches.

The NXIO 100-RE Board is equipped with serial Flash Loader to start the firmware automatically from a MMC card. Further the board provides two 100 MBit/s Ethernet ports for real-time Ethernet communication.

All elements of the board are powered by an onboard switching DC power supply, which can be powered by a wide range of simple (unregulated) standard power supplies from 12V to 30V output voltage.



Note: The NXIO 100-RE is in no way optimized in terms of EMC compatibility. This product is intended to be used for evaluation and development purposes in lab environments only and is not suitable for production use!

Depending on the loaded firmware the NXIO 100-RE uses the communication protocols of one of the following real time Ethernet systems:

- PROFINET IO-Device
- EtherCAT Slave
- EtherNet/IP Adapter (Slave)
- SERCOS III Slave
- Ethernet Powerlink Controlled Node (Slave)
- Open Modbus/TCP Server

3.2 Requirements

1. DC power supply with 12 - 30 V (DC) output voltage
2. Communication Master
3. Ethernet Cable

4 Configuration

4.1 PROFINET IO-Device

4.1.1 General Data

Real-Time Ethernet System	PROFINET IO-Device
Address Switch	Not used
GSDML	GSDML-V2.2-HILSCHER-NXIO 100 RE PNS-20091204.xml
Master Device	Every PROFINET IO-Controller, e. g. Siemens S7-317 CPU, Siemens S7-315 CPU
Configuration Tool	STEP7 V5.3 SP3
Parameters set by the firmware	Module configuration
Firmware Support USB	Current Firmware has no USB Support

Table 7: General Data PROFINET IO-Device

4.1.2 Protocols

I/O Data	2 Byte Input 2 Byte Output
Communication	PROFINET IO RT VLAN- and Priority-tagging
Functions	cyclic process data DCP Context Management over CLRPC Target/Actual Configuration comparison

Table 8: Protocols PROFINET IO-Device

4.1.3 Configuring NXIO 100-RE for PROFINET IO

1. CAUTION! To prevent damage from electrostatic discharge to the NXIO 100-RE-Board, first put the NXIO 100-RE-Board within its protective packaging on a table and touch the table before you unpack and touch the board.
2. Disconnect power.
3. Slot the MMC card for PROFINET IO into SD / MMC Card Connector.
4. Connect the power supply to the NXIO 100-RE Board.
5. Connect the devices using Ethernet cable. Insert necessary switches.

Communication System	Hub	Switch
PROFINET IO	forbidden	applicable (100 MBit/s, Full duplex)

Table 9: Use of Hubs and Switches for PROFINET IO

6. Set device name using the Ethernet Device Configuration tool.



Note: For further information refer to the operation instruction manual **Ethernet Device Configuration** (Setting IP Address for Ethernet compatible Hilscher Devices using the DCP Protocol, ENDevCfg_en.pdf).

7. Configure the Master.

4.1.4 How to configure the S7 Controller

Configuration Steps:

1. Open a new Project.
2. Select the CPU (e. g. CPU 315-2 PN-DP).
3. Configure the S7 Controller Hardware:
 - Set IP Address and Subnet Mask.

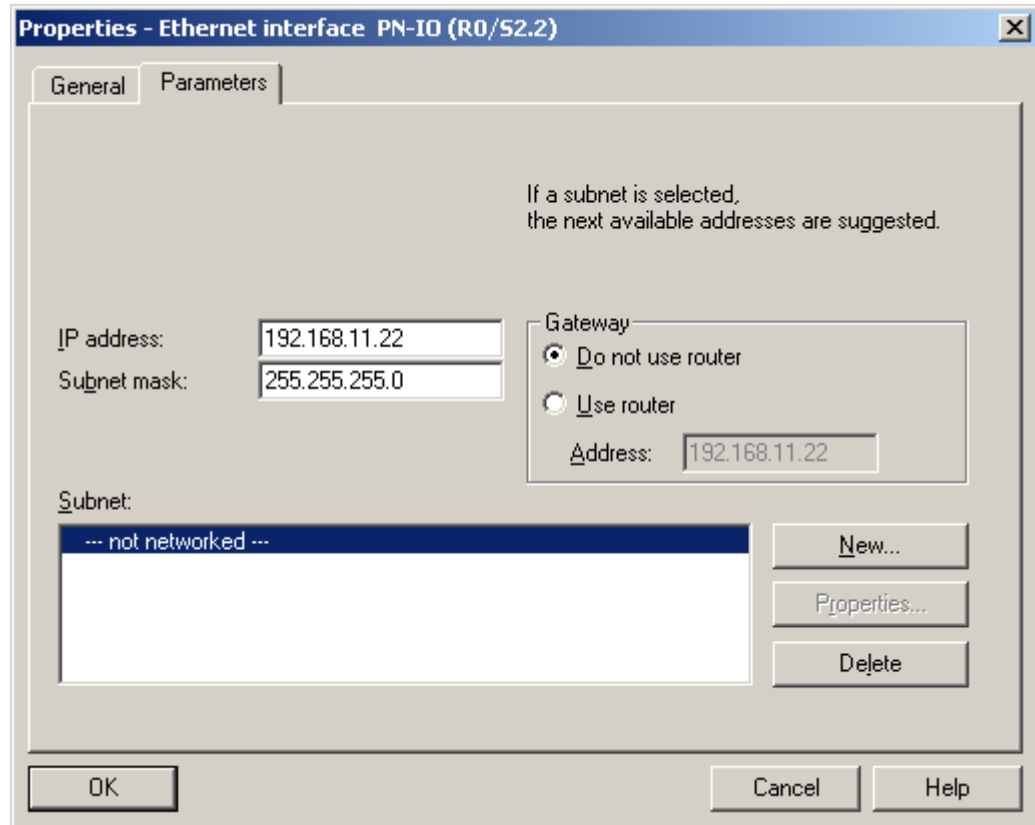


Figure 2: S7 Controller Configuration - IP Address and Subnet Mask

- Select button **New** to enter a new subnet.

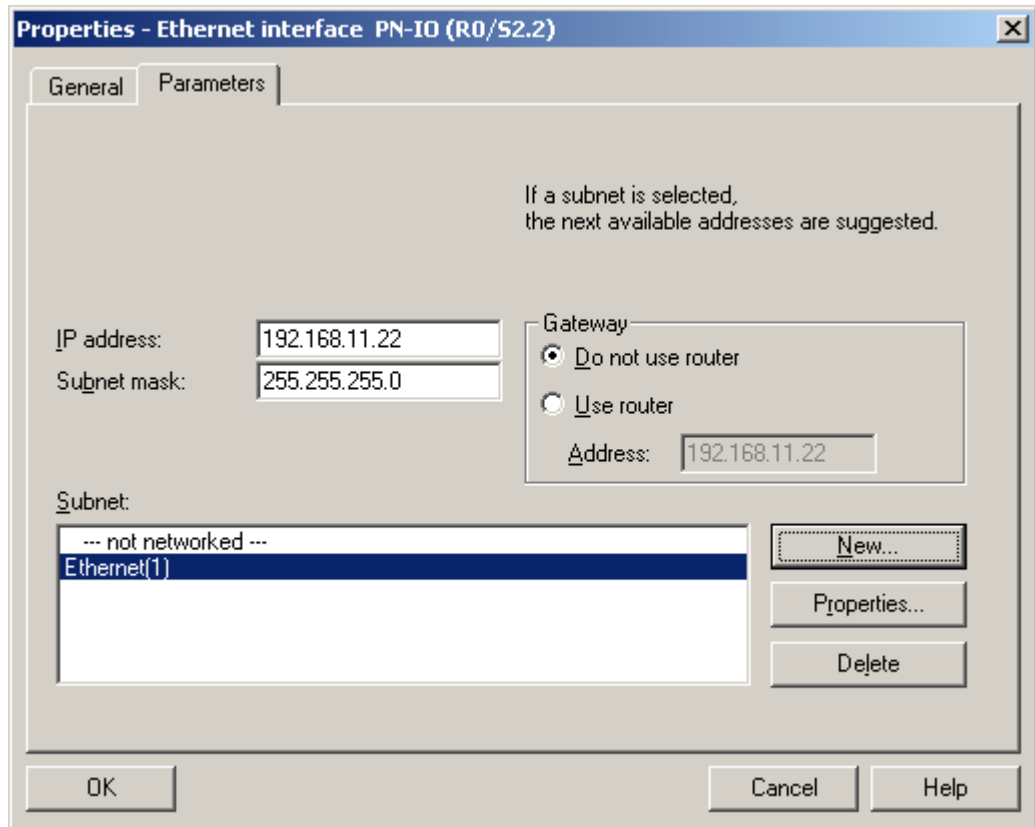


Figure 3: S7 Controller Configuration - New Subnet

- Set name of PROFINET IO-Device system.

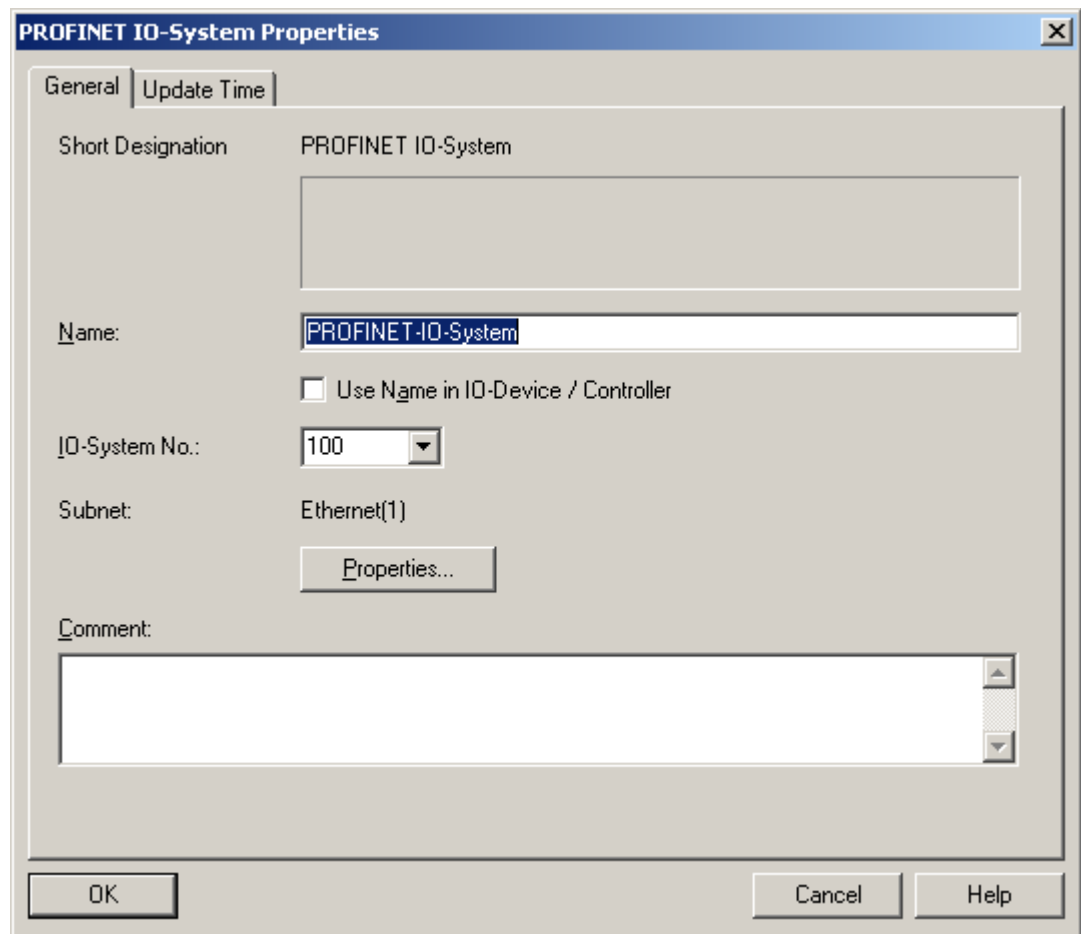


Figure 4: S7 Controller Configuration -- Name of PROFINET IO-Device system

4. Insert the NXIO 100-RE PROFINET IO-Device:

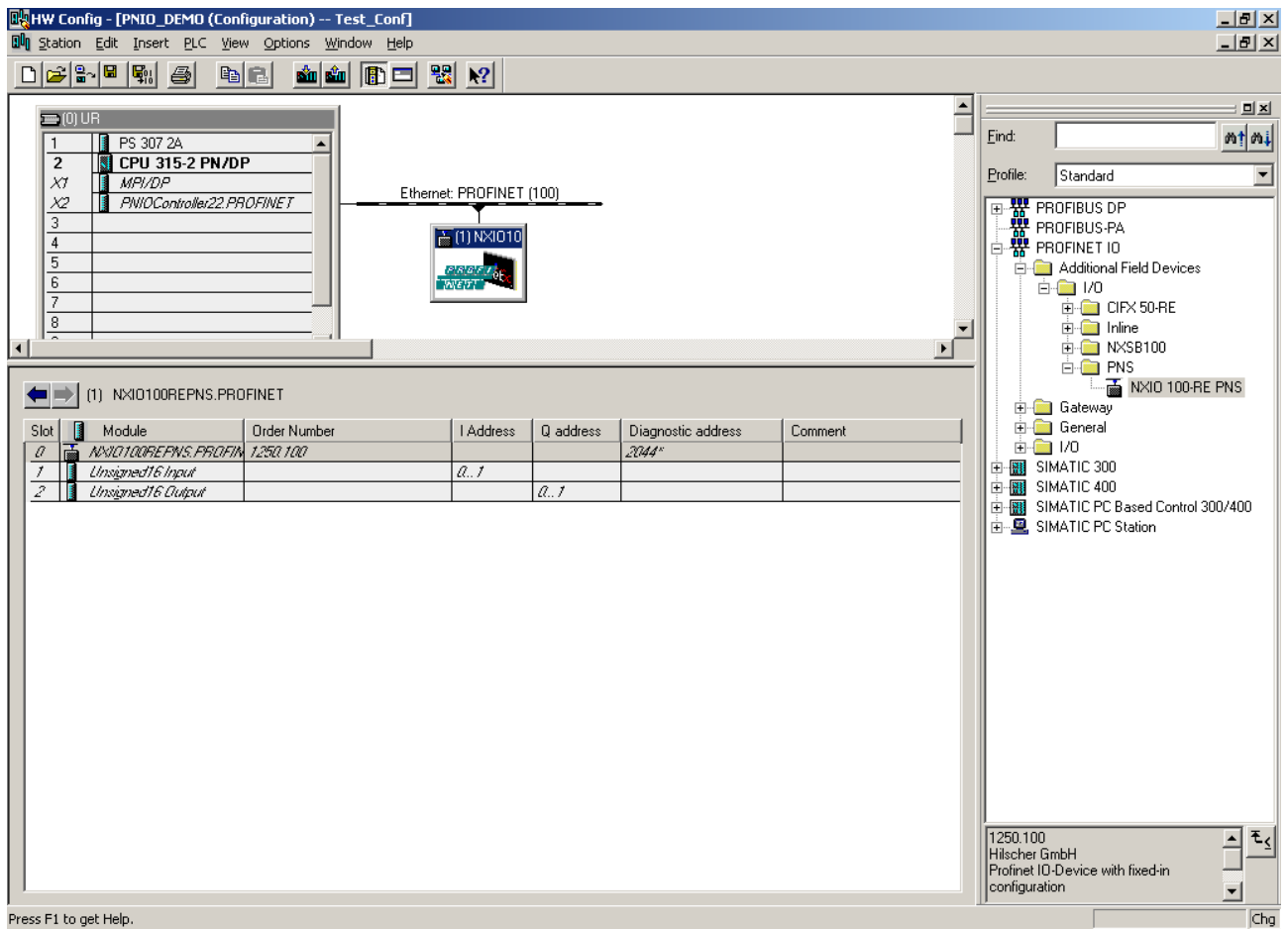


Figure 5: Insert the NXIO 100-RE PROFINET IO-Device

5. Configure the NXIO 100-RE Digital Inputs and Outputs.

To configure the 16 Bit DIN and to configure the 16 Bit DOUT of the NXIO 100-RE PROFINET IO-Device, proceed as follows:

- Set **Device Name** of the NXIO 100-RE PROFINET IO-Device.

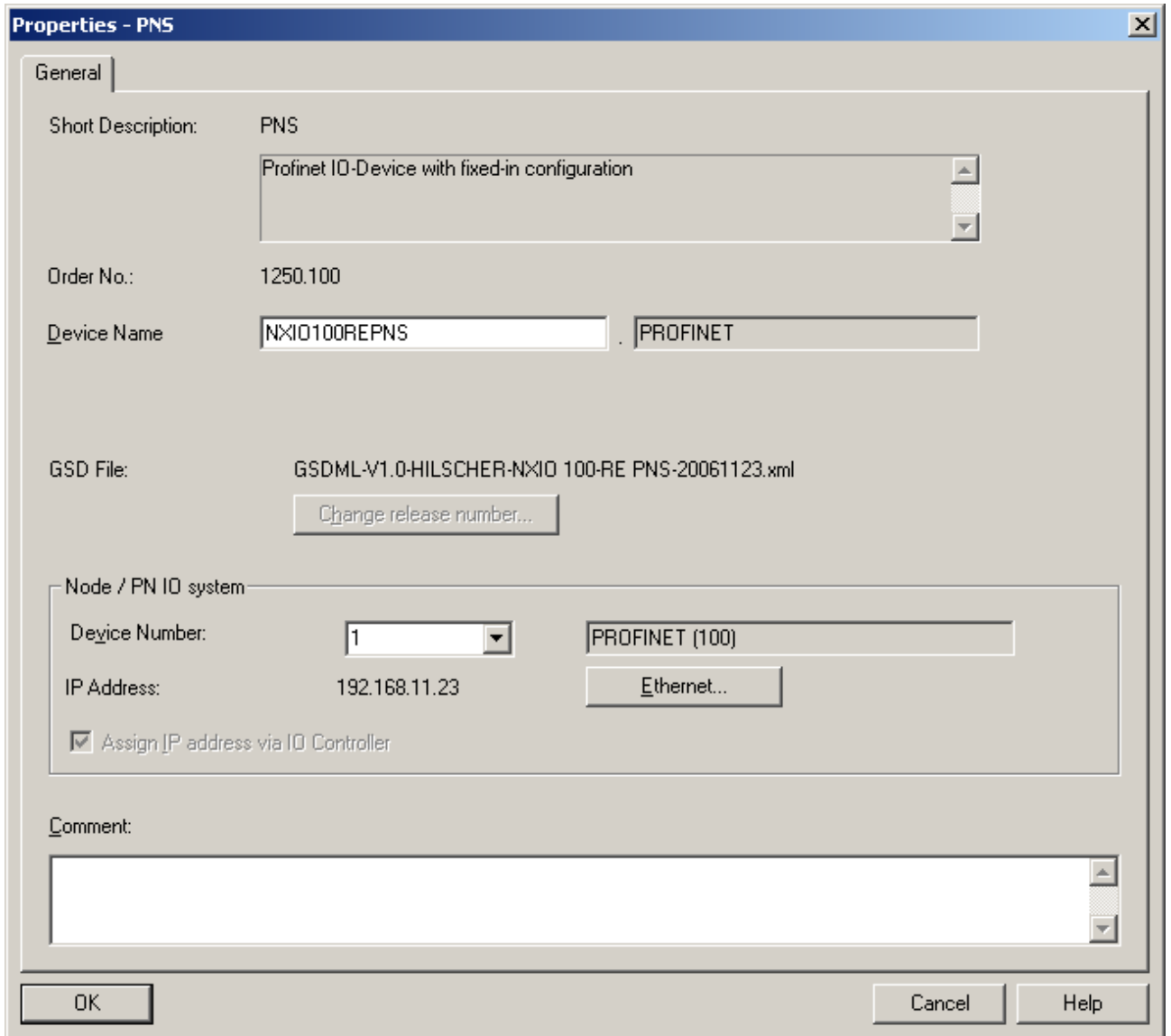


Figure 6: Configure NXIO 100-RE DIN and DOUT - Device Name

➤ Configure the S7 Controller **Update Time**.

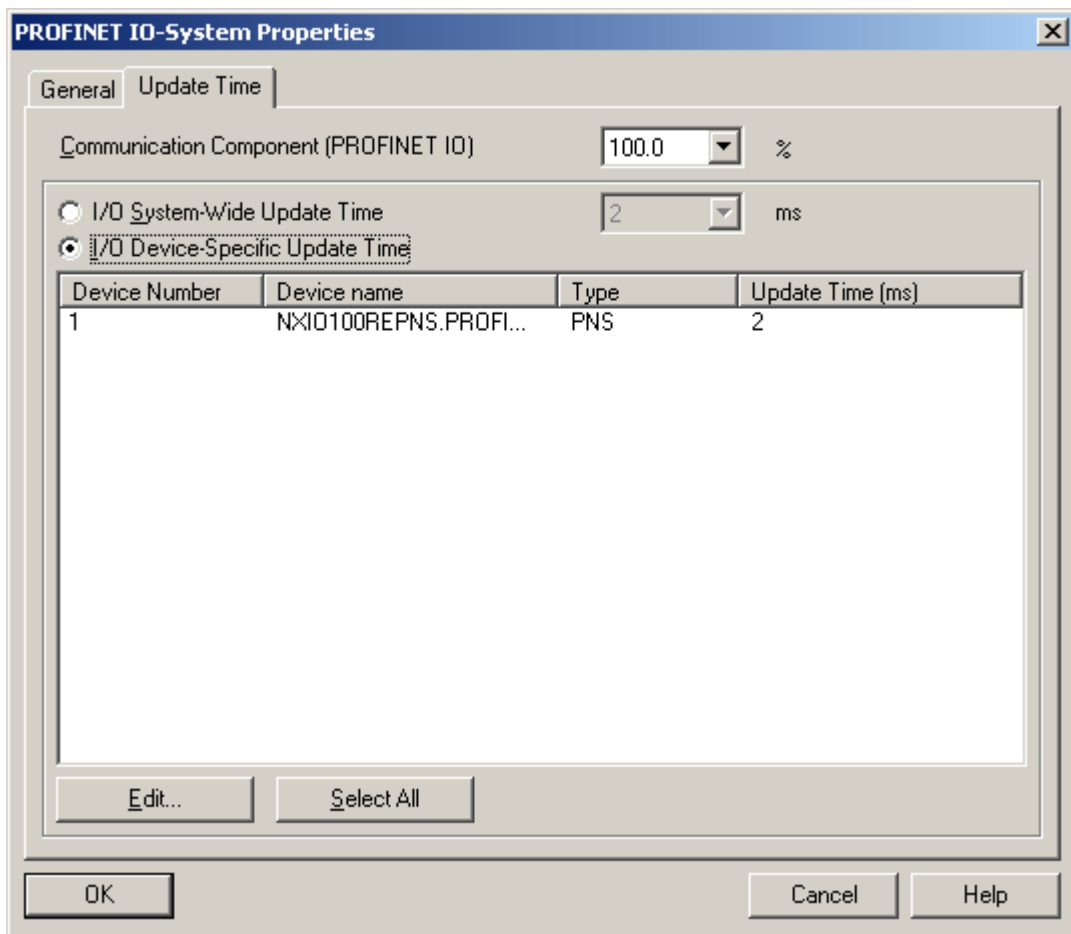


Figure 7: Configure DIN and DOUT - Controller **Update Time**

6. Save the configuration.
7. Transmit the configuration to the S7 Controller.
8. Start communication.

4.1.5 Display Data

Configure the **Variable Table**:

1. To display the input data use IB0 to IB1.
2. To display the output data use QB0 to QB1.

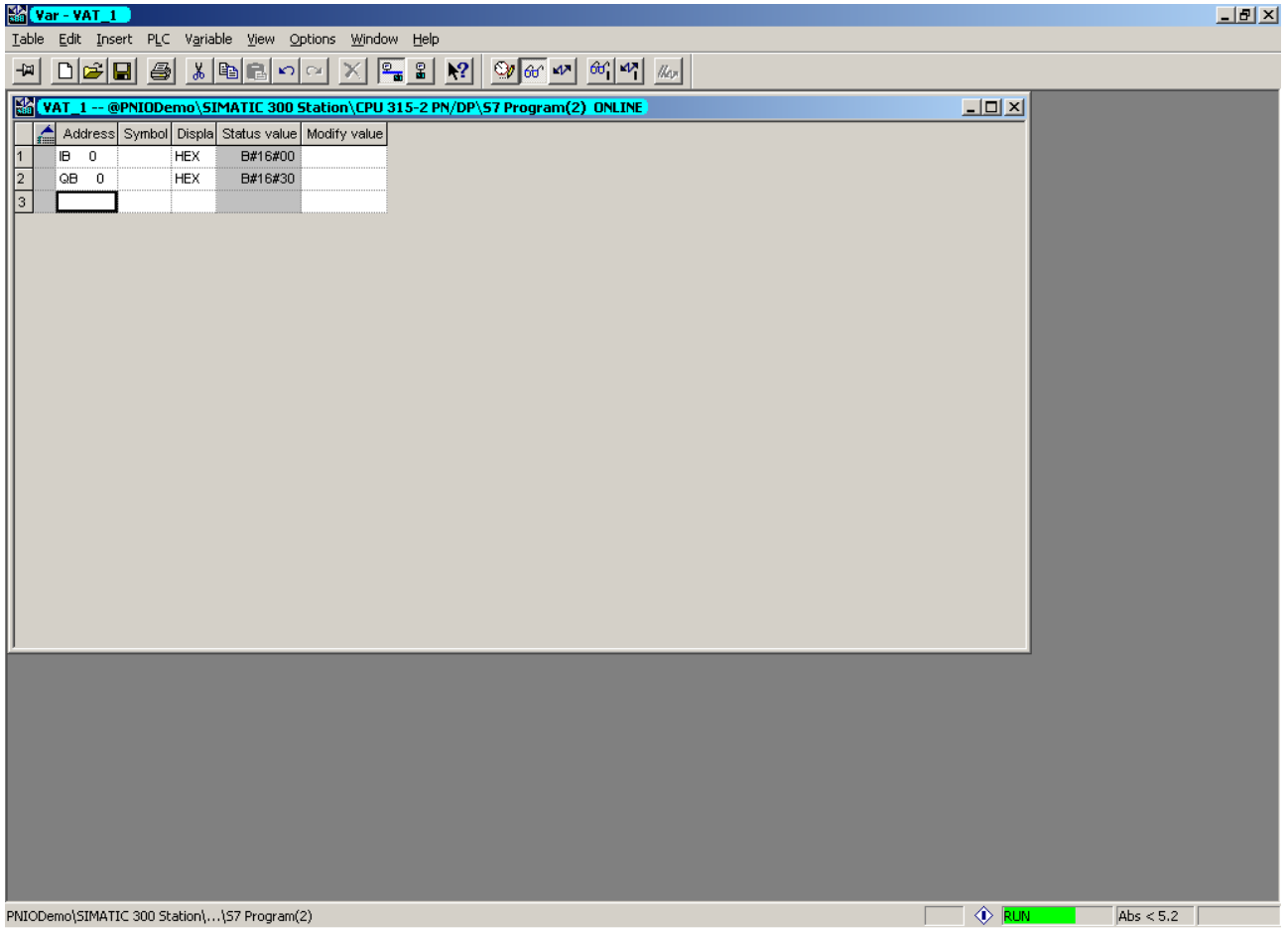


Figure 8: Variable Table, display the Input Data and the Output Data

4.2 EtherCAT Slave

4.2.1 General Data

Real-Time Ethernet System	EtherCAT Slave
Address Switch	Not used
XML	Hilscher NXIO 100-RE ECS.xml
Master Device	e. g. TwinCAT
Configuration Tool	TwinCAT System Manager
System Requirements	EtherCAT Master, e. g. TwinCAT
Parameters set by the firmware	All functionalities of the EtherCAT firmware are fixed and come from the XML file.
Firmware Support USB	Current firmware has no USB support.

Table 10: General Data EtherCAT Slave

4.2.2 Protocols

Cyclic data	4 Byte RxPDO (Bits 15:0 are sampled from DIL switches) 4 Byte TxPDO (Bits 15:0 are output on LEDs)
Acyclic Data	128 Bytes Mailbox Out 128 Bytes Mailbox In
Functions	Complex Slave CoE (CANopen over EtherCAT) 3 FMMU Channels and 4 SyncManager Channels Distributed Clocks

Table 11: Protocols EtherCAT Slave

4.2.3 Configuring NXIO 100-RE for EtherCAT Slave

1. Disconnect power.
2. Slot the MMC card for EtherCAT into SD / MMC Card Connector.
3. Connect the power supply to the NXIO 100-RE Board.
4. Connect the devices using Ethernet cable. Insert necessary switches.

Communication System	Hub	Switch
EtherCAT	forbidden	applicable only between Master and 1. participant

Table 12: Use of Hubs and Switches for EtherCAT

5. Configure the Master.

4.2.4 How to configure the TwinCAT

Configuration Steps:

1. Copy XML file to folder.
 - Copy the XML file *Hilscher NX-IO RE.xml* to the folder *C:\Programs\TwinCAT\IO\EtherCAT*.
2. Start the TwinCAT System Manager.
3. Create a New Project via **File > New**.
4. Insert a Master.
 - Select **I/O - Configuration > I/O Devices**.

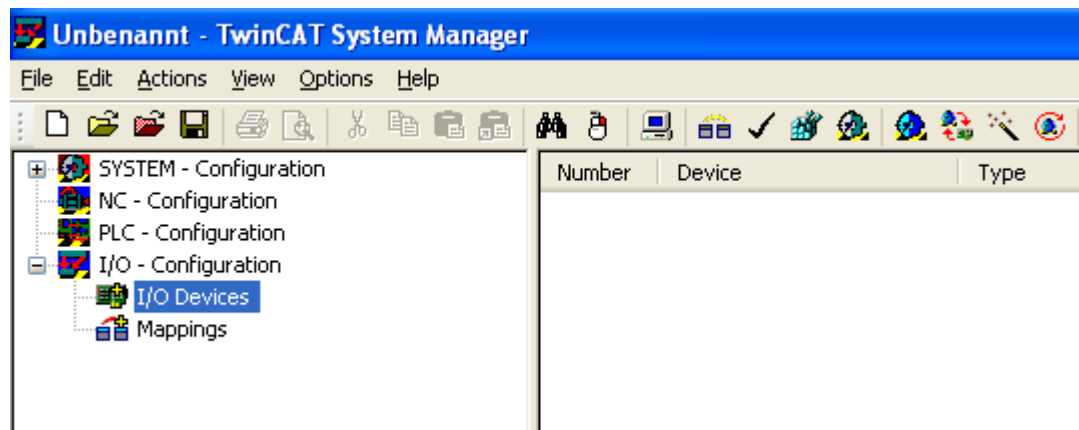


Figure 9: TwinCAT System Manager - Insert Master

- Open right mouse menu and select **Scan Devices**.
- The window **new devices found** appears:

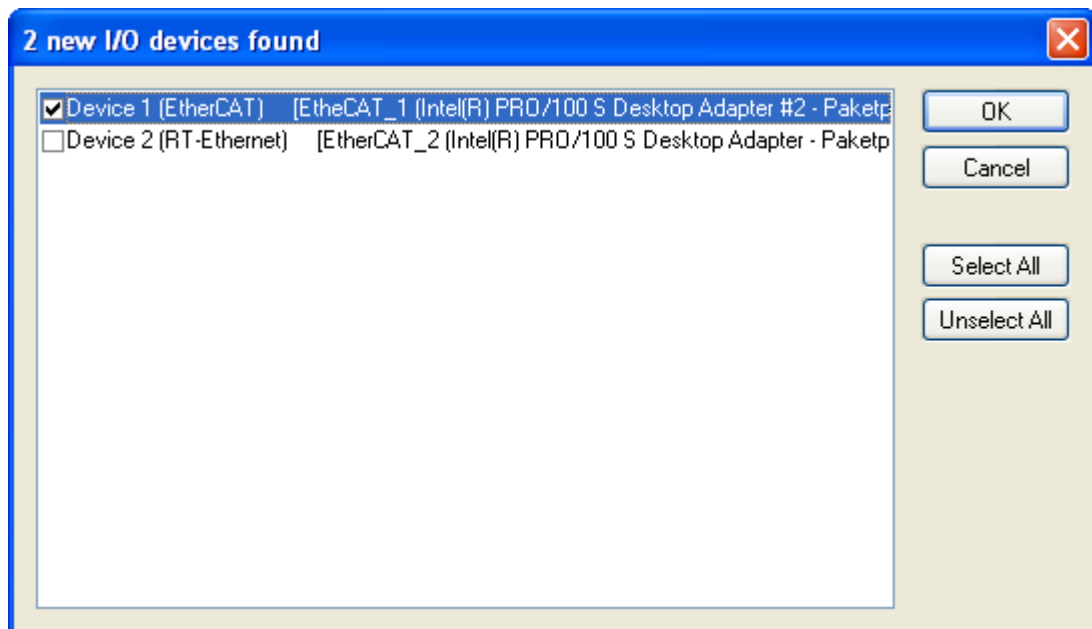


Figure 10: new devices found - Select Device

- Select the Master device.
- Click **OK**.

5. Insert a Slave.
 - Select **I/O - Configuration > I/O Devices**.
 - Open right mouse menu and select **Scan Box**.
 - Answer to the request **Scan for boxes** with **OK**.
 - Answer to the request **Activate Free Run** with **Yes**.
 - The connection from the NXIO 100-RE Board is established, the Master and all Slaves are activated.

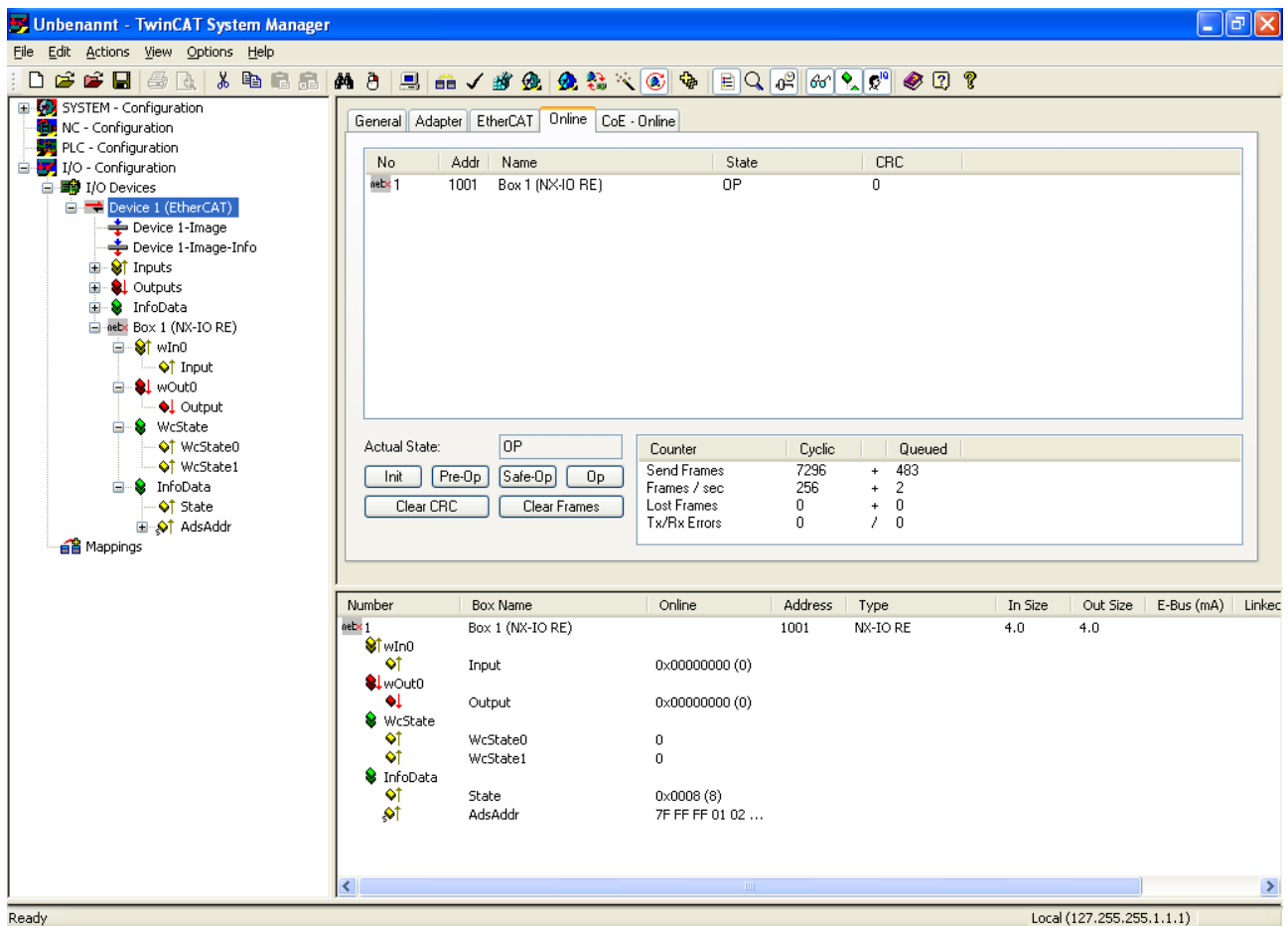



Figure 11: TwinCAT System Manager - Communication is running

If **State: OP** is displayed, communication is running.

6. Restart TwinCAT in configuration mode and download
 - Press the icon **Set/Reset TwinCAT to Config Mode** .
 - Answer the request **Set/Reset TwinCAT to Config Mode** with **OK**.
 - Answer the request **Load IO Devices** with **Yes**.
 - Answer the request **Activate Free Run** with **Yes**.
 - The system has been restarted.

4.2.5 Display Data

Set Output values.

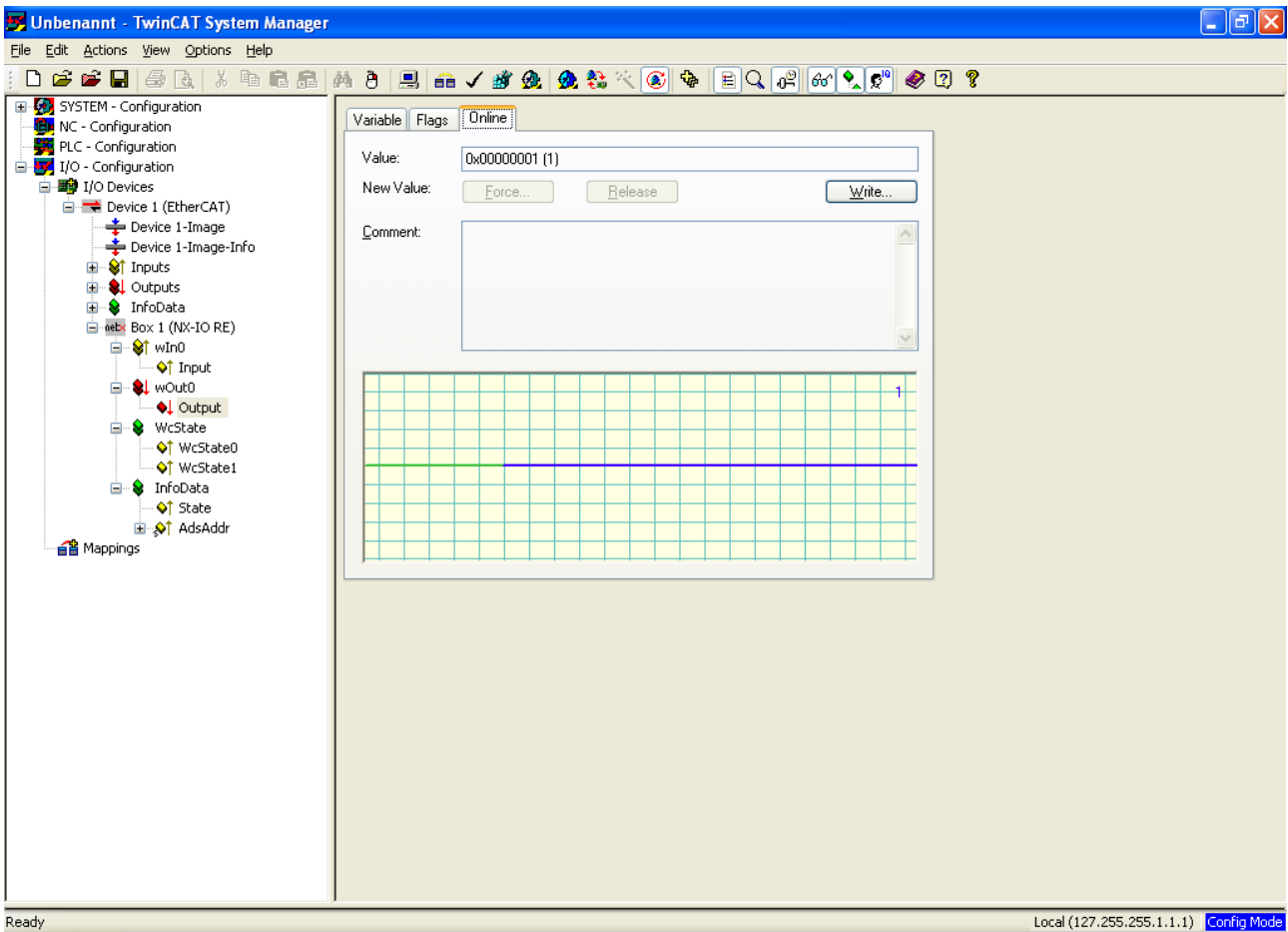


Figure 12: TwinCAT System Manager - Set Output Values

➤ Select **Online > Write**.

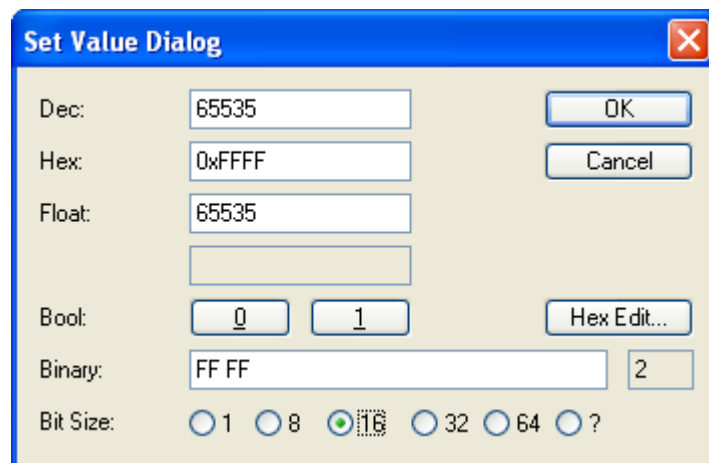


Figure 13: Set Value Dialog - Set Output Values

Display of Input Values:

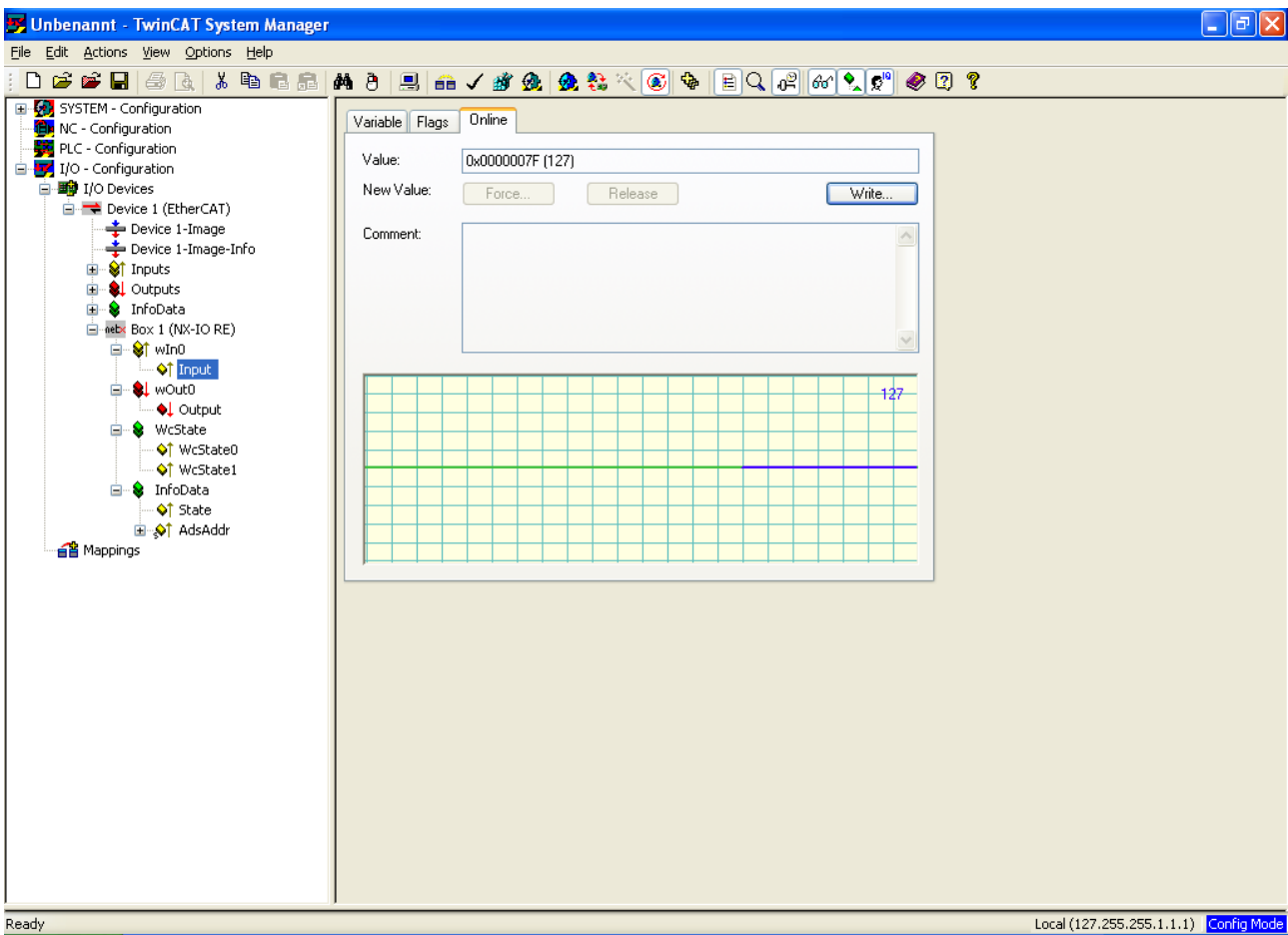


Figure 14: TwinCAT System Manager - Set Input Values

4.3 EtherNet/IP Adapter (Slave)

4.3.1 General Data

Real-Time Ethernet System	EtherNet/IP Adapter (Slave)
Address Switch	Set both address rotary switches to F. Then the saved configuration is loaded and DHCP is used for startup.
EDS	HILSCHER NXIO EIS 1.1.EDS
Master Device	Rockwell, each EtherNet/IP Master, example with Compact Logix from Rockwell
Configuration Tool	RSLogix5000
System Requirements	For the first setting into operation the IP address must be assigned via the DHCP server. The setup behavior can be changed via the TCP/IP object.
Parameters set by the firmware	Default setup behavior DHCP
Firmware Support USB	Current firmware has no USB support.

Table 13: General Data EtherNet/IP Adapter (Slave)

4.3.2 Protocols

I/O Data	2 Byte Input 2 Byte Output
Communication	1 I/O connection, 8 non-cyclic connections cyclic and acyclic communication BOOTP, DHCP
Non-cyclic Communication	Unscheduled Data max. 1400 Byte per telegram Get_Attribute_Single Get_Attribute_All Set_Attribute_Single Set_Attribute_All

Table 14: Protocols EtherNet/IP Adapter (Slave)

4.3.3 Configuring NXIO 100-RE for EtherNet/IP Adapter (Slave)

1. Disconnect power.
2. Slot the MMC card eTHERnET7ip into SD / MMC Card Connector.
3. Connect the power supply to the NXIO 100-RE Board.
4. Connect the devices using Ethernet cable. Insert necessary switches.

Communication System	Hub	Switch
EtherNet/IP	forbidden	applicable (10 MBit/s / 100 MBit/s, Full or Half Duplex, Auto-Negotiation)

Table 15: Use of Hubs and Switches for EtherNet/IP

5. Configure the Master.

4.3.4 How to configure the RSLogix5000

1. Select Module
 - Create a new project in RSLogix5000 using a CompactLogix controller.
 - Then the first step is to select the module and add it to your project. Right click on the **I/O Configuration > CompactBus Local** of the controller project.
 - Select **New Module** as shown below.

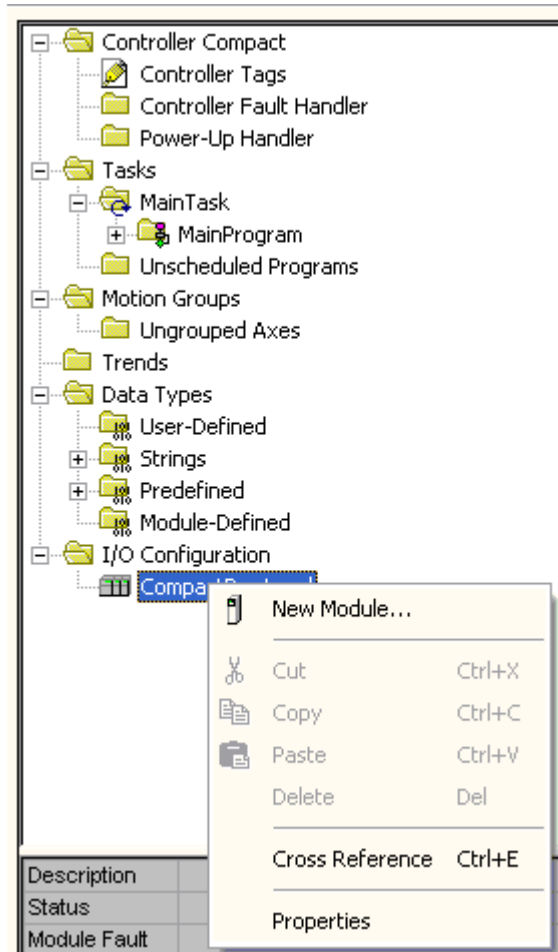


Figure 15: Insert New Module

The following dialog box appears for the selection of the new module.

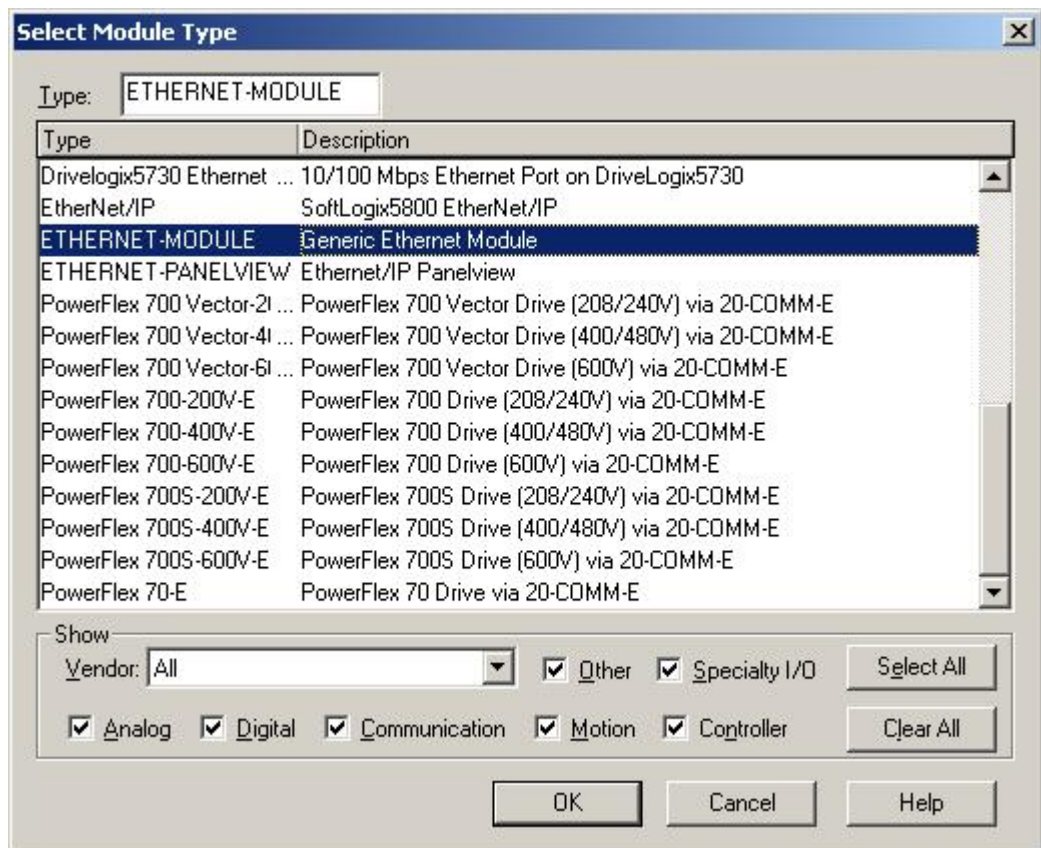


Figure 16: Select Module Type

- Select **“ETHERNET-MODULE Generic Ethernet Module”** from the select module type list and then **OK**.

- Set the communications parameters for the module as shown in the dialog below.

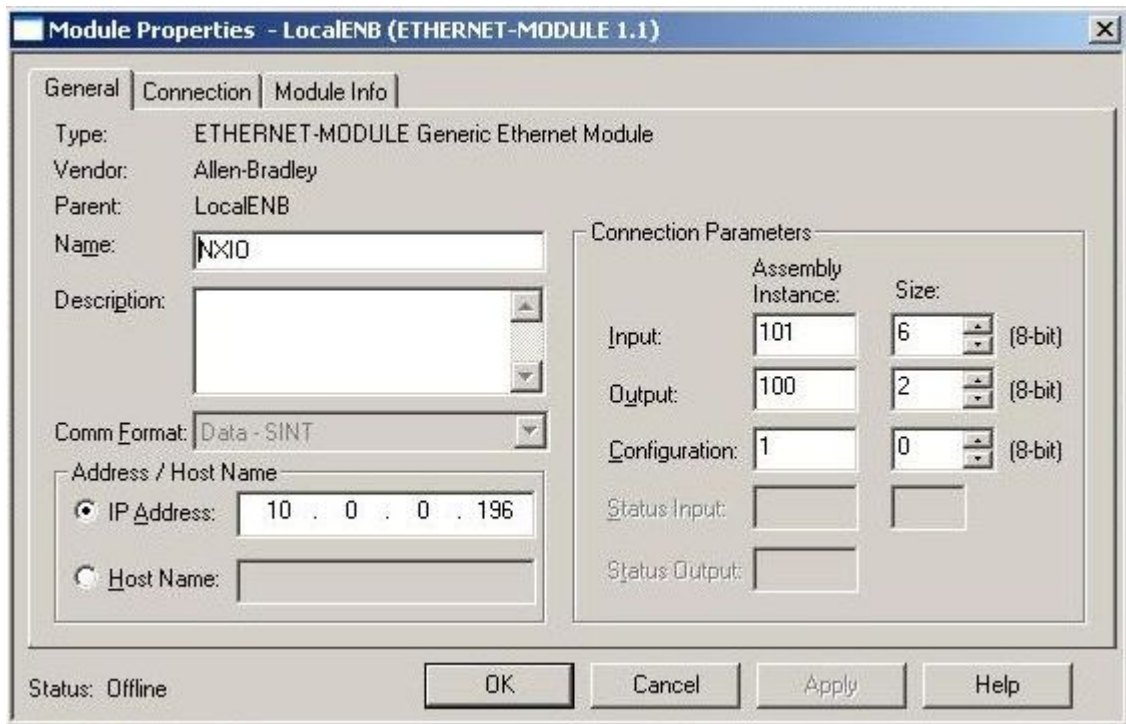


Figure 17: Module Properties

- Determine a name and enter a short description of the module.
- Select the slot number in which the module is installed in the controller.
- Select **Data - INT** as the **Comm_Format**.
- Set the connection parameters as they are shown in the dialog.

Connection Parameter	Assembly Instance	Size (in Words)
Input	101	6
Output	100	2
Configuration	1	0

Table 16: Connection Parameters

4.3.5 Display Data

To display the input and output values use the controller Tags as shown in the following picture.

Tag Name	Value	Style	Type	Description
- NXIO:0	{...}		AB:ETHERNET_MODULE_SINT_2Bytes:0:0	
- NXIO:0.Data	{...}	Decimal	SINT[2]	
+ NXIO:0.Data[0]	55	Decimal	SINT	
+ NXIO:0.Data[1]	77	Decimal	SINT	
- NXIO:1	{...}		AB:ETHERNET_MODULE_SINT_6Bytes:1:0	
- NXIO:1.Data	{...}	Decimal	SINT[6]	
+ NXIO:1.Data[0]	1	Decimal	SINT	
+ NXIO:1.Data[1]	0	Decimal	SINT	
+ NXIO:1.Data[2]	0	Decimal	SINT	
+ NXIO:1.Data[3]	0	Decimal	SINT	
+ NXIO:1.Data[4]	2	Decimal	SINT	
+ NXIO:1.Data[5]	119	Decimal	SINT	
+ NXIO:C	{...}		AB:ETHERNET_MODULE:C:0	
+ Local:2:I	{...}		AB:1769_DI16:I:0	
+ Local:1:O	{...}		AB:1769_DO16:O:0	
+ Local:1:I	{...}		AB:1769_DI16:I:0	
+ Local:1:C	{...}		AB:1769_DO16:C:0	

Figure 18: Controller Tags for input and output Data

4.4 Configuration SERCOS III Slave

4.4.1 General Data

Real-Time Ethernet System	SERCOS III Slave
Address Switch	Device address from 1 to 127 Bytes
SDDML	Hilscher NXIO100 RE S3S FSPIO FixCFG.xml
Master Device	Bosch Rexroth, Automata
Configuration Tool	Manufacturer depending
System Requirements	-
Firmware Support USB	Current firmware has no USB support.

Table 17: General Data SERCOS III Slave

4.4.2 Protocols

I/O Data	16 Bit Input 16 Bit Output via P-0-1502 and P-0-1503 SUC or cyclic parameterizable
Functions	Real-Time data Service Channel Synchronization Phase Run Up Ring and Line Topology

Table 18: Protocols SERCOS III Slave

4.4.3 Configuring NXIO 100-RE for SERCOS III

1. Disconnect power.
2. Slot the MMC card SERCOS III into SD / MMC Card Connector.
3. Set the NXIO 100-RE address switch for device address (x1) respectively for device address (x16).
4. Connect the power supply to the NXIO 100-RE Board.
5. Connect the devices using Ethernet cable. (Hubs and switches are forbidden for EtherNet/IP.)
6. Configure the Master.

4.5 Open Modbus/TCP Server

4.5.1 General Data

Real-Time Ethernet System	Open Modbus/ TCP Server
Address Switch	Not used
EDS	Not necessary
Master Device	Open Modbus TCP Client: e. g. ModScan32
Configuration Tool	e. g. ModScan32
System Requirements	IP Address via DHCP
Parameters set by the firmware	-
Firmware Support USB	Current firmware has no USB support.

Table 19: General Data Open Modbus/TCP Server

4.5.2 Protocols

I/O Modbus Server	2 Byte Input 2 Byte Output
Function Codes	1, 2, 3, 4, 5, 6, 7, 15, 16 Function Code 1: 1 ... 16 (coil read) Function Code 3: 40,001 (1 register read) Function Code 5: 1 ... 16 (coil read) Function Code 16: 40,001 (1 register write)
Message Modus	Server

Table 20: Protocols Open Modbus/TCP Server

4.5.3 Configuring NXIO 100-RE for Open Modbus/TCP Server

1. CAUTION! To prevent damage from electrostatic discharge to the NXIO 100-RE-Board, first put the NXIO 100-RE-Board within its protective packaging on a table and touch the table before you unpack and touch the board.
2. Disconnect power.
3. Slot the MMC card Open Modbus TCP into SD / MMC Card Connector.
4. Connect the power supply to the NXIO 100-RE Board.
5. Connect the devices using Ethernet cable. If the necessary hubs and switches.

Communication System	Hub	Switch
Open Modbus/TCP	applicable	applicable

Table 21: Use of Hubs and Switches for Open Modbus/TCP

6. Configure the Master.

4.5.4 How to configure the ModScan32

To read the 16 digital inputs, use function code 1 with length 16 as displayed in the following figure.

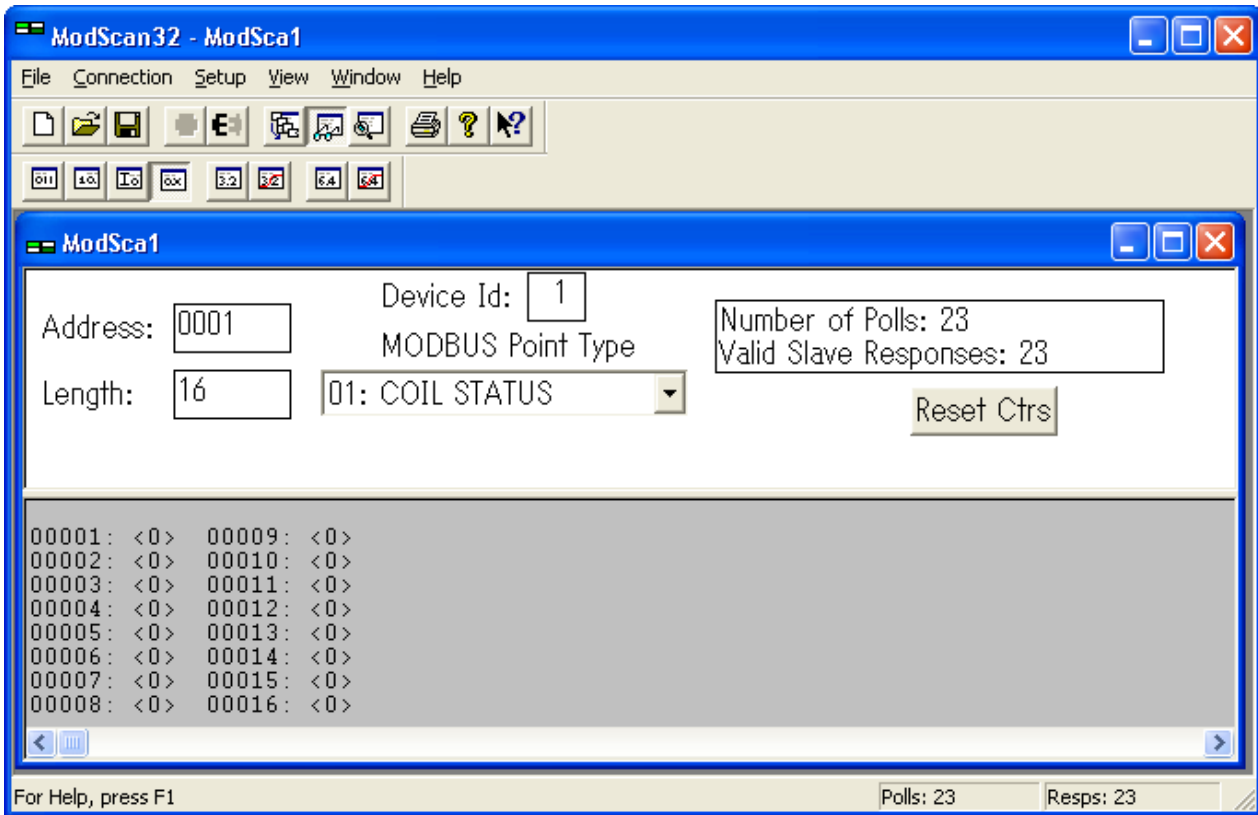


Figure 19: ModScan32 Configuration

4.6 Powerlink Controlled Node (Slave)

4.6.1 General Data

Real-Time Ethernet System	Ethernet Powerlink Controlled Node (Slave)
Address Switch	Bus address of the Ethernet Powerlink Controlled Node (Slave)
XML	00000044_NXIO 100-RE PLS.xdd
Master Device	ZWH, lxxat, further
System Requirements	Correspondingly configuratble Master (Managing Node).
Parameters set by the firmware	All configuration data as PDO configuration etc.
Firmware Support USB	Current firmware has no USB support.

Table 22: General Data Powerlink Controlled Node (Slave)

4.6.2 Protocols

I/O Data	2 Byte Input 2 Byte Output
Version	V2
Poll Request/ Response	Response Time 1µs
Functions	SDO Upload/Download SDO over ASND, integrated Hub PDO Mapping

Table 23: Protocols Powerlink Controlled Node (Slave)

4.6.3 Configuring NXIO 100-RE for Powerlink Controlled Node (Slave)

1. CAUTION! To prevent damage from electrostatic discharge to the NXIO 100-RE-Board, first put the NXIO 100-RE-Board within its protective packaging on a table and touch the table before you unpack and touch the board.
2. Disconnect power.
3. Slot the MMC card Pwoerlink into SD / MMC Card Connector.
4. Connect the power supply to the NXIO 100-RE Board.
5. Connect the devices using Ethernet cable. Insert the necessary hubs.

Communication System	Hub	Switch
Powerlink	applicable	forbidden

Table 24: Use of Hubs and Switches

6. Configure the Master.

5 Device Drawings and Connections

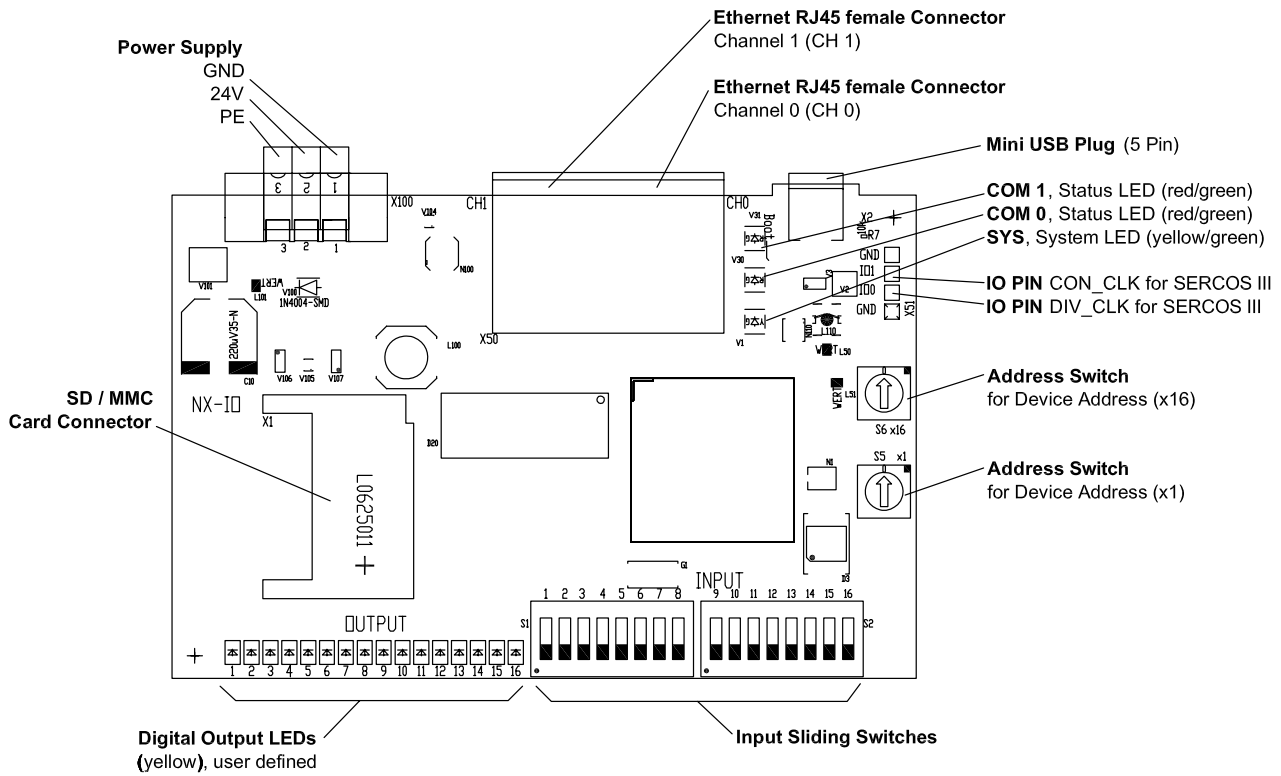


Figure 20: NXIO 100-RE Board



Note: IO Pin CON_CLK for SERCOS III and IO Pin DIV_CLK for SERCOS III are for oscilloscope measurements only.

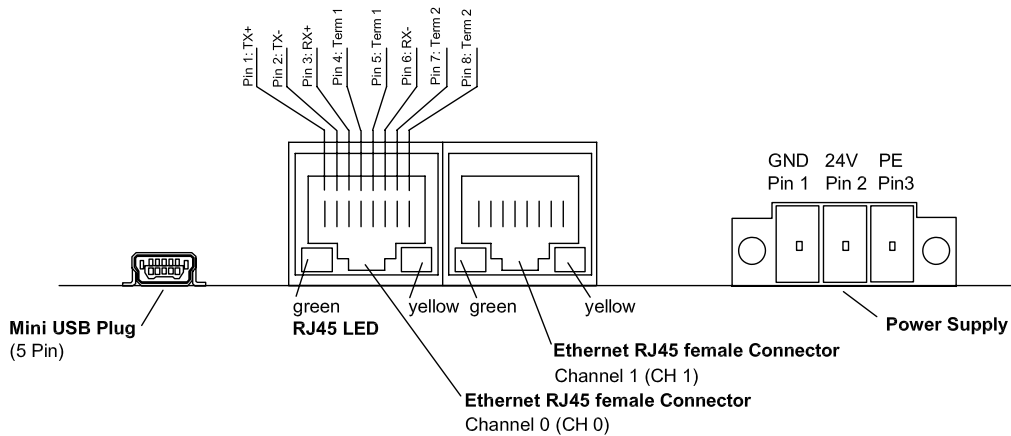


Figure 21: Side View NXIO 100-RE Board - with Ethernet RJ45

5.1 Power Supply

The NXIO 100-RE Board can be operated by a DC power supply from 12 V to 30 V, which is to be plugged into the power jack X100 located in the lower right corner of the board.

The polarity of the power plug must be taken care of. An AC supply shall not be used, as the input capacitors are not designed for that mode of operation. The current drawn by the NXIO 100-RE Board depends on several factors such as operating mode of the netX, CPU load, use of additional hardware and mainly on the level of the input voltage (the higher the voltage, the lower the current).

Pin	Description
1	Ground
2	12 - 30 V
3	PE

Table 25: Power Supply, X100

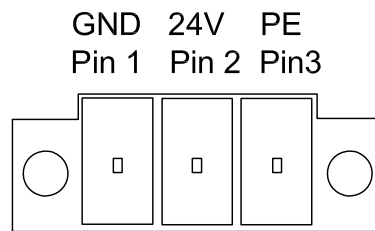


Figure 22: Power Supply, X100

5.2 Ethernet Interface

For the Ethernet interface use RJ45 plugs and twisted pair cable of category 5 (CAT5) or higher, which consists of 4 twisted cores and has a maximum transmission rate of 100 MBit/s (CAT5).

5.2.1 Ethernet pinning at the RJ45 Socket



Note: The device supports the Auto Crossover function. Due to this fact RX and TX can be switched. The following figure shows the RJ45 standard pinning.

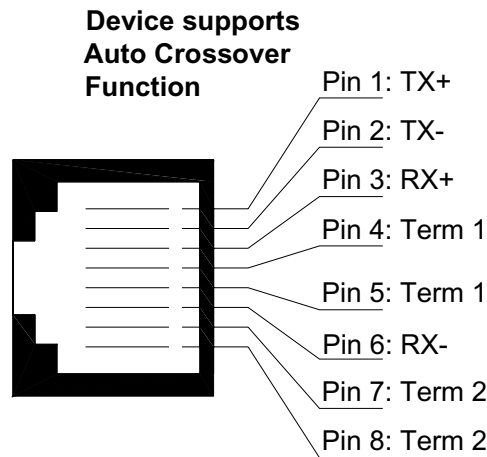


Figure 23: Ethernet pinning at the RJ45 Socket

Pin	Signal	Meaning
1	TX+	Transmit Data +
2	TX-	Transmit Data -
3	RX+	Receive Data +
4	Term 1	Connected to each other and terminated to PE through RC circuit*
5	Term 1	
6	RX-	Receive Data -
7	Term 2	Connected to each other and terminated to PE through RC circuit*
8	Term 2	
		* Bob Smith Termination

Table 26: Ethernet pinning at the RJ45 Socket

5.2.2 Ethernet Connection Data

Medium	2 x 2 Twisted-Pair cupric cable, CAT5 (100 MBit/s)
Length of cable	max. 100 m
Transmission rate	10 MBit/s / 100 MBit/s

Table 27: Ethernet Connection Data

5.2.3 Use of Hubs and Switches

For the corresponding communication systems the use of hubs and switches is forbidden or applicable. The following table shows the use of hubs and switches by communication system:

Communication System	Hub	Switch
EtherCAT	forbidden	applicable only between Master and 1. participant
EtherNet/IP	allowed	applicable (10 MBit/s / 100 MBit/s, Full or Half Duplex, Auto-Negotiation)
Open Modbus/TCP	allowed	applicable (10 MBit/s / 100 MBit/s, Full or Half Duplex, Auto-Negotiation)
Powerlink Controlled Node	allowed	forbidden
PROFINET IO	forbidden	applicable only, if the switch supports 'priority tagging' (100 MBit/s, Full duplex)
SERCOS III	forbidden	forbidden

Table 28: Use of Hubs and Switches

5.3 Mini-B USB Connector (5 Pin)

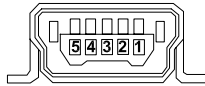


Figure 24: Mini-B USB Connector (5 Pin), X2

Pin	Name	Description
1	USB_EXT	USB Bus Power (+5 V, supplied externally)
2	D-	Data -
3	D+	Data +
4	ID	Not connected
5	GND	Ground

Table 29: Pin out, X2

5.4 Pinning X51

Pin	Signal
1	GND
2	IO 0: CON_CLK for SERCOS III
3	IO 1: DIV_CLK for SERCOS III
4	GND

Table 30: Pinning for X51

6 LED

6.1 LED Real Time Ethernet Systems

6.1.1 LED Names for each Real Time Ethernet System



Note: Depending from the configured MMC card the NXIO 100-RE Board LEDs are configured to the corresponding real-time Ethernet system.

LED		EtherCAT Slave	EtherNet/IP	Powerlink	Open Modbus/TCP	PROFINET IO	SERCOS III
SYS (yellow / green)		SYS	SYS	SYS	SYS	SYS	SYS
COM 0 (red/ green)		RUN	MS	BS	RUN	SF	S3
COM 1 (red/ green)		ERR	NS	BE	ERR	BF	-
RJ45 Ch0	green	L/A IN	LINK	L/A	LINK	LINK	L/A
	yellow	-	ACT	-	ACT	RX/TX	-
RJ45 Ch1	green	L/A OUT	LINK	L/A	LINK	LINK	L/A
	yellow	-	ACT	-	ACT	RX/TX	-

Table 31: LED Names for each Real Time Ethernet System

LED	Name	Meaning
System Status	SYS	System
Communication Status	RUN	Run
	ERR	Error
	S3	SERCOS Status
	STA	Status
	SF	System Failure
	BF	Bus Failure
	MS	Module Status
	NS	Network Status
	BS	Bus Status
RJ45	BE	Bus Error
	LINK, L	Link
	ACT, A	Activity
	L/A	Link/Activity
	L/A IN	Link/Activity Input
	L/A OUT	Link/Activity Output

Table 32: Meaning LED Names

6.1.2 LED EtherCAT Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherCAT Slave protocol is loaded to the device.













LED	Color	State	Meaning
RUN Name in the device drawing: COM 0	Duo LED red/green		
	 (off)	Off	INIT: The device is in state INIT
	 (green)	Blinking	PRE-OPERATIONAL: The device is in state PRE-OPERATIONAL
	 (green)	Single Flash	SAFE-OPERATIONAL: The device is in state SAFE-OPERATIONAL
	 (green)	On	OPERATIONAL: The device is in state OPERATIONAL
ERR Name in the device drawing: COM 1	Duo LED red/green		
	 (off)	Off	No error: The EtherCAT communication of the device is in working condition
	 (red)	Blinking	Invalid Configuration: General Configuration Error (Example: State change commanded by master is impossible due to register or object settings.)
	 (red)	Single Flash	Unsolicited State Change: Slave device application has changed the EtherCAT state autonomously: Parameter "Change" in the AL status register is set to 0x01:change/error (Example: Synchronization Error, device enters Safe-Operational automatically.)
	 (red)	Double Flash	Application Watchdog Timeout: An application watchdog timeout has occurred. (Example: Sync Manager Watchdog timeout)
 (red)	On	PDI Watchdog Timeout: A PDI Watchdog timeout has occurred (Example: Application controller is not responding any more)	
L/A IN/ RJ45 Ch0 L/A OUT/ RJ45 Ch1	LED green		
	 (green)	On	A link is established
	 (green)	Flashing	The device sends/receives Ethernet frames
	 (off)	Off	No link established
RJ45 Ch0 RJ45 Ch1	LED yellow		
	-	-	This LED is not used.

Table 33: LEDs EtherCAT Slave

LED State Definition for EtherCAT Slave for the RUN and ERR LEDs

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of 2,5 Hz: on for 200 ms, followed by off for 200 ms.
Single Flash	The indicator shows one short flash (200 ms) followed by a long off phase (1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each 200 ms), separated by a short off phase (200 ms). The sequence is finished by a long off phase (1,000 ms).

Table 34: LED State Definition for EtherCAT Slave for the RUN and ERR LEDs

6.1.3 LED EtherNet/IP Adapter (Slave)

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the EtherNet/IP Adapter (Slave) protocol is loaded to the device.















LED	Color	State	Meaning
MS Name in the device drawing: COM 0	Duo LED red/green		
	 (green)	On	Device operational: If the device is operating correctly, the module status indicator shall be steady green.
	 (green)	Flashing	Standby: If the device has not been configured, the module status indicator shall be flashing green.
	 (red)	On	Major fault: If the device has detected a non-recoverable major fault, the module status indicator shall be steady red.
	 (red)	Flashing	Minor fault: If the device has detected a recoverable minor fault, the module status indicator shall be flashing red. NOTE: An incorrect or inconsistent configuration would be considered a minor fault.
	 (red/green)	Flashing	Self-test: While the device is performing its power up testing, the module status indicator shall be flashing green/red.
	 (off)	Off	No power: If no power is supplied to the device, the module status indicator shall be steady off.
NS Name in the device drawing: COM 1	Duo LED red/green		
	 (green)	On	Connected: If the device has at least one established connection (even to the Message Router), the network status indicator shall be steady green.
	 (green)	Flashing	No connections: If the device has no established connections, but has obtained an IP address, the network status indicator shall be flashing green.
	 (red)	On	Duplicate IP: If the device has detected that its IP address is already in use, the network status indicator shall be steady red.
	 (red)	Flashing	Connection timeout: If one or more of the connections in which this device is the target has timed out, the network status indicator shall be flashing red. This shall be left only if all timed out connections are reestablished or if the device is reset.
	 (red/green)	Flashing	Self-test: While the device is performing its power up testing, the network status indicator shall be flashing green/red.
LINK/RJ45 Ch0 & Ch1	LED green		
	 (green)	On	A connection to the Ethernet exists
	 (off)	Off	The device has no connection to the Ethernet
ACT/RJ45 Ch0 & Ch1	LED yellow		
	 (yellow)	Flashing	The device sends/receives Ethernet frames

Table 35: LEDs EtherNet/IP Adapter (Slave)

6.1.4 LED Open Modbus/TCP

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the Open Modbus/TCP protocol is loaded to the device.











LED	Color	State	Meaning
RUN Name in the device drawing: COM 0	Duo LED red/green		
	 (off)	Off	Not Ready OMB task is not ready
	 (green)	Flashing cyclic with 1Hz	Ready, not configured yet OMB task is ready and not configured yet
	 (green)	Flashing cyclic with 5Hz	Waiting for Communication: OMB task is configured
	 (green)	On	Connected: OMB task has communication – at least one TCP connection is established
ERR Name in the device drawing: COM 1	Duo LED red/green		
	 (off)	Off	No communication error
	 (red)	Flashing cyclic with 2Hz (On/Off Ratio = 25 %)	System error
	 (red)	On	Communication error active
LINK/RJ 45 Ch0 & Ch1	LED green		
	 (green)	On	A connection to the Ethernet exists
	 (off)	Off	The device has no connection to the Ethernet
ACT/RJ 45 Ch0 & Ch1	LED yellow		
 (yellow)	Flashing	The device sends/receives Ethernet frames	

Table 36: LEDs Open Modbus/TCP

6.1.5 LED Powerlink Controlled Node / Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the Powerlink Controlled Node/Slave protocol is loaded to the device.








LED	Color	State	Meaning
BS Name in the device drawing: COM 0	Duo LED red/green		
	 (off)	Off	Slave initializing
	 (green)	Flickering	Slave is in Basic Ethernet state
		Single Flash	Slave is in Pre-Operational 1
		Double Flash	Slave is in Pre-Operational 2
		Triple Flash	Slave is in ReadyToOperate
		On	Slave is Operational
	Blinking	Slave is Stopped	
BE Name in the device drawing: COM 1	Duo LED red/green		
	 (off)	Off	Slave has no error
	 (red)	On	Slave has detected an error
L/A/ RJ45 Ch0 & Ch1	LED green		
	 (green)	On	Link: A connection to the Ethernet exists
	 (green)	Flashing	Activity: The device sends/receives Ethernet frames
	 (off)	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1	LED yellow		
	-	-	This LED is not used.

Table 37: LEDs Powerlink Controlled Node/Slave

LED State Definition for Powerlink Controlled Node/Slave for the BS/BE LEDs

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Blinking	The indicator turns on and off with a frequency of approximately 2,5 Hz: on for approximately 200 ms, followed by off for 200 ms. Red and green LEDs shall be on alternately.
Flickering	The indicator turns on and off with a frequency of approximately 10 Hz: on for approximately 50 ms, followed by off for 50 ms. Red and green LEDs shall be on alternately.
Single Flash	The indicator shows one short flash (approximately 200 ms) followed by a long off phase (approximately 1,000 ms).
Double Flash	The indicator shows a sequence of two short flashes (each approximately 200 ms), separated by a short off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1,000 ms).
Triple Flash	The indicator shows a sequence of three short flashes (each approximately 200 ms), separated by a short off phase (approximately 200 ms). The sequence is finished by a long off phase (approximately 1,000 ms).

Table 38: LED State Definition for Powerlink Controlled Node/Slave for the BS/BE LEDs

6.1.6 LED PROFINET IO-RT-Device

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the PROFINET IO-RT-Device protocol is loaded to the device.










LED	Color	State	Meaning
SF Name in the device drawing: COM 0	Duo LED red/green		
	 (red)	On	Watchdog timeout; channel, generic or extended diagnosis present; system error
	 (red)	Flashing cyclic at 2 Hz (for 3 sec.)	DCP signal service is initiated via the bus
	 (off)	Off	No error
BF Name in the device drawing: COM 1	Duo LED red/green		
	 (red)	On	No configuration; or low speed physical link; or no physical link
	 (red)	Flashing cyclic at 2 Hz	No data exchange
	 (off)	Off	No error
LINK/RJ45 Ch0 & Ch1	LED green		
	 (green)	On	A connection to the Ethernet exists
	 (off)	Off	The device has no connection to the Ethernet
RX/TX/RJ45 Ch0 & Ch1	LED yellow		
	 (yellow)	Flashing	The device sends/receives Ethernet frames

Table 39: LEDs PROFINET IO-RT-Device

6.1.7 LED SERCOS III Slave

The subsequent table describes the meaning of the LEDs for the Real-Time Ethernet device when the firmware of the SERCOS III Slave protocol is loaded to the device.











LED	Color	State	Meaning
STA Name in the device drawing: COM 0	Duo LED red/green/orange (orange = red/green simultaneously)		
	 (green)	On	CP4: Communication phase 4, Normal operation, no error
	 (green)	Flashing (4 Hz)	Loopback: The network state has changed from „fast-forward“ to „loopback“.
	 (red/green)	Flashing (4 Hz), <i>The LED flashes at least for 2 seconds from red to green.</i>	Communication Error: Depends on IDN S-0-1003 (for details refer to SERCOS III Slave Protocol API documentation). Shows how long the Master may in the communication phases CP3 and CP4 not received Master SYNC telegrams.
	 (red)	On	SIII C1D: Error detected according to Sercos III Cass 1 Diagnosis.
	 (orange)	On	CP0 ... CP3: Communication phase 0 to Communication phase 3
	 (orange)	Flashing (4 Hz)	Identification: Bit 15 in the Slave device control that indicates remote address allocation or configuration errors between Master and Slaves (for details refer to SERCOS III Slave Protocol API documentation).
	 (off)	Off	No SERCOS III Communication
Name in the device drawing: COM 1	Duo LED red/green		
	-	-	This LED is not used.
L/A/RJ45 Ch0 & Ch1	LED green		
	 (green)	On	Link: A connection to the Ethernet exists
	 (green)	Flashing	Activity: The device sends/receives Ethernet frames
	 (off)	Off	The device has no connection to the Ethernet
RJ45 Ch0 & Ch1	LED yellow		
	-	-	This LED is not used.

Table 40: LEDs SERCOS III Slave

LED State Definition for SERCOS III Slave for the S3 LED

Indicator state	Definition
On	The indicator is constantly on.
Off	The indicator is constantly off.
Flashing (4 Hz)	The indicator turns on and off with a frequency of 4 Hz: on for appr. 125 ms, followed by off for appr. 125 ms.

Table 41: LED State Definition for SERCOS III Slave for the S3 LED

6.1.8 Digital Output LEDs

The Digital Output LEDs O1 to O16 can be turned on and off by controlling the appropriate GPIOs.

LED		Color
V4	O1: Digital Out	yellow
V5	O2: Digital Out	yellow
V6	O3: Digital Out	yellow
V7	O4: Digital Out	yellow
V8	O5: Digital Out	yellow
V9	O6: Digital Out	yellow
V10	O7: Digital Out	yellow
V11	O8: Digital Out	yellow
V12	O9: Digital Out	yellow
V13	O10: Digital Out	yellow
V14	O11: Digital Out	yellow
V15	O12: Digital Out	yellow
V16	O13: Digital Out	yellow
V17	O14: Digital Out	yellow
V18	O15: Digital Out	yellow
V19	O16: Digital Out	yellow

Table 42: Digital Output LEDs

7 Technical Data

7.1 Technical Data NXIO 100-RE

Item	NXIO 100-RE Board
Function	Real-Time-Ethernet
Communication	Determined by the loaded firmware
Protocols	EtherCAT Slave, EtherNet/IP Adapter (Slave), Open Modbus/TCP Server, Ethernet Powerlink Controlled Node (Slave), PROFINET IO-Device, SERCOS III Slave,
Ethernet Frame Types	Ethernet II
Processor	netX 500
Transmission Rate	10/100 MBit/s, Auto-Negotiation, Cross-Over, Halfduplex/Fullduplex (100 MBit/s)
Inputs	16x DIL Switch as Digital Input
Outputs	16x LED as Digital Output
Displays	SYS, 2x COM
Control Elements	2x Address Rotary Switches 0-15
Measuring Points	2x Synchronization Signal
Memory Interface	MMC
Diagnostic Interface	USB Device, Mini-B Plug
Communication Interface	2x Ethernet 100 Base-TX, RJ45 isolated
Power Supply	+12 ... +30 V DC / 3 W power consumption
Operating Temperature	0 °C ... 50 °C
Dimensions (L x W x H)	100 x 65 x 20 mm

Table 43: Technical Data NXIO 100-RE Board

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