



Industri<mark>al</mark> Automation

# DEVICENET™-MASTER USER MANUAL





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# Warning! Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighboring units that are live.
- Follow the engineering instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.



# **Table of Contents**

## **About this Manual**

Documentation concept	0-2
Description of symbols used	0-3
General information	0-4
Prescribed use	0-4
Notes concerning planning /installation of this product	0-4
List of revisions	0-5

## **1** The DeviceNet<sup>™</sup> master-function

General information	1-2
Power supply	1-3
General	1-3
FXEN	1-3
BL67	1-3
DeviceNet™subnet	1-4
DeviceNet™ connector	1-4
Configuration of the DeviceNet™ subnet	1-5
DeviceNet <sup>™</sup> configuration via IO-ASSISTANT 3 (FDT/DTM)	1-6
Address setting for the DeviceNet <sup>™</sup> subnet	1-10
MAC-ID of the DeviceNet <sup>™</sup> master	1-10
Baud rate setting	1-10
Reset the device to factory settings	1-10
Status indicators/ LED behavior	1-11
Getting started for the DeviceNet™master	1-12
The DeviceNet™master in the IO-ASSISTANT 3 (FDT/DTM)	1-14

# 2 DeviceNet<sup>™</sup> master with EtherNet/IP

Modules for EtherNet/IP	2-2
FXEN-IM16-0001-IP-DN	2-2
BL67-GW-EN-IP-DN	2-3
Process image	2-4
Example: input image	2-4
Example: output image	2-5
Status/control words of the DeviceNet™subnet via I/O data	2-6
Status words	2-6
Control word	2-8
Assembly Instances	2-9

VSCs for the DeviceNet <sup>™</sup> master-function	2-10
DeviceNet™ master class (VSC122, 7Ah)	2-11
DeviceNet <sup>™</sup> slave class (VSC 123, 7Bh)	2-14

# 3 Application example: FXEN at Allen Bradley PLC

Hard- and software	3-2
Hardware	3-2
Software	3-2
Network configuration and IP-address-setting	3-3
Settings of the network interface card	3-3
Address setting at the FXEN-module via DHCP-mode	3-3
Configuration of the network in "RSLogix 5000"	3-6
Configuration of the controller	3-6
Configuration of the FXEN	3-8
Downloading the I/O configuration	3-13
Examples for process data acces	3-18
Explicit Messaging within the PLC program	3-20
Controller Tag definition	3-20
The PLC program	3-23
Example for VSC access	3-26
VSC access to DeviceNet <sup>™</sup> master or DeviceNet <sup>™</sup> nodes	3-29

# 4 DeviceNet<sup>™</sup> master with Modbus TCP

Modules for Modbus TCP	4-2
BL67-GW-EN-DN	4-2
Modbus data layout	4-3
Process data	4-6
Example: input image	4-6
Example: output image	4-7
Status/control words of the DeviceNet™ subnet via I/O data	4-8
Status words	4-8
Control word	4-10
RUN/IDLE Mode	4-11
Register layout	4-11

# 5 Application Example: BL67 with Modbus Server Tester

Hard- and software	5-2
Hardware	5-2
Software	5-2
Natural configuration and ID address setting	5.0
Network configuration and IP-address-setting	5-3
Settings of the network interface card	5-3



Address setting at the BL67-module	
Modbus communications configuration	5-4
Modbus Server Tester configuration	5-4
Examples of communication parameter changes and I/O testing	5-13
Reading slave inputs and forcing slave outputs	5-22

## 6 Index



# **About this Manual**

Documentation concept	2
Description of symbols used	3
General information	4
Prescribed use	
Notes concerning planning /installation of this product	

#### **Documentation concept**

This manual contains information about the DeviceNet<sup>™</sup> master function integrated in TURCK I/O-products.

A DeviceNet<sup>™</sup> connector on the device can be used to access a DeviceNet<sup>™</sup> subnet with up to 63 manufacturer independent DeviceNet<sup>™</sup> nodes (detailed information see chapter 2).

The following chapters contain a short DeviceNet<sup>™</sup> master function description and information about the handling of the DeviceNet<sup>™</sup> master function for different primary fieldbus systems (EtherNet/IP and Modbus TCP).

All information (hardware, firmware, etc.) about the respective devices and their connection to the primary fieldbus can be found in different device-manuals:

#### EtherNet/IP

- FXEN user manual for EtherNet/IP (TURCK-Documentation-No.: English D301155)
- BL67 user manual for EtherNet/IP (TURCK-Documentation-No.: English D300888)

#### **Modbus TCP**

BL67 user manual for Modbus TCP (TURCK-Documentation-No.: English D300815)



#### **Description of symbols used**



#### Warning

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software) and to the facility.

This sign means for the operator: work with extreme caution.



#### Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel and damages to the system (hardware and software) and to the facility.



#### Note

This sign can be found next to all general notes that supply important information about one or more operating steps. These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

#### **General information**



## Attention

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual contains all necessary information about the prescibed use of the TURCK products with DeviceNet<sup>™</sup> master function.

It has been specially conceived for personnel with the necessary qualifications.

#### **Prescribed use**



#### Warning

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

#### Notes concerning planning /installation of this product



#### Warning

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



#### List of revisions

In comparison to the previous manual edition, the following changes/ revisions have been made:

<i>Tabelle 1:</i> List of revi- sions	Chapter	Subject	new	changed
	all	Additions for the new Modbus TCP-funciton		Х
	4	DeviceNet <sup>™</sup> master with Modbus TCP	Х	
	5	Application Example: BL67 with Modbus Server Tester	Х	

# i

Note

The publication of this manual renders all previous editions invalid.

**About this Manual** 



# **1** The DeviceNet<sup>™</sup> master-function

General information	2
Power supply	3
General	3
FXEN	3
BL67	3
DeviceNet™ subnet	4
DeviceNet™ connector	4
– FXEN	4
– BL67	4
Configuration of the DeviceNet <sup>™</sup> subnet	5
– DeviceNet™ -configuration with SET-button (hardware)	5
DeviceNet <sup>™</sup> configuration via PACTware <sup>™</sup> (I/O-ASSISTANT V3)	6
Address setting for the DeviceNet™ subnet	
MAC-ID of the DeviceNet <sup>™</sup> master	
Baud rate setting	
Reset the device to factory settings	
Status indicators/ LED behavior	11
Getting started for the DeviceNet™master	12
The DeviceNet <sup>™</sup> master in the PACTware <sup>™</sup> (I/O-ASSISTANT V3)	14

#### **General information**

The TURCK products with DeviceNet<sup>™</sup> master function provide a full DeviceNet<sup>™</sup> master in addition to their standard primary fieldbus (e. g. EtherNet/IP, Modbus TCP).

The TURCK modules work as gateways between their primary fieldbus and DeviceNet<sup>™</sup>. Via the DeviceNet<sup>™</sup> master, a complete DeviceNet<sup>™</sup> network with up to 63 standard DeviceNet<sup>™</sup> nodes can thus be connected to the primary fieldbus.

The handling of the DeviceNet<sup>™</sup> process data is done in the PLC connected to EtherNet/IP or Modbus TCP for example.

The DeviceNet<sup>™</sup> master function is currently implemented in the following TURCK products:

#### EtherNet/IP

- FXEN (compact I/Os)
   FXEN with EtherNet/IP: FXEN-IM16-0001-IP-DN, page 2-2
- BL67 (modular I/Os)
   BL67 with EtherNet/IP: BL67-GW-EN-IP-DN, page 2-3

#### **Modbus TCP**

BL67 (modular I/Os)
 BL67 with Modbus TCP: BL67-GW-EN-DN, page 4-2

#### **Power supply**



#### General

The DeviceNet<sup>™</sup> master on the modules provides CAN\_H, CAN\_L, Shield, and Ground for the DeviceNet<sup>™</sup> communication.

The 24 V DC DeviceNet<sup>™</sup> supply voltage (V+/ V-) for the master and the connected DeviceNet<sup>™</sup> nodes has to be provided from an external power supply unit.

## FXEN

The FXEN station itself is also supplied through the DeviceNet<sup>™</sup> cable via the external power supply. No additional power feed at the FXEN module is necessary.

## **BL67**

In BL67, only the DeviceNet<sup>™</sup> master is fed through the DeviceNet<sup>™</sup> supply voltage (V+/ V-). The modular BL67 station (gateway plus connected I/O modules) has to be supplied additonally through the 7/8'' power connector at the gateway.

#### **DeviceNet™subnet**

The DeviceNet<sup>™</sup> connector on the different devices is used to access a DeviceNet<sup>™</sup> subnet with up to 63 vendor independent DeviceNet<sup>™</sup> nodes.



The DeviceNet<sup>™</sup> master function of the device is only activated if a subnet is connected to the DeviceNet<sup>™</sup> connector.

#### **DeviceNet™ connector**

Note

Depending on the module type used, the connection of the DeviceNet<sup>™</sup> master to the subnet is realized as follows:

#### **FXEN**

The FXEN module provides two 7/8" DeviceNet<sup>™</sup> connectors "DN", one male and one female which are assigned as follows:

Figure 1: 7/8"-connectors and pin assignment

-	Pin-No.			
4 . 2	1	Shield		
5 1	2	V+		
-	3	V-		
3 2 6 4	4	CAN_H		
1%-95	5	CAN_L		

#### **BL67**

The BL67 gateway provides one male M12 × 1 DeviceNet<sup>™</sup> connector "DN" which is assigned as follows.:

Figure 2: M12-male connector and pin assignment	3	Pin-No.			
	4	1	Shield		
	5	2	not connected		
		3	V-	Ground	
		4	CAN_H		
		5	CAN_L		

#### Note

Please use an external bus tee or Y-junction for the bus transmission.



#### Configuration of the DeviceNet<sup>™</sup> subnet

#### **DeviceNet<sup>™</sup>-configuration with SET-button (hardware)**

Upon pressing the SET-button at the device, the DeviceNet<sup>™</sup> master scans all nodes attached to the DeviceNet<sup>™</sup> subnet. The network is then automatically mapped.

All nodes connected to the subnet are read-in with their MAC-ID (DeviceNet<sup>™</sup> address), their Vendor ID, their product type and their product code and are stored in the scan list of the DeviceNet<sup>™</sup> master.

The I/O data of the connected DeviceNet<sup>™</sup> nodes is automatically mapped to the "Process image" (word alignment) of the master based on the size of the Consumed and Produced Data of each of the nodes.

The CCV is read from the Identity object and stored as the expected configuration consistency value.

#### **BL67 - special scanning behavior**

Once the scan of the subnet is complete, the DeviceNet<sup>™</sup> master in the BL67-gateway scans the locally connected I/Os mounted right to the gateway and adds their I/O data to the I/O mapping.



#### Note

Please note, that after every address or baud rate-change a power reset has to be executed.



#### Attention

In case of a node or network fault, the "Set" button **must not** be pressed. It may remap the I/O data. 1

#### DeviceNet<sup>™</sup> configuration via IO-ASSISTANT 3 (FDT/DTM)

The configuration of the network can also be done using the software IO-ASSISTANT 3.

The IO-ASSISTANT 3 is a Network Configuration tool on FDT/DTM basis. It helps to create networks offline and online. Configuring a network offline, the network can be checked for validity (i.e., adequate power for the network). Configuring a network online, the network will assume that the master has valid addresses (IP, MAC-ID) and that the connecting devices have unique node addresses. Baud rates for the connecting devices can be set automatically with the "autobaud function" or set to the desired rate.

The following example shows the scanning process via IO-ASSISTANT 3 using the FXEN module for EtherNet/IP with DeviceNet<sup>™</sup> master (FXEN-IM16-0001-IP-DN). This network is being configured online.

To configure the DeviceNet<sup>™</sup> network via the IO-ASSISTANT 3, please carry out the followong steps.

- 1 Create a new project in PACTware<sup>™</sup>. If PACTware<sup>™</sup> is started for the first time, the software will start with a new project. If not, open create a new project by using "File New…".
- **2** Add a TCP/IP-communication DTM "BL Service Ethernet" to the project and start the Busaddress Management.

To do this, execute a rightclick on the TCP/IP-entry and select "Additional functions  $\rightarrow$  Busaddress management".



1

**3** Select your network interface and start the network scan using the "search"-button.

#### Figure 4: Scan function

							الكال
n 👔 🔹 👔 Device t	ype B	L Service Ethern	iet			TUR	ск
Descripti	on <b>B</b>	L Service over e	thernet commun	ication D1	TM	Industrial Auto	mation
🗏 • 😤 🖈 🛛 🔊	🧶   IP‡ I	P†   +8   14			Busaddress	s manag	ement
Online available devices	earch						
Drahtlose Netzwerkverbindung	) 2 (192.168.1	.47/255.255.255.0)					•
Device type	Online ID	IP address	Netmask	Gateway	Ethernel	t address	Mode
<							
Planned devices							
Planned devices     Device type	Online ID	Busaddress	Designation ('Ta	ag')	Device short nar	me	
Planned devices     Device type     FXEN-XSG16-0001-IP	Online ID 1100019/8	Busaddress 192.168.1.200	Designation ('T	∍g') 001-IP	Device short nar	ne	
Planned devices           Device type           FXEN:XSG16-0001-IP           FXEN:IN16-0001-IP-DN	Online ID 1100019/8 110001A/8	Busaddress 192.168.1.200 192.168.1.115	Designation ('T FXEN-XSG16-0 FXEN-IM16-000	ag') 001-IP 01-IP-DN	Device short nar	ne	
Planned devices Device type FXEN-XSG16-0001-IP FXEN-IM16-0001-IP-DN	Online ID 1100019/8 110001A/8	Busaddress 192.168.1.200 192.168.1.115	Designation (T- FXEN-XSG16-0 FXEN-IM16-000	ag') 001-IP 01-IP-DN	Device short nar	ne	
Planned devices       Device type       FXEN-XSG16-0001-IP       FXEN-XM16-0001-IP-DN	Online ID 1100019/8 110001A/8	Busaddress 192.168.1.200 192.168.1.115	Designation (T. FXEN-XSG16-0 FXEN-IM16-000	agʻ) 001-IP 11-IP-DN 11-IP-DN	Device short nar	ne	Abbility

- 4 The software scans the Ethernet-Network and all devices which can be found are listed up with their IP-address, their Ethernet-MAC-ID and, if the devices are known to the software, with their device type.
- 5 Select the module with the DeviceNet<sup>™</sup> master, in this example the module FXEN-IM16-0001-IP-DN, and add it to the project using the button "Add Device/DTM to the project" (see figure below).
- 6 The software identifies the connected FXEN as a module with DeviceNet<sup>™</sup> master and therefore tries to add the connected DeviceNet<sup>™</sup> nodes to the station structure.
- 7 In the following dialog box, check "Add DTMs for connected modules" and press ok and the FXEN-module is added to the project structure.
- 8 If the DeviceNet<sup>™</sup> master has already created a scanlist of it's DeviceNet<sup>™</sup> network, all DeviceNet<sup>™</sup> nodes stored in this scanlist will also be added to the project.
   But:

In this example, this is currently not possible as the DeviceNet<sup>™</sup> scanlist in the master has not been created, yet (creating a scan list: see following steps or page 1-5).

#### Note For a

For a modular station like BL67, the software would automatically add the whole BL67 station (gateway **and** directly connected BL67 IO-modules) to the project structure.

Figure 5: Adding the device to the oroject	I PACTware - [TCP/IP Busaddress management] Ele Edit View Project Device Extras Window Help - 문×  D  2  2  2  2  2  2  2  2  2  2  2  2  2
	Project • • • • • • • • • • • • • • • • • • •
	□ ••••••••••••••••••••••••••••••••••••
	Device type Online ti Perice type Perice type Online ti Perice type Per
	CCP/IP>BL Service
	add online modules

- **9** Go online with the module: right click on the module  $\rightarrow$  "connect"
- **10** Open the module's "Online parameters": right click on the module  $\rightarrow$  Parameters  $\rightarrow$  Online parameters
- **11** Set the parameter "Who" to "New scan of slaves and store list in FLASH" and send the parameter changes to the device using the button "transmit data to the device".

Figure 6:	PACTware - [192.168.1.115/FXEN-	IM16-0001-IP-DN Online parame	terization]		
Scanning the DeviceNet™	Eile     Edit     View     Project     Device     Ext       Image: Image	ras Window Help			- 6
	Project	Device type	FXEN-IM16-0001-IP-DN AIM, EtherNet/IP, 16 digital inputs, Device	Net-master (BL remo	ote) TURCK
	01/Intern-IM16	Name Device DeviceNet Master	Value	Parameters: Devi	iceNet-master
		MACID Baud Rate Bus-Off Counter	0 125k 0 E nable	Parameter name         Va           MACID         0 (************************************	Iue         Meaning           *) -62         Node Address of the Device           MACID is only valid after a p
		MAX OBJECT ATTRIBUTE WHO SUBNET OUTPUT WORD	113 current slave list store in FLASH current slave list store in FLASH	Baud rate 0 = (*)	125k A change of the baud rate is 250k
		ADR Global Fail safe state Global EPR	use IDLE Mode 100 ms 94 ms	Bus-Off 0 (' Counter 0 ( Quick_Connect 0 =	*) USINT: Number of times CAN
		mercean period	01 MV	Dis 1 = Ena (*)	able
				MAX OBJECT rea	id only Contains the number of the

**12** The DeviceNet<sup>™</sup> master starts the scanning process.



- **13** A completed and error free scan is indicated by all NET-LEDs at the DeviceNet<sup>™</sup> nodes and the DN-LED at the FXEN is constant green. This can take up to 2 minutes. → The master stores the scan list.
- **14** Now, delete the FXEN-module from the project structure and start again with scanning the Ethernet using the "Busaddress Management" (follow steps 3 to 5).
- **15** With the scan list stored to the master, the IO-ASSISTANT 3 can readout the list and add the DeviceNet<sup>™</sup> nodes to the master.



The following DeviceNet<sup>™</sup> nodes are connected to the FXEN-module:

Tabelle 2: Nodes nodes at connected to the master	Node-Address	Node
	11	FDN20-4S4XSG-E DeviceNet™ module with 4 digital input channels and 4 digital chan- nels configurable as in- or output.
	14	FDNQ-CSG44-T DeviceNet <sup>™</sup> module with 4 digital input channels and 4 digital output channels → The module is shown as Generic (GN)-DeviceNet <sup>™</sup> node because it's EDS-file has not been registered in the I/O-ASSISTANT, yet.
	22	FDNP-S0808G-TT DeviceNet™ module with 8 digital input and 8 digital output channels
	63	Ni4-DSU35-2DNetX4-H1150 Inductive dual sensor with DeviceNet™ interface.

#### Address setting for the DeviceNet<sup>™</sup> subnet

The MAC-ID (DeviceNet<sup>™</sup> address) of all nodes within the DeviceNet<sup>™</sup> subnet connected to the DeviceNet<sup>™</sup> master of the device are read-in automatically when the subnet is scanned (see also section "Configuration of the DeviceNet<sup>™</sup> subnet"). Keep in mind, all nodes must have unique addresses.

#### MAC-ID of the DeviceNet<sup>™</sup> master

- possible range: 0 to 63
- default MAC-ID (DeviceNet<sup>™</sup> address) = 0
- $\rightarrow$  Setting the MAC-ID for the DeviceNet^M subnet can be done
  - via IO-ASSISTANT 3 (FDT/DTM),
  - via the EtherNet/IP Class DeviceNet™ master class (VSC122, 7Ah)
  - via Modbus TCP commands (section "DeviceNet™ master with Modbus TCP")

#### **Baud rate setting**

- Possible baud rate: 125 Kbit/s, 250 Kbit/s and 500 Kbit/s
- Default setting = 125 Kbit/s
- → Setting the bit rate for the DeviceNet<sup>™</sup> subnetcan be done
  - via IO-ASSISTANT 3,
  - via the EtherNet/IP Class DeviceNet<sup>™</sup> master class (VSC122, 7Ah)
  - via Modbus TCP commands (section "DeviceNet™ master with Modbus TCP").

#### Reset the device to factory settings

If necessary, the complete device including the DeviceNet<sup>™</sup> master can be set to its default settings by turning the three rotary switches to position 900 "F\_Reset".



#### Attention

This reset has effect an **all** parameter settings stored in the device's FLASH.

#### FXEN

After a power reset at the device, all parameters in the module's flash are overwritten.



#### Attention

Please wait for at least 2 minutes before setting a new address.

#### **BL67**

After a power reset at the device, all parameters in the module's flash are overwritten. The writing process is indicated by the orange GW LED. The completion of the operation is indicated by the GW LED staying solid green for minimum 20 seconds.

After the reset is done, set the rotary switches back to their original position and execute a power reset again.

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Tabelle 3: LED	LED	Status	Meaning	Remedy
	DN	Green	Device is online and communi- cating. Master is communi- cating with all registered slaves.	
		Green, flashing	– Auto-discovery in progress.	-
		Red	<ul> <li>Duplicate MAC-ID on the master</li> </ul>	<ul> <li>Check the correct assignment of MAC-IDs (DeviceNet<sup>™</sup> address). One node has the same MAC-ID as the master.</li> </ul>
		Red, flashing	<ul> <li>– Empty scanlist (no DeviceNet<sup>™</sup> node stored into scan list)</li> <li>– Size errors</li> </ul>	<ul> <li>Check the size of the I/O data sent via EtherNet/IP (max. 500 bytes for DeviceNet<sup>™</sup> subnet + local I/O)</li> </ul>
		Red/green flashing	– DeviceNet™ node missing	<ul> <li>Check the communication to the DeviceNet<sup>™</sup> nodes.</li> <li>Check the Global EPR (Global Expected Packet Rate) and set it to a larger value using the IO-ASSISTANT 3, VSC122 (0×7A), instance 1, Attr. 70h for EtherNet/IP or register 0×308E for Modbus TCP.</li> </ul>
	MS	OFF	- No supply voltage	-
		Green	<ul> <li>Display of logic connection to Master (1. Ethernet/IP Connection)</li> </ul>	-
		Green, flashing	- Ready for operation	-
		Red	– Error	-
		Red, flashing	- DHCP/BOOTP Searching settings	-

## Status indicators/ LED behavior

#### Getting started for the DeviceNet<sup>™</sup> master

#### **BL67 - start-up behavior**

This section assumes that the device is in "Out-of the box state" with all parameters set to default values. It provides a step by step guide on starting up the network.

- 1 Make sure that the switch position is not 900 (F\_Reset).
- **2** Power-up the device.
- 3 DN LED has to be OFF.
- 4 Setup the MAC-ID (DeviceNet<sup>™</sup> address) of the master
  - via IO-ASSISTANT 3 (FDT/DTM)
  - via VSC122 (0×7A), instance 1, Attr. 01h in EtherNet/IP, page 2-11
  - via Modbus TCP register 0x308A.
- **5** Wait for approx. 1 minute.
- 6 Make sure that the **GW** LED is green for 20 seconds.
- 7 Power-down the device
- 8 Power-down all the slaves
- 9 Turn on the slaves
- 10 Turn on the device
- 11 Press and hold the SET-button until the DN LED starts blinking.

Depending on the number of slaves in the DeviceNet<sup>™</sup> subnet, the time for scanning the subnet will differ. In case of an error free scanning, the **DN** LED will first start **blinking green**, then it will **blink red** and afterwards it will become solid **green**.

In case of errors during scanning the subnet:

If the **DN** LED is **red**, duplicate DeviceNet<sup>™</sup> MAC-IDs or a Bus-off condition occurred.

#### **Remedy:**

If a bus-off condition occurred, check the DeviceNet<sup>™</sup> subnet for correctly installed bus terminations, check the DeviceNet<sup>™</sup> nodes for correct bit rate settings (or check if all nodes are set to autobaud). Power cycle the device and restart this procedure.

- If the DN LED is flashing green/red, it is possible that the selected Global EPR (Global Expected Packet Rate) is too small. Chose a larger EPR by using either
  - the IO-ASSISTANT 3 (FDT/DTM)
  - VSC122 (0×7A), instance 1, Attr. 70h in EtherNet/IP, page 2-11
  - or Modbus TCP register 0x308E

#### Note

In case of any of these problems, power cycle the device, modify the master settings and restart this procedure at point 4.



1

#### **FXEN - start-up behavior**

This section assumes that the device is in "Out-of the box state" with all parameters set to default values. It provides a step by step guide on starting up the network.

- **1** Make sure that the switch position is not 900 (F\_Reset).
- **2** Power-up the device.
- 3 DN LED has to be OFF.
- 4 Setup the MAC-ID (DeviceNet<sup>™</sup> address) of the master
  - via IO-ASSISTANT 3 (FDT/DTM)
  - via VSC122 (0×7A), instance 1, Attr. 01h in EtherNet/IP, page 2-11
- **5** Wait for approx. 1 minute.
- 6 Power-down the device
- 7 Power-down all the slaves
- 8 Turn on the slaves
- 9 Turn on the device

10 Press and hold the SET-button until the DN LED starts blinking.

Depending on the number of slaves in the DeviceNet<sup>™</sup> subnet, the time for scanning the subnet will differ. In case of an error free scanning, the **DN** LED will first start **blinking green**, then it will **blink red** and afterwards it will become solid **green**.

In case of errors during scanning the subnet:

If the DN LED is red, duplicate DeviceNet<sup>™</sup> MAC-IDs or a Bus-off condition occurred.

#### **Remedy:**

If a bus-off condition occurred, check the DeviceNet<sup>™</sup> subnet for correctly installed bus terminations, check the DeviceNet<sup>™</sup> nodes for correct bit rate settings (or check if all nodes are set to autobaud). Power cycle the device and restart this procedure.

- In case of alternate gree/red flashing DN LED. the selected Global EPR (Global Expected Packet Rate) may be too small. Chose a larger EPR by using either
  - IO-ASSISTANT 3 (FDT/DTM)
  - VSC122 (0×7A), instance 1, Attr. 70h in EtherNet/IP



**Note** In case of any of these problems, power cycle the device, modify the master settings and restart this procedure at point 4.

#### **Useful hints:**

- Set all nodes in the DeviceNet<sup>™</sup> subnet to UCMM, to shorten the time for scanning the DeviceNet<sup>™</sup>.
- Set all nodes in the DeviceNet<sup>™</sup> subnet to autobaud to simplify possible changing of the baud rate.
- Check the DeviceNet<sup>™</sup> master alarms to see the current state of the operations (no alarms, Errors, Bus-off, duplicate MAC-ID (DeviceNet<sup>™</sup> address) ....).
  - For EtherNet/IP, these alarms can be found in the Vendor Specific Classe VSC122, see section "DeviceNet<sup>™</sup> slave class (VSC 123, 7Bh)", page 2-14.
  - For Modbus TCP these alarms can be found in register 0x3088.

#### The DeviceNet™master in the IO-ASSISTANT 3 (FDT/DTM)

The I/O-ASSISTANT 3 is the TURCK project planning software on FDT/DTM basis for configuration, parameterization, set-up support, diagnostics, documentation etc..

The software provides 2 possibilities for accessing the nodes of the DeviceNet<sup>™</sup> network.

1 Parameterization via DTMs after installation of EDS-files for the connected nodes



Figure 9: online parameterization via DTM after EDSimport





2 Class Instance Editor for Generic (unknown) DeviceNet<sup>™</sup> nodes





#### Note

For detailed information about the I/O-ASSISTANT and it's functions, please see the Online Help of the software.

The I/O-ASSISTANT 3 with all TURCK-DTMs as well as the FDT/DTM frame application PACT*ware*<sup>™</sup> can be downloaded free of charge from the TURCK homepage www.turck.com. The DeviceNet<sup>™</sup> master-function



# 2 DeviceNet<sup>™</sup> master with EtherNet/IP

Modules for EtherNet/IP2
FXEN-IM16-0001-IP-DN
Process image4
Example: input image
Status/control words of the DeviceNet™subnet via I/O data
Status words
Assembly Instances9
VSCs for the DeviceNet™ master-function10
DeviceNet <sup>™</sup> master class (VSC122, 7Ah)

2-1

#### **Modules for EtherNet/IP**

#### FXEN-IM16-0001-IP-DN

Figure 11: FXEN-IM16-0001-IP-DN



The FXEN I/O module with DeviceNet<sup>™</sup> master function is part of the FXEN product line. It allows direct connection of 16 inputs to EtherNet/IP and the connection of a complete DeviceNet<sup>™</sup> network to the DeviceNet<sup>™</sup> master. The process data of the DeviceNet<sup>™</sup> subnet are thus handled via EtherNet/IP (see also chapter 1).

The connection to EtherNet/IP is realized via two 4-pole, D-coded M12 x 1-round connectors. The integrated switch allows the creation of a line topology with the I/O modules.



#### BL67-GW-EN-IP-DN

Figure 12: BL67-GW-EN-IP-DN



The BL67 gateway for EtherNet/IP with DeviceNet<sup>™</sup> master function is part of the modular I/O system BL67.

The gateway is used to connect a modular BL67-station with different I/O and technology modules to EtherNet/IP. Additionally, this gateway offers the possibility to connect a complete DeviceNet<sup>™</sup> subnet to it and to handle the process data of the DeviceNet<sup>™</sup> subnet via EtherNet/IP (see also chapter 1).

The connection to EtherNet/IP is realized via one 4-pole, D-coded M12 x 1-round connector.



## Note

The BL67 gateway contains no integrated Ethernet switch!

2

#### **Process image**

The nodes of the DeviceNet<sup>™</sup> subnet are mapped into the input image of the EtherNet/IP device.

In the process image, their in- and output data follow the in- and output data of the local I/Os directly placed on the device (e. g. FXEN) or connected to the device (e. g. BL67).

The mapping of the I/O data of the DeviceNet<sup>™</sup> subnet is structured according to the nodes' DeviceNet<sup>™</sup> MAC-IDs (see chapter 3, "Application example: FXEN at Allen Bradley PLC").

For the explanation of the I/O data mapping the following **example subnet structure** is assumed.

Table 4: Example subnet at DeviceNet™ master	DeviceNet™ MAC-ID	ModuleD	DeviceNet I/O da	ta
A Status and			Input	Output
Control byte are mapped into process data (map- ping can be deactivated, see VSCs in chapter 3)	EtherNet/IP module with DeviceNet™ master		1 word status A	1 word control A
	– local I/O-channels		n byte	n byte
	7	DeviceNet™ <b>node A</b>	2 byte	2 byte
	9	DeviceNet™ <b>node B</b>	3 byte	2 byte
	25	DeviceNet™ <b>node C</b>	1 byte	3 byte
	62	DeviceNet™ <b>node D</b>	-	4 byte

#### Example: input image

	Byte y	Byte x				
Word 0	Status v EtherNet/IP module wit	Status word of EtherNet/IP module with DeviceNet™ master				
Word 1						
	m byte input data o	f local I/O channels				
Word n						
Word n +1	1 byte input data of subnet	1 byte input data of subnet node Module <b>A</b> , MAC-ID 7				
Word n + 2	1 byte input data of subnet	node Module <b>B</b> , MAC-ID 9				
Word n + 3	-	Last byte of input data of subnet node Module <b>B</b> , MAC-ID 9,				
Word n + 4	-	Input data of subnet node Module <b>C</b> , MAC-ID 25				



## Example: output image

	Byte y	Byte x				
Word 0	Control word of EtherNet/IP module with DeviceNet™ master					
Word 1						
	m byte output data c	of local I/O channels				
Word n						
Word n + 1	2 byte of output data of subne	et node Module <b>A</b> , MAC-ID 7				
Word n + 2	2 byte of output data of subne	2 byte of output data of subnet node Module <b>B</b> , MAC-ID 9				
Word n + 3	2 byte of output data of subne	t node Module <b>C</b> , MAC-ID 25				
Word n + 4	-	Last byte of output data of subnet node Module <b>C</b> , MAC-ID 25				
Word n + 5	4 byte output data of subnet node Module <b>D</b> , MAC-ID 62					
Word n + 6						

2

#### Status/control words of the DeviceNet<sup>™</sup> subnet via I/O data

The DeviceNet<sup>™</sup> master provides an additional status information (9 words) and control bytes (1 word) for the DeviceNet<sup>™</sup> subnet.

These bytes can be mapped into the process data [enable mapping: VSC122 (7Ah), instance 1, attr. 75h.

#### Status words

If the 9 status words are mapped into the process data, they are mapped in front of the input data of the DeviceNet<sup>™</sup> subnet-nodes, which means they directly follow the input data of the local I/Os at the EtherNet/IP-device (in the example on page 2-4 they would be mapped following byte n).

This status information is structured as follows:

- I word for the DeviceNet<sup>™</sup> communication (word no. 0)
- 4 words for the "scanlist" information (word no. 1-4)
- 4 words for "errored nodes" information (word no. 5-8)

Table 5: Word 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	DNM status	slave missing	empty scan list	CAN error	Dup MacID	subnet input	subnet output	comm. error
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8

#### reserved

Table 6: Bit moonings	Bit	Meaning
Ji meanings	DNM Status	0 = IDLE 1 = RUN
	Slave missing	0 = subnet ok 1 = one or more slaves missing
	Empty scan list	<ul> <li>0 = scanlist ok</li> <li>1 = The scanlist of the master is empty. No slave has been found during the scan process</li> </ul>
	CAN error	0 = no error 1 = CAN error (communication problem with CAN controller)
	DupMacID	0 = ok 1 = Master DupMacID fault →dupplicate MAC-IDs found in the DeviceNet™ subnode
	subnet input	0 = ok 1 = the size of the input data of the subnet is too large (max. number of bytes 500 byte)
	subnet output	0 = ok 1 = the size of the output data of the subnet is too large (max. number of bytes 500 byte)
	comm. error	0 = no error 1 = communication error or bus off.


The following table represents the scan list of the master:

Each node which has been scanned as being a part of the subnet is indicated by one bit (the order is done by MAC-ID):

0 = no node with this MAC-ID found

1 = node with the MAC-ID found and stored in the master's scan list

Table 7:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 7	Node 6	Node 5	Node 4	Node 3	Node 2	Node 1	Node 0
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 15	Node 14	Node 13	Node 12	Node 11	Node 10	Node 9	Node 8
Word 4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 55	Node 54	Node 53	Node 52	Node 51	Node 50	Node 49	Node 48
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 63	Node 62	Node 61	Node 60	Node 59	Node 58	Node 57	Node 56

The following bits describe each node status. They show a list of nodes, to which the DeviceNet<sup>™</sup> master could not build up a communication:

0 = node present

1 = node not present

Table 8:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
word 5	Node 7	Node 6	Node 5	Node 4	Node 3	Node 2	Node 1	Node 0
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 15	Node 14	Node 13	Node 12	Node 11	Node 10	Node 9	Node 8
Word 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 55	Node 54	Node 53	Node 52	Node 51	Node 50	Node 49	Node 48
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 63	Node 62	Node 61	Node 60	Node 59	Node 58	Node 57	Node 56

2

#### **Control word**

The control word is used to set the DeviceNet<sup>™</sup> master into RUN or IDLE mode.

If the control word is mapped into the process data, it is mapped at the beginning of the output data of the DeviceNet<sup>™</sup> subnet-nodes, which means it directly follows the output data of the local I/Os at the EtherNet/IP-device (in the example on page 2-5 they would be mapped following byte n).

This control word is structured as follows:

Table 9: Word 1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		reserved						
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
				res	erved			



# **Assembly Instances**

TURCK devices with integrated DeviceNet<sup>™</sup> master contain two possibilities of process data mapping:

- Assembly instances 101 and 102: Fixed assembly instances. The size of each of those assembly instances is 256 bytes.
- 2 Assembly instances 103 and 104: Variable assembly sizes. The assembly size is calculated to support the stations I/Oconfiguration, enabled diagnostics, DeviceNet<sup>™</sup> subnet.
  - output assembly instance: 104
  - input assembly instance. 103

The size of each assembly instance can be retrieved through the assembly object and can vary between **2** and **496** bytes.

#### VSCs for the DeviceNet<sup>™</sup>master-function

The VSCs describing the standard EtherNet/IP communication of the devices can be found in the manuals for the Ethernet/IP devices:

- FXEN, document-no.: D301155
- BL67, document-no.: D300888

The manuals can be downloaded from www.turck.com.



#### DeviceNet<sup>™</sup>master class (VSC122, 7Ah)

This class contains parameters and data for the DeviceNet<sup>™</sup> master.

#### **Class Instances of the VSCs**

# Note

1

Class Instance attributes are the same for each Vendor Specific Class. Class-specific Object Instances and the corresponding attributes are explained below for the different VSC.

The general VSC - Class Instance attributes are defined as follows:

Table 10: Class instance	Attr. No.	Attribute Name	Get∕ Set	Туре	Description
	100 (0×64)	CLASS REVISION	G	UINT	States the revision number of the class: Maj. Rel. *1000 + Min. Rel.
	101 (0×65)	MAX INSTANCE	G	USINT	Contains the number of the highest instance of an object created on this level in the class hierarchy.
	102 (0×66)	# OF INSTANCES	G	USINT	Contains the number of Object Instances created in this class.
	103 (0×67)	MAX CLASS ATTRIBUTE	G	USINT	Contains the number of the last Class Attribute to be implemented.

# **Object Instance**

Table 11: Object instance	Attr. No. dec. (hex.)	Attribute name	Get/ Set	Туре	Description
	1	MACID	G/ S	USINT	Node Address, Range 0-63; A change of the master's MACID is only valid after a power-reset 0 = default
	2	Baud Rate	G/ S	USINT	0 = 125 kBit/s (default) 1 = 250 kBit/s 2 = 500 kBit/s A change of the baud rate is only valid after a power-reset.
	4	Bus-Off Counter	G/ S	USINT	Number of times CAN went the bus- off state
	10 (0Ah)	Quick_Connect	G/ S	BOOL	0 = Disable 1 = Enable (Default) ← different to ODVA
	100 (64h)	Max object attribute	G	USINT	Contains the number of the last object attribute to be implemented.

Attr. No.

Attribute name Get/

~

Table 11:

Object instance

<i>.</i> c	dec. (hex.)		Jel		
	101 (65h)	WHO	S	BOOL	0 = current slave list store in FLASH 1 = new scan of slaves and store list in FLASH
	102 (66h)	SUBNET OUTPUT WORD COUNT	G	UINT	States the number of output words (consumed words) of the entire subnet
	103 (67h)	SUBNET INPUT WORD COUNT	G	UINT	States the number of input words (produced words) of the entire subnet
	104 (68h)	OUTPUT	G/ S	ARRAY OF WORD	Contains the output data (consumed data) of the module.
	105 (69h)	INPUT	G	ARRAY OF WORD	Contains the input data (produced data) of the module.
	106 (6Ah)	Status Array Register of DN Mstr	G	USINT	Bit 0 - Bus Off Bit 1 - Output size too big Bit 2 - Input size too big Bit 3 - Duplicate MAC-ID of the master Bit 4 - DeviceNet <sup>™</sup> errors detected Bit 5 - Empty Scanlist Bit 6 - One or more slaves missing Bit 7 - DNM status (RUN=1/IDLE=0)
	107 (6Bh)	Present Node	G	ARRAY OF BYTE	Each bit describes one node (8 Byte length)
	108 (6Ch)	Node Error	G	ARRAY OF BYTE	Each bit describes one node (8 Byte length)
	109 (6Dh)	Slave List	G	ARRAY OF BYTE	Each bit describes one node that should be connected (8 Byte length)
	110 (6Eh)	reserved	-	-	-
	111 (70h)	Global Fail safe state	G/S	BYTE	State is activated by loss or termina- tion of Ethernet connection 0 = use IDLE Mode (default) 1 = freeze (all DN outputs are frozen) 2 = force (see VSC 123, attr 113 and 114 for details)
	112 (70h)	Global EPR	G/ S	ARRAY OF BYTE	Default = 100 ms Specifies the EPR in ms EPR = 100, setting for 10 slaves and 256 byte process data In case of more than 10 slaves or more than 256 byte process data needed, please increase the Global EPR value.

Туре

Description



Table 11: Object instance	Attr. No. dec. (hex.)	Attribute name	Get/ Set	Туре	Description
	113 (71h)	Interscan period	G	ARRAY OF BYTE	This is a status information which allows the user to know how much margin is left when defining the Global EPR. In order to guarantee error-free communication, please observe that a rest-margin of at least 5 ms should be calculated.
	114 -116 (72 h to 74h)	reserved			
	117 (75h)	75h) Extended scanner control/ diagnostics		WORD	By enabling this parameter – the I/O Data of the DeviceNet-Subnet <sup>™</sup> are mapped into the input data of the DeviceNet <sup>™</sup> subnet 0 = mapping disabled 1 = mapping enabled

#### DeviceNet<sup>™</sup>slave class (VSC 123, 7Bh)

This class contains parameters and data of each DeviceNet<sup>™</sup> slave.

#### **Class Instance (Instance 0)**



Note

Please refer to paragraph "Class Instances of the VSCs", page 2-11, for the description of the class instance for the VSC.

#### Object Instance 1 to 64 (≅ DeviceNet<sup>™</sup> nodes with MAC-ID 0 to 63)

Object Instance **0×01** refers to DeviceNet<sup>™</sup> node with MAC-ID **0** (usually this is the master) Object Instance **0×02** refers to DeviceNet<sup>™</sup> node with MAC-ID **1** 

...

Object Instance 0×40 refers to DeviceNet<sup>™</sup> node with MAC-ID 63

Table 12: Object instance 1 to 63	Attr. No. dec. (hex.)	Attribute name	Get/ Set	Туре	Description
	4	Get Revision Major Revision Minor Revision		STRUCT OF USINT USINT	Revision Number of the connected slave
	100 (64h)	Max. object attribute	G	USINT	Contains the number of the last object attribute to be implemented.
	101 (65h)	Attribute list	G	ARRAY OF USINT	List of all attributes that are supported by this instance
	102 (66h)	Node Address	G	USINT	Node address of the connected slave.
	103 (67h)	Vendor	G	UINT	Vendor ID
	104 (68h)	Product code	G/ S	UDITN	e.g. device-ID
	105 (69h)	Product type	G	UINT	Product Type see also DeviceNet™Class 1, Instance 1, Attribute 2 for details
	106 (6Ah)	Product name Length Name	G	STRUCT OF USINT STRING	
	107 (6Bh)	Node Mode	G	BOOL	0 = not present 1 = is present and running



2

Table 12:	Attr. No.	Attribute name	Get/	Туре	Description
Object instance 1 to 63	dec. (hex.)		<b>S</b> et		
	108 (6Ch)	Node State	G	ENUM USINT	0 = Slave not in use 1 - 4 = Slave tries to allocate 5 = Slave sets explicit message EPR 6 = Slave activates timer 10 = Slave sets quick-connect 20 = Get VendorID 21 = Get product type 22 = Get product code 23 = Get revision # 24 = Get serial # 25 = Get product name 26 = Get CCV 30 = Get product size 31 = Get cons size 40 = Allocate Poll message 41 = Set Poll EPR 42 = I/O Mode 50 = Re-connect error wait 60 = Close poll message 61 = Close explicit message 80 = Master 90 = Network Found 91 = Network Not Found
	109 (6Dh)	Slave output word count	G	UINT	States the number of output words (consumed bytes) of slave
	110 (6Eh)	Slave input word count	G	UINT	States the number of input words (produced bytes) of slave
	111 (70h)	Output	G/ S	ARRAY OF WORD	Contains the output data (consumed data) of the slave.
	112 (70h)	Input	G	ARRAY OF WORD	Contains the input data (produced data) of the slave.
	113 (71h)	Fail safe set	G/ S	ARRAY OF WORD	Contains the output data fail safe values for the slave If there was no set default -> 0.
	114 (72h)	Slave Fail safe state	G/ S	BYTE	0 = all outputs set to 0 (default) 1 = all outputs set to 1 2 = use attr 113
	115 (73h)	Quick_Connect	G	BOOL	0 = Disabled 1 = Enabled
	116 (74h)	CCV	G	UINT	Contains the Configuration Consis- tency Value

DeviceNet<sup>™</sup> master with EtherNet/IP



# **3** Application example: FXEN at Allen Bradley PLC

Hard- and software	2
Hardware	2
Software	2
Network configuration and IP-address-setting	3
Settings of the network interface card	3
Address setting at the FXEN-module via DHCP-mode	3
Configuration of the network in "RSLogix 5000"	6
Configuration of the controller	6
Configuration of the FXEN	8
– I/O-mapping report via PACTware™ (I/O-ASSISTANT V3)	. 10
Downloading the I/O configuration	. 13
– I/O data mapping for the example station	. 15
Examples for process data acces	. 18
– Input data evalutaion	. 18
– Output data (forcing an output)	. 19
Explicit Messaging within the PLC program	.20
Controller Tag definition	. 20
- MESSAGE Controller Tag	. 20
- Start bit for MSG instruction	. 21
- Data array for the MSG instruction	. 22
The PLC program	. 23
– Entering the MSG instruction	. 23
– Triggering the MSG instruction	. 25
Example for VSC access	. 26
<ul> <li>Read out product name of FXEN-IM16-0001-IP-DN</li> </ul>	. 26
VSC access to DeviceNet <sup>™</sup> master or DeviceNet <sup>™</sup> nodes	. 29
- Example: Read out the slave list from the master	. 29
– Example: Read out the Maj./ Min. revision of DeviceNet <sup>™</sup> subnet node with MAC-ID 11	. 30

#### Hard- and software

#### Hardware

For this application example, the following hardware is used:

- Allen Bradley PLC, ControlLogix5555<sup>™</sup>, 1756-PA72/B, firmware version V 16.21.12 with:
  - EtherNet/IP Bridge, 1756-ENBT, firmware version V 4.7.19
- FXEN-IM16-0001-IP-DN, 16 digital input channels and DeviceNet<sup>™</sup> master with:
  - Addr. 11, FDN20-4S4XSG-E: DeviceNet<sup>™</sup> module with 4 digital input channels and 4 digital channels configurable as in- or output
  - Addr. 14, FDNQ-CSG44-T: DeviceNet<sup>™</sup> module with 4 digital input and 4 digital output channels
  - Addr. 22, FDNP-S0808G-TT: DeviceNet<sup>™</sup> module with 8 digital input and 8 digital output channels
  - Addr. 63, Ni4-DSU35-2DNetX4-H1150 Inductive dual sensor with DeviceNet<sup>™</sup> interface

#### Software

For this application example, the following software is used:

- BootP/DHCP-Server from Rockwell Automation, version 2.3.2.0
- I/O-ASSISTANT 3 from TURCK (PACTware<sup>™</sup> and TURCK-DTMs), version 3.5
- RSLogix<sup>™</sup>5000 from Rockwell Automation, standard edition, version 16.00.
- RSLinx from Rockwell Automation, version 2.43.01



#### Network configuration and IP-address-setting

#### Settings of the network interface card

The TURCK modules for EtherNet/IP are delivered with the default IP address 192.168.1.254.



Note

In order to build up the communication between the TURCK product and a PLC/ PC or a network interface card, both devices have to be hosts in the same network.

To achieve this, you have whether:

 to adjust the gateway's IP address via BootP, DHCP etc. for integrating it into your own network

or

• to change the IP address of the used PC or network interface card

In this example, the network setting of the network card are the following:

IP address: 192.168.1.47

Subnet mask: 255.255.255.0

#### Address setting at the FXEN-module via DHCP-mode

In this application example, the IP address is set via DHCP using the software tool "BootP/ DHCP-Server" version 2.3.2.0 from Rockwell Automation.



Note

Addresses in the range from 1 to 254 can be allocated in the default subnet 192.168.1. The addresses 0 and 255 are reserved for broadcast messages in the subnet.

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	J			

The rotary coding switches on the module must be set to "400" or "600" in order to enable the DHCP-Mode or respectively the PGM-DHCP-mode.

After having been connected to the network, the FXEN-module sends DHCP requests to the server using its MAC-ID.

Figure 14: DHCP-request of FXEN gate- way	BOOTP/DHCP Server 2.3 Ele Iools Help Request History Clear History Add to Relation List	
	(hr:min:sec) Type Ethernet Address (MAC) IP Address Hostname	
	15:13:06     DHCP     00:07:46:FF:60:15       Relation List     New     Delete   Finable B00TP  Enable B00TP  Disable B00TP/DHCP	
	Ethernet Address (MAC) Type IP Address Hostname Description	
	_ Status E	ntries
	Unable to service DHCP request from 00:07:46:FF:60:15.	of 256

A double click on the request-entry opens the "New Entry" dialog box in which an IP address can be assigned to the module's MAC-ID.

Figure 15: Setting the IP address via DHCP	BOOTP/DHCP Server Eile Iools Help Request History Clear History Add	2.3 to Relation List			X
DITO	(hr:min:sec) Type	Ethernet Address (MAC)	IP Address	Hostname	
	15:13:54 DHCP 15:13:22 DHCP	00:07:46:FF:60:15 00:07:46:FF:60:15	1		
	15:13:06 DHCP	New Entry		×	
		Ethernet Address (MAC):	00:07:46:FF:60:15		
		IP Address:	192.168.1	.115	
	Relation List	Hostname:			
	New Delete Ena	Description:			
	Ethernet Address (MAC	1	ОК Са	ancel	
	Status Unable to service DHCP (	equest from 00:07:46:FF:60:1	5.		Entries 0 of 256



The BootP/DHCP-Server sends the IP Address via BootP/DHCP to the FXEN-module and, after a few seconds, the module answers with its new IP address when having stored it.



The "Relation list" can be stored for further applications. It can serve for permanent assignment of defined IP addresses to MAC-IDs/ modules.



#### Attention

If the BootP/DHCP-server is shut down, the FXEN-module loses the IP address after a power reset!

#### Configuration of the network in "RSLogix 5000"

The EtherNet/IP hosts (PLC, EtherNet/IP interface, I/O modules) have to be configured using the software "RSLogix 5000" (in this example version 15) from Rockwell Automation.

Start RSLogix and open a new project using the "File" menu.

Figure 17: Creating a new	💕 RSLogix 5000										
project in	File	Edit View	Search	Logic	Communications	Tools					
RSLogix	Ē	<u>N</u> ew			Ctrl+	N					
0	2	Open			Ctrl+	0					
		⊆lose									
		<u>S</u> ave			Ctrl+	s					
		Save <u>A</u> s									
		New Compo	nent			ъİ					
						_					
		Compact									

#### **Configuration of the controller**

Enter the information related to the controller depending on your configuration, as well as a name for the controller.

Figure 18: Configuration of the controller

New Controlle	+]		
Vendor:	Allen-Bradley		
<u>Т</u> уре:	1756-L55 ControlLogix5555 Controller	-	ОК
Re <u>v</u> ision:	15 🗸		Cancel
	Eedundancy Enabled		Help
Na <u>m</u> e:	FXEN_TURCK		
Descri <u>p</u> tion:		~	
<u>C</u> hassis Type:	1756-A10 10-Slot ControlLogix Chassis	•	
Sl <u>o</u> t:	0 Safety Partner Slot:		
Cr <u>e</u> ate In:	C:\RSLogix 5000\Projects		Browse

Your project will be opened offline. In order to configure the network, please right-click "I/O Configuration" and select "new Module" to add the first host, the EtherNet/IP bridge, to the network.



Open "Communications" and select the bridge. In this example this would be 1756-ENBT/A.



Module - 1756-CNBR/E - 1756-DHRIO/B - 1756-DHRIO/D - 1756-DHRIO/D - 1756-ENET/A - 1756-ENET/A - 1756-ENET/A - 1756-ENET/A - 1756-ENET/B - 1756-ENET/B - 1756-ENET/A - 1756-ENE	Description 1756 ControlNet Bridge, Redundant Media 1756 DH+ Bridge/RIO Scanner 1756 DH+ Bridge/RIO Scanner 1756 DH+ Bridge/RIO Scanner 1756 DeviceNet Scanner 1756 10/100 Mbps Ethernet Bridge, Twisted-Pair Media 1756 10/100 Mbps Ethernet Bridge, Twisted-Pair Media 1756 Ethernet Communication Interface 1756 Ethernet Communication Interface 1756 10/100 Mbps Ethernet Bridge w/Enhanced Web Serv SynchLink Interface	Vendor Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley Allen-Bradley
By Category By Ve	ndor Favorites OK Cancel	Add Favorite

Enter the "Major Revision" of your EtherNet/IP bridge and click "OK".

X

-

Help

Figure 20: Maior Revision	Select Major Revision
of the EtherNet/ IP Bridge	Select major revision for new 1756-ENBT/A module being created.
	Major Revision: 3
	OK Cancel Help

In the following dialog box "New Module" enter the a name for the bridge and define its IP Address (in this example 192.168.1.100).

Figure 21: Configuring the	New Module		×
EtherNet/IP	Туре:	1756-ENBT/A 1756 10/100 Mbps Ether	net Bridge, Twisted-Pair Media
Bridge	Vendor:	Allen-Bradley	
	Parent:	Local	
	Na <u>m</u> e:	Ethernet_IP	Address / Host Name
	Descri <u>p</u> tion:		
		×	C Host Name:
	Sl <u>o</u> t:	1 📮	
	<u>R</u> evision:	3 💌 1 🕂	Electronic Keying: Compatible Keying
	🔽 Open Mod	uļe Properties	OK Cancel Help

In the following dialog box "Module Properties: Local..." press "OK". You may also browse offline through the module properties when you click "Next". At this point there is no need for further entry action.

If "Next" is selected, the "Module Properties" window displays information that will be available when the module is online. The configuration of the interface is completed. Press "Finish" to close the dialog box.

#### **Configuration of the FXEN**

Add the FXEN to the I/O configuration by using a right-click on the EtherNet/IP bridge module 1756-ENBT/A and select "New Module".

Open "Communications" and select the entry "Generic Ethernet Module" to configure a BL67 gateway.



1757-FFLD/A 1768-ENBT/A 1769-L32E Etherne	1757 Foundation Fieldbus Linking Device 1768 10/100 Mbps Ethernet Bridge, Twisted-Pair /	Allen-Bradley Media Allen-Bradley
1768-ENBT/A 1769-L32E Etherne	1768 10/100 Mbps Ethernet Bridge, Twisted-Pair (	Media Allen-Bradley
- 1769-L32E Etherne	A DARDO MARK THE WARK DOWN OF COMPANY AND SHOOD	
	TU/TUU Mops Ethernet Port on CompactLogix5332	E Allen-Bradley
- 1769-L35E Etherne	10/100 Mbps Ethernet Port on CompactLogix5335	E Allen-Bradley
- 1788-EN2DN/A	1788 Ethernet to DeviceNet Linking Device	Allen-Bradley
- 1788-ENBT/A	1788 10/100 Mbps Ethernet Bridge, Twisted-Pair I	Media Allen-Bradley
- 1788-EWEB/A	1788 10/100 Mbps Ethernet Bridge w/Enhanced W	√eb Serv… Allen-Bradley
- 1794-AENT/A	1794 10/100 Mbps Ethernet Adapter, Twisted-Pai	r Media 🛛 Allen-Bradley
- Drivelogix5730 Eth	. 10/100 Mbps Ethernet Port on DriveLogix5730	Allen-Bradley
ETHERNET-BRIDGE	Generic EtherNet/IP CIP Bridge	Allen-Bradley
ETHERNET-MODULE	Generic Ethernet Module	Allen-Bradley
EtherNet/IP	SoftLogix5800 EtherNet/IP	Allen-Bradley
	The super build and any Trade and Data Manda	Parker Hannif
PH-PSSCENA/A	Ethernet Adapter, Twisted-Pair Media	1 antor Harming
PH-PSSCENA/A	Ethernet Adapter, Twisted-Pair Media	
PH-PSSCENA/A	Ethernet Adapter, Twisted-Pair Media	
EtherNet/IP	SoftLogix5800 EtherNet/IP	Allen-Brad Parker Har

Please enter the Connection Parameters for the FXEN as follows.

Assembly Instances 103 and 104 have to contain the exact in- and output size of the FXEN with DeviceNet<sup>™</sup> network. In this example this would be:

Figure 23: Configuration of FXEN with De- viceNet <sup>™</sup> mas- ter and the example net- work	Module Pro	perties: EtherNetIP_FXEN (EThereiting)         ection       Module Info         ETHERNET-MODULE Generic Etherne         Allen-Bradey         EtherNetIP_FXEN         FXEN_EtherNetIP_with_DNET         FXEN_module for EtherNetIP/P         With DeviceNetMaster         Data - INT         ost Name         sss:       132.168.1.115	t Module Connection Par Input: Qutput: Configuration: Status Input: Status Output	Assembly Instance: 103	Size:	(16-bit) (16-bit) (8-bit)
	Status: Offline	OK	Cancel	Apply	H	lelp

The exact number of in- and output bytes of an EtherNet/IP-station with DeviceNet<sup>™</sup> master and of the connected DeviceNet<sup>™</sup> nodes can easily be determined by using the I/O-ASSIS-TANT. Please read the following section "I/O-mapping report via IO-ASSISTANT 3 (FDT/ DTM)", page 3-10. Note



# i

If the Assembly Instances 101 and 102, the Connection Parameters have to be set to a static in- and output size of 128 words each.

In the "Connection" tab set the "Requested Packet Interval" (RPI) to 10 ms, which normally should be the default setting. For FXEN, the successfully tested RPI range is 5 and higher.

Figure 24: Set connection	Module Properties: Ethernet_BL67 (ETHERNET-MODULE 1.1)	
options for FXEN	General       Connection       Module Info         Bequested Packet Interval (RPI):       IIII = ms       (1.0 - 3200.0 ms)         Inhibit Module       Inhibit Module       Major Fault On Controller If Connection Fails While in Run Mode         Use Scheduled Connection over ControlNet       Module Fault	
	Status: Offline OK Cancel Apply Help	

# I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)

With IO-ASSISTANT 3 (FDT/DTM), an EtherNet/IP-report for each connected EtherNet/IP station can be created.

This EtherNet/IP report is part of the station report for an EtherNet/IP node and contains mapping tables for the complete I/O data (EtherNet/IP station + DeviceNet<sup>™</sup> nodes).

- 1 Created a station report using a right-click on the respective station  $\rightarrow$  Additional functions  $\rightarrow$  station report. The station has to be connected!
- **2** Activate the EtherNet/IP report check box and create the station report by pressing the "Apply" button.





3 The EtherNet/IP report contains a station description as well as separate mapping tables for the in-and output data of the EtherNet/IP-node (status and control word + input data) as well as of the DeviceNet<sup>™</sup> nodes connected to the master. For this example configuration it would be as follows:

figuration	Station address: 192.168.1.115														
	Adr./Slot	Name		TAG	Descr.	Data Size In	Data Size Ou	t							
	Slot 0*	FXEN-IM16-000	J1-IP-DN	192.168.1.115/F> -IM16-0001-IP-DI	KEN Term0A N	16 bit	16 bit								
	Slot 1	Intern-IM16		01/Intern-IM16	Term0B	16 bit									
		DeviceNet proc	ess data			8 Byte	8 Byte								
	Total size for in/out data in bytes (rounded on full words) 12 10														
	*For detailed information about status/control word see online help														
	1.2. I/O m	1.2. I/O map for input data													
		1.2. NO map for mput udta													
	D#	Byten	/ten												
	Word0* 0	A.15 0A.14 0A.	13 12 11 .13 0A.12 0A.11	QA.10 QA.9 I	0A.8 0A.7	DA.6 DA.5 DA.	4 0A.3 0A.2	0A.1 0							
	Word1 0	B.15 0B.14 0B.	.13 0B.12 0B.11 DeviceNet Slave Adv. 11	0B.10 0B.9 (	08.8 08.7	08.6 08.5 08. Dovisional	4 08.3 08.2	0B.1 0							
	Word3**		DeviceNet Slave Adr. 14	(Byte 1)		DeviceNe	t Slave Adr. 14 (Byte 0)								
	Word4** Word5**		DeviceNet Slave Adr. 22 DeviceNet Slave Adr. 63	! (Byte 1) ! (Byte 1)		DeviceNe DeviceNe	t Slave Adr. 22 (Byte 0) t Slave Adr. 63 (Byte 0)								
	Horas		Democratic blane Aldi. 00			Devicerve	Colure Adi. 00 (byte b)								
	*For detailed i	nformation about s	status/control word s	ee online help											
	**DeviceNet	online process data	a												
	Process input data: 12 Byte														
	Process inpl		1.3. I/O map for output data												
	1.3. I/O m	ap for outpu	ut data												
	1.3. I/O m	iap for outpu	ut data												
	1.3. I/O m	nap for outpu	ut data												
	1.3. I/O m	nap for outpu	ut data	10 0	0 7	6 5	Byten								
	Process Inpu 1.3. I/O m Bit Word0' 0	15 14 A.15 0A.14 0A.	Byte n+1           13         12         11           13         0A.12         0A.11	10 9 04.10 04.9 1	8 7 0A.8 0A.7	6 5 04.5 04.	Byten 4 3 2 4 0A.3 0A.2	04.1 0							
	Process Inpl 1.3. I/O m Bit Word0' 0 Word1'	15 14 A.15 0A.14 0A.	Byte n+ 1           13         12         11           13         0.12         0.4.11           DeviceNet Slave Adr. 11         DeviceNet Slave Adr. 14	10         9           0A, 10         0A, 3         (           (Byte 1)         (         (	8 7 0A.8 0A.7	6 5 04.6 04.5 04.	Byten 4 3 2 4 0.3 0A.2 1 Slave Adr. 11 (Byte 0) 2 Slave Adr. 14 (Byte 0)	<b>1</b> QA.1 (							
	Bit Word0° Word1 Word3°	15 14 A.15 0A.14 0A.	Byte n+1           13         12         11           13         0.4.12         0.4.11           DeviceNet Slave Adr. 14         DeviceNet Slave Adr. 14           DeviceNet Slave Adr. 14         DeviceNet Slave Adr. 14	10         9         1           04,10         04.9         1           (Byte 1)         (Byte 1)         (Byte 1)	8 7 0A.8 0A.7	6 5 A.6 OA.5 OA. DeviceNet DeviceNet DeviceNet	Byten           4         3         2           4         0.4.3         0.4.2           Slave Adr. 11 (Byte 0)         Slave Adr. 14 (Byte 0)           Slave Adr. 14 (Byte 0)         Slave Adr. 22 (Byte 0)	<b>1</b> QA.1 C							

**4** The EtherNet/IP report for the station FXEN-IM16-0001-IP-DN with the IP address 192.168.1.115 in this example defines thus an input data size of 12 byte (6 words) and an output data size of 10 byte (5 word).

These sizes have to be entered for the Assembly Instances in RSLogix (see "Configuration of the FXEN", page 3-8).

Those bytes are composed as follows:

Figure 27: In -and output	Station addre	ess: 192.168.1.115					
data manning of	Adr./Slot	Name	TAG	Descr.	Data Size In	Data Size (	Out
the station	Slot 0*	FXEN-IM16-0001-IP-DN	192.168.1.115/FXEN -IM16-0001-IP-DN	Term0A	16 bit	16 bit	А
	Slot 1	Intern-IM16	01/Intern-IM16	Term0B	16 bit		В
		DeviceNet process data			8 Byte	8 Byte	С
	Total size fo	or in/out data in bytes (rounded on fu	ll words)		12	10	D

\*For detailed information about status/control word see online help

- A 2 byte of input data for the station's Status-Word and 2 byte of output data for the station's Control-Word
- B 2 byte of input data for the 16 internal inputs
- C 8 byte of DeviceNet  $^{\rm TM}$  data for the subnet nodes
- D Total sum of in and output bytes for the FXEN incl. DeviceNet™ -subnet to be entered in the PLC



F Input data of the modules in the DeviceNet<sup>™</sup> subnet (DeviceNet<sup>™</sup>: addr. 11 to addr. 63), see also "I/O data mapping for the example station"

Figure 29: Ouput data mapping of the station

#### 1.3. I/O map for output data

		Byte n+1								Byten						
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Word0*	0A.15	0A.14	0A.13	0A.12	0A.11	0A.10	QA.9	0A.8	0A.7	0A.6	0A.5	0A.4	0A.3	0A.2	0A.1	0A.0 (
Word1		DeviceNet Slave Adr. 11 (Byte 1) DeviceNet Slave Adr. 11 (Byte 0)														
Word2**		DeviceNet Slave Adr. 14 (Byte 0)														
Word3**			Dev	/iceNet Slave	Adr. 22 (B	lyte 1)					Dev	riceNet Slave	Adr. 22 (By	te O)		IН
Word4**			Dev	/iceNet Slave	Adr. 63 (B	lýte 1)					Dev	riceNet Slave	e Adr. 63 (By	rte O)		1
*For detail **DeviceN	ed inform et online	ation abo	out statu: data	s/control v	word see	e online h	nelp									

Process output data: 10 Byte

G Control-Word of the station

H Output data of the modules in the DeviceNet<sup>™</sup> subnet (DeviceNet<sup>™</sup>: addr. 11 to addr. 63), see also "I/O data mapping for the example station"



The I/O-ASSISTANT mapping is depicted in byte format.

In RSLogix, the in - and output size entries at the Assembly instances are normally depicted in words (DATA -INT) or even in double-words (DATA - DINT).

The I/O-ASSISTANT mapping results have thus to be converted into the respective data format.



#### Downloading the I/O configuration

If the configuration of the network is completed, it can be downloaded to the controller by using for example the "Communication  $\rightarrow$  Download" command.

In the "Download" dialog box, start the download by pressing the "Download" button.

If an error message is generated, warning, that the communication path can not be found, please open the "Path" menu (see Figure 31: "Communication Path"), select your controller and press "Set Project Path" (see Figure 32: "Set Project Path").

Figure 30: Error message	RSLogix 5000       Image: Constraint of the controller.         Communications path needed.         Image: Communication path needed.         Image: Communicati
Figure 31: Communica- tion Path	Path:     Knone>       Image: Select Recent Communications Path       Image: Select Recent Communications Path
Figure 32: Set Project Path	Select Recent Communications Path     Controller     Peth     PR0J_PXEN_IP_DN _ 48_ETHIP-1\192.168.1.100\Backplane\0     Upload     Download     Dose     Help      Show Only Paths Matching Serial Number in Project     Serial Number in Project: <none>     Path in Project: <none></none></none>

If the correct communication path is set, it is possible to download the configuration.

Once the I/O configuration is downloaded and the controller is in "Run" or "Remote Run" mode, the I/O-data mapping of the FXEN station is shown in the "Controller Tags":



The Controller Tags are divided into:

- FXEN\_EtherNetIP...: C mapped configuration data
- FXEN\_EtherNetIP...: I mapped input data
- FXEN\_EtherNetIP...: O mapped output data



3

# I/O data mapping for the example station

In order to be able to calculate the I/O-data for the DeviceNet<sup>™</sup> nodes, their special I/O data assignments have to be considered.



For the I/O data mapping of the DeviceNet<sup>™</sup> subnet, please read "I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)", page 3-10).



#### Note

The in- and output sizes of the respective DeviceNet<sup>™</sup> nodes can be found in the documentation (data sheet, manual etc.) for these products.

#### I/O mapping for a FXEN-IM16-0001-IP-DN

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
Byte 0		Status Word									
Byte 1											
Byte 2	ln7	In6	In5	In4	ln3	In2	In1	In0			
Byte 3	In15	In14	In13	In12	In11	In10	ln 9	In 8			
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
Byte 0				Con	trol Word						
Byte 1											

Inx = input x (0 = off, 1 = on)

# I/O mapping for a FDN20-4S4XSG-E; MAC-ID: 11

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	ln7	In6	In5	In4	ln3	In2	In1	In0
Byte 1	IGS	OGS	reserved					
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	-	-	-	-	Out3	Out2	Out1	Out0

Inx	= input x (0 = off, 1 = on)
Outx	= output x (0 = off, 1 = on)
IGS	= Input Group Status (0 = working, 1 = fault)
OGS	= Output Group Status (0 = working, 1 = fault)

#### **I/O mapping for a FDNQ-CSG44-T**; MAC-ID: 14

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	IGS	OGS	-	-	ln3	ln2	In1	In0
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	-	-	-	-	Out3	Out2	Out1	Out0

Inx	= input x (0 = off, 1 = on)
Outx	= output x (0 = off, 1 = on)
IGS	= Input Group Status (0 = working, 1 = fault)
OGS	= Output Group Status (0 = working, 1 = fault)



#### **I/O mapping for a FDNP-S0808G-TT**; MAC-ID: 22

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
Byte 0	ln7	In6	In5	In4	ln3	In2	In1	In0			
Byte 1	IGS	OGS	-	-	-	-	-	-			
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0			
Byte 0	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0			
	Inx = input x ( $0 = off, 1 = on$ )										

Outx	= output x (0 = off, 1 = on)
IGS	= Input Group Status (0 = working, 1 = fault)
OGS	= Output Group Status (0 = working, 1 = fault)

#### **I/O mapping for a Ni4-DSU35-2DNetX4-H1150**; MAC-ID: 63

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	InErr	-	-	-	-	OutErr	S02_In	S01_In
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	-	-	-	-	-	-	-	ValveOut

S0x_In	= Input signal x (0 = off, 1 = on)
OutErr	= Output error (0 = no error, 1 = error at output)
InErr	= Inout error (0 = no error, 1 = error at input)
ValveOut	= status of valve output ( $0 = off, 1 = on$ )

#### Examples for process data acces

# Input data evalutaion

- Input word I.Data[4], Bit 5 is set
  - I.Data[4] → input word of DeviceNet<sup>™</sup> node with MAC-ID 22 (compare "I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)", page 3-10)
  - Bit 5 of I.Data[4] is set → input 5 is active (compare "I/O data mapping for the example station", page 3-15)

Figure 35: Input active at channel 5, DNet-node with MAC-ID 22	P C RETURN	Image: Scope     I										
	N 🔼	Se	coge: TPROJ_FXEN_IP,  Show	Show All								
			Name 🛆	Value 🔸	Force 🗲	Style	Data Ty	Description				
				{}	{}		AB:E					
			FXEN_EtherNetIP_with_DNET:I	{}	{}		AB:E					
			FXEN_EtherNetIP_with_DNET:I.Data	{}	{}	Decimal	INT[6]					
			FXEN_EtherNetIP_with_DNET:I.Data[0]	0		Decimal	INT	Status Word FXEN-IM16-0001-IP-DN				
			FXEN_EtherNetIP_with_DNET:I.Data[1]	0		Decimal	INT	Input Word FXEN-IM16-0001-IP-DN				
			FXEN_EtherNetIP_with_DNET:I.Data[2]	0		Decimal	INT	Input Word FDN20-4S-4XSG (MAC-ID 11)				
			FXEN_EtherNetIP_with_DNET:I.Data[3]	0		Decimal	INT	Input Word FDNQ-CSG44-T (MAC-ID 14)				
			FXEN_EtherNetIP_with_DNET:I.Data[4]	▼ 32		Decimal	INT	Input Word FDNP-S0808-G-TT (MAC-ID 22)				
				7	65	4 3 2	1 0	Input Word NI4-DSU65-2DNet (MAC-ID 63)	.			
				7-0 0	0 1	0 0	0 0					
			±-Local:1:I	15-8 0	0 0	0 0 0	0 0					
			±-Local:1:0	{}	{}		AB:17					
			± Local:1:S	{}	{}		AB:17					
						×						



#### **Output data (forcing an output)**

- Output channel no. 3 of a FDNQ-CSG44-T with MAC-ID 14 has to be set
  - O.Data[2] → output word of DeviceNet<sup>™</sup> node with MAC-ID 14 (compare "I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)", page 3-10)
  - Bit 3 of O.Data[2] is forced → output no. 3 is set (compare "I/O data mapping for the example station", page 3-15).



#### Explicit Messaging within the PLC program

The access to the EtherNet/IP-classes (Mandatory and Vendor Specific) of an EtherNet/IPnode through Explicit Messages within the PLC program is done via a MSG (Message) instruction.

Before inserting the MSG instruction in your PLC program, please set up the necessary variables (Controller Tags).

#### **Controller Tag definition**

#### **MESSAGE** Controller Tag

The MSG instruction in the PLC program requests a Controller Tag (variable structure) of type MESSAGE.

1 To define this Controller Tag open the "Edit Tags" tab and go to the last line of tags. Open the dialog "Select Data Type" in the column "Data Type". Chose the MESSAGE type and confirm your selection with "OK".

Figure 37: Define a	RSLogix 5000 - PROJ_FXEN_IP_DN in PR     File Edit View Search Logic Communications	OF_FXEN_IP_DN./	ACD [1756-L55]* - [Controlle	er Tags - PROJ_FXE	N_IP_DN(contro	ller)]				
Controller Tag			• &&& []= [	V <b>R</b> QQ						
of type	Offline	Path:	AB_ETHIP-1\192.168.1.100\Backp	lane\0* 🗾 🚽	2 E					
MESSAGE	No Forces No Edits Redundancy Redundancy No Forces: Enabled None Installed None Installed No	I I I I I I I I I I I I I I I I I								
	Controller PROJ_FXEN_IP_DN	Scope: 🛐 PRO.	FXEN_IP Show Sh	now All						
	Controller Tags	Name		△ Alias For	Base Tag	Data Type	Style 🔺			
	Power-Up Handler	+ FXEN_Ether	NetIP_with_DNET:C			AB:ETHERNET_				
	🖻 📇 Tasks	+ FXEN_Ether	NetIP_with_DNET:I			AB:ETHERNET_				
	E 🔁 MainTask	+ FXEN_Ether	NetIP_with_DNET:0			AB:ETHERNET_				
	Program	+ Local:1:1				AB:1756_DNB_5	ā			
	MainRoutine	+ Local:1:0	Select Data Type			AB:1756_DNB_4	ł			
	Unscheduled Programs	+ Local:1:S	Data Types:				št			
	E G Motion Groups		MESSAGE		ОК					
	Ungrouped Axes		hair							
	- Data Types			^	Cancel					
	User-Defined		MESSAGE		Ush I					
	🕀 🙀 Strings		MINIMUM CAPTURE		нер					
	Add-On-Defined		MOTION_GROUP							
	Predefined		MOTION_INSTRUCTION							
	Trends		MOVING_AVERAGE							
	E G I/O Configuration			~						
	🖻 📾 1756 Backplane, 1756-A7		- Array Dimensions							
	0] 1756-L55 PROJ_FXEN_IP_DN		Dim 2 Dim 1							
			0 0	- 0 -						
	E B Ethernet		1	base ( base						
	1756-ENET/B EtherNetIP_F		Show Data Types by Groups							
	ETHERNET-MODULE FXEN_					-				
		Monitor T:	aus , Edit Tags /	•			•			
	Ready		· · · · · · · · · · · · · · · · · · ·							

2 Enter a name for the MESSAGE tag structure - in this example "FXEN\_VSC\_access".



**3** The complete MESSAGE structure is created automatically. It contains for example tags for the Class Instance Attribute access.

ure 38:	B RSLogix 5000 - PROJ_FXEN_IP_DN in PR	OF_FXEN_IP_DN.ACD [1756-L55]* - [Controller Ta	ags - PROJ_FXI	EN_IP_DN(contro	oller)]	
ucture of the	Elle Edit Yew Search Logic Communication:	s <u>T</u> ools <u>wi</u> ndow Help				~
ESSAGE		- &&& & E	<u> </u>			
ntual Tax	Offline	Path: AB_ETHIP-1\192.168.1.100\Backplane\	0* 🔽	8		
ntroi i ag	No Forces Disabled					
	No Edite SFC Forces:	- H H H H TON TOF RTO CTU CTC	RES			
	Enabled 000	■    Favorites    Alarms    Bit    Timer/Co	unter 🖌 Input/Ou	itput 🔏 Compare	🕻 Compute/Math 🔏 M	ove/Logical
	None Installed		~ ~			
	Controller PROJ FXEN IP DN	Scope: To PROJ_FXEN_IP - Show Show A	JI			
	📱 🛛 🖉 Controller Tags		A Alex For	Dava Tan	Data Tura	Cuda 🔺
	Controller Fault Handler	T EVEN ENAND with DMET/C		Dase ray		style
	Power-Up Handler	E PZEN_EUreineur_with_DNET.c			AD.CTUCONCT	
	E Casks	T P/EN_Enemene_win_DNET:			ADIE I HENNET	
		THRACH_EmerinedP_with_DINET:0			ABLETHERNET	
	Program Tags				AB:1756_DINB_5.	
	MainRoutine				AB:1756_DNB_4.	
	Unscheduled Programs	± Local 1:5			AB:1756_DNB_St	
	E S Motion Groups	- FXEN_with_UN_VSL_access			MESSAGE	
		+ FXEN_with_DN_VSU_access.Flags			INI	Hex
	Data Types	FXEN_with_DN_VSC_access.EW			BOOL	Decin
	User-Defined	FXEN_with_DN_VSC_access.ER			BOOL	Decin
	🗉 🛄 Strings	FXEN_with_DN_VSC_access.DN			BOOL	Decin
	Add-On-Defined	FXEN_with_DN_VSC_access.ST			BOOL	Decin
	Predefined	FXEN_with_DN_VSC_access.EN			BOOL	Decin
	Hodule-Defined	FXEN_with_DN_VSC_access.TO			BOOL	Decin
	Irends	FXEN_with_DN_VSC_access.EN_CC			BOOL	Decin
	= 1756 Backplane, 1756-A7	+ FXEN_with_DN_VSC_access.ERR			INT	Hex
	0 [0] 1756-L55 PROJ FXEN IP DN	FXEN_with_DN_VSC_access.EXERR			DINT	Hex
	😟 🖞 [1] 1756-DNB DNET	FXEN_with_DN_VSC_access.ERR_SRC			SINT	Decin
	E [2] 1756-ENET/B EtherNetIP_FXEN	FXEN_with_DN_VSC_access.DN_LEN			INT	Decin
	E Brenet	+ FXEN_with_DN_VSC_access.REQ_LEN			INT	Decin
	1756-ENET/B EtherNetIP_F	FXEN_with_DN_VSC_access.DestinationLink			INT	Decin
	I ETHERNET-MODULE PXEN_	+ FXEN_with_DN_VSC_access.DestinationNode			INT	Octal
		A DATA TARE A Feit Tare			INIT	Derit Z
		Montor rays Acut rays /				<u> </u>

#### Start bit for MSG instruction

- **4** The MSG instruction has to be triggered by a start bit which also has to be defined in the Controller Tags.
- **5** Define a Controller Tag of type BOOL and enter a name in this example this would be "FXEN\_start\_VSC".



#### Data array for the MSG instruction

- **6** The data to be read from the VSCs or to be written to them via the MSG instruction are sent to a data array which has to be defined in the Controller Tags.
- 7 Define this array by adding a SINT of a special data width for example 100 byte- to the Controller Tags and enter a name for it in this example "FXEN\_RW\_VSC".

Figure 40:	Select Data Type	
Data array for	Data Types: SINT[100]	ОК
INE IVISG IN-	SELECT_ENHANCED SELECTABLE_NEGATE	Cancel
Struction	SELECTED_SUMMER SERIAL_PORT_CONTROL SFC_ACTION SFC_STEP SFC_STOP	Help
	Array Dimensions           Dim 2         Dim 1         Dim 0           0	
	□ Show Data Types by Groups	



#### The PLC program

#### Entering the MSG instruction

1 Go to the PLC program (Main Routine), add a new network (rung) to the program and insert a MSG instruction.



**2** Click on the "?" in the MSG instruction and assign the MESSAGE Controller Tag to be used by the instruction.

Figure 42:	RSLogix 5000 - PROJ_FXEN_IP_DN in Pl	ROF_FXEN_IP_DN.ACD [1756-L55]* - [MainProgram - MainRoutine*]
definition for the MSG instruction	Image: Constraint of the second se	
	Controller PROJ_FXEN_IP_DN  Controller Tags Controller Tags Controller Tags Controller Tags Controller Tags MainTask  MainTas	Image: State of the state o
	Enter operand of type MESSAGE	Kung U or 1 (APP MER)

- **3** Open the "Message Configuration" dialog box by pressing the "View Configuration Dialog"-button in the MSG instruction.
- **4** In this dialog box, chose the "Configuration" tab and define "Message Type", "Service Type" and, for the data read out from the VSCs via MSG instruction, the "Destination" or, for the data to be written to the VSCs via MSG instruction, the "Source Element". In this case this would be the data array defined above "FXEN\_RW\_acces".

Figure 43: Configuration of	BRSLogix 5000 - PROJ_FXEN_IP_DN in PROF_FXEN_IP_DN.ACD [1756-L55]* - [MainProgram - MainRoutine*]     IN INFORMATION INF
the MSG	
	0ffline 1/0 Forces: Path A8_ETHIP-1\192168.1.100\Backplane\0*
Instruction	Disabled Disabled
	No Fele a Forces:
	Seducine 1. Sector Annu Sector
	None installed in the second
	│ P 😂 Controller PROJ_FXEN_JP_DN    街 强强固团
	Controller Tags
	CEN-     CEN-     CEN-     CEN-
	Easis     Message Control FXEN_with_DN_VSC_access (DP)     (DN)     (DN)
	B Ca MainProgram
	Message Configuration - FXEN_with_0/SC_access
	Configuration* Communication Tag
	A Gamma Country Countr
	La Ungrouped Axes Message Type: CIP Generic
	Service Service Get Attribute Single Source Element
	Brings Source Length: 1 (Bytes)
	Add-On-Defined Service e (Hex) Class: 0 (Hex) Destination
	Medden Defind
	Name Data Type Description
	E Can I/O Configuration
	Trans-Enterridge with Date to the second secon
	In 1755-ENET/RETerevent/P FX
	Error Code: Extended Error Code:
	1756-ENET/B EtherNett Error Path: Controller
	D ETHERNET-MODULE PXI Error Lexic     Program
	OK Abbrechen U Show All >>
	View Configuration Dialog



- 5 Additionally, please define the Class, Instance and Attribute you want to read out or to write to or set it = 0. Confirm your entries by pressing the "Apply" button and change to the "Communication" tab.
- 6 Define the Message Path by browsing the I/O Configuration and selecting the EtherNet/IP node with which the PLC has to communicate in this example this is the FXEN-IM16-0001-IP-DN with the IP address 192.16.1.115.

X

**7** Confirm your settings.

Message Configuration - FXEN\_with\_DN\_VS

Figure 44: Configuration of the path for the MSG instruction

Path:		Browse
Commu	Message Path Browser	
C OF	Path: FXEN_EtherNetIP_with_DNET	
So	FXEN_EtherNetIP_with_DNET	
<ul> <li>Enable</li> <li>Error Co</li> <li>Error Path:</li> <li>Error Text:</li> </ul>	금         1726 Backplane, 1736A7           →         1736 Backplane, 1736A7           →         101756-L55 PR0L_FXEN_IP_DN           ⇒         111756-DNB DNET           →         ⇒           ↓         111756-DNB DNET           →         ⇒           ↓         121756-ENET //8 EthenNetIP_FXEN           ⇒         ⇒           ↓         121756-ENET //8 EthenNetIP_FXEN           ↓         12766-ENET //8 EthenNetIP_FXEN           ↓         12766-ENET //8 EthenNetIP_FXEN           ↓         12766-ENET //8 EthenNetIP_FXEN	erNetiP_with_DNET]
	× III	Hilfe
•    <del></del>		
	OK Cancel	Help

#### **Triggering the MSG instruction**

The MSG instruction has to be triggered by setting a start bit.

8 Add a normally open contact to your rung and assign the "FXEN\_start\_VSC" bit.

Figure 45: Normally open	H MainProgram - MainRoutine*	
contact for trig- gering the MSG instruction	0     Message Message Control     FXEN_wth_DN_VSC_access       (End)     (End)	
	MainProgram	

**9** Go online with the PLC and download your program.

3

#### **Example for VSC access**

#### Read out product name of FXEN-IM16-0001-IP-DN

The product name of every EtherNet/IP-devices can be found in its Identity Object (Class 01h, Instance 01h, Attribute 07h) defined by the ODVA.

1 In order to read out data from the Classes of an EtherNet/IP-node, the Service Type of the MSG instruction has to be defined as "Get Single Attribute" service.

Figure 46:	Message Configuration - FXEN_VSC_access
Get Single	Configuration* Communication Tag
Attribute	Message Iype: CIP Generic 💌
	Service Get Attribute Single Source Element Source Length: Service e (Hex) Class: 0 (Hex) Destination FXEN_RW_VSC  Instance: 0 Attribute 0 (Hex) New Tag
	© Enable © Enable Waiting © Start © Done Done Length: 0 © Error Code: Extended Error Code: □ Timed Out ◆ Error Text: OK Abbrechen Übernehmen Hilfe

**2** Go to the "Monitor Tags" tab in the Controller Tags and enter the Class 01h, Instance 01h, Attribute 07h information into the respective Controller Tag lines (see below).




**3** Set the start bit "FXEN\_start\_VSC" to trigger the MSG instruction. Be sure that the I/O Forcing in the PLC in enabled.

ure 48:	& RSLogix 5000 - PROJ_FXEN_IP_DN in PROF_FXEN_IP_DN.ACD [1756-L55]* - [Controller Tags - PROJ_FXEN_IP_DN(controller)]         Image: Control of the second								
-orcing the start									
	Rem Run 1 10 10 Forces: ABSII 20 Patr. AB_ETHIP-1/192.168.1.100/Backplane/0* 🔽 📩								
	No Forces								
	Redundancy Red		compare 🔥 compare	A MOVE/Logical A File/Misc. A File/Shift					
	Controller PROJ FXEN IP DN	Scoge: To PROJ_FXEN_IP,  Show Show All							
	🖉 🖉 Controller Tags	Name	∧ Value	← Stule ▲					
	Controller Fault Handler	EXEN with DN VSC access DN		Decimal					
	Power-Up Handler	EXEN with DN VSC access ST	-	Decimal					
	A MainTask	FXEN with DN VSC access.EN	1	Decimal					
	🖹 🥞 MainProgram	FXEN with DN VSC access.TO	0	Decimal					
	🧟 Program Tags	FXEN with DN VSC access.EN CC	1	Decimal					
	MainRoutine	+ FXEN with DN VSC access.ERR	16#0000	Hex					
	Motion Groups	+ FXEN with DN VSC access.EXERR	16#0000 0000	Hex					
	Ungrouped Axes	+ FXEN with DN VSC access.ERR SRC	0	Decimal					
	- Add-On Instructions	+ FXEN_with_DN_VSC_access.DN_LEN	21	Decimal					
	🖻 🔄 Data Types	+ FXEN with DN_VSC_access.REQ_LEN	0	Decimal					
	User-Defined	+ FXEN_with_DN_VSC_access.DestinationLink	0	Decimal					
	Add-On-Defined		8#000 000	Octal					
	Predefined	+ FXEN_with_DN_VSC_access.SourceLink	0	Decimal					
	🖅 🙀 Module-Defined	+ FXEN_with_DN_VSC_access.Class	16#0001	Hex					
	- Canada Trends	+ FXEN_with_DN_VSC_access.Attribute	16#0007	Hex					
	E-G I/O Configuration	+ FXEN_with_DN_VSC_access.Instance	1	Decimal					
	1/56 Backplane, 1/56-A/	+ FXEN_with_DN_VSC_access.LocalIndex	0	Decimal					
		+ FXEN_with_DN_VSC_access.Channel	'\$00'	ASCII					
	E- [2] 1756-ENET/B EtherNetIP_FXE	+ FXEN_with_DN_VSC_access.Rack	8#000	Octal					
	Ethernet	+ FXEN_with_DN_VSC_access.Group	0	Decimal					
	1756-ENET/B EtherNetIP	+ FXEN_with_DN_VSC_access.Slot	0	Decimal					
	ETHERNET-MODULE FXEN	+ FXEN_with_DN_VSC_access.Path	'\$01\$02\$12\$r	{}					
			0	Decimal					
		FXEN_with_DN_VSC_access.RemoteElement	1.1	()					
		+ FXEN_with_DN_VSC_access.UnconnectedTimeout	3000000	Decimal					
		+ FXEN_with_DN_VSC_access.ConnectionRate	7500000	Decimal					
		FXEN_with_DN_VSC_access.TimeoutMultiplier	0	Decimal					
		FXEN_start_VSC	1	Decimal					
			()	() Decimal					
		A A D Manifes Tame ( E-44 Tame (		1					

**4** The result of the Get Single Attribute operation can be found in the Controller Tags "FXEN\_RW\_VSC".

Figure 49:	8 RSLogix 5000 - PROJ_FXEN_IP_DN in PROF_FXEN_IP_DN.ACD [1756-1.55]* - [Controller Tags - PROJ_FXEN_IP_DN(controller)]								
Forcing the start	Elle Edit View Search Logic Communications	Tools Window Help		_ 6' ×					
bit									
	Rem Run 🚺 🔽 1/0 proces: 🔤 🗱 Patr. A8_ETHIP-1\192168.1.100\Backplane\0" 💙 📸								
	No Edits SFC Forces: Frabled		NS OSR OSF						
	Redundancy None Installed	Add-On & Alarms & Bit & Timer/Counter	A input/Output A compare A compute/Math A Mo	ve/Logical <b>Λ</b> File/Misc. <b>Λ</b> File/Shiπ /					
		Scope: 1 PROJ_FXEN_IP.  Show All							
	Controller Tags	Name	Value Force Mask	♦ Style					
	Power-Lip Handler	+ FXEN_DN_RW_VSC[0]	'\$14'	ASCII					
	E-G Tasks	+ FXEN_DN_RW_VSC[1]	(F)	ASCII					
	📄 🤕 MainTask	+ FXEN_DN_RW_VSC[2]	'X'	ASCII					
	🖻 🥞 MainProgram	FXEN_DN_RW_VSC[3]	'Е '	ASCII					
	Program Tags	+ FXEN_DN_RW_VSC[4]	'N'	ASCII					
	Linscheduled Programs	+ FXEN_DN_RW_VSC[5]	()	ASCII					
	E-G Motion Groups	+ FXEN_DN_RW_VSC[6]	·I ·	ASCII					
	Ungrouped Axes	FXEN_DN_RW_VSC[7]	'M'	ASCII					
	- Add-On Instructions	+ FXEN_DN_RW_VSC[8]	11	ASCII					
	E-C Data Types	+ FXEN_DN_RW_VSC[9]	161	ASCII					
	Stripes	+ FXEN_DN_RW_VSC[10]	1_1	ASCII					
	Add-On-Defined	FREN_DN_RW_VSC[11]	101	ASCII					
	🕀 🔙 Predefined	+ FXEN_DN_RW_VSC[12]	·0·	ASCII					
	🗄 🛶 Module-Defined	+ FXEN_DN_RW_VSC[13]	101	ASCII					
	- Trends	+ FXEN_DN_RW_VSC[14]	11	ASCII					
	- I/O Configuration	FXEN_DN_RW_VSC[15]	· - ·	ASCII					
	1/36 Backplane, 1/36 AV	FXEN_DN_RW_VSC[16]	·I'	ASCII					
		+ FXEN_DN_RW_VSC[17]	· p ·	ASCII					
	🖃 🗍 [2] 1756-ENET/B EtherNetIP_FXEN	FXEN_DN_RW_VSC[18]	1_1	ASCII					
	⊟ යි Ethernet	+ FXEN_DN_RW_VSC[19]	'D'	ASCII					
	1756-ENET/B EtherNetIP_F	+ FXEN_DN_RW_VSC[20]	'N'	ASCII					
	U ETHERNET-MODULE PXEN_	+ FXEN_DN_RW_VSC[21]	0	Decimal					
		+ FXEN_DN_RW_VSC[22]	0	Decimal					
		+ FXEN_DN_RW_VSC[23]	0	Decimal					
		+ FXEN_DN_RW_VSC[24]	0	Decimal					
		+ FXEN_DN_RW_VSC[25]	0	Decimal					
		+FXEN_DN_RW_VSC[26]	0	Decimal					
		+ FXEN_DN_RW_VSC[27]	0	Decimal					
		+FXEN_DN_RW_VSC[28]	0	Decimal _1					
		Monitor Tags / Edit Tags /		<u> </u>					
				<u>a</u> //					



## VSC access to DeviceNet<sup>™</sup> master or DeviceNet<sup>™</sup> nodes

To access the DeviceNet<sup>™</sup> master use Vendor Specific Class VSC 122 (7Ah).

To access the connected DeviceNet<sup>™</sup> nodes use Vendor Specific Class VSC 123 (7Bh).

#### Example: Read out the slave list from the master

The Slave list of the master can be read out from VSC122 (7Ah), Instance 1, attribute 109 (6Dh).

Figure 50: Read out the slave list

controller Tags - PROJ_FXEN_IP_DN(controller)				
pe: DROJ_FXEN_IP, V Show Show All				
Name	🛆 Value 🔶	Force Mask	Style	Data Type
-FXEN_VSC_access.DN	1		Decimal	BOOL
-FXEN_VSC_access.ST	0		Decimal	BOOL
-FXEN_VSC_access.EN	1		Decimal	BOOL
-FXEN_VSC_access.TO	0		Decimal	BOOL
FXEN_VSC_access.EN_CC	1		Decimal	BOOL
+ FXEN_VSC_access.ERR	16#0000		Hex	INT
+ FXEN_VSC_access.EXERR	16#0000_0000		Hex	DINT
E FXEN_VSC_access.ERR_SRC	0		Decimal	SINT
FXEN_VSC_access.DN_LEN	8		Decimal	INT
+ FXEN_VSC_access.REQ_LEN	0		Decimal	INT
+ FXEN_VSC_access.DestinationLink	0		Decimal	INT
+ FXEN_VSC_access.DestinationNode	8#000_000		Octal	INT
+ FXEN_VSC_access.SourceLink	0		Decimal	INT
+ FXEN_VSC_access.Class	16#007a		Hex	INT
+ FXEN_VSC_access.Attribute	16#006d		Hex	INT
	1		Decimal	DINT
+ FXEN_VSC_access.LocalIndex	0		Decimal	DINT
+ FXEN_VSC_access.Channel	'\$00'		ASCII	SINT
+ FXEN_VSC_access.Rack	8#000		Octal	SINT
+ FXEN_VSC_access.Group	0		Decimal	SINT
+ FXEN_VSC_access.Slot	0		Decimal	SINT
+ FXEN_VSC_access.Path	'\$01\$02\$12\$r	{}		STRING
+ FXEN_VSC_access.RemoteIndex	0		Decimal	DINT
+ FXEN_VSC_access.RemoteElement	1.1	{}		STRING
+ FXEN_VSC_access.UnconnectedTimeout	3000000		Decimal	DINT
+ FXEN_VSC_access.ConnectionRate	7500000		Decimal	DINT
FXEN_VSC_access.TimeoutMultiplier	0		Decimal	SINT
FXEN_start_VSC	1		Decimal	BOOL
FXEN_RW_VSC	{}	{}	ASCII	SINT[100]
+ FXEN_RW_VSC[0]	0		Decimal	SINT
Monitor Tags (Edit Tags /				



Do not forget to set the start bit in "FXEN\_start\_VSC".

The result can again be found in the Controller Tags "FXEN\_RW\_VSC" and has to be read a follows:

Each bit of this ARRAY of BYTE (8 byte length) represents one DeviceNet<sup>™</sup> MAC-ID:

For Example:

- Bit 0 of byte 0 represents MAC-ID 0
- Bit 1 of byte 0 represents MAC-ID 1 ...
- Bit 8 in byte 8 MAC-ID 63.

If a bit is set to 1, a node with the corresponding MAC-ID has been found in the DeviceNet<sup>™</sup> subnet.

Figure 51:		Controller Tags - PROJ_FXEN_IP_DN(controller)				$\mathbf{X}$
Slave list from	S	coge: 🚺 PROJ_FXEN_IP 💌 Show Show All				
ехаттріе		Name 🛆	Value 🗧	Force Mask 🗧 🗧	Style	
network			0		Decimal	
		FXEN_start_VSC	1		Decimal	
		-FXEN_RW_VSC	{}	{}	Binary	
		+ FXEN_RW_VSC[0]	2#0000_0000	→MAC-ID 0	Binary	
			2#0100_1000	→MAC-ID 11 u. 14	Binary	
			2#0100_0000		Binary	
			2#0000_0000		Binary	
		+ FXEN_RW_VSC[4]	2#0000_0000		Binary	
		+ FXEN_RW_VSC[5]	2#0000_0000		Binary	
		+ FXEN_RW_VSC[6]	2#0000_0000		Binary	
		+ FXEN_RW_VSC[7]	2#1000_0000	→MAC-ID 63	Binary	
			2#0000_0000		Binary	
			2#0000_0000		Binary	
		+ FXEN_RW_VSC[10]	2#0000_0000		Binary	
		+ FXEN_RW_VSC[11]	2#0000_0000		Binary	
		+ FXEN_RW_VSC[12]	2#0000_0000		Binary	
			2#0000_0000		Binary	-
	4	Monitor Tags (Edit Tags /	•			· //

In this example, the nodes with MAC-IDs 11, 14, 22 and 63 could be found.

# Example: Read out the Maj./ Min. revision of DeviceNet<sup>™</sup> subnet node with MAC-ID 11

The Maj./ Min. revision of each DeviceNet<sup>™</sup> node can be read out from it's Identity Object.

VSC 123 is used to read out the Identity object of every standard DeviceNet<sup>™</sup> node (not only TURCK products) via a TURCK Vendor Specific Class.

1 To read out the Maj./ Min. revision of the DeviceNet<sup>™</sup> node with MAC-ID 11, the followings VSC access has to be done: VSC 123 (7Bh), Instance 12, Attribute 04h)

•	
- <b>-</b> -	

## Note

Please observe, that the instance **12** is used to read out data from MAC-ID **11**. The instance-no. corresponds to the node's MAC-ID + 1. Please read also "DeviceNet<sup>™</sup> slave class (VSC 123, 7Bh)", page 2-14.

Figure 52: Major/Minor revision of **DeviceNet**™ node 11

FXEN_VSC_access.SourceLink	0		Decimal	INT
+ FXEN_VSC_access.Class	16#007b		Hex	INT
FXEN_VSC_access.Attribute	16#0004		Hex	INT
FXEN_VSC_access.Instance	12		Decimal	DINT
+ FXEN_VSC_access.LocalIndex	0		Decimal	DINT
+ FXEN_VSC_access.Channel	'\$00'		ASCII	SINT
FXEN_VSC_access.Rack	8#000		Octal	SINT
+ FXEN_VSC_access.Group	0		Decimal	SINT
+ FXEN_VSC_access.Slot	0		Decimal	SINT
FXEN_VSC_access.Path	'\$01\$02\$12\$r	{}		STRING
FXEN_VSC_access.RemoteIndex	0		Decimal	DINT
+ FXEN_VSC_access.RemoteElement	1.1	{}		STRING
	3000000		Decimal	DINT
FXEN_VSC_access.ConnectionRate	7500000		Decimal	DINT
+ FXEN_VSC_access.TimeoutMultiplier	0		Decimal	SINT
FXEN_start_VSC	1		Decimal	BOOL
FXEN_RW_VSC	{}	{}	Decimal	SINT[100]
FXEN_RW_VSC[0]	4		Decimal	SINT
EVEN BW VSC(1)	2		Decimal	SINT

- 2 The result of this VSC access is again sent to "FXEN\_RW\_VSC".
- **3** The Maj. revision of the node is 4, the Min. revision 2.



## 4 DeviceNet<sup>™</sup> master with Modbus TCP

Hard- and software	2
Hardware Software	2 2
Network configuration and IP-address-setting	3
Settings of the network interface card	
Address setting at the BL67-module	3
Modbus communications configuration	4
Modbus Server Tester configuration	4
–I/O-mapping report via PACTware™	7
– I/O data mapping for the example station	
Examples of communication parameter changes and I/O testing	
- Baud Rate change	
– Scanlist and Node Error present	18
Reading slave iInputs and forcing slave outputs	22

## **Modules for Modbus TCP**

## **BL67-GW-EN-DN**

Figure 53: BL67-GW-EN-DN



The BL67 gateway for Modbus TCP with DeviceNet<sup>™</sup> master function is part of the modular I/O system BL67.

The gateway is used to connect a modular BL67-station with different I/O and technology modules to Modbus TCP. Additionally, this gateway offers the possibility to connect a complete DeviceNet<sup>™</sup> subnet to it and to handle the process data of the DeviceNet<sup>™</sup> subnet via Modbus TCP (see also chapter 1).

The connection to Modbus TCP is realized via one 4-pole, D-coded M12 x 1-round connector.



Note

The BL67 gateway contains no integrated Ethernet switch!



## Modbus data layout

The DeviceNet<sup>™</sup> master's register layout is structured as follows:

Table 13: Modbus Layout	Direction	In place	Register	Process data	Comment
A If status- and control- word are en-	Input	Always	0x0000	Local process data	
wise the DN master's pro- cess data		Always (See Note Below)		Status of GW word	
register ad- dress.		Always	Module bus Diagnostics		
		Always	1 Bit for each Module		
		Must be enabled	0x0c00 <b>A</b>	DN-master status word	0x3089 register enables this information
		Must be enabled		Slave in scanlist 0-15	0x3089 register enables this information
		Must be enabled		Slave in scanlist 16-31	0x3089 register enables this information
		Must be enabled		Slave in scanlist 32-47	0x3089 register enables this information
		Must be enabled		Slave in scanlist 48-63	0x3089 register enables this information
		Must be enabled		Slave error present 0-15	0x3089 register enables this information
		Must be enabled		Slave error present 16-31	0x3089 register enables this information
		Must be enabled		Slave error present 32-47	0x3089 register enables this information
		Must be enabled		Slave error present 48-63	0x3089 register enables this information
		always	0xC00 <b>A</b>	DN-master process data	0x3089 register enables this information. Then scanlist defined Slave Process Data. Padded Byte must be added if Slave Byte Data size is odd
		always	0xC00	DN-master process data	In scanlist defined slave process data. Padded byte must be added if slave byte data size is odd

Table 13: Modbus Layout	Direction	In place	Register	Process data	Comment
	Output	Always	0x800	Local Process Data	
		Must be enabled	0x3D00 A	DN –master control word	0x3089 register enables this information. Then scanlist defined slave output data. Padded byte must be added if slave byte data size is odd.
		Always	0x3D00	DN master process data	In scanlist defined slave output data. Padded byte must be added if slave byte data size is odd.

Table 14:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Word	V <sub>out</sub> I	V <sub>out</sub> h	Lin o		I/O cfg w			I/O Diag
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	I/O err	FM	DN M	DN S	I/O cfg	I/O com	V <sub>in</sub> I	V <sub>in</sub> h

Table 15: Meaning of the status bits	Bit	Meaning
	I/O err	The communication controller for the I/O system is faulty
	FM	The I/O-ASSISTANT Force Mode is active at the gateway.
	DN M	DeviceNet Master error: – duplicate MAC-ID has been detected – bus condition is off – wrong data size
	DN S	DeviceNet slaves error – not all slaves are in poll state
	I/O cfg	The I/O configuration has been changed and is now incompatible
	I/O com	No communication on the I/O module bus
	Vin I	V <sub>in</sub> too low
	Vin h	V <sub>in</sub> too high
	Vout I	V <sub>out</sub> too low
	Vout h	V <sub>out</sub> too high
	Lin o	line overcurrent



4

Table 15: Meaning of the status bits	Bit	Meaning	
	I/O cfg w	Warning, the I/O configuration has been changed	
	I/O diag	I/O diagnostics active	

#### **Process data**

The DN master IO data is mapped into registers 0x3C00 - 0x3DFF of the Modbus/TCP register table.

Based on the attached nodes, the scan list is filled in and the I/O data is automatically mapped into the data block (word aligned) based on the consume and produce size.

The consume/produce data of the slave is mapped in order of the actual node addresses on the DeviceNet bus.

Optionally, the control/status information is appended in front of the Process Data - based on the value of the register "0x3089".

For the explanation of the I/O data mapping the following **example subnet structure** is assumed.

Table 16: Example subnet at DeviceNet™ master	DeviceNet™ Module MAC-ID		DeviceNet I/O data		
	Node address		Input	Output	
	2	DeviceNet™ node <b>A</b>	2 byte		

7	DeviceNet™ <b>node B</b>	2 byte	2 byte
9	DeviceNet™ <b>node C</b>	3 byte	7 byte
Nata			



#### Note

Again, a padded byte must be added if the slave data size is odd.

#### **Example: input image**

	Byte 1	Byte 0					
Word 0	process data, node address 2						
Word 1	process data, node address 7						
	process data, node address 9						
Word n-1	padded byte	process data, node address 9					
Word n	unused						



## Example: output image

	Byte 1	Byte 0				
Word 0	process data, node address 7					
Word 1						
Word n-2	process data, n	ode address 9				
Word n-1	process data, node address 9					
Word n	padded byte	process data, node address 9				

## Status/control words of the DeviceNet<sup>™</sup> subnet via I/O data

The DeviceNet<sup>™</sup> master provides an additional status information (9 words) and control bytes (1 word) for the DeviceNet<sup>™</sup> subnet. Status and control information will be mapped in front of Input and Output DeviceNet<sup>™</sup> Slave data if the information is enabled. The information is enabled in register 0x3089 (0=Disabled, 1=Enabled (Default)).

## **Status words**

If the 9 status words are enabled and mapped into the process data, they are located in registers **0x3C00**...**0x3Cff**. If they are disabled, then Word 0 would be receiving Input Data from Device Net Slaves.

This status information is structured as follows:

- I word for the DeviceNet<sup>™</sup> communication (word no. 0)
- 4 words for the "scanlist" information (word no. 1-4)
- 4 words for "error nodes" information (word no. 5-8)

Table 17: Word 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	DNM status	slave missing	empty scan list	CAN error	Dup MacID	subnet input	subnet output	comm. error
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8

```
reserved
```

Table 18: Bit meanings	Bit	Meaning			
	DNM Status	0 = IDLE 1 = RUN			
	Slave missing	0 = subnet ok 1 = one or more slaves missing			
	Empty scan list 0 = scanlist ok 1 = The scanlist of the master is empty. No slave found during the scan process				
	CAN error	0 = no error 1 = CAN error (communication problem with CAN controller			
	DupMacID	0 = ok 1 = Master DupMacID fault →duplicate MAC-IDs found in the DeviceNet™ subnode			
	subnet input	0 = ok 1 = the size of the input data of the subnet is too large (max. number of bytes 500 byte)			
	subnet output	0 = ok 1 = the size of the output data of the subnet is too large (max. number of bytes 500 byte)			
	comm. error	0 = no error 1 = communication error or bus off.			



The following table represents the scan list of the master:

Each node which has been scanned as being a part of the subnet is indicated by one bit (the order is done by Node):

0 = no node is found in GW scan list

1 = node is found and stored in the master's scan list

Table 19: Word 1	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 7	Node 6	Node 5	Node 4	Node 3	Node 2	Node 1	Node 0
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 15	Node 14	Node 13	Node 12	Node 11	Node 10	Node 9	Node 8
Word 4	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 55	Node 54	Node 53	Node 52	Node 51	Node 50	Node 49	Node 48
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 63	Node 62	Node 61	Node 60	Node 59	Node 58	Node 57	Node 56
Table 20:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Table 20:	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Word 5	Node 7	Node 6	Node 5	Node 4	Node 3	Node 2	Node 1	Node 0
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 15	Node 14	Node 13	Node 12	Node 11	Node 10	Node 9	Node 8
Word 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Node 55	Node 54	Node 53	Node 52	Node 51	Node 50	Node 49	Node 48
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	Node 63	Node 62	Node 61	Node 60	Node 59	Node 58	Node 57	Node 56

#### **Control word**

The control word is used to set the DeviceNet<sup>™</sup> master into RUN or IDLE mode.

If the 1 control word is enabled and mapped into the process data, they are located in registers **0x3D00** ... **0x3DFF**. If they are disabled, then Word 0 would be receiving Output Data from Device Net Slaves.

Table 21: Word 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	reserved							1=RUN 0=IDLE
	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
	reserved							

This control word is structured as follows:



#### **RUN/IDLE Mode**

Default operation: The RUN/IDLE Mode is basically controlled by Modbus/TCP. As soon as the Modbus/TCP connection is established – the subnet goes into the Run Mode. When there is no Modbus/TCP connection present – the gateway is in the IDLE Mode.

Run/IDLE functionality can be overridden by the IO-ASSISTANT Force Mode. In IDLE Mode no output data are sent to the slaves, but input data from the slaves are still read in. Every subnet slave switched into IDLE Mode will set its output to the preconfigured IDLE Status.

In Run Mode output data are sent and input data from the slaves are read in.

## • Note

The control over Run/IDLE Mode of the DeviceNet<sup>™</sup> master is established via the parameter Enable Control/Status Information (0x3089). If the Control/Status information is disabled the default operation will take place. If the Control/Status information is enabled then the Run/IDLE control is part of the I/O Data.

## **Register layout**

This layout contains parameters and data for the DeviceNet<sup>™</sup> master.



## Note

There are other existing registers associated with a BL67 GW-EN-DN Module. Please refer to the TURCK document no. D300815 to identify the complete register layout for this module.

DeviceNet<sup>™</sup> master register layout is as follows:

Table 22: Register layout	Register Range	Access	Name	Туре	Description
	0x3000 0x303F	RO	Input Sizes	Array of Short	This array contains the information of the input sizes of each slave (2 bytes per slave)
	0x3040 0x307F	RO	Output Sizes	Array of Short	This array contains the information of the output sizes of each slave (2 bytes per slave)
	0x3080 0x3083	RO	Scanlist	Array of bits	Bit position 063 define whether the specific slave is present in the scanlist
	0x3084 0x3087	RO	Error Slaves	Array of bits	Value one of each bit in bit posi- tions 063 defines that the specific slave is present in the scanlist but the master couldn't establish I/O Connection to that slave

Table 22: Register layout	Register Range	Access	Name	Туре	Description
	0x3088	RO	DeviceNet™ Master Diagnostics	Byte	Bit 0 = Bus off Bit 1 = Output Size is too big Bit 2 = Input Size is too big Bit 3 = Duplicate MacID of the master Bit 4 = CAN Error (possibly due to Bus off) Bit 5 = Empty Scanlist Bit 6 = one or more slaves missing Bit 7 = DNM RUN/IDLE
	0x3089	RW	Enable Control, Status information in the DeviceNet process data	Short	If enabled – the first write register is control register, the first 18 read registers are status registers Changes of enable/disable take effect only after restart 0 = disable 1 = enable
	0x308A	RW	MacID of the DeviceNet master	Short	Node address, range 0-63, changes of master MacID take effect only after restart 0 = default
	0x308B	RW	Baud Rate of the DeviceNet master	Short	0 = 125k (default) 1 = 250k 2 = 500k Changes to baud rate take effect only after restart
	0x308C	RW	Quick Connect	Short	0 = disable 1 = enable
	0x308D	RW	Subnet Discovery trigger (WHO)	Short	0 = disable 1 = enable (default) – different from ODVA
	0x308E	RW	Global EPR	Short	Specifies the EPR in ms, default = 100ms With 100ms the subnet limitations are about: 10 slaves and 256 bytes process data If there are more than 10 slaves or more than 256 bytes of data needed, the user should increase the Global EPR value
	0x308F	RO	Interscan period	Short	Interscan period in ms This is status information which allows the user to know how much margin allowed when defining the Global EPR.



4

Table 22: Register layout	Register Range	Access	Name	Туре	Description
	0x3100 0x34FF	RO	Slave Input Data	Array	Up to 32 bytes input data per slave allocated on the 32 byte boundary. (If the slave data is bigger than 32 bytes – it will be truncated.)
	0x3500 0x38FF	RW	Slave Output Data	Array	Up to 32 bytes output data per slave allocated on the 32 byte boundary. (If the slave data is bigger than 32 bytes – it will be truncated.)
	0x3900 0x39FF	RW	Get/Set Object Command Request	Structure	This register set allows to get/set specific system objects which provide a powerful mechanism to configure the DeviceNet <sup>™</sup> master parameters, send explicit messages to slaves. The format of this structure is the following: - Byte 0: - Bits 03 → req_counter → used for synchronization purposes, - Bits 47 = Command 1 = Set 0 = Get - Byte 1,2,3,4: UID - Byte 5,6: Inst - Byte 7,8: Length of the data following byte - Byte 9: Data (up to 503 bytes of data)

D301118 - BL remote - DeviceNet™ master 0209

Table 22: Register layout	Register Range	Access	Name	Туре	Description
	0x3A00 0x3AFF	RO	Get/Set Object Command Response	Structure	This register set provides the response to execution of the "object command" described above. The format of this structure is the following: - Byte 0: - Bits 0 to $3 \rightarrow$ req_counter $\rightarrow$ used for synchronization purposes, - Bits 47 = Command 1 = Set 0 = Get - Byte 1, 2, 3, 4: UID - Byte 5, 6: Inst - Byte 7, 8: Length of the data following byte - Byte 9: Data (up to 503 bytes of data)
	0x3B00 0x3B3F	RO	Input Offsets	Array of short	Input offsets of each of the slaves on the scanlist
	0x3B40 0x3B7F	RO	Output Offsets	Array of short	Output offsets of each of the slaves on the scanlist
	0x3C00 0x3CFF	RO	DNM Input	Array of Byte	DeviceNet <sup>™</sup> master Input Assembly – this object contains the status/diagnostic data (if enabled) and all slave input data
	0x3D00 0x3DFF	RO	DNM Output	Array of Byte	DeviceNet <sup>™</sup> master Output Assembly – this object is used to control the master via the master control word (if enabled) and to send the subnet data to the DeviceNet <sup>™</sup> slaves



## 5 Application Example: BL67 with Modbus Server Tester

Hard- and Software	2
Hardware Software	2 2
Network Configuration and IP-Address-Setting	3
Settings of the Network Interface Card Address setting at the BL67-module	
Modbus Communications Configuration	4
Modbus Server Tester Configuration – I/O-Mapping Report via PACTware <sup>™</sup> – I/O Data Mapping for the Example Station Examples of Communication Parameter Changes and I/O Testing – Baud Rate Change – Scanlist and Node Error present	
Reading Slave Inputs and Forcing Slave Outputs	22

## Hard- and software

## Hardware

For this application example, the following hardware is used:

- BL67-GW-EN-DN, Modbus TCP Gateway with DeviceNet<sup>™</sup> master with:
  - addr. 1, FDNL-CSG88-T: DeviceNet<sup>™</sup> module with 8 digital input channels and 8 digital output channels
  - addr. 3, FDNQ-XSG08: DeviceNet<sup>™</sup> module with 4 digital input and 4 digital output channels
  - addr. 11, FDNL-L1600-T: DeviceNet™ module with 16 digital input channels
  - addr. 22, FDNL-L0800-T: DeviceNet™ module with 8 discrete input channels
  - also, there are two IO modules connected to the BL67, one BL67-4DI-P and BL67-4DO-0.5A-P

## Software

For this application example, the following software is used:

- Modbus Server Tester version 1.5 (Modbus.org)
- IO-ASSISTANT 3 (FDT/DTM) from TURCK (TURCK-DTMs + FDT-Frame Application PACTware<sup>™</sup>), version 3.5



#### Network configuration and IP-address-setting

Note

#### Settings of the network interface card

The TURCK modules for Modbus TCP are delivered with the default IP address 192.168.1.254.



In order to build up the communication between the TURCK product and a PLC/PC or a network interface card, both devices have to be hosts in the same network.

To achieve this, you have to either:

- to adjust the gateway's IP address via BootP, DHCP etc. for integrating it into your own network
  - or
- to change the IP address of the used PC or network interface card

In this example, the network card setting is the following:

IP address: 192.168.1.1

Subnet mask: 255.255.255.0

#### Address setting at the BL67-module

In this application example, the IP address is set via the rotary switch to 192.168.1.7.

Addresses in the range from 1 to 254 can be allocated in the default subnet 192.168.1. The addresses 0 and 255 are reserved for broadcast messages in the subnet.



## Note

The rotary coding switches on the module must be set to "400" or "600" in order to enable the DHCP-Mode or respectively the PGM-DHCP-mode.

#### Modbus communications configuration

#### **Modbus Server Tester configuration**

The Modbus Server Tester Software is used to test I/O Mapping. The user can confirm bits, bytes, and registers being passed back and forth. The Software can also force outputs and read inputs.

Start the software by going to Program Files  $\rightarrow$  Modbus.org $\rightarrow$  Modbus-TCP Server Tester.



When the Modbus Server Tester is running, the user will be asked to select how they are communicating with the device (Ethernet or Serial). For the BL67-EN-DN, Ethernet is selected. Then, the IP address of the Gateway is entered.



Figure 55: Setting the IP address for Modbus Tester to connect with Gateway

	Configuration	
Exchange Control Sent Received Serial Line Tests Burst 100 Add Silence N° Date (	Ethernet Serial Line  Connection  IP Address  Response Timeout  Time out  10 sec  Address  Slave Address  FF (in Hexa)	
	OK Cancel	

Figure 56:	Server Modbus Server	Tester				
Modbus Tester	File View Tests H	elp				
connection suc-	😅 🖬 🚳   -0 🎽	€ °"\$ 🖣 🕨	= 🕜  💡			
Cess	Exchange Control					
	Sent 0			Exception 0	Invalid 🛛	0
	Received 0			Error 0	No response	0
	Nº Date (n	a) Time	Frama			
	M Date (h	D) I TAPE	Trame			
	Ethernet Configuration	192.168.1.7		Clear T Ethernet	Connection	Hexa

The user will be notified if the connection has taken place or not.

Figure 57: Modbus Tester	Modbus Server Tester Error
connection failed	Ethernet Connection Failed : 192.168.1.7
	OK



## I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)

With the IO-ASSISTANT 3 (FDT/DTM), an Modbus-report for each connected Modbus station can be created.

This Modbus report is part of the station report for an Modbus node and contains mapping tables for the complete I/O data (Modbus station + DeviceNet<sup>™</sup> nodes).

- 1 Created a station report using a right-click on the respective station  $\rightarrow$  Additional functions  $\rightarrow$  station report. The station has to be connected!
- 2 Activate the Modbus report check box and create the station report by pressing the "Apply" button.



## Application Example: BL67 with Modbus Server Tester

Figure 59:	MModbusTest.PW3 - PACTware				
Proating an	Bie Edit View Project Device Extras	<u>Window H</u> elp			
Jicaling an	0 0 0 0 0 0 0 0 0 0 0 0 0	3 8 8 8			
Modbus	Project	9 x	192.168.1.7/-8L67-GW-EN-DN Station report		
ronart	Device tag	Address 0 26	The second of the second secon	Device type	BL67-GW-EN-DN
epon	HOST PC	5 m		Derive ope	
	E TCP/IP	кФа	\$	Description	Gateway for BL57 170 system. Interface for MODBUS TCP with BL remote (DeviceNet).
	= 192.168.1.7/-BL67-GW-EN-DN	1 👲	0		
	-B S DeviceNet	4	- @ @ G		
	01/GN-DeviceNet [FDNL-CSG88-T]	01 sp	Report I ( Jack I		
	- us/car-bevicenet [FDAQ-XScole-1]	11 12	retor Lease		
	-/- [FDNL-L0800-T]	22 10	All chapters		
	B T Modulbus		Station overview Station image	DeviceNat	report.
		01 💠	Station parameters Station dimension	Ethertici/II	* report
		02 A	Station article list	ModBus rep	port
			with pices		
			- patagoi tor bilacia		
			Options		
			Unit 💿 mm 🔘 inch		
			Ab Disconnected		
	MModbusTest.PW3 Adm	nistrator			MModbusTest,PW3 - PACTware



3 The Modbus report contains a station description as well as separate mapping tables for the in-and output data of the Modbus-node (status and control word + input data) as well as of the DeviceNet<sup>™</sup> nodes connected to the master. For this example configuration it would be as follows:

Figure 60:	Industry Track DMD - DAPTerson							
	Edit View Project Device Edit	as Window Help					E	
The Modbus		8 86 B. C.						
report for the	1 22.165.1// BLSZ-GW-EN-ON Station report result							
	100		Device type BL67-GW-EN-D				TUR	
example			Description Gateway for BL	7 1/0 system. Interface for MODBU	S TCP with BL remote (DeviceNet)	5	bolanar.	
configuration							Adam	
connguration	<u>⊐•8° 2</u> ≣						Station report r	
	-1.1. Station descript	1 K Q * @						
	-1.2.1/0 map for ingi	1. Modb	ous report					
		1.1. Statio	on description					
		Station addre	ss: 192.168.1.7					
		Adr./Slot	Name	TAG	Data Size In	Data Size Out		
		0*	BL67-GW-EN-DN	192.168.1.7/-BL67- GW-EN-DN	16 bit	0 bit	_	
		1	BL67-4DI-P	-/-4DI-P	4 bit	0 bit		
		2	BL67-4DO-0.5A-P	-/-4DO-0.5A-P	0 bit	4 bit		
			Summarized diagnostics		1 Words	0 Words		
			DeviceNet Master control/status		9 Words	1 Words		
		Total size fo	DeviceNet process data		/ Words	2 Words		
		Total Size IO	r in/out data rounded on full words		19 Words	4 Words		
		*For detailed in	nformation about status/control word se	e online help				
		1.2. I/O m	ap for input data					
	2							
ſ							0	
i i i i i i i i i i i i i i i i i i i	Disconnected Data set lo	sked						
E.	MModbusTest PW3	Administrator						

**4** The Modbus report for the station BL67-GW-EN-DN with the IP address 192.168.1.7 in this example defines thus an input data size of 38 byte (19 words) and an output data size of 8 byte (4 word).

Those bytes are composed as follows:

- 1 byte (16 bit) of input data for the Station's Status word
- 4 bits of input data for the 4DI-P module
- 4 bits of output data for the 4DO-0.5A-P module
- 1 word of input data for the Gateway Diagnostics
- 9 words of input data for the DN Master Status
- 1 word of output data for the DN Master Control
- 7 words of input data from the Slaves process data
- 2 words of output data from the Slaves control data



A Status-word of the station

B Input data of the modules in the DeviceNet<sup>™</sup> subnet (DeviceNet<sup>™</sup>: addr. 1 to addr. 22),

Figure 62: Output data mapping of the station

#### 1.3. I/O map for output data



Description: 1.Column=Register, n. Column=Modul number.register \*) Correct position not available in this firmware version

**C** Control-word of the station

D Output data of the modules in the DeviceNet<sup>™</sup> subnet (DeviceNet<sup>™</sup>: addr. 1 to addr. 22)



## Note

Please observe: The IO-ASSISTANT mapping is depicted in byte format. The mapping results have to be converted into the respective data format.



## I/O data mapping for the example station

In order to be able to calculate the I/O-data for the DeviceNet<sup>™</sup> nodes, their special I/O data assignments have to be considered.

For the I/O data mapping of the DeviceNet<sup>™</sup> subnet, please read I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM), I/O-mapping report via IO-ASSISTANT 3 (FDT/DTM)).



Note

The in- and output sizes of the respective DeviceNet<sup>TM</sup> nodes can be found in the documentation (data sheet, manual etc.) for these products.

## I/O mapping for a FDNL-CSG88-T; MAC-ID: 1

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	ln7	In6	In5	In4	In3	In2	In1	In0	
Byte 1	IGS	OGS	-	-	-	-	-	-	
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out0	

Inx	= input x (0 = off, 1 = on)
Outx	= output x (0 = off, 1 = on)
IGS	= Input Group Status (0 = working, 1 = fault)
OGS	= Output Group Status (0 = working, 1 = fault)

## I/O mapping for a FDNQ-XSG08-T; MAC-ID: 3

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	ln7	In6	ln5	In4	ln3	In2	ln1	In0	
Byte 1	IGS	OGS	-	-	-	-	-	-	
Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Byte 0	Out7	Out6	Out5	Out4	Out3	Out2	Out1	Out1	

Inx	= input x (0 = off, 1 = on)
Outx	= output x (0 = off, 1 = on)
IGS	= Input Group Status (0 = working, 1 = fault)
OGS	= Output Group Status (0 = working, 1 = fault)

## I/O mapping for a FDNL-L1600-T; MAC-ID: 11

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	In7	In6	In5	In4	ln3	In2	In1	In0
Byte 1	ln15	ln14	In13	In12	In11	In10	In9	ln8
Byte 2	ISS-7	ISS-6	ISS-5	ISS-4	ISS-3	ISS-2	ISS-1	ISS-0
Byte 3	ISS-15	ISS-14	ISS-13	ISS-12	ISS-11	ISS-10	ISS-9	ISS-8
Byte 4	IOS-7	IOS-6	IOS-5	IOS-4	IOS-3	IOS-2	IOS-1	IOS-0
Byte 5	IOS-15	IOS-14	IOS-13	IOS-12	IOS-11	IOS-10	IOS-9	IOS-8

= input x (0 = off, 1 = on)

Inx

ISS = Input Short Status (0 = working, 1 = fault)

IOS = Input Open Status (0 = working, 1 = fault)

## I/O mapping for a FDNL=L0800-T; MAC-ID: 22

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	In7	In6	ln5	In4	In3	In2	In1	In0
Byte 1	ISS-7	ISS-6	ISS-5	ISS-4	ISS-3	ISS-2	ISS-1	ISS-0
Byte 2	IOS-7	IOS-6	IOS-5	IOS-4	IOS-3	IOS-2	IOS-1	IOS-0

Inx = input x (0 = off, 1 = on)

ISS = Input Short Status (0 = working, 1 = fault)

IOS = Input Open Status (0 = working, 1 = fault)



## Examples of communication parameter changes and I/O testing

#### **Baud Rate change**

The registers for the Baud Rate Setting are Read/Write. When writing a new Baud Rate setting, the gateway will need to have its power cycled so the new setting(s) will be implemented. This example will show you how to set the Baud Rate. The same sequence can be used for all applicable parameter settings.

- the register to change the Baud Rate is 0×308B
  - Under "Tests" select and click on "Send Frame" or click on the "Send Frame" icon on the toolbar

## Figure 63: Send Frame



1 In the dialog box, double-click on function code 06, "Write Single Register". A "Request Data" dialog box appears. The function code is set and cannot be changed. The Modbus Server Tester uses the Hex Modbus addressing format. For the Baud Rate, the register address is 0×308B, and for the example, the rate will change to 250 kBit/s. Therefore, the register value would be "1". When complete, click "Finish".

## Note

Refer to chapter 4 for the Modbus register layout, if any questions on where parameters are located in respective registers.

## Application Example: BL67 with Modbus Server Tester





Register Address	308B	
Register Value	1	



**2** After clicking "Finish", the Function code 06 "Write Single Register" should be checked. Press "Send", the results will show that a "1" was sent to register 0×308B.



差 🔛 🗄 Exchange	🗟   🤁 💥   Control	°III (	•    =	8	?					
Sent	1					Exception	þ	- Inv	alid 🗾	0
Received	1					Error	(	No respo	onse 🔽	0
N°	Date (ms)	Type	Fram	•						
1	0.00	Req	00 0	1 00	00 0	0 06 FF	06 3	0 8B 00	01	

3 After the results have been confirmed, cycle power on the gateway so the changes will be implemented. When power resumes and the gateway DN has a steady green LED signal. Click on the "Send Frame" icon and double-click on Function Code 04 "Read Input Registers". Enter "Starting address" to be "308B", and the "Quantity of Registers" to be "1". Click "Finish" and then send for the Read Results to confirm that the Baud Rate has been changed to 250 kBit/sec. or 1 in register.





#### Note

This example would be a good method for changing DN master parameter settings (i.e., MAC-ID). After writing to the register, make sure you cycle power on the gateway and then read the register to ensure that the change has been implemented.



## Parameterization with IO-ASSISTANT 3 (FDT/DTM)

The IO-ASSISTANT 3 (FDT/DTM) can make Baud Rate and MAC-ID changes easier. With online parameterization a user can set the baud rate and MAC-ID among other things. Here's an example. Please keep in mind that the gateway will still need to have power cycled for the changes to take effect.



#### **Scanlist and Node Error present**

There are two places to see the nodes present in the scanlist. Register  $0 \times 3080$  to  $0 \times 3083$  and if the status/control Information is enabled ( $0 \times 3089$ ), registers  $0 \times 3C01$  to  $0 \times 3C04$ . For this portion of the example, the nodes present in the scanlist will be identified in registers  $0 \times 3080$  to  $0 \times 3083$ . The nodes present in the scanlist and a node error will be created when the status and control Information is enabled.

1 Click on the "Send Frame" icon and double click on Function code 04. In the Request Data dialog box for Function Code 4, please enter "3080" in "Starting Address" and "4" in "Quantity of registers. When complete, click "Finish".

Figure 69: Reading the scanlist for nodes present	St Request Data O4 Read Input Registers Function Code	
with register 0×3080	Starting Address 3080 Quantity of registers 00004	
	Cancel Sack Next <u>Einish</u>	

**2** When the "Send Frame" dialog box appears, make sure Function code 04 checkbox is checked and then press "Send".



**3** The results breakdown is as follows: 0A byte number is for Nodes 1 & 3 (2 + 8 = A hex) and 08 byte number is for Node 11. 40 hex byte number is for Node 22.


4 To look at the nodes present in scanlist in registers 0×3C01 to ox3C04, the register 0×3089 must have be enabled. To enable the register value must be equal to 1. Click on the "Send Frame" icon then double click on the write single register function code 06. Enter 3089 in the "Register Address" text box and "1" in the "Register value" text box. When complete, click "Finish".

Figure 71: Enable Status/ Control Info	Image: Second system       Image: Second system         06       Write Single Register         Function Code       06         Register Address       3089         Register Value       1
	Cancel < Back Next> Einish

**5** When the "Send Frame" dialog box appears, make sure Function code 06 checkbox is checked and then press "Send". The results will then appear.



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Exchan <u>c</u> Ser Receive	ge Control			Exception 10 Invalid Error 0 No response	
N°	Date (ms)	Туре	Frame		
1 2	0.00 3.20	Req Resp	00 01 00 00 00 01 00 00	00 06 FF 06 30 89 00 01 00 06 FF 06 30 89 00 01	
	Configuration 19	2 168 1 7		Beque: Ethernet Connection	Heva

6 To look at the nodes present in scanlist in registers 0×3C01 to 0×3C04, click on the "Send Frame" icon then double click on the read input register function code 04. Enter 3C00 in the "Starting Address" text box and 9 in the "Quantity of registers" text box (Nine Registers is enough to see the scanlist and potential node errors as well). When complete, click "Finish".

Figure 73: View registers 3C00 to 3C08	04 Read Input Registers         Function Code       04         Starting Address       3C00         Quantity of registers       9
	Cancel < Back Next > <u>Finish</u>

7 When the "Send Frame" dialog box appears, make sure Function code 04 checkbox is checked and then press "Send". The results will then appear.



**8** The results breakdown is as follows: 0A byte number is for nodes 1 & 3 ( $2 + 8 = A_{hex}$ ) and 08 byte number is for node 11. 40 byte number is for node 22.



**9** To produce a node error, node 22 was pulled of the device net network. Then re-send the read input register function code 04.



**10** The byte number value 40 shows that node 22 is missing.

Again, IO-ASSISTANT 3 (FDT/DTM) can make this easier. With the Gateway module connected and online, right click on the module and select Diagnostics. The user will be notified that a node is missing.



#### Reading slave inputs and forcing slave outputs

To read inputs and force outputs from slaves, the method is similar to what is done to change parameters. To receive input feedback, read function codes are needed. To force outputs, write function codes are needed.

For this slave input portion of the example, two proximity sensors will be used. The sensors will be connected to node 3 input 1 and node 22 input 1. For the slave output portion, two arbitrary bits will be forced from two different nodes.

- Click on the "Send Frame" icon and double click on Function code 04. In the "Request Data" dialog box for Function Code 4, please enter "3C00" in the "Starting Address" and "20" in the "Quantity of Registers". When complete, click "Finish".
- 2 When the "Send Frame" dialog box appears, make sure Function code 04 checkbox is checked and then press "Send". The results will then appear. Status/control Information is enabled still from the previous section.





Figure 78: Same results except the status/control information is disabled



#### **Forcing outputs**

In this portion of the example, the first output for node 1 will be energized via the Modbus Server Tester software. The status/control information is enabled.



#### Note

f the status/control information is enabled, address 0×3D00 contains the control information. To force outputs, bit 0 of this register needs to be "1". This indicates that the gateway is in Run Mode.

- 1 Click on the "Send Frame" icon and double click on Function code 04. In the "Request Data" dialog box for Function Code 4, please enter "3D00" in the "Starting Address" and "1" in the "Quantity of Registers". When complete, click "Finish".
- 2 When the "Send Frame" dialog box appears, make sure Function code 04 checkbox is checked and then press "Send". The Results will then appear. This verifies that the gateway is in Run Mode.

Figure 79: Verify Run Mode	O4       Read Input Registers         Function Code       ID4         Starting Address       3D00         Quantity of registers       0001
	Cancel < Back Next > Einish

	- Exchang	ge Control															
	Sei	nt 🔽 1						Ex	cepti	on 🛛	0			In	valid	0	
	Receive	d 1							En	ror [		0	No	) resp	onse	0	
	N°	Date (ms)	Type	Fre	ame	1										 	
	1 2	0.00	Req Resp	00	05	00	00	00	06	FF FF	04	3D 02	00	00	01		



- 3 Click on the "Send Frame" icon and double click on Function code 06. In the "Request Data" dialog box for Function Code 6, please enter "3D01" in the "Register Address" and "1" in the "Register Value". When complete, click "Finish".
- **4** When the "Send Frame" dialog box appears, make sure Function code 06 checkbox is checked and then press "Send". The results will then appear. This will force the first output of node 1 on.

Figure 81: Turn node 1, output 1 to ON	O6 Write Single Register         Function Code         06         Register Address         3D01         Register Value
	Cancel <back next=""> Einish</back>

Figure 82: Node 1, output 1 is energized

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Exchang	je Control														 
Se	nt 1						Ex	ceptic	n [	0			Inv	/alid	0
Receive	d 🚺 1							Erro	or [		0	No	o resp	onse	0
N°	Date (ms	) Type	Fra	ame											
1	0.0	0 Req	00	07	00	00	00	06	FF	06	3D	01	00	01	

Application Example: BL67 with Modbus Server Tester

#### TURCK

## 6 Index

#### A

address setting 1-	10
--------------------	----

## D

DeviceNet <sup>™</sup> -Connector	
– BL67	1-4
– FXEN	1-4
DeviceNet <sup>™</sup> master function	1-1

#### Е

EtherNet/IP	
- application example	3-1
- Assembly Instances	3-8
- BL67-GW-EN-IP-DN	2-3
- configuration FXEN	3-8
- control word	2-8
- Controller Tags	3-14
<ul> <li>DeviceNet<sup>™</sup> slave class (VSC 123, 7Bh)</li> </ul>	2-14
– DHCP	3-3
- example station	3-15
- Explicit Messaging	3-20
- FXEN-IM16-0001-IP-DN	2-2
- gateway, rotary-mode	3-3
- mapping report	3-10
- MESSAGE Controller Tag	3-20
- modules	2-2
- MSG instruction	3-20
- network interface card settings	3-3
- PLC program	3-20
- process data acces	3-18
- report	11
- RSLogix 5000	3-6
- status words	2-6
- status/control	2-6
- VSC access	3-29

## G

Getting Started	 1-12

### I

I/O-ASSISTANT V3		1-1	14
------------------	--	-----	----

## L

_		
LEDs	· ·	1-11

#### Μ

MAC-ID	1-10
Modbus TCP	
- application example	5-1
- BL67-GW-EN-DN	4-2
- gateway, rotary-mode	5-3
- mapping report	5-7
- Modbus data layout	4-3
- modules	4-2

## Industri<mark>al Automation</mark>

- network interface card settings	5-3
- report	5-9
- status bits	

#### Ρ

Power supply	······································	1-3
prescribed use	9	)-4

## S

SET-button	1-5
symbols	0-3

#### Т

transport, appropriate	0-4
------------------------	-----

#### Index



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