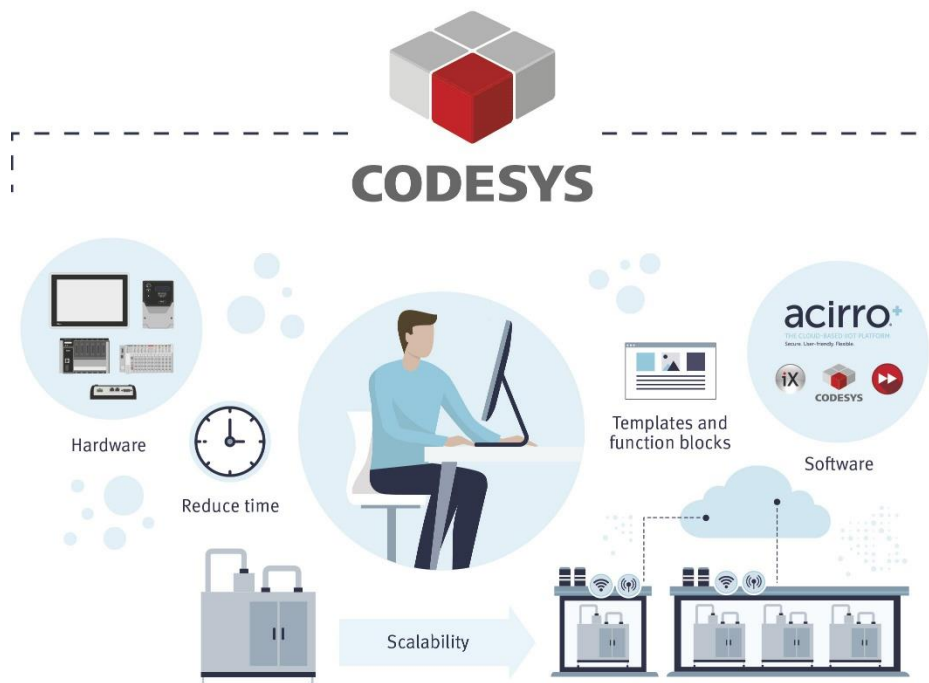


# Quick start guide

## CanOpen communication BFI-P2/E3

SER0039 - Nexto control of BFI-P2/E3 by CanOpen



## 1 Function and area of use

This document provides guidelines when using Nexto as CanOpen Master communicating with Beijer Frequency Inverter, BFI-P2 or BFI-E3.

The program example contains two BFI, one BFI-E3 and one BFI-P2.

## 2 About this document

This quick start document should not be considered as a complete manual. It is an aid to be able to start up a normal application quickly and easily.

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Use the following hardware, software, drivers and utilities in order to obtain a stable application:

### Software:

- BCS Tools 3.51
- iX Developer 2.50
- BFI-Tools 2.8.1.0

### Hardware:

- Nexto Xpress, BCS-XP300, BCS-XP315, BCS-XP325, BCS-XP340 and BCS-XP350.
- NX-3008
- BFI-P2 with at least firmware 2.50
- BFI-E3 with at least firmware 3.11
- **Note!** It is not possible to run Modbus RTU and CANopen at the same time.

### For further information refer to

- BFI-P2 User Guide
- BFI-P2 Start-Up Manual KI00306C
- BFI-E3 User Guide
- BFI-E3 Start-Up Manual KI00369C
- BCS Nexto Xpress – User Manual

All these documents can be obtained from our homepage, [Beijer Electronics knowledge database, HelpOnline](#).

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## 4 System setup

BFI-P2 and BFI-E3 have built-in CanOpen slave interface. Beijer can provide CanOpen. Other communication options are presented according to the table below.

Bus	HMI Controller	Nexto controller				Distributed IO controller		
	X2 control / marine / extreme / Box2	Xpress, XP	Modular, NX-			PIO		
		All	3008	3020, 3030	3003, 3004, 3005, 3010	GN- 9372/9373	GL- 9972/9973	GL-9981
Modbus RTU	Yes, SE & AG	Yes, SE & AG		Yes	Yes	Yes, SE & AG		
Can Open	Yes, SE	Yes, SE		No	No	No		
Modbus TCP	Yes, SE	Yes, SE		Yes	Yes	Yes, SE		
EtherCat	Yes, SE & AG	Yes, SE & AG		Yes, SE & AG	No	No	No	Yes
Profinet	No	Yes				No	No	Yes
Ethernet IP	No	Yes				No	No	Yes
MQTT	Yes	Yes				No	No	Yes
OPC UA	Yes							
Visualization	iX 2.50	340: Webvisu	Webvisu		3005: Webvisu	GN-9373: Webvisu		WebIQ

**Yes:** Supported but no as Smart engineering object and not Auto generated in BCS Tools from 3.51.

**Yes, SE:** Supported with Smart engineering object but cannot be Auto generated in BCS Tools from 3.51.

**Yes, SE & AG:** Supported with Smart engineering objects and can be Auto generated in BCS Tools from 3.51.

**No:** Communication not supported.

Table 4.1 Controllers and buses

BFI's can act like slave or device according to table below:

Bus Type	BFI-E3	BFI-P2	BFI-H3
Modbus RTU	Yes, built-in	Yes, built-in	Yes, built-in
Can Open	Yes, built-in	Yes, built-in	No
BacNet serial	No	No	Yes, built-in
Modbus TCP	BFI option version IP66, Gateway for IP20	Option board	Option board
EtherCat	No	Option board	Option board
Profinet	No	Option board	Option board
Ethernet IP	No	Option board	Option board
MQTT	No	Option board	Option board
OPC UA	No	Option board	Option board

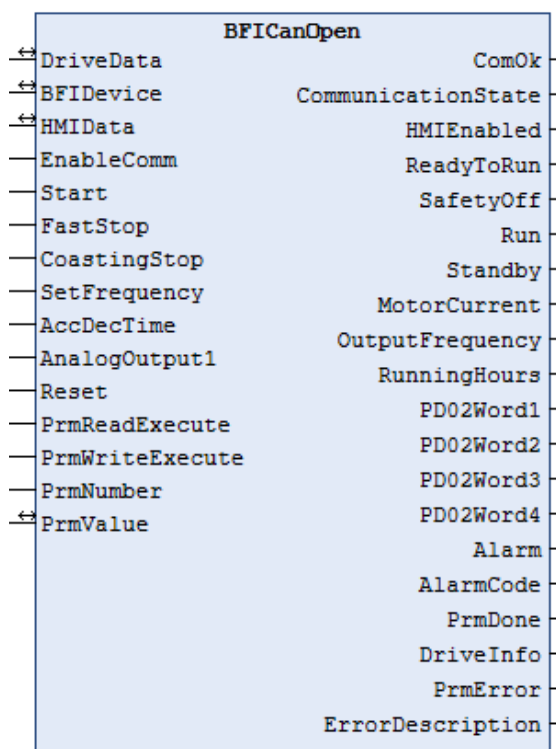
Table 4.2 Supported communication to BFI



## 5 Function Block BFICanOpen

The function block is saved in the project as a compiled library file. Means that the PLC-code inside the FB can't be monitored or changed. But all variables used inside the FB can be monitored online. See chapter 6, [Libraries](#).

Information	Description
Library	BFICanOpen ver 1.0.0.0
Versions in BCS Tools	BCS Tools 3.51 Nexto Xpress/NX3008 firmware: 1.12.24.0 Compiler: 3.5.17.40 Device (XP3xx or NX3008) CANopen_Manager: 3.5.17.0 BFI CanOpen Device: CANRemoteDevice_Diag 3.5.1.0
Recommended Baud rate	500 kbits/sec
Function Block	BFICanOpen
Functionality	This function block is used to control and Read/Write Data with a BFI-P2/E3 by CanOpen.
PLC Types	Nexto Xpress XP300, XP315, XP325, XP340, NX3008

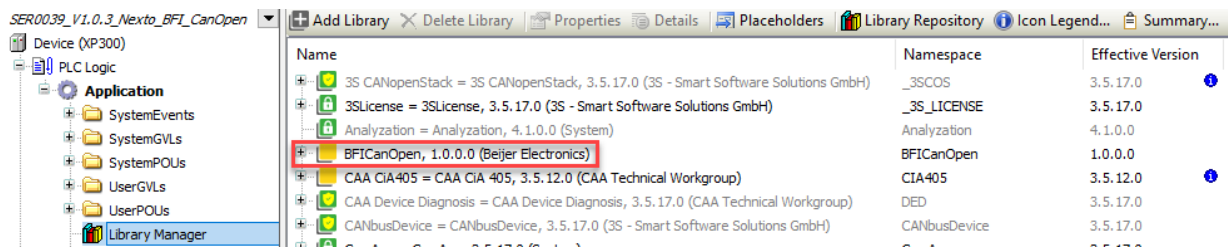


Input_Output	Type	Function
DriveData	strBFItoFromPlc	Reference to variables connected to BFI by CANopen.
BFIDevice	CANRemoteDevice_Diag	Connection to CANopen Slave (Name of the CANopen Slave)
HMIData	strBFIHMI	Reference to variables from/to HMI

Input	Type	Function
EnableComm	BOOL	Activate the communication with BFI from PLC.
Start	BOOL	Start of Drive. 0=>Stop 1=>Running. Direction decided by sign of Set frequency.
FastStop	BOOL	1 => Fast stop of motor with ramp in P2-25 for BFI-P2 and P-24 for BFI-E3.
CoastingStop	BOOL	1=> Coasting stop of motor. No output frequency.
SetFrequency	REAL	Set frequency for motor, 50.0=50.0 Hz. Positive value => Rotation clockwise. Negative value=> Rotation counterclockwise.
AccDecTime	REAL	Used if P5-07=Enabled in BFI-P2 or P-12=8 in BFI-E3. If so, Acceleration and Deceleration time [0.1 sec].
AnalogOutput1	INT	Value 0-1000 sets Analog output to 0-10 VDC or 4-20 mA.
Reset	BOOL	Reset an alarm or error message from BFI.
PrmReadExecute	BOOL	Read a value from a Parameter in BFI.
PrmWriteExecute	BOOL	Write a value to a Parameter in BFI.
PrmNumber	INT	Specifies parameter number to be read or written.
Input_Output	Type	Function
PrmValue	INT	Value to be written to a parameter or read value from a parameter.
Output	Type	Function
ComOk	BOOL	True=Communication up running without any errors.
CommunicationState	STRING	Actual Bus status
HMIEnabled	BOOL	BFI controlled from HMI page.
ReadyToRun	BOOL	BFI Ready to run. Power ON, Enabled, Safety ok.
SafetyOff	BOOL	Safe Torque off, False if STO wires is not connected. Not BFI-E3.
Run	BOOL	Start signal received by BFI.
Standby	BOOL	BFI has start signal but not sufficient output frequency to run.
MotorCurrent	REAL	Motor current / A.
OutputFrequency	REAL	Output frequency / Hz.
RunningHours	INT	Total Running Hours / Hours.
PD02Word1	INT	Digital Input Status / Can be adjusted by User.
PD02Word2	INT	Analog Input1 / Can be adjusted by User.
PD02Word3	INT	Analog Input2 / Can be adjusted by User.
PD02Word4	INT	Speed Controller Reference / Can be adjusted by User.
Alarm	BOOL	Alarm in inverter.
AlarmCode	STRING	Error code of the alarm, read automatically.
PrmDone	BOOL	Read or write of parameter has been done.
DriveInfo	STRING	Drive ID, Type, Voltage, Firmware version, serial number.
PrmError	BOOL	Parameter operation error or not allowed message was sent to BFI.
ErrorDescription	STRING	Error and status description.

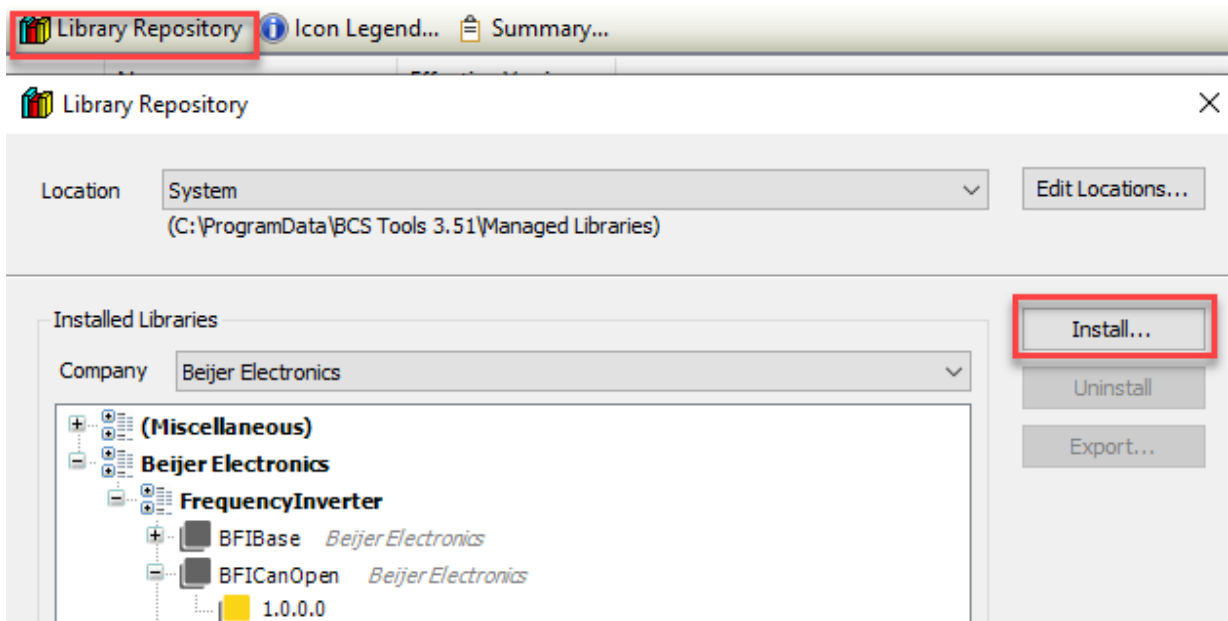
## 6 Library

There is one library that must be included in the Library Manager of the project to make it work, BFICanOpen.



The library is automatically imported into the Library Repository of BCS Tools when extracting the projectarchive file containing this Smart Engineering object.

It is also available on [www.beijerelectronics.com](http://www.beijerelectronics.com) and after download of the file it must be manually installed into Library Repository and then added into a project.

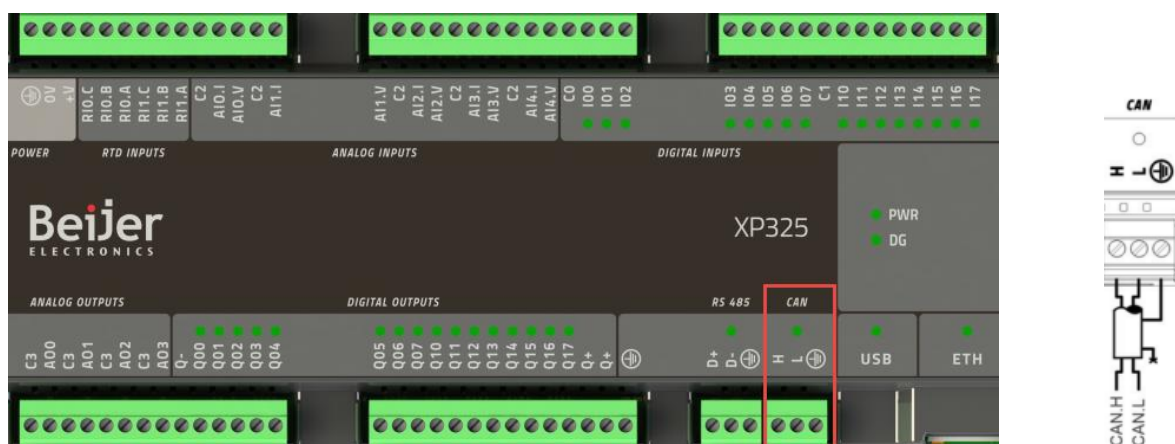


Recommendation is to extract a projectarchive file and job is done.

## 7 Nexto

### 7.1 Nexto Xpress

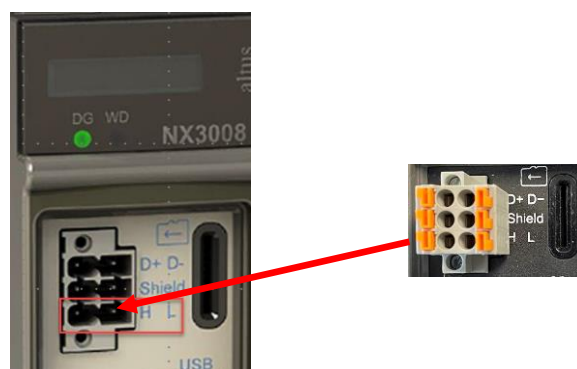
Nexto Xpress has one serial RS-485 port of screw terminals to be used for CanOpen marked as “CAN” with CAN-H, CAN-L and ground. Normally the shield of the communication cable should be connected to earth terminal. Termination is activated/deactivated in BCS Tools. Use cable CAB155, see chapter [7.4](#), for BFI connection.



**Figure 7.1** CanOpen connection of Nexto Xpress and terminal layout

### 7.2 NX-3008

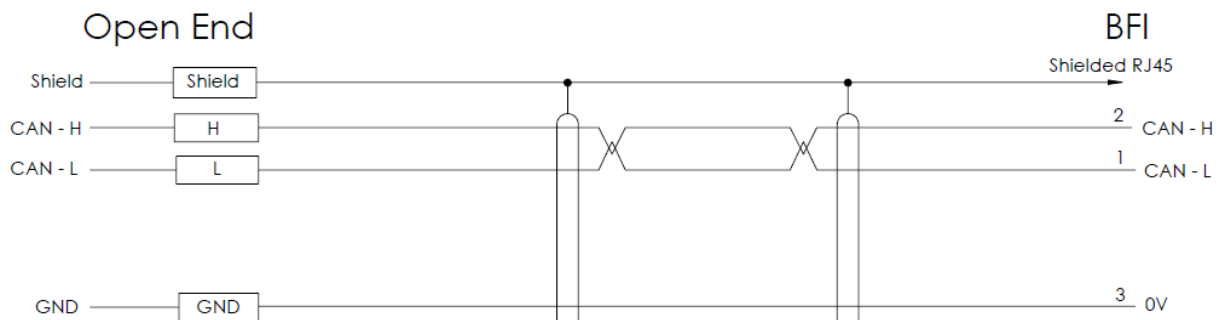
NX-3008 has one CanOpen port. Screw terminals to be used are marked with H, L and Shield. Connect the shield of the communication cable to terminal “Shield”. Use cable CAB155, see chapter [7.3](#), for BFI connection.



**Figure 7.2** CanOpen connection of Nexto BCS-NX3008. Right picture is the zoomed CanOpen terminals.

### 7.3 CAB155 intended for connection between Nexto and BFI

3m cable with open-end with 2 wires and one shield for Nexto connection and RJ-45 for connection to BFI-P2/E3.



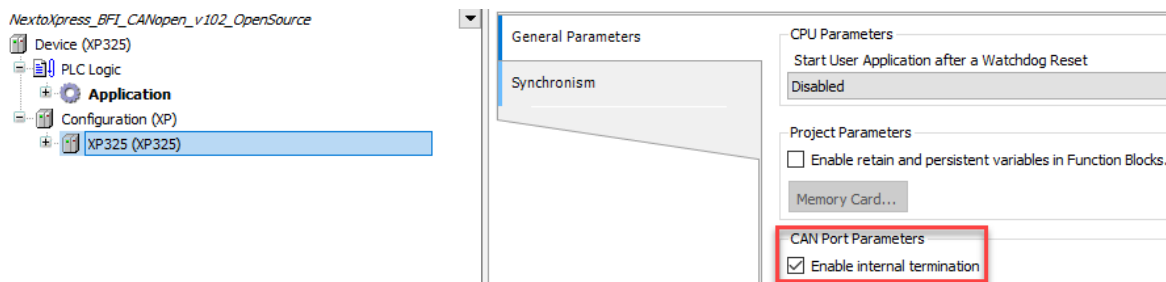
**Figure 7.3** Drawing of CAB155 from Nexto PLC to BFI by CanOpen

### 7.4 Termination of the RS-485 bus in Nexto

A RS485 network should normally be terminated with 2 pieces of 120-ohm resistor, one in each end of the physical network.

In Nexto PLC:s the termination is activated in BCS Tools, see below figure 7.4.

Termination of BFI is solved by an option, a RJ45 connector with built-in resistor, see chapter 8.5.



**Figure 7.4** Activation of end termination resistor in Nexto PLC

## 7.5 Accessories Nexto PLC and BFI

Number of CanOpen ports in BFI depends on model. All BFI IP66 has two RJ45 connectors for incoming and outgoing network cabling. All BFI IP20 and IP55 has one RJ45 for Modbus RTU connection.

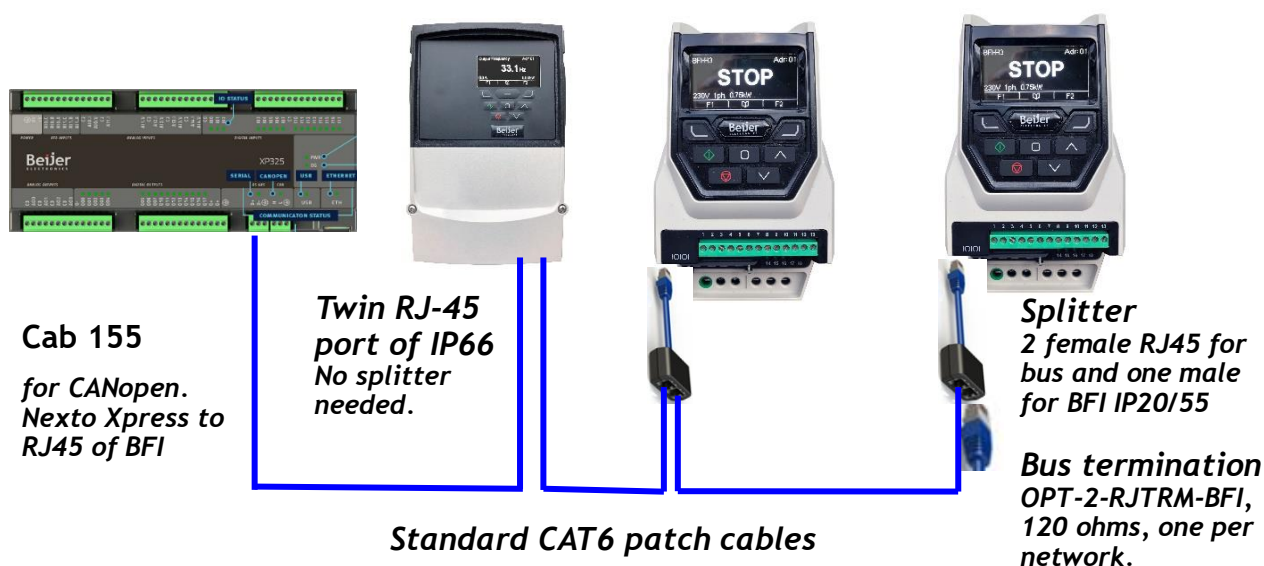


Figure 7.5 CanOpen network with Nexto Xpress and BFI.

Name	Item number	Explanation
<b>CAB155</b>	100-1180	3m cable open end and RJ-45 between Nexto Xpress, BFI-P2/E3 for CANopen. Separate termination resistor of 120 ohm included.
<b>Splitter:</b> OPT-2-J45SP-BFI	63148	RS485 Serial communication Data Cable 2-port Splitter for BFI-P2, BFI-H3, BFI-E3 for Modbus RTU and CANopen.
<b>Bus termination:</b> OPT-2-RJTRM-BFI	63202	RJ-45 with End termination, 120 ohm, RJ45 plug for CANopen and Modbus RTU communication to BFI.

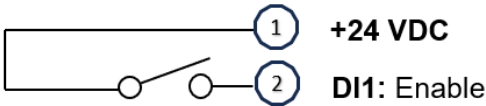
Table 7.1 Additional option to connect BFI by CanOpen with Nexto PLC

## 8 CanOpen port and digital signals to BFI

### 8.1 Hardware signals to BFI-E3

BFI-E3 requires one digital signal to be run by communication.

*DI1, terminal 2, must be at 24 VDC*



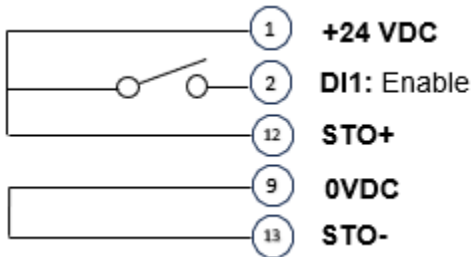
**Figure 8.1** Hardware signals required to run BFI-E3 by CanOpen.

Running can also be a combination of communication instructions and analog/digital signal. See User Manual or contact Beijer Electronics support.

### 8.2 Hardware signals to BFI-P2 and BFI-H3

BFI-P2/H3 require a software enable, 24VDC, on DI1, terminal 2.

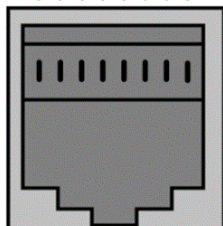
They also have 2 STO-inputs. If the STO-inputs are not to be used, they need to be bridged as picture below.



**Figure 8.2** Hardware signals required to run BFI-P2 and BFI-H3 by CanOpen.

Running can also be a combination of communication instructions and analog/digital signal. See User Manual or contact Beijer Electronics support.

### 8.3 The pin configuration of the RJ-45 in BFI-E3/BFI-P2

	1: CanOpen -
	2: CanOpen +
	3: 0 Volt
	4: Optibus / Remote keypad / PC Connection -
	5: Optibus / Remote keypad / PC Connection +
	6: +24 Volt Remote keypad Power Supply
	7: RS 485- Modbus RTU
	8 : RS 485+ Modbus RTU
<b>Warning:</b> This is not an Ethernet connection.	

**Figure 8.3** Pin configuration of RJ45 in BFI

## 8.4 RJ-45 connector in BFI IP20, IP55 and IP66

CanOpen port in BFI depends on model. It has either one or two RJ45 connector.

- All BFI IP66 have two RJ45 connectors for incoming and outgoing CanOpen cabling.
- All BFI IP20 and IP55 have one RJ45 for CanOpen connection.

Red marked area shows location of the RJ45 supporting Modbus RTU, CanOpen and internal bus.



**Figure 8.5** Location of serial port in BFI

Note! Do NOT mix the serials port with the Ethernet ports in BFI-E3 IP66 with built-in ethernet or option boards intended for ethernet.

## 8.5 Termination of the BFI

Termination of BFI is made by an RJ45 contact with resistors included for both CanOpen and Modbus, OPT-2-J45SP-BFI. If BFI only has one RJ45 port also a splitter is required, OPT-2-RJTRM-BFI.



**Figure 8.6** Termination plug for CANopen and Modbus RTU

Splitter

## 9 System setup with Smart Engineering object

There are 2 different PLC-programs, \*.projectarchive files, depending on PLC type in use.  
The same iX project supports all these PLC-projects.

- Nexto Xpress 300
- Nexto Xpress 340 with Webvisu

The PLC-project supports one BFI-E3 with station number 1 and one BFI-P2 with station number 2. Controllers can be Nexto Xpress or NX-3008.

Fastest way to set up a system:

### 1. Set up of Station number address and communication speed in each BFI.

All parameters can be set on the display of BFI, with PC software BFI-Tools with BFI-Tools Mobile or use BFI-Smartstick. See chapter [10.1](#).

### 2. Every BFI needs to have 24VDC on terminal 2, software enable.

Either control terminal 2 from a PLC or switch or put a jumper between terminal 1 and 2.  
See chapter [8.1](#) or [8.2](#).

### 3. For BFI-P2: STO inputs need to be properly connected.

BFI-E3 has no STO, Safe Torque Inputs. See chapter [8.2](#).

### 4. Connect the CanOpen communication cable from Nexto Xpress to RJ-45 port of BFI.

See chapter [7.5](#).

### 5. Termination of network

Make sure termination of the communication network is correct. See chapter [7.4](#) and [8.5](#)

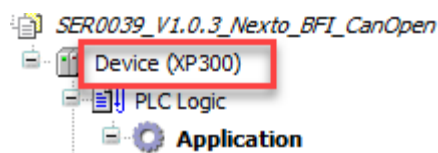
### 6. Make sure using correct software versions of BCS Tools and iX Developer

### 7. Set up the IP address of Nexto Xpress or NX-3008.

Default is 192.168.15.1. See chapter [12.7](#).

### 8. Download the Smart Engineering object, PLC-project, to Beijer controller.

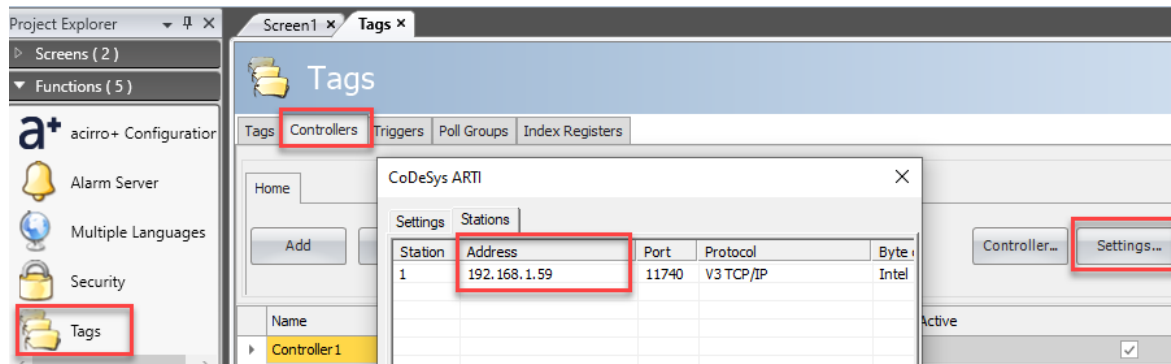
Chose the project archive file corresponding to the Beijer controller being used. Adjust the device to fit the used hardware.



### 9. Check that station number of each BFI correspond with PLC-program and eds file.

Node-Id 1 is a BFI-E3 and Node-Id 2 is BFI-P2 Size2\_3.

10. If iX is to be used as HMI the IP-address of the Nexto must be set in the project  
Below is IP-address of PLC 192.168.1.59.



## 10 Settings in BFI

### 10.1 Parameter settings for BFI-P2/E3

Set following parameters in BFI-E3

- **P-12** = 7: CANopen control with Acceleration and Deceleration time in parameter P-03 and P-04.
- **P-12** = 8: CANopen control with Acceleration and Deceleration time sent by CANopen.
- **P-14** = 201: Make all parameters available.
- **P-25** = 13: Analog Output of BFI-E3 controlled by bus.
- **P-36** = Node ID number. Default=1.
- **P-36** = 500 Kbits/sec. We recommend to not use 500 kbit/sec.

Set following parameters in BFI-P2

- **P1-12** = 6 for CANopen control.
- **P1-14** = 201 to make all parameters available.
- **P5-01** = Node ID number. Default=1.
- **P5-02** = 500 Kbits/sec. We recommend using 500 kbit/sec.
- **P5-07** = Disable=> Acceleration and Deceleration time set in parameter P1-03 and P1-04
- **P5-07** = Enable=> Acceleration and Deceleration time ramp sent by bus.
- **P9-33** = 2: Analog Output1 on terminal 8 of BFI-P2 will be controllable from PLC.

### 10.2 Communication timeout

The reaction at communication interruption between CanOpen master and BFI is set in BCS Tools. It is on individual bases for each BFI.

**If the BFI is to trip at communication is interrupted, set as below:**

NodeID of Guarded Node=127 (=CANopen Master) and Consumer Time means the BFI needs to have a message from the Master within this time frame. 300 ms in example below means trip of BFI if no message within 300 milliseconds.

The time settings in P-36 of BFI-E3 and P5-05 in BFI-P2 has no effect.

Enable Heartbeat Producing

Producer Time (ms): 200

Heartbeat Consuming (1/1 active)

Heartbeat Consuming Properties

Enable	NodeID of Guarded Node	Consumer Time (ms)
<input checked="" type="checkbox"/>	127	300

OK Cancel

**If the BFI is to continue at communication interruption, set as below:**

Enable Heartbeat Producing

Producer Time (ms): 200

Heartbeat Consuming (0/1 active)

Heartbeat Consuming Properties

Enable	NodeID of Guarded Node	Consumer Time (ms)
<input type="checkbox"/>		

OK Cancel

## 11 Visualization

### 11.1 Use of iX-project

All BCS Tools projects has a corresponding iX project. The project contains one Start page and one BFI\_Control Screen.

#### Explanation of Screen1:

This is the start screen intended for the User. It contains 2 objects .

- The Red Marked field "Text" will when online contain the name of the Device controlling the network.
- Nextto will indicate type, XP300, XP315, XP325, XP340, XP350 or NX-3008.
- A button for jump to BFI\_control.

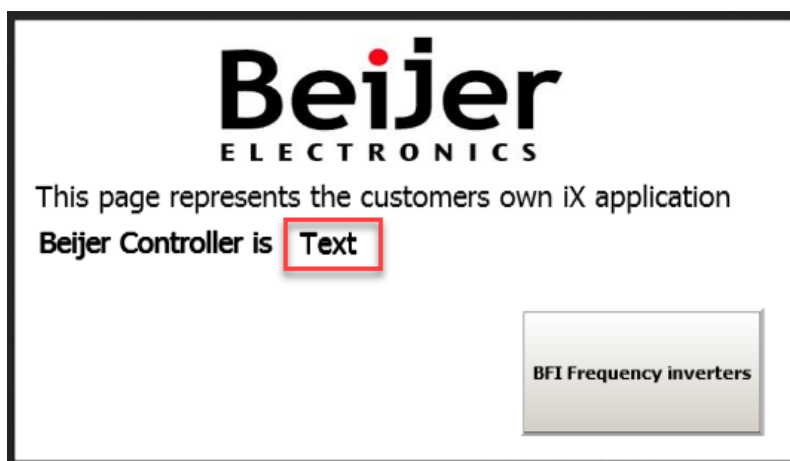


Figure 11.1 Explanation of Screen1.

#### Explanation of BFI\_Control Screen:

All presented data is from one BFI. BFI is chosen in 1. Sort order is according to the tree structure of BFI devices in BCS Tools. For data from several BFI, see further down.

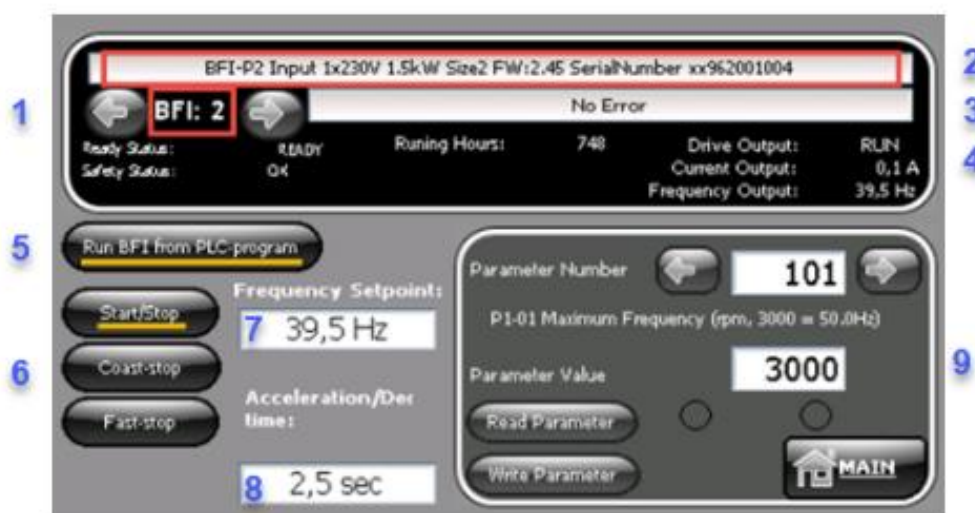


Figure 11.2 Explanation of BFI\_Control Screen.

1. Choose Station number of which BFI to be monitored or controlled. Either tap in the Station number or use Increase/Decrease button
2. BFI data
  - a. Type of BFI.
  - b. Bus type.
  - c. Input voltage and number of phases.
  - d. Power.
  - e. Physical size.
  - f. Firmware version.
  - g. Serial number.
3. Description of Communication error or User error.
4. Actual status of BFI
  - a. Ready to Run or not.
  - b. Safety Status (STO) in BFI-P2.
  - c. Total Running Hours.
  - d. Motor in Run or Stop.
  - e. Motor current.
  - f. Output frequency.
  - g. If Alarm in BFI it is shown.
  - h. Explanation of what the alarm code means.
  - i. Standby. Means start signal on but BFI in Sleep mode.
5. Take control of the BFI from this menu. PLC-program is neglected.
6. Start/stop- Coast- and Fast stop buttons.
7. Frequency Setpoint.
8. Acceleration/Deceleration Time to be used if P-12=8 in BFI-E3 and P5-07=1 in BFI-P2.
9. Parameter handling
  - a. Parameter number to be either tapped in or Increase/Decrease buttons.
  - b. Name/Explanation of parameter is shown.
  - c. Read Parameter value or to be written.
  - d. Button Read Parameter.
  - e. Button Write Parameter.
  - f. Status whether Read/Write of parameter Succeeded or not.

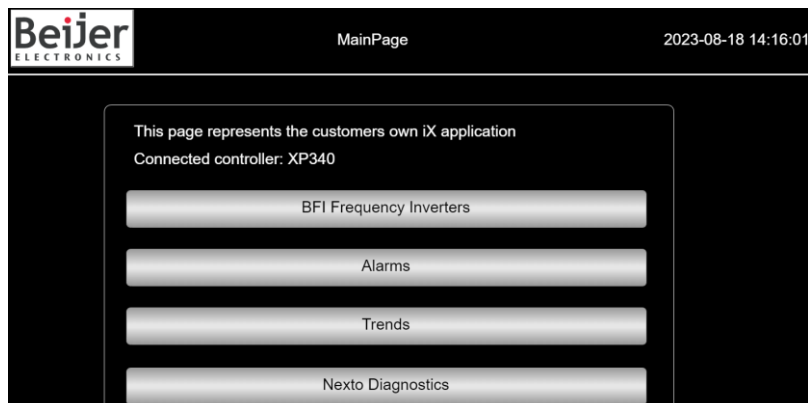
## 11.2 Nexto Xpress and Webvisu

A number of Nexto PLC:s, see chapter 4.1, supports Webvisu.

There is a PLC program made for Nexto Xpress 3.40 where code for Webvisu has been added to the standard Smart Engineering object.

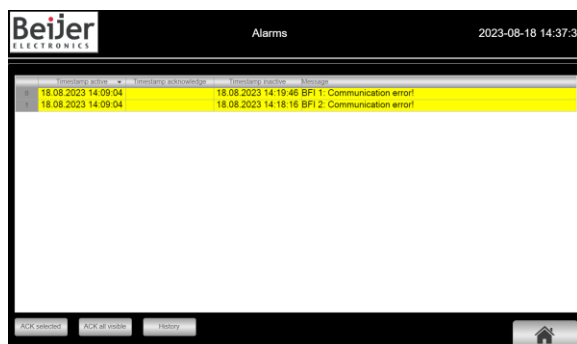
- Just download the project archive file, SER0039\_V1.0.3\_Next0340Webvisu\_BFI\_CanOpen
- Start your web browser and access the pls by <http://192.168.15.1:8080/webvisu.htm> and you will see the start page.

Except Main Page four additional pages are available.



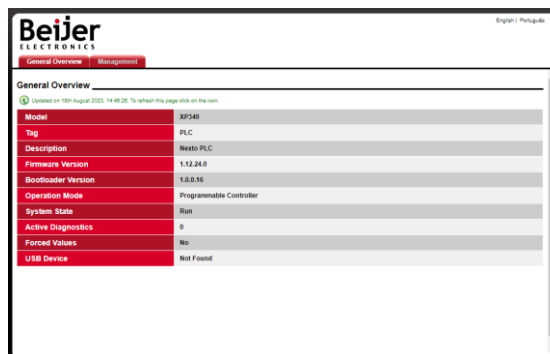
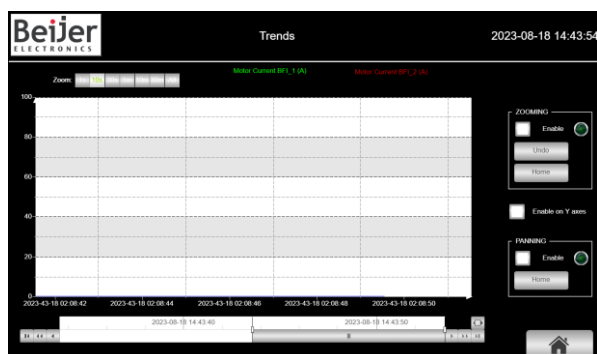
BFI Frequency Inverters

Alarms



Trends

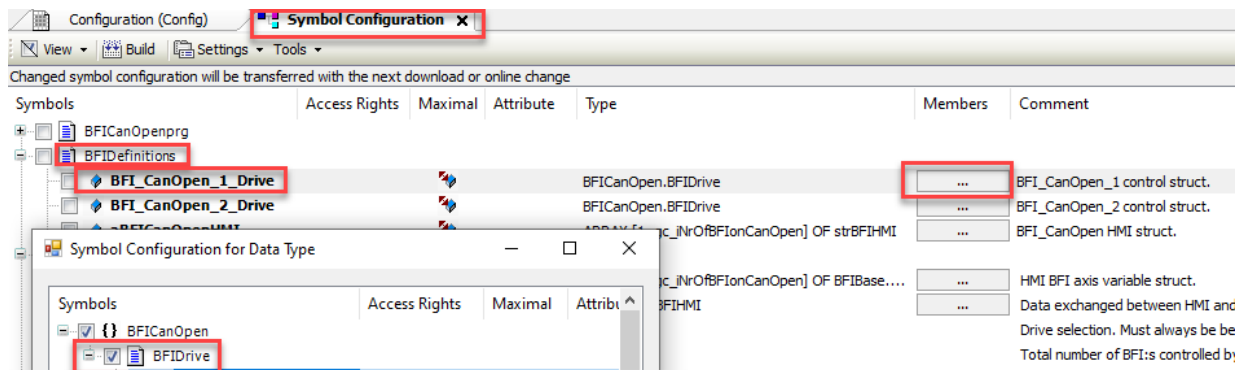
Nexto Diagnostics



### 11.3 Data from several BFI on the same iX-or Webvisu screen

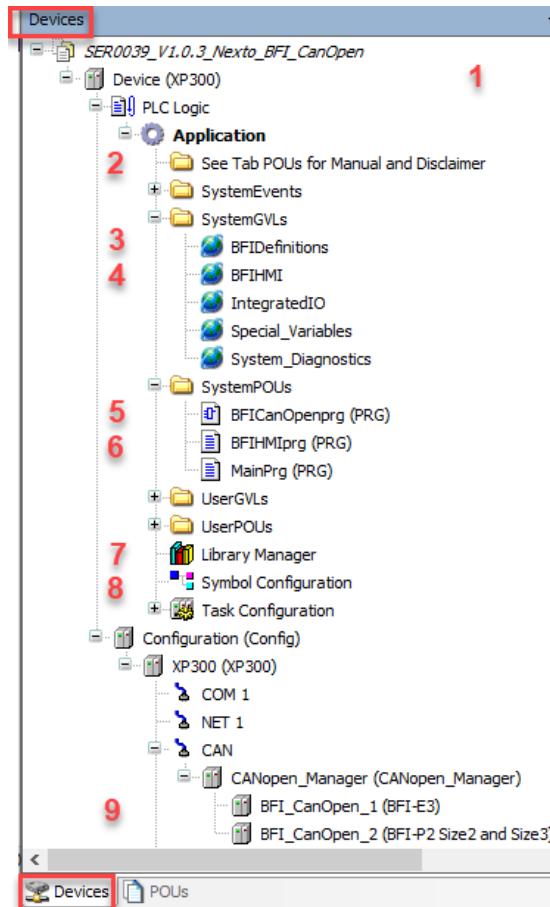
It is possible to have a sheet containing data from several BFI. These individual Tags from each BFI need to be configured in Symbol Configuration of BCS Tools and then imported to iX Developer.

If variables from BFI1 is to be shown chose Members for BFI\_CanOpen\_1\_Drive. Pick variables from the list. To decrease amount of communication, just chose variables that are being used in the HMI.

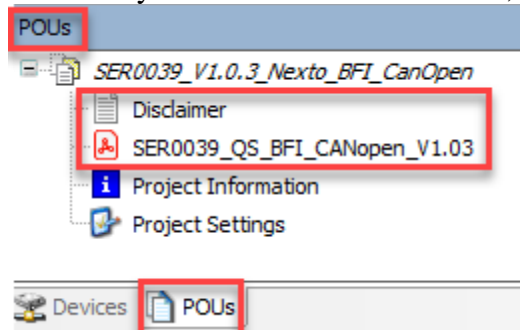


## 12 Program example in BCS Tools

### 12.1 Settings in PLC



1. **Device (XP3xx or NX-3008)**  
Description of hardware containing BCS Tools program.  
Should be at least firmware version, see chapter 5. This or later versions are to be downloaded and can found on [www.beijerelectronics.com](http://www.beijerelectronics.com).
2. **Manual and Disclaimer is to be found in Tab POU:s.**  
When stored in POU:s they are NOT stored in the PLC, only in the project.



3. **BFIDefinitions**  
Contain Structs for Variables connected on pins to/from FB, Variables to/from iX used inside FB and Variables connecting each BFI with corresponding input/output data (CANopen I/O Mapping).

**4. BFIHMI**

Contain variables to be used together with HMI. Important are the constant describing number of BFI in network and Structure containing variables copied to/from HMI.

**5. BFIHMIprg**

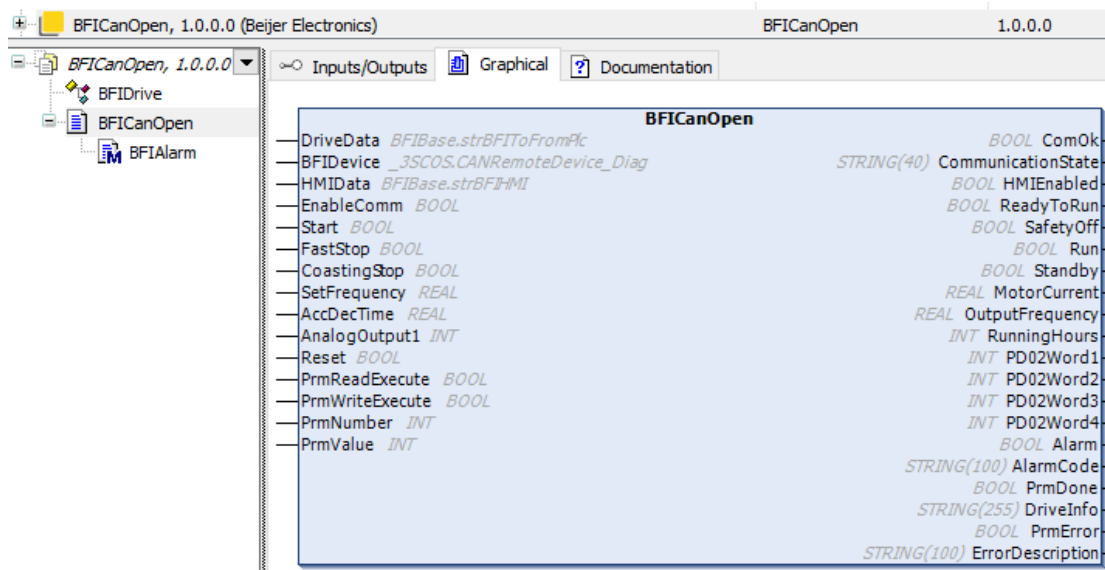
6. Containing Function blocks, one FB for each BFI. Not activated in Main Task but in BFIHMIprg.

**7. BFICanOpenprg**

Containing Function blocks, one FB for each BFI.

**8. Library Manager with BFICanOpen**

One of the libraries is Nexto BFI CANopen. Contains the FB to control BFI by CANopen. The FB is compiled and by that not possible to open up. Requires one FB per BFI.

**9. Symbol Configuration**

Definition of all data exchange with an HMI or WebIQ.

**10. BFI Slaves**

BFI Slaves in the network. Each BFI must have an individual name and Station number.

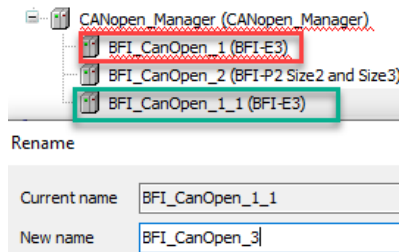
**12.2 How to add an additional BFI in the network**

Here is a description of how to add a BFI number 3 to the 2 BFI:s already existing in the Smart Engineering program.

- BFIDefinitions: Number of BFI:s in network is to be set in variable *gc\_iNrOfBFIonCanOpen*. Increase 2 to 3.
- Add a new variable called *BFI\_CanOpen\_3\_Drive* of type BFICanOpen.BFIDrive.

Scope	Name	Data type	Initialization	Comment
VAR_GLOBAL CONSTANT	<b>gc_iNrOfBFIonCanOpen</b>	INT	<b>3</b>	Number of BFI using FB BFICanOpen.
VAR_GLOBAL	<b>BFI_CanOpen_1_Drive</b>	BFICanOpen.BFIDrive		BFI_CanOpen_1 control struct.
VAR_GLOBAL	<b>BFI_CanOpen_2_Drive</b>	BFICanOpen.BFIDrive		BFI_CanOpen_2 control struct.
VAR_GLOBAL	<b>BFI_CanOpen_3_Drive</b>	BFICanOpen.BFIDrive		BFI_CanOpen_3 control struct.
VAR_GLOBAL	<b>aBFICanOpenHMI</b>	ARRAY[1..gc_iNrOfBFIonCanOpen] OF strBFIHMI		BFI_CanOpen HMI struct.

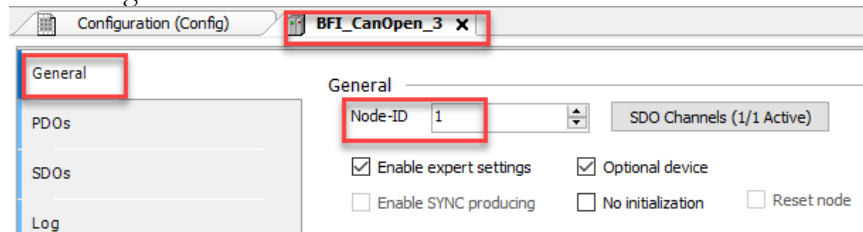
- If BFI nr3 is to be a BFI-E3, copy/paste BFI\_CanOpen\_1\_Drive. Then refactor the name to BFI\_CanOpen\_3.
- If BFI nr3 is to be a BFI-P2 Size2 or 3, copy/paste BFI\_CanOpen\_2\_Drive and then refactor the name to BFI\_CanOpen\_3.
- If BFI nr3 is a BFI-P2 Size4 or 7 a new Device needs to be added, BFI-P2 Size4 to Size7. If the device is not available, it needs to be imported. The eds file is available on [www.beijerelectronics.com](http://www.beijerelectronics.com).



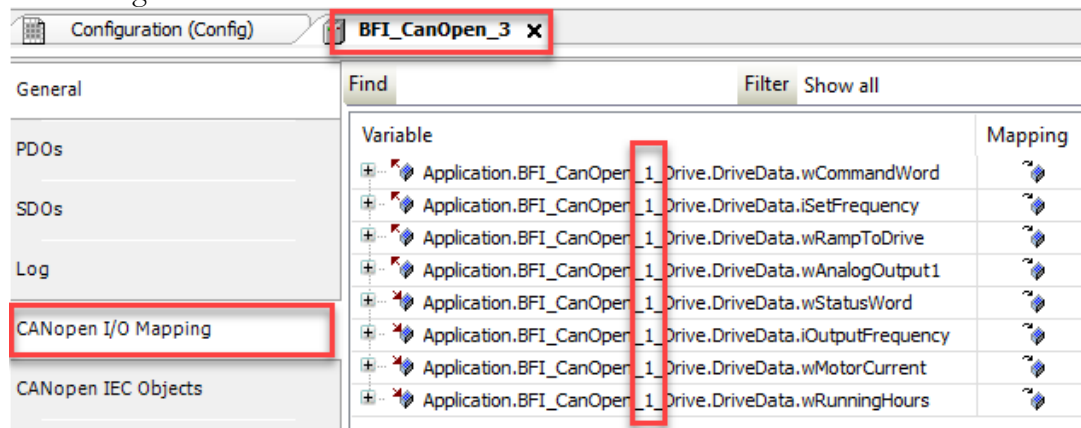
Then follow the rest of all steps.

Name	Vendor	Version
Fieldbuses		
CANopen		
Remote Device		
BFI-E3	Beijer Electronics AB	Revision=16#00000000, FileVersion=1.1, File=BFI-E3.eds
BFI-E3	Beijer Electronics	Revision=16#00000000, FileVersion=3.1, File=BFI-E3_Ver31.eds
BFI-E3	Beijer Electronics	Revision=16#00000000, FileVersion=3.3, File=BFI-E3_Ver33.eds
BFI-P2 Size2 and Size3	Beijer Electronics	Revision=16#00000000, FileVersion=3.1, File=BFI-P2_Size2_and_3_Ver31.eds
BFI-P2 Size2 and Size3	Beijer Electronics	Revision=16#00000000, FileVersion=3.3, File=BFI-P2_Size2_and_3_Ver33.eds
BFI-P2 Size4 to Size7	Beijer Electronics	Revision=16#00000000, FileVersion=3.1, File=BFI-P2_Size4_to_7_Ver31.eds
BFI-P2 Size4 to Size7	Beijer Electronics	Revision=16#00000000, FileVersion=3.3, File=BFI-P2_Size4_to_7_Ver33.eds

- Change Node-ID to 3.



- Change all variable names from 1 to 3.



- Add a variable called fbControlBFI3 of type BFICanOpen in the variable list of type BFICanOpenprg.

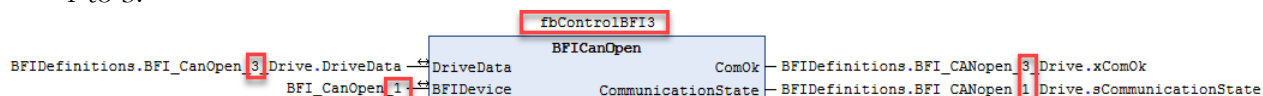
Configuration (Config) **BFICanOpenprg** x

```

PROGRAM BFICanOpenprg
VAR
    fbControlBFI1: BFICanOpen; // FB to control BFI 1.
    fbControlBFI2: BFICanOpen; // FB to control BFI 2.
    fbControlBFI3: BFICanOpen; // FB to control BFI 3.
END_VAR

```

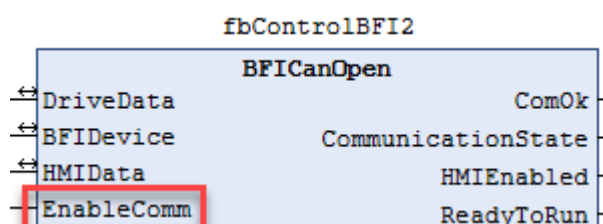
- Copy network with function block fbControlBFI1, paste it and rename all variables from 1 to 3.



## 12.3 Enable/Disable Devices

If a BFI is not to be used in the network during commissioning or for any other reasons it can be disabled, and communication turned off. This can be done by a tag in the PLC-program.

### Enable/Disable by plc-program



#### EnableComm

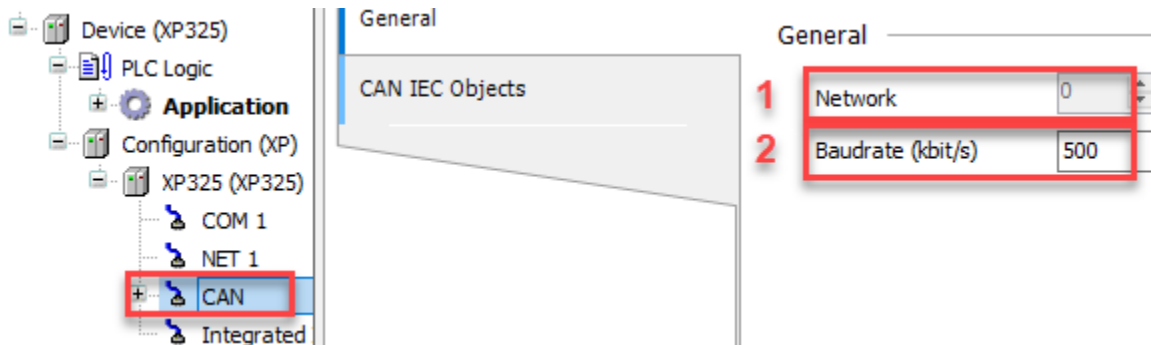
True = Communication is running.

False = Communication turned off and all outputs from function block is 0.

Normally this can be set to always True.

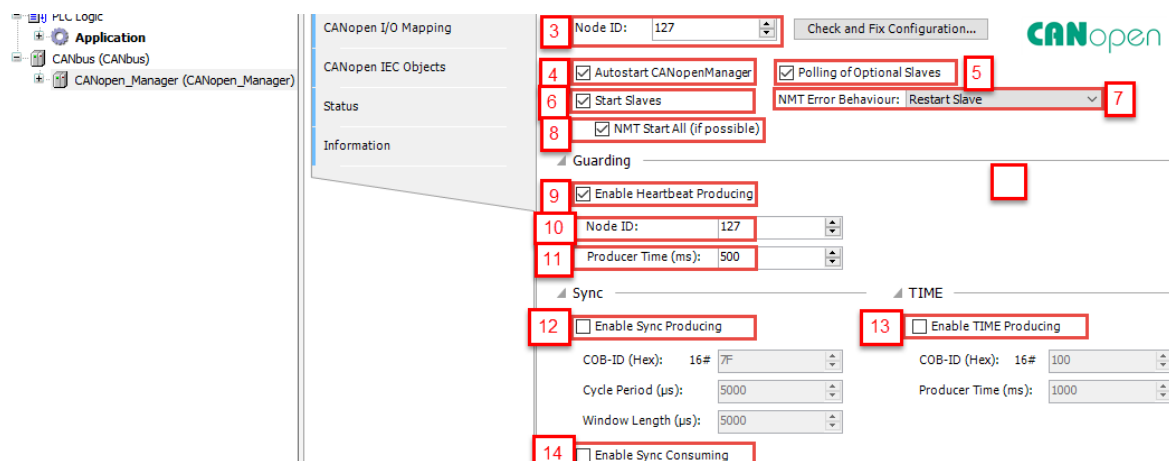
## 12.4 CanOpen setting

The setting of the CanOpen port is done in BCS Tools, both for the Master and for all Slaves.



1. Number of the CAN network to be linked via the CANbus interface.  
For Nexto Xpress Network should always be 0.
2. Baud rate [bits per second] for transmitting data on the bus.  
Maximum working baud rate is decided by limitations in CANopen Slaves, required bandwidth, network cable length and cross-area. Try to keep baud rate as low as possible to avoid communication interruption due to noise.

## 12.5 CanOpen Master and Slave settings



### 3: Node ID

The node number identifies the CANopen manager as unique and if corresponds to the number set on the module (value between 1 and 127). Normally set to 127.

### 4: AutostartCANopenManager

☒: The CANopen manager starts automatically (switches to OPERATIONAL mode) after all required Slaves are ready.

☐: You must start the CANopen manager from the application, using the CiA405 NMT function block.

### 5: Polling of Optional Slaves

☒: When a Slave does not respond during the boot sequence, the CANopen manager interrogates it every second until it does respond.

Constantly polling the Slave increases the bus cycle time, which can interfere with the application (especially motion applications). You can deactivate polling to avoid this behaviour. If polling is deactivated, then a Slave is detected again when it sends a bootup message.

#### 6: Start Slaves

- ☒ The CANopen manager is responsible for starting the Slaves.
- ☐ You must start the Slaves from the application, using the CiA405 NMT function block.

#### 7: NMT Error Behaviour

Restart Slave. If an error occurs during Slave monitoring (NMT Error Event), then the Slave is restarted automatically by the stack (NMT Reset + SDO Configuration + NMT Start).

Stop Slave. If an error occurs during Slave monitoring (NMT Error Event), then the Slave is stopped. Then you must reset the Slave from the application, using the CiA405 NMT function block.

#### 8: NMT Start All

- ☒ If the *Start Slaves* option is activated, then the CANopen manager starts all Slaves with an “NMT Start All” command. The “NMT Start All” command is not executed as long as optional Slaves are not yet ready to be started. In this case, the CANopen manager starts each Slave individually. The “NMT StartAll” command can be guaranteed only in a project without optional Slaves.

### GUARDING

#### 9: Enable Heartbeating Producing

- ☒ The Master sends heartbeat messages that define the time interval in the Producer Time. When the Slaves are provided with the heartbeat function, a heartbeat consuming entry from the Slave is created for the master. Then the node ID and the 1.5x heartbeat interval of the master are applied.
- ☐ Node-guarding is activated for the Slaves and the settings are used from the EDS file of the Slave. If the values there cannot be used, then default values are used. Please note that a CANopen Slave device can also be configured as a heartbeat producer.

#### 10: Node ID

Unique identification (1-127) of the heartbeat producer on the bus.  
Should normally be the master with 127.

#### 11: Producer Time (ms)

Interval length between successive heartbeats (in milliseconds).

### Synch and Time:

#### 12: Enable Sync Producing

- ☒ (deactivated by default) The CANopen manager sends SYNC telegrams.

The synchronous PDOs are sent directly after the SYNC telegram.

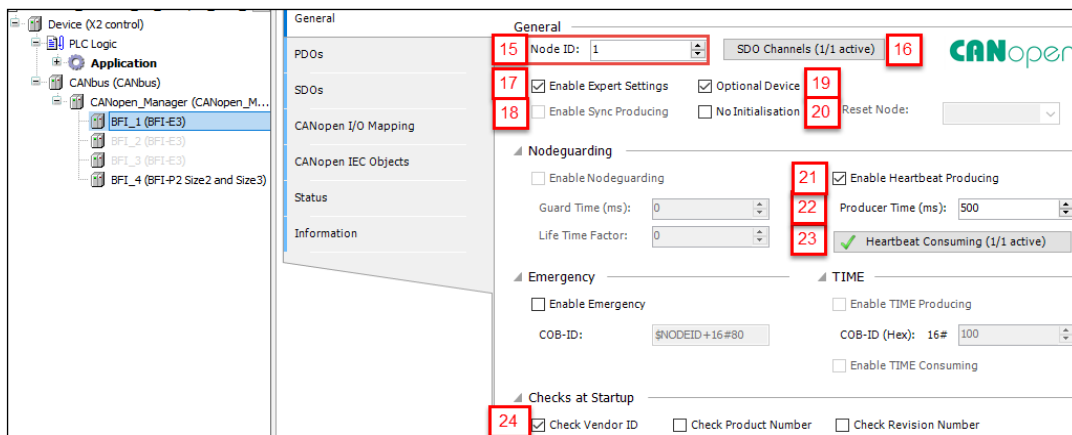
#### 13: Enable Time Producing

- ☒ (deactivated by default) The CANopen manager sends TIME messages.

#### 14: Enable Sync Consuming

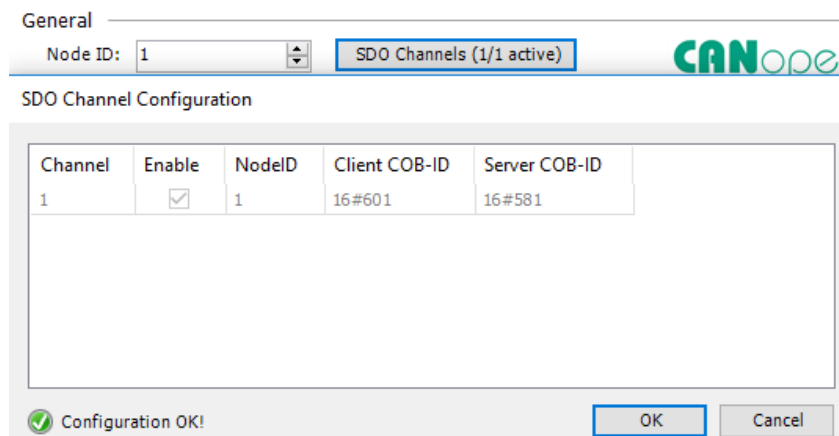
- ☒ (deactivated by default) The CANopen manager sends SYNC telegrams.

The synchronous PDOs are sent directly after the SYNC telegram.



**15:** The node number identifies the CAN module as unique, and it corresponds to the number set on the module (value between 1 and 127). You provide the node ID as a decimal.

**16:** Click this button to open a dialog for activating the SDO channels that are predefined in the EDS file. Service data objects (SDOs) allow access to all entries in the CANopen object directory. An SDO creates a peer-to-peer communication channel between two devices (SDO server and client channel).



**17:** ☒: All settings are displayed that are predefined by the device description (EDS file) for the device.

**18:** Available only when the Enable Sync Producing option is cleared in the CANopen manager.

☒: The I/O transmission is synchronized on the bus. The Slave works a sync producer. The parameters of the sync interval are defined in the settings of the CANopen manager.

**19:** ☒: The Slave is optional and not required for starting the CAN network. Meaning network communication is started up even though Slaves are missing in the network. If this is not set for a Slave, the complete network won't start up (all Slaves ready to be run stays in Preoperation) until this Slave are ready to start.

**20:** This option is for non-configurable Slave that already start with a valid configuration.

✓: The master does not send configuration SDOs or NMT start commands to the Slave. PDO communication and monitoring (heartbeat, node guarding) are performed when this has been configured in the configurator.

If the Slave does not start automatically, then the user can use the CiA405 NMT function block to send an NMT start command to the Slave.

### 21: Use Heartbeat producing instead of Nodeguarding

✓: The CANopen manager sends a message to the Slave in the Guard Time (ms) interval. If the Slave does not respond with the given Guard COB ID (Communication Object Identifier), then the CANopen manager resends this message as many times as defined in Lifetime Factor or until the Slave responds.

If the Slave does not respond, then it is marked as “unavailable”.

### 22:

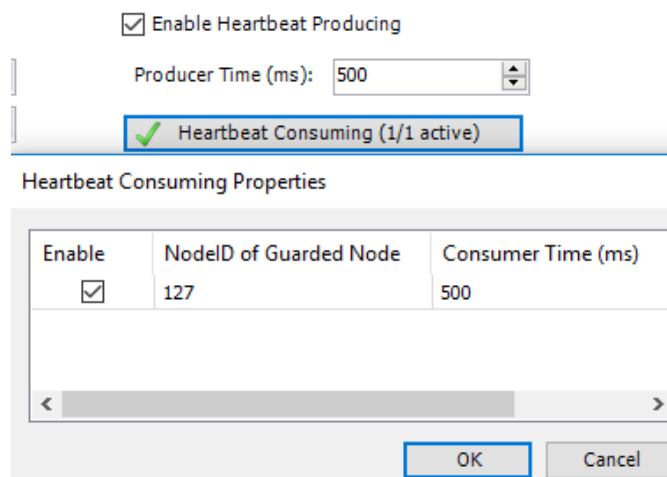
✓: The module sends heartbeats in the time intervals as given in *Producer Time (ms)*.

23: The default setting is 200 as long as there is no special entry or the entry in the device description file is 0.

This Heartbeat Consuming Time must be higher than Heartbeat Producing Time set in CANopen Manager. Set Heartbeat Consuming Time =  $1,5 \times \text{Heartbeat Producing Time}$

### 24:


Heartbeat Consuming: Opens the Heartbeat Consuming Properties dialog box where you activate the Slaves that you will monitor.



The number of possible Slaves to be monitored is defined in the EDS file. TO do this, you must select the “Enable” check box and enter the node ID of the Slave and the required values in the Heartbeat Time field (in milliseconds). Then the Slave monitors the heartbeats that are sent from the affected Slaves (defined by the node ID). When no more heartbeats are received, the Slave switches off the I/Os.

While a Slave is monitoring, a green check mark is shown on the Heartbeat Consuming switch.

Note: When you insert a device with the heartbeat function, its heartbeat settings are harmonized automatically with the master (CANopen manager).

**25:**  Check the vendor ID of the Slave at start up. Vendor ID for Beijer Electronics is 145. If not, corresponding communication will not start up.

## 12.6 Eds files describing BFI Slaves

The eds file for each Slave must be correct. BFI have three different eds files as below:

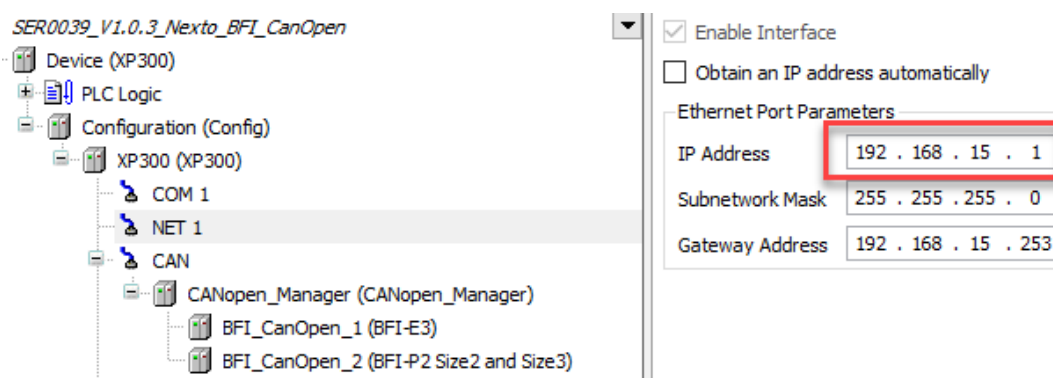
- **BFI-E3:** BFI-E3\_Ver33.eds
- **BFI-P2 Size2 to Size3:** BFI-P2\_Size2-3\_Ver33.eds
- **BFI-P2 Size4 to Size7:** BFI-P2\_Size4-7\_Ver33.eds

The files are attached the program example but also available on [www.beijerelectronics.com](http://www.beijerelectronics.com).

## 12.7 Ethernet setting in BCS Tools

### Nexto Xpress

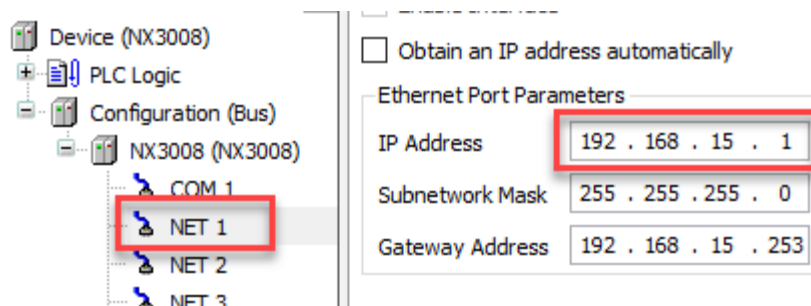
The only Ethernet port of Nexto Xpress is named “ETH” and is used for programming and HMI communication. The IP-address setting is done in Configuration/NET 1 in BCS Tools. Default IP-address is 192.168.15.1.



### Nexto NX-3008

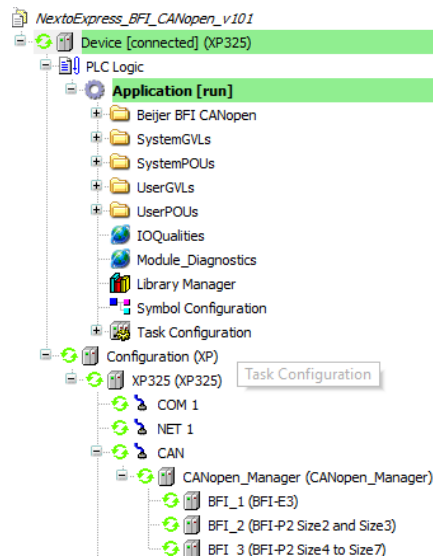
NX-3008 has 3 Ethernet ports named NET1, NET2 and NET3.

NET1 is to be used for programming and HMI communication. The IP-address setting is done in Configuration/NET 1 in BCS Tools. Default IP-address is 192.168.15.1.

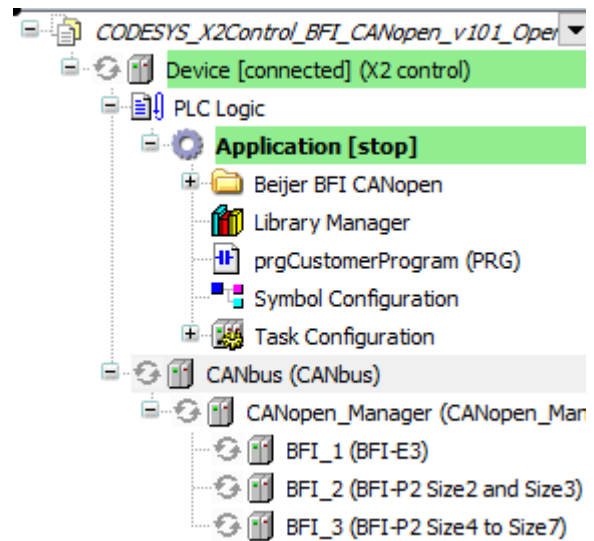


## 13 Troubleshooting Communication problems

BCS Tools is the tool to check status of the CanOpen communication.

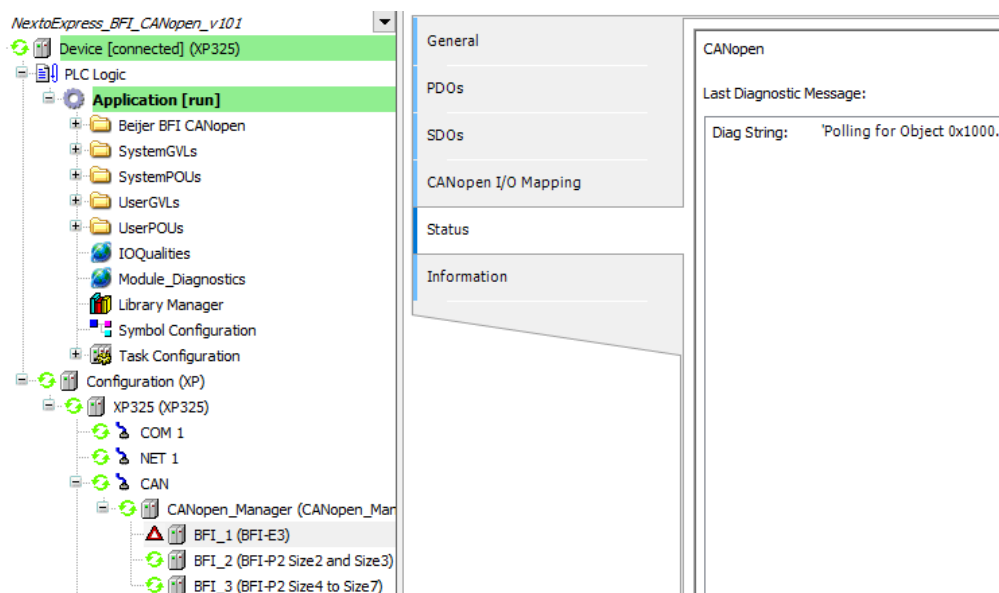


PLC in RUN communicating with devices



PLC in STOP

### 13.1 One device does not reply



Check following items:

#### Hardware

- Is the cable from Nexto Xpress, CAB155, correct installed?
- Have wires for CAN-H and CAN-L been mixed between Nexto Xpress and BFI?
- Termination must be used. 1 pieces of 120 ohms in each end of the network. In Nexto termination is activated by software, see [7.4](#). In BFI it is done with an option containing aRJ-45 with built-in resistor, see chapter [8.5](#).

- Setting in BCS Tools must be “Network”=0 of CANbus (CANbus)/General, see chapter [12.4](#).
- Power turned on to BFI-P2/E3?

#### Software or settings

- P1-12 = 6 in BFI-P2 and P-12 = 7 or 8 in BFI-E3?
- Communication speed setting in each Slave corresponding to Master setting in BCS Tools, P-36 in BFI-E3 or P5-02 in BFI-P2?
- Individual Station number, P-36 in BFI-E3 or P5-01 in BFI-P2, done?
- Station number setting in each BFI correspond with settings in BCS Tools?
- The same station number settings in several BFI:s?
- Are correct eds file for each BFI being used?

### 13.2 Power failure in BFI-P2 or BFI-E3

#### Power 1\*230 or 3\*400 VAC Turned off to BFI-P2 =>

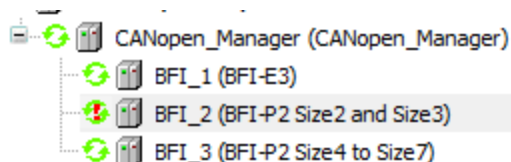
- Communication can still work with BFI-P2 due to an external 24 VDC supply on terminal 1 and 7 or by network cables and the other BFI in network.
- Diagnostic Message in BCS Tools “EMCY Code 3207, Register 05.
- BFI is tripped showing Undervoltage alarm.
- Alarm can’t be reseted, disappears when power Turned on again.

#### Power 1\*230 or 3\*400 VAC Turned off to BFI-E3 =>

- BFI-E3 turns black.
- Module not found in BCS Tools “Diag String “Polling for Object 0x1000.

### 13.3 Communication ok but Diagnostic message

A Slave can also look like BFI\_2 below.



This means that the communication is working but something else is wrong and there is a Diagnostic message for this Slave describing the fault. Examples are:

- EMCY Code :3207, Register:05; Field 00 00 00 00 07 => Power Off BFI-P2.
- EMCY Code :1012, Register:01; Field 00 00 00 00 12 => Alarm 4-20 mA missing.

BFI-P2 tripped due to CANopen communication failure, SC-F02 =>

- Diagnostic Message in BCS Tools “EMCY Code 1033, Register 01
- BFI is tripped showing Undervoltage alarm.

### 13.4 Communication ok but BFI-P2/E3 doesn't run the motor

- Inhibit in display? Safe Torque Off signals are missing to BFI-P2, see chapter [8.2](#).
- Software enable on terminal 2 for BFI-P2 in place? see chapter [8.2](#).
- Software enable on terminal 2 for BFI-E3 in place? see chapter [8.1](#).
- No alarm in BFI-P2/E3?
- Parameter P1-12 = 6 in BFI-P2 and P-12=7 or 8 in BFI-E3?
- Variable "Ready to Run" must be 1 to run the BFI-P2/E3. Check!
  - o Software Enable signal on terminal 2=24VDC?
  - o Safe Torque Off terminals are properly connected on BFI-P2?
  - o 3x400 or 1x230 VAC connected to BFI?
  - o Reset any active alarm in BFI?
- Stop in display?
  - o Start signal by bus is missing. As soon as BFI receives a start signal a value between 0 and Maximum speed is displayed instead of Stop.
- H 0.0 in display?
 

Start signal arrived but no speed setpoint?

  - o Speed sent to BFI-P2/E3 must be a value between parameter value P1-01 and P1-02.
  - o Speed into Function block is a REAL. Value 50.0 Hz means value 500 being sent to BFI-P2/E3
  - o Check that sent speed by bus corresponds with value in P0-07 in BFI-P2 and P0-03 in BFI-E3.
  - o Check parameter P0-52:2 (word2 of the 4 cyclic words). This is the speed value send in cyclic data word2. The value is Hexadecimal.

### 13.5 EMC noise

Nexto might lose communication with one or several with one or several slaves without any logic reason. Basic rules to avoid problems with EMC-noise:

1. Use Cat 6 patch cables.
2. Make sure that CAN-H and CAN-L for all devices in the network are disconnected from common ground. They are in BFI and Beijer distributed I/O:s.
3. The motor cables for all motor driven by a BFI must be shielded and the shield MUST be grounded in both ends of the cable.
4. Make sure that motor cables are patch cables have a distance of minimum 30 cm from each other.
5. If a patch cable must cross a motor cable it must be in a 90 degrees angle.

#### How to solve?

EMC noise is not detected by any controller and the fastest way to find the root cause is by exclusive testing. Try to see pattern how and when the problem occurs. Start all over again and activated the slaves one-by one.

- Does the problem occur when all slaves in the network are activated, and BFI is not running any motor?
- Start up the BFI:s one by one and to see if it is a specific BFI causing the problem.
- Is the problem caused by one specific BFI or is it all BFI:s together causing the problem?
- If one specific BFI is causing the problem, remove all I/O wires and just keep the bridges between 1 to 2, 1 to 12 and 9 to 13. Any improvement?

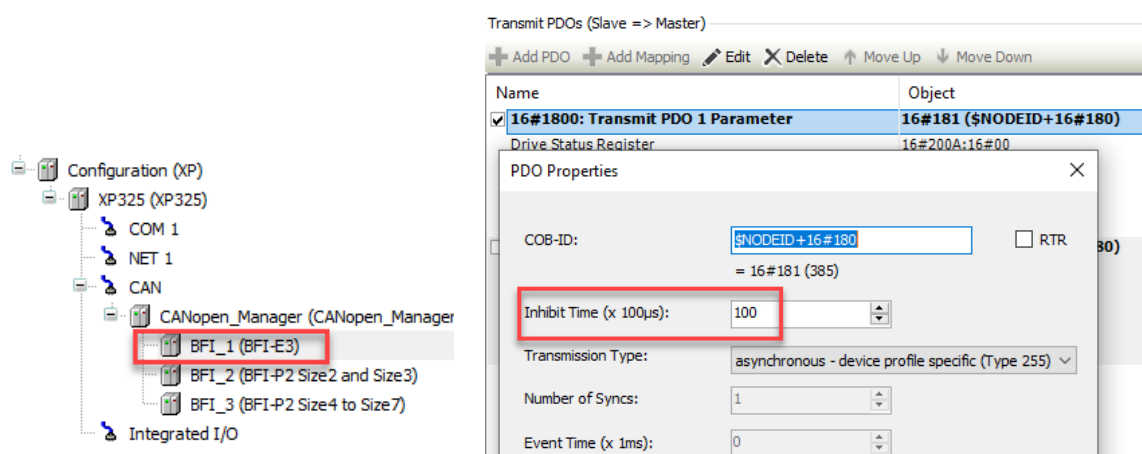
## 13.6 Bandwidth problem

This problem might occur during commissioning. Nexto Xpress might lose communication with one or several slaves without any logic reason. Symptom is similar as EMC noise.

Normally setting is that components in network send data as soon as new data is available. Distributed I/O:s with analog inputs or high-speed counters and BFI-P2 with encoder feedback might send new data every msec. With Low bus speed and several slaves, the traffic on the bus might too high and problem occur.

### How to solve?

- Start to calculate theoretically if bus speed can handle the amount of data on the bus. A speed of 500 Kbit/sec is the same as 500 bits/msec. And one message on the bus is in total normally about 100 bits.
- Decrease number slaves in network, especially those who might send a lot of data. What happens?
- Limit the amount of data sent from a specific slave with a minimum time between two messages, set "Inhibit time". In example below inhibit time is set to 10 msec for the BFI-E3.

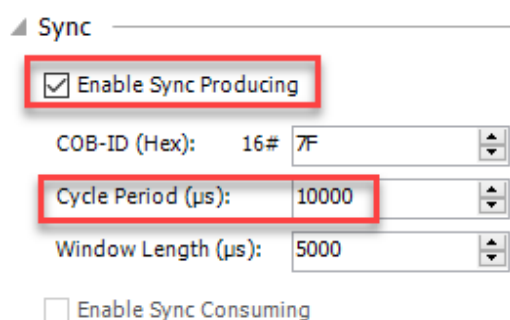


## 13.7 Use SYNC to read encoder data from motor connected to BFI-P2

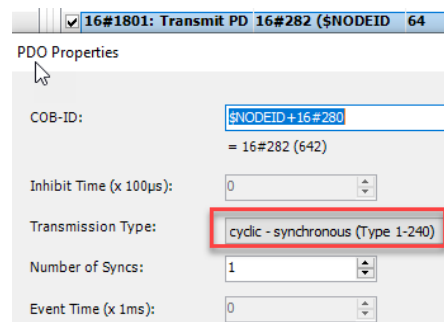
Instead of using Inhibit time to decrease the CANopen communication rate it is possible set the CANopen Master poll slaves for data.

Activate SYNC function in the CANopen Manager and configure the time. In this example it is set to 10 msec.

Activate SYNC for each PDO of each slave and set it to cyclic transmission.



Setting in CANopen Manager



Setting of one PDO in one slave

## 14 CANopen data in BFI-P2/E3 Register Mapping

### 14.1 CANopen Protocol Specification

The tables below show the Index and Sub Index required to address each parameter. All User Adjustable parameters are accessible by CAN, except those that would directly affect the communications. All parameter values can be read from the drive and written to, depending on the operating mode of the drive – some parameters may be changed whilst the drive is enabled for example. BFI-P2 provides the following default COB-ID and functions:

Table 1: Messages and COB-IDs		
Type	COB-ID	Function
NMT	000h	Network management
Sync	080h	Synchronous message COB-ID can be configured to other value.
Emergency	080h + Node address	Emergency message. COB-ID can be configured to other value.
PDO1 (TX)	180h + Node address	Process data object. PDO1 is pre-mapped and enabled by default. PDO2 is pre-mapped and disabled by default. Transmission mode, COB-ID and mapping can be configured.
PDO1 (RX)	200h + Node address	
PDO2 (TX)	280h + Node address	
PDO2 (RX)	300h + Node address	
SDO (TX)	580h + Node address	SDO channel can be used for drive parameter access.
SDO (RX)	600h + Node address	
Error Control	700h + Node address	Guarding and Heartbeat function are supported. COB-ID can be configured to other value.

- BFI-P2 SDO channel only supports expedited transmission.
- BFI-P2 can only support up to 2 Process Data Objects (PDO). All PDOs are pre-mapped however PDO2 is disabled by default. The table below gives the default PDO mapping information.
- Customer configuration (mapping) will NOT be saved during power down. This means that the CANopen configuration will restore to its default condition each time the drive is powered up.

### 14.2 PDO Default Mapping

	Objects No.	Mapped Object	Length	Mapped Function	Transmission Type
RX PDO1	1	2000h	Unsigned 16	Control command register*	255 Valid immediately
	2	2001h	Integer 16	Speed reference	
	3	2003h	Unsigned 16	User ramp reference	
	4	2002h	Unsigned 16	Torque Reference	
TX PDO1	1	200Ah	Unsigned 16	Drive status register	255
	2	200Bh	Integer 16	Motor speed Hz	
	3	200Dh	Unsigned 16	Motor current	
	4	203Eh	Integer 16	Total Run Hour	
RX PDO2	1	0006h	Unsigned 16	Dummy	255
	2	0006h	Unsigned 16	Dummy	
	3	0006h	Unsigned 16	Dummy	
	4	0006h	Unsigned 16	Dummy	
TX PDO2	1	2012h	Unsigned 16	Digital input status	255
	2	2013h	Unsigned 16	Analog input 1 (%)	
	3	2014h	Integer 16	Analog input 2 (%)	
	4	2044h	Integer 16	Speed Controller Reference	

\* Drive control can only be achieved when P-12=7 or 8 provided that P-31 = 0, 1, 4 or 5.

### 14.3 PDO transmission type

Various transmission modes can be selected for each PDO. For RX PDO, the following modes are supported:

Transmission Type	Mode	Description
0 – 240	Synchronous	The received data will be transferred to the drive active control register when the next sync message is received.
254, 255	Asynchronous	The received data will be transferred to the drive active control register immediately without delay.

For TX PDO, the following modes are supported:

Transmission Type	Mode	Description
0	Acyclic synchronous	TX PDO will only be sent out if the PDO data has changed and PDO will be transmitted on reception of SYNC object
1-240	Cyclic synchronous	TX PDO will be transmitted synchronously and cyclically. The transmission type indicates the number of SYNC object that are
254	Asynchronous	TX PDO will only be transferred once corresponding RX PDO has been received.
255	Asynchronous	TX PDO will only be transferred anytime if PDO data value has changed.

### 14.4 CANopen specific Object table

Index	Sub Index	Function	Access	Type	PDO Map	Default Value
1000h	0	Device Type	RO	U32	N	0
1001h	0	Error Register	RO	U8	N	0
1002h	0	Manufacturer Status Register	RO	U16	N	0
1005h	0	COB-ID Sync	RW	U32	N	00000080h
1008h	0	Manufacturer Device Name	RO	String	N	BFI-P2
1009h	0	Manufacturer Hardware Version	RO	String	N	x.xx
100Ah	0	Manufacturer Software Version	RO	String	N	3.00
100Ch	0	Guard Time (1ms)	RW	U16	N	0
100Dh	0	Lifetime Factor	RW	U8	N	0
1014h	0	COB-ID EMCY	RW	U32	N	00000080h+Node ID
1015h	0	Inhibit Time Emergency (100µs)	RW	U16	N	0
1016h	0	Consumer Heartbeat Time No. of entries	RO	U8	N	1
	1	Consumer Heartbeat Master Node & Time	RW	U32	N	0
1017h	0	Producer Heartbeat Time (1ms)	RW	U16	N	0
1018h	0	Identity Object No. Of entries	RO	U8	N	4
	1	Vendor ID	RO	U32	N	0x00000145
	2	Product Code	RO	U32	N	Drive Dependent
	3	Revision Number	RO	U32	N	x.xx
	4	Serial Number	RO	U32	N	Drive Dependent
1200h	0	SDO Parameter No. Of entries	RO	U8	N	2
	1	COB-ID Client -> Server (RX)	RO	U32	N	00000600h+Node ID
	2	COB-ID Server -> Client (TX)	RO	U32	N	00000580h+Node ID
1400h	0	RX PDO1 comms param. no. of entries	RO	U8	N	2
	1	RX PDO1 COB-ID	RW	U32	N	40000200h+Node ID
	2	RX PDO transmission type	RW	U32	N	254

1401h	0	RX PDO2 comms param. no. of entries	RO	U8	N	2
	1	RX PDO2 COB-ID	RW	U32	N	C0000300h+Node ID
	2	RX PDO2 transmission type	RW	U8	N	0
1600h	0	RX PDO1 1 mapping / no. of entries	RW	U8	N	4
	1	RX PDO1 1st mapped object	RW	U32	N	20000010h
	2	RX PDO1 2nd mapped object	RW	U32	N	20010010h
	3	RX PDO1 3rd mapped object	RW	U32	N	20030010h
	4	RX PDO1 4th mapped object	RW	U32	N	00060010h
1601h	0	RX PDO2 1 mapping / no. of entries	RW	U8	N	4
	1	RX PDO2 1st mapped object	RW	U32	N	00060010h
	2	RX PDO2 2nd mapped object	RW	U32	N	00060010h
	3	RX PDO2 3rd mapped object	RW	U32	N	00060010h
	4	RX PDO2 4th mapped object	RW	U32	N	00060010h
1800h	0	TX PDO1 comms parameter number of entries	RO	U8	N	3
	1	TX PDO1 COB-ID	RW	U32	N	40000180h+Node ID
	2	TX PDO1 transmission type	RW	U8	N	254
	3	TX PDO1 Inhibit time (100µs)	RW	U16	N	0
1801h	0	TX PDO2 comms param no. of entries	RO	U8	N	3
	1	TX PDO2 COB-ID	RW	U32	N	C0000280h+Node ID
	2	TX PDO2 transmission type	RW	U8	N	0
	3	TX PDO2 Inhibit time (100µs)	RW	U16	N	0
1A00h	0	TX PDO1 mapping / no. of entries	RW	U8	N	4
	1	TX PDO1 1st mapped object	RW	U32	N	200A0010h
	2	TX PDO1 2nd mapped object	RW	U32	N	200B0010h
	3	TX PDO1 3rd mapped object	RW	U32	N	200D0010h
	4	TX PDO1 4th mapped object	RW	U32	N	20100010h
1A01h	0	TX PDO2 mapping / no. of entries	RW	U8	N	4
	1	TX PDO2 1st mapped object	RW	U32	N	20110010h
	2	TX PDO2 2nd mapped object	RW	U32	N	20120010h
	3	TX PDO2 3rd mapped object	RW	U32	N	20130010h
	4	TX PDO2 4th mapped object	RW	U32	N	20140010h

## 14.5 Parameter Access Overview BFI-P2 and BFI-E3

CanOpen addresses for parameters and Actual status is to be found in Application note for BFI-E3 and BFI-P2. This to be found on [www.beijerelectronics.com](http://www.beijerelectronics.com).

## 15 About Beijer Electronics

Beijer Electronics is a multinational, cross-industry innovator that connects people and technologies to optimize processes for business-critical applications. Our offer includes operator communication, automation solutions, digitalization and support. As experts in user-friendly software, hardware and services for the Industrial Internet of Things, we empower you to meet your challenges through leading-edge solutions.

Beijer Electronics is an Ependion company. Ependion (formerly Beijer Group) is listed on the NASDAQ OMX Nordic Stockholm Mid Cap list under the ticker EPEN.

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