

DEVICENET CONFIGURATION WITH ABB ROBOTSTUDIO 6 ON A IRC5



FOREWORD

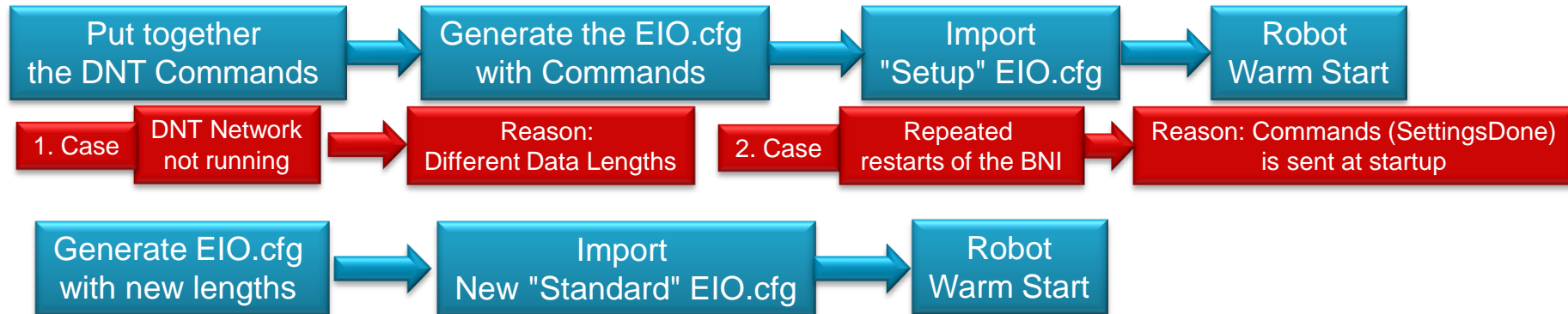
- This manual will help you in configuring a Balluff DeviceNet Module with an ABB IRC5 Robot Controller, without an additional PLC.
- For the configuration are the following requirements necessary:
 - EDS-File of the BNI Module from Balluff
 - Experience with a DeviceNet Network
 - Knowledge of Robotstudio and an understanding of safe handling of the Robot with EIO.cfg
 - Maybe a text editor, ex. Notepad ++ or Ultraedit
 - Different user manuals of devices used.
 - IRC5 with DeviceNet Card

Tested with Robotstudio & RobotWare 6.03

CONFIGURATION PROCEDURE

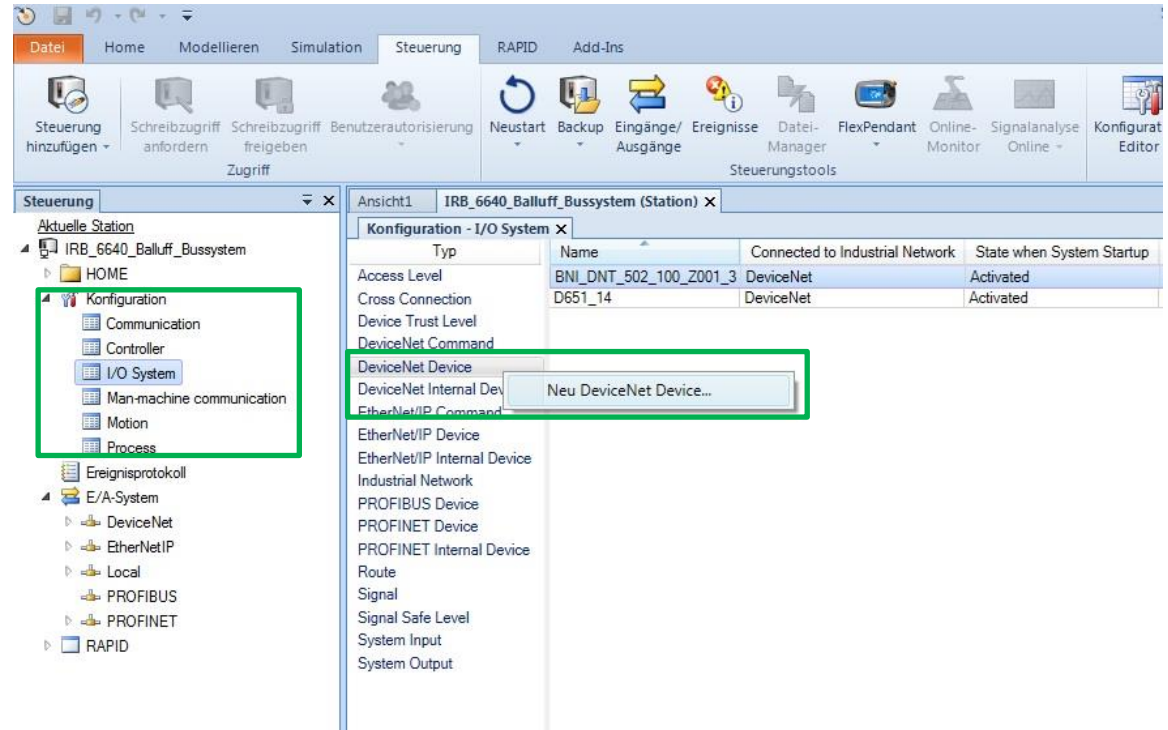
- For the configuration of DeviceNet, two main steps would be required,
 1. Sending the configuration to commission the BUS
 2. Adjustment of the Communication Data Length and deletion of the parameter commands

- Flow Chart



MODULE ADDITION

- To add a DeviceNet module in RobotStudio, open 'Configuration -> I/O System'
- Right click on 'DeviceNet Device' and choose 'New DeviceNet Device'



MODULE ADDITION

- In the opened Instance-Editor, fill all the fields.
- The information, for ex. Vendor ID, ProductCode etc. can be found in the EDS file.
- The address should be noted and the BNI set to the same using the display.

Name	Wert	Informationen
Name	BNI_DNT_502_100_Z001_3	
Connected to Industrial Network	DeviceNet	
State when System Startup	Activated	
Trust Level	DefaultTrustLevel	
Simulated	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Vendor Name	Balluff	
Product Name	BNI DNT-502	
Recovery Time (ms)	5000	
Identification Label		
Address	3	
Vendor ID	43	
Product Code	502	
Device Type	12	
Production Inhibit Time (ms)	10	
ConnectionType	Change-Of-State (COS)	
PollRate	1000	
Connection Output Size (bytes)	18	
Connection Input Size (bytes)	8	
Quick Connect	<input type="radio"/> Activated <input checked="" type="radio"/> Deactivated	

Value (RAPID)
Die Änderungen werden erst wirksam, wenn die Steuerung warmgestartet wurde.
Mindestanzahl an Zeichen ist <ungültig>. Maximale Anzahl an Zeichen ist <ungültig>.

OK Abbrechen

[Device]

```

VendCode = 43;           $ Vendor Code (Balluff, Inc.)
VendName = "Balluff";   $ Vendor Name
ProdType = 12;
ProdTypeStr = "Communications Adapter";
ProdCode = 502;         $ Product Code
MajRev = 1;             $ Device Major Revision
MinRev = 1;             $ Device Minor Revision
ProdName = "BNI DNT-502-100-Z001"; $ Product Name
DeviceStatusAssembly = 100;
Catalog = "BNI005A";
Icon = "DNT-502-100-Z001.ico";
DNetQC =
    0x0001,             $ DeviceNet Quick Connect
                        supported
                        $ at power up
                        $ First MACID request message
                        after ... [ms]
50;
    
```

MODULE ADDITION

- The I/O message size is very important for communication.
- The lower limit is -1 (Value unknown) and the Upper limit is 64.
- For the first commissioning, you can use 8 byte input and 6 byte output or the value -1.
- Caution: the Screenshot has other example values

Instanz-Editor

Name	Wert	Informationen
Name	BNI_DNT_502_100_Z001_3	
Connected to Industrial Network	DeviceNet	
State when System Startup	Activated	
Trust Level	DefaultTrustLevel	
Simulated	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Vendor Name	Balluff	
Product Name	BNI DNT-502	
Recovery Time (ms)	5000	
Identification Label		
Address	3	
Vendor ID	43	
Product Code	502	
Device Type	12	
Production Inhibit Time (ms)	10	
ConnectionType	Change-Of-State (COS)	
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Value (RAPID)
Die Änderungen werden erst wirksam, wenn die Steuerung warmgestartet wurde.
Mindestanzahl an Zeichen ist <ungültig>. Maximale Anzahl an Zeichen ist <ungültig>.

OK Abbrechen

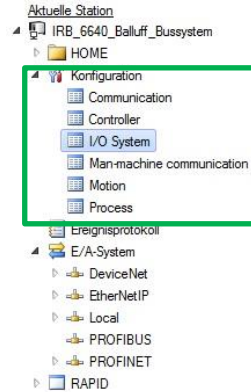
Die E/A-Nachrichtengröße hängt von den Einstellungen der IO-Link-Kanäle ab. Die minimalen E/A-Nachrichtengrößen sind **8 Bytes für Eingang** und **6 Bytes für Ausgang** bei inaktivierten IO-Link-Ports. Die maximalen E/A-Nachrichtengrößen sind 136 Bytes für Eingang und 134 Bytes für Ausgang, wenn alle IO-Link-Kanäle aktiviert sind und für jeden Kanal-Port-Modus 32/32 Bytes eingestellt wurde.

Vom Modul erzeugte E/A-Daten	
Byte	Name
0	
1	Eingangsstatus
2	
3	Überlaststatus
4	Kurzschlussstatus
5	Hilfsstromstatus
6	
7	IO-Link-Status
IOL CH1 (0~32) Bytes	IO-Link-Kanal 1 Eingangsdaten
IOL CH2 (0~32) Bytes	IO-Link-Kanal 2 Eingangsdaten
IOL CH3 (0~32) Bytes	IO-Link-Kanal 3 Eingangsdaten
IOL CH4 (0~32) Bytes	IO-Link-Kanal 4 Eingangsdaten

Vom Modul verarbeitete E/A-Daten	
Byte	Name
0	
1	Ausgangsstatus
2	
3	Ausgangs-Reset
4	Display
5	Leerplatz
IOL CH1 (0~32) Bytes	IO-Link-Kanal 1 Ausgangsdaten
IOL CH2 (0~32) Bytes	IO-Link-Kanal 2 Ausgangsdaten
IOL CH3 (0~32) Bytes	IO-Link-Kanal 3 Ausgangsdaten
IOL CH4 (0~32) Bytes	IO-Link-Kanal 4 Ausgangsdaten

ADDING THE COMMANDS

- The configuration will be sent to the DeviceNet module with commands. For a new command – Right Click on 'Configuration → I/O System' and then on 'DeviceNet Command' → 'Neu DeviceNet Command...'



A screenshot of a table titled 'Konfiguration - I/O System'. The table has columns: Typ, Name, Device, Download Order, Path, Service, and Value. A context menu is open over the 'DeviceNet Command' row, showing 'Neu DeviceNet Command...'. The 'DeviceNet Device' row is also highlighted with a green box.

Typ	Name	Device	Download Order	Path	Service	Value
Access Level	BNI_IOL_ACT	BNI_DNT_502_100_Z001_3	1	6,20 64 24 00 30 07.D1,1	Set Attribute Single	7
Cross Connection	BNI_IOL_DATAOUT1	BNI_DNT_502_100_Z001_3	2	6,20 65 24 01 30 04.C6,1	Set Attribute Single	15
Device Trust Level	BNI_IOL_DATAOUT2	BNI_DNT_502_100_Z001_3	3	6,20 65 24 02 30 04.C6,1	Set Attribute Single	15
DeviceNet Command	BNI_IOL_DATAOUT3	BNI_DNT_502_100_Z001_3	4	6,20 65 24 03 30 04.C6,1	Set Attribute Single	15
DeviceNet Device		BNI_DNT_502_100_Z001_3	5	6,20 64 24 00 30 08.C1,1	Set Attribute Single	1
DeviceNet Internal Device						
EtherNet/IP Command						
EtherNet/IP Device						
EtherNet/IP Internal Device						
Industrial Network						
PROFIBUS Device						
PROFINET Device						
PROFINET Internal Device						
Route						
Signal						
Signal Safe Level						
System Input						
System Output						

ADDING THE COMMANDS

- Assign a meaningful name and select the Device, to which the commands will be sent.
- The "Download Order" sets the logical sequence, similar to "Priority".
- The path can be extracted from the EDS file.
- For "Service" select "Set Attribute Single" and for the "Value" set the desired value.

The screenshot shows the 'Instanz-Editor' window with a configuration table and a code editor window.

Name	Wert	Informationen
Name	BNI_IOL_ACT	
Device	BNI_DNT_502_100_Z001_3	
Download Order	1	
Path	6,20 64 24 00 30 07,D1,1	
Service	Set Attribute Single	
Value	7	


```

Aus der EDS
Param107 =
    0,
    6,"20 64 24 00 30 07",
    0x0000,
    0xD1,
    1,
    "IOL Port Enable",
    "",
    "New Help String",
    0,0x0F,0,
    "",
    "",
    ;
Enum107 =
    0,"IO-Link Channel 1 (Port 2.4)",
    1,"IO-Link Channel 2 (Port 3.6)",
    2,"IO-Link Channel 3 (Port 6.12)",
    3,"IO-Link Channel 4 (Port 7.14)";
    
```

\$ IOL Port Enable
 \$ reserved, shall equal 0
 \$ Link Path Size, Link Path
 \$ Descriptor
 \$ Data Type
 \$ Data Size in bytes
 \$ name
 \$ units
 \$ help string
 \$ min, max, default data values
 \$ mult, div, base, offset scaling
 \$ mult, div, base, offset links
 \$ decimal places

Value (Zeichenfolge)
 Die Änderungen werden erst wirksam, wenn die Steuerung warmgestartet wurde.
 Mindestanzahl an Zeichen ist <ungültig>. Maximale Anzahl an Zeichen ist <ungültig>.

OK Abbrechen

COMMAND EXAMPLE

- As an example we will activate 3 I/Olink ports with 4bytes of Output Data each for a Balluff Smartlight.

- The "Download Order":
 1. Ports Setup (Activate IO-Link)
 2. Output data for the 1st IO-Link Port
 3. Output data for the 2nd IO-Link Port
 4. Output data for the 3rd IO-Link Port
 5. Set SettingsDone Flag, to finish the configuration process.

Konfiguration - I/O System X						
Typ	Name	Device	Download Order	Path	Service	Value
Access Level	BNI_IOL_ACT	BNI_DNT_502_100_Z001_3	1	6,20 64 24 00 30 07,D1,1	Set Attribute Single	7
Cross Connection	BNI_IOL_DATAOUT1	BNI_DNT_502_100_Z001_3	2	6,20 65 24 01 30 04,C6,1	Set Attribute Single	15
Device Trust Level	BNI_IOL_DATAOUT2	BNI_DNT_502_100_Z001_3	3	6,20 65 24 02 30 04,C6,1	Set Attribute Single	15
DeviceNet Command	BNI_IOL_DATAOUT3	BNI_DNT_502_100_Z001_3	4	6,20 65 24 03 30 04,C6,1	Set Attribute Single	15
DeviceNet Device	BNI_IOL_SDone	BNI_DNT_502_100_Z001_3	5	6,20 64 24 00 30 08,C1,1	Set Attribute Single	1
DeviceNet Internal Device						
EtherNet/IP Command						
EtherNet/IP Device						
EtherNet/IP Internal Device						
Industrial Network						
PROFIBUS Device						
PROFINET Device						
PROFINET Internal Device						
Route						
Signal						
Signal Safe Level						
System Input						
System Output						

COMMAND EXAMPLE

- BNI_IOL_ACT:
- Activation of the IO-Link Ports
 - Device Selection
 - The 1. Download (Order)
 - Path from the EDS File
 - Set Attribute Single
 - Value 7 for 3 Ports (1 Bit per Port 'BBBB' – 1 / 2 / 4 / 8) (XXXX BBBB)

Name	Device	Download Order	Path	Service	Value
BNI_IOL_ACT	BNI_DNT_502_100_Z001_3	1	6,20 64 24 00 30 07,D1,1	Set Attribute Single	7

```

Aus der EDS
Param107 =
0,
6,"20 64 24 00 30 07",
0x0000,
0xD1,
1,
"IO-Link Port Enable",
"",
"New Help String",
0,0x0F,0,
,,,,
,,,,
;
Enum107 =
0,"IO-Link Channel 1 (Port 2.4)",
1,"IO-Link Channel 2 (Port 3.6)",
2,"IO-Link Channel 3 (Port 6.12)",
3,"IO-Link Channel 4 (Port 7.14)";
    
```

\$ IOL Port Enable
 \$ reserved, shall equal 0
\$ Link Path Size, Link Path
 \$ Descriptor
\$ Data Type
\$ Data Size in bytes
 \$ name
 \$ units
 \$ help string
 \$ min, max, default data values
 \$ mult, div, base, offset scaling
 \$ mult, div, base, offset links
 \$ decimal places

COMMAND EXAMPLE

- BNI_IOL_DATAOUT1:
- Output Data Size for 1st IO-Link Port
 - Device Selection
 - The 2. Download (Order)
 - Path from the EDS file
 - Set Attribute Single
 - Value 15 for Output 4 Byte
- BNI_IOL_DATAOUT2 and BNI_IOL_DATAOUT3 are configured similarly in the example.

Name	Device	Download Order	Path	Service	Value
BNI_IOL_ACT	BNI_DNT_502_100_Z001_3	1	6.20 64 24 00 30 07.D1.1	Set Attribute Single	7
BNI_IOL_DATAOUT1	BNI_DNT_502_100_Z001_3	2	6.20 65 24 01 30 04.C6.1	Set Attribute Single	15

Aus der EDS

```

Param304 =          $ CH1 Port Mode
0,                  $ reserved, shall equal 0
6,"20 65 24 01 30 04", $ Link Path Size, Link Path
0x0000,             $ Descriptor
0xC6,              $ Data Type
1,                  $ Data Size in bytes
"CH1 Port Mode",   $ name
" ",               $ units
"New Help String", $ help string
4,36,36,           $ min, max, default data values
,,,,              $ mult, div, base, offset scaling
,,,,              $ mult, div, base, offset link
0;                $ decimal places

Enum304 =
4,"Input 1 [byte]",
5,"Input 2 [bytes]",
6,"Input 4 [bytes]",
7,"Input 6 [bytes]",
8,"Input 8 [bytes]",
9,"Input 10 [bytes]",
10,"Input 16 [bytes]",
11,"Input 24 [bytes]",
12,"Input 32 [bytes]",
13,"Output 1 [byte]",
14,"Output 2 [bytes]",
15,"Output 4 [bytes]",
16,"Output 6 [bytes]",
17,"Output 8 [bytes]",
    
```

```

18,"Output 10 [bytes]",
19,"Output 16 [bytes]",
20,"Output 24 [bytes]",
21,"Output 32 [bytes]",
22,"In/Out 1/1 [byte]",
23,"In/Out 2/2 [bytes]",
24,"In/Out 2/4 [bytes]",
25,"In/Out 4/4 [bytes]",
26,"In/Out 4/2 [bytes]",
27,"In/Out 2/8 [bytes]",
28,"In/Out 4/8 [bytes]",
29,"In/Out 8/2 [bytes]",
30,"In/Out 8/4 [bytes]",
31,"In/Out 8/8 [bytes]",
32,"In/Out 4/32 [bytes]",
33,"In/Out 32/4 [bytes]",
34,"In/Out 16/16 [bytes]",
35,"In/Out 24/24 [bytes]",
36,"In/Out 32/32 [bytes]";
    
```

COMMAND EXAMPLE

- BNI_IOL_SDone:
- Setting of the 'SettingsDone' Flag
 - Device Selection
 - The 5. Download (Order)
 - Path from the EDS file
 - Set Attribute Single
 - Value 1 for True
- **This flag induces a BNI module restart and with it the parameters are commissioned / put into use.**
- **As a consequence the I/O Message Size also changes !**

Name	Device	Download Order	Path	Service	Value
BNI_IOL_ACT	BNI_DNT_502_100_Z001_3	1	6,20 64 24 00 30 07,D1,1	Set Attribute Single	7
BNI_IOL_DATAOUT1	BNI_DNT_502_100_Z001_3	2	6,20 65 24 01 30 04,C6,1	Set Attribute Single	15
BNI_IOL_DATAOUT2	BNI_DNT_502_100_Z001_3	3	6,20 65 24 02 30 04,C6,1	Set Attribute Single	15
BNI_IOL_DATAOUT3	BNI_DNT_502_100_Z001_3	4	6,20 65 24 03 30 04,C6,1	Set Attribute Single	15
BNI_IOL_SDone	BNI_DNT_502_100_Z001_3	5	6,20 64 24 00 30 08,C1,1	Set Attribute Single	1

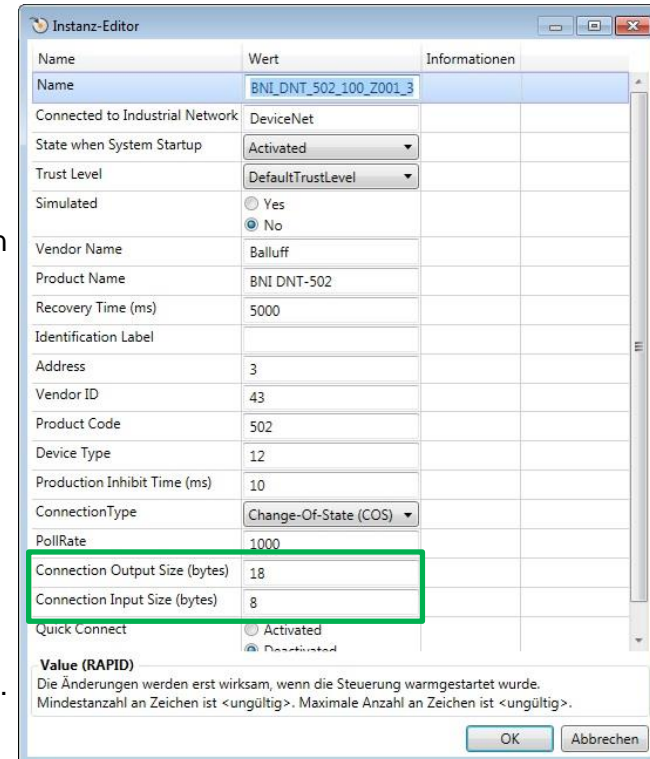
```

Aus der EDS
Param108 =
0,
6,"20 64 24 00 30 08",
0x0000,
0xC1,
1,
"Settings Done",
"",
"New Help String",
0,1,0,
,,,,
,,,,
;
Enum108 =
0,"False",
1,"True";
    
```

\$ Settings Done
 \$ reserved, shall equal 0
\$ Link Path Size, Link Path
 \$ Descriptor
\$ Data Type
\$ Data Size in bytes
 \$ name
 \$ units
 \$ help string
 \$ min, max, default values
 \$ mult, div, base, offset scaling
 \$ mult, div, base, offset links

NOTES

- Through the 'SettingsDone' Flag a restart of the BNI Module will be triggered.
- **Case 1:** In the Instance-Editor a value of -1 for the connection size is entered.
Then the commands will be sent again directly, once the communication is established.
This results in a new start etc.....
- **Case 2:** In Instance-Editor the values of the connection size are entered (not -1)
Then the communication cannot be established, since the I/O Message Size between the Master and the Slave are not in agreement.
- **Solution:**
Generate two EIO.cfg files.
The 1. would be used for the configuration of the BNI and would contain the commands
The 2. would contain the configuration for the serial operation, without commands.



EXCERPT FROM THE EIO.CFG

- An excerpt from the EIO.cfg file shows the entered commands.

```
EIO:CFG_1.0:6:1::
#
INDUSTRIAL_NETWORK:
-Name "DeviceNet" -Label "DeviceNet Master/Slave Network" -Address "2"
#
EIO_DEVICE_TRUSTLEVEL:
-Name "NoDeactivate" -DenyDeactivate -ActionWhenLost "Stop"
-Name "EnergyTrustLevel" -EnergySavingActive -ReportWhenLost "None"
-ReportWhenReconnected "None"
#
DEVICENET_DEVICE:
-Name "D651_14" -Simulated -VendorName "ABB Robotics"
-ProductName "D-651" -Label "DeviceNet Auto Configuration" -Address 16
-ProductCode 25 -DeviceType 100 -OutputSize 5 -InputSize 1

-Name "BNI_DNT_502_100_Z001_3" -VendorName "Balluff"
-ProductName "BNI DNT-502" -Address 3 -VendorId 43 -ProductCode 502
-DeviceType 12 -ConnectionType "COS" -OutputSize 18 -InputSize 8
#
DEVICENET_DEVICE_TEMPLATE:
-Name "d378A" -VendorName "ABB Robotics" -ProductName "CCLink Adapter"
-Label "DSQC 378A CCLink Adapter" -ProductCode 17 -DeviceType 7
-PollRate 50 -OutputSize -1 -InputSize -1

-Name "d377A" -VendorName "ABB Robotics" -ProductName "Qtracker"
-ProductCode 16 -DeviceType 100 -PollRate 20 -OutputSize 6 -InputSize 19
#
DEVICENET_COMMAND:
-Name "BNI_IOL_ACT" -Device "BNI_DNT_502_100_Z001_3" -OrderNr 1\
-Path "6,20 64 24 00 30 07,D1,1" -Value "7"

-Name "BNI_IOL_DATAOUT1" -Device "BNI_DNT_502_100_Z001_3" -OrderNr 2\
-Path "6,20 65 24 01 30 04,C6,1" -Value "15"

-Name "BNI_IOL_DATAOUT2" -Device "BNI_DNT_502_100_Z001_3" -OrderNr 3\
-Path "6,20 65 24 02 30 04,C6,1" -Value "15"

-Name "BNI_IOL_DATAOUT3" -Device "BNI_DNT_502_100_Z001_3" -OrderNr 4\
-Path "6,20 65 24 03 30 04,C6,1" -Value "15"

-Name "BNI_IOL_SDone" -Device "BNI_DNT_502_100_Z001_3" -OrderNr 5\
-Path "6,20 64 24 00 30 08,C1,1" -Value "1"
```

LINKS

- More information and files can be found on the Websites of Balluff and ABB.
- **Balluff – DeviceNet :**
- <http://www.balluff.com/balluff/MDE/de/produkte/selector-bni.jsp#/BNI?Interface=Devicenet>
- **ABB - RobotStudio:**
- <http://new.abb.com/products/robotics/de/robotstudio/downloads>