CONTROL TECHNOLOGY
FROM PARKER

C3 I22T11

Application Note

Connecting Compax3 I22T11 and Allen Bradley / Rockwell PLCs via DeviceNet

C3I22_A1010_eng

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Contents

1. General

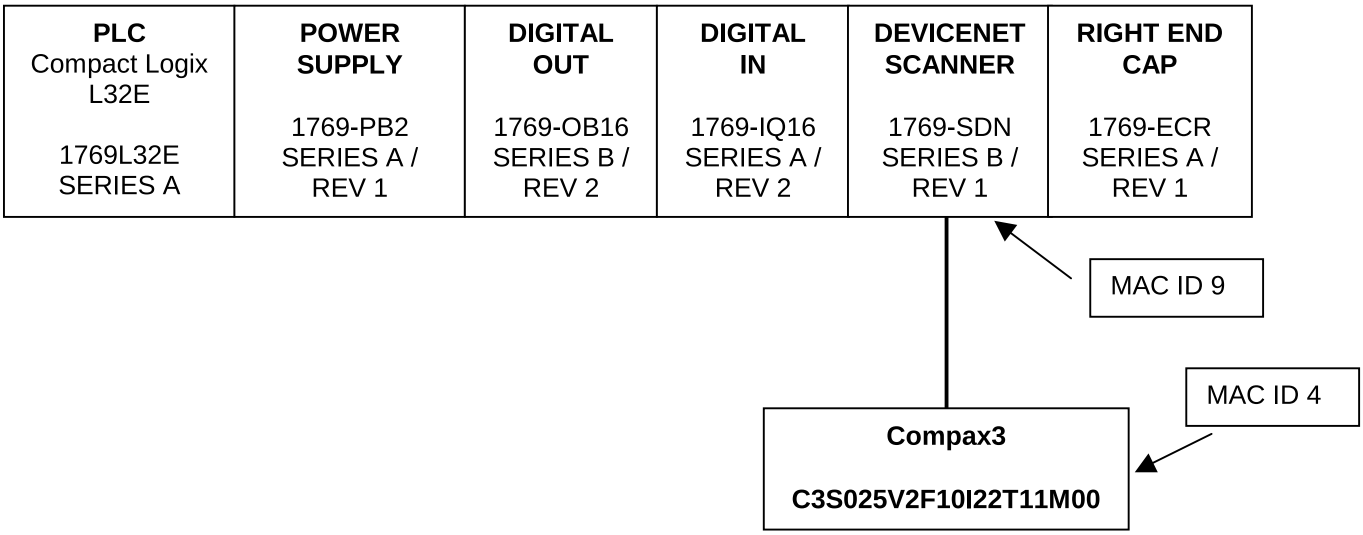
This document describes how to connect Compax3 I22T11 devices to Rockwell (Allen Bradley) PLCs via DeviceNet by the following steps:

- How to setup the Compax3 DeviceNet configuration
- How to setup the DeviceNet scanner
- How to control the axis via a tiny PLC program example written in Structured Text (ST)

It is assumed that the user has basic knowledge of Rockwell software tools and PLCs.

2. System overview

2.1. Hardware overview



PLC	POWER SUPPLY	DIGITAL OUT	DIGITAL IN	DEVICENET SCANNER	RIGHT END CAP
Compact Logix L32E 1769L32E SERIES A	1769-PB2 SERIES A / REV 1	1769-OB16 SERIES B / REV 2	1769-IQ16 SERIES A / REV 2	1769-SDN SERIES B / REV 1	1769-ECR SERIES A / REV 1

Figure 1: hardware overview

The bus speed in this application example is 125 kBaud/sec.

2.2. Software overview

The following software packages were used:

• Compax3 ServoManager V2.0.2.2	→ Compax3 configuration
• RSLogix 5000 with Structured Text (ST) externsion V13.03.00	→ PLC configuration and programming
• RSNetWorx for DeviceNet V6.00.00	→ DeviceNet network configuration

3. DeviceNet configuration of Compax3

3.1. Defining the process data

The first step is to determine the process data to be exchanged between the PLC and Compax3.

This application example uses 8 bytes of bidirectional process data that is defined as follows:

- PLC → Compax3

Signal	Data size
Controlword	16 Bit (2 bytes)
Operation Mode	16 Bit (2 bytes)
Target position	32 Bit (4 bytes)

- Compax3 → PLC

Signal	Data size
Statusword	16 Bit (2 bytes)
Last device error	16 Bit (2 bytes)
Actual position	32 Bit (4 bytes)

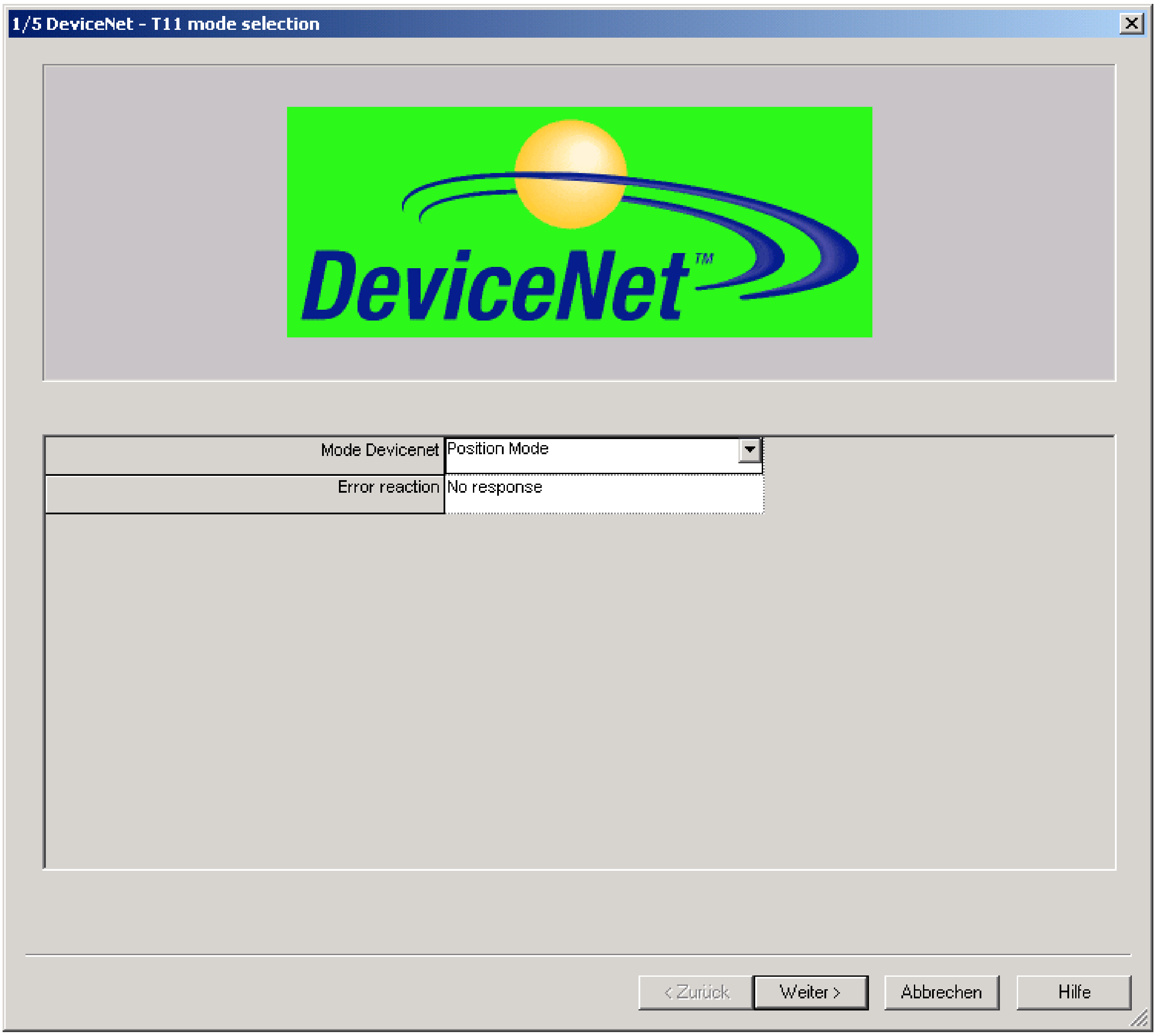
⚠

Due to the fact the process image of Rockwell PLCs is arranged in arrays of 32 Bit integer values (DINT) it is recommended to take special care of the byte alignment.
32 Bit values (e.g. Target position) should not overlap two array elements because this would make them difficult to handle.
In the example above the first element of the process data array is covered by the controlword and the operation mode. The second element is entirely covered by the target position.

3.2. Configuration

The following screenshots show how to configure Compax3 via the DeviceNet wizard.

3.2.1. Default Operation mode and error behavior

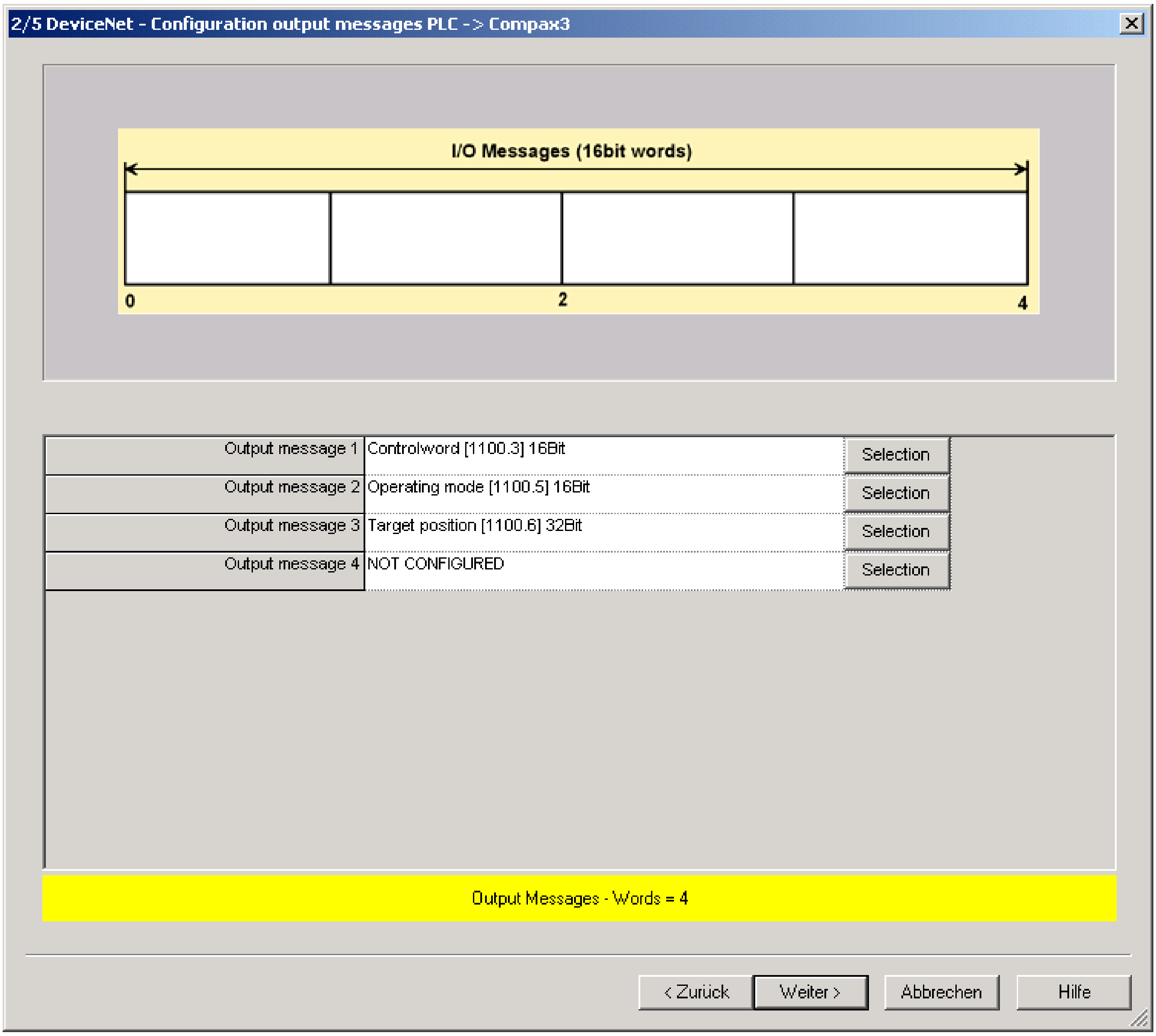


1/5 DeviceNet - T11 mode selection

Mode Devicenet: Position Mode

Error reaction: No response

3.2.2. Output messages (PLC → Compax3)

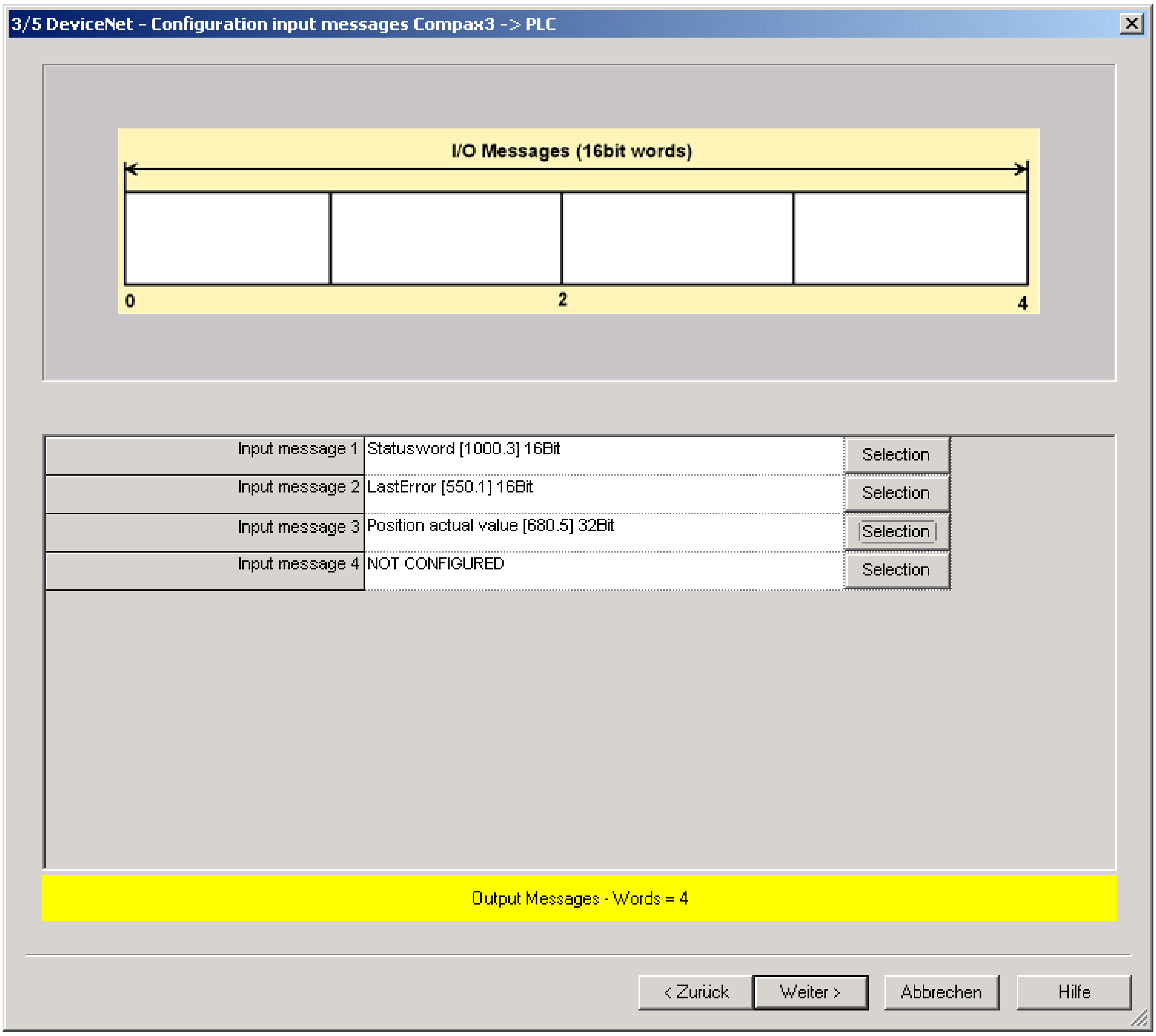


2/5 DeviceNet - Configuration output messages PLC -> Compax3

Output message 1	Controlword [1100.3] 16Bit	Selection
Output message 2	Operating mode [1100.5] 16Bit	Selection
Output message 3	Target position [1100.6] 32Bit	Selection
Output message 4	NOT CONFIGURED	Selection

Output Messages - Words = 4

3.2.3. Input messages (Compax3 → PLC)

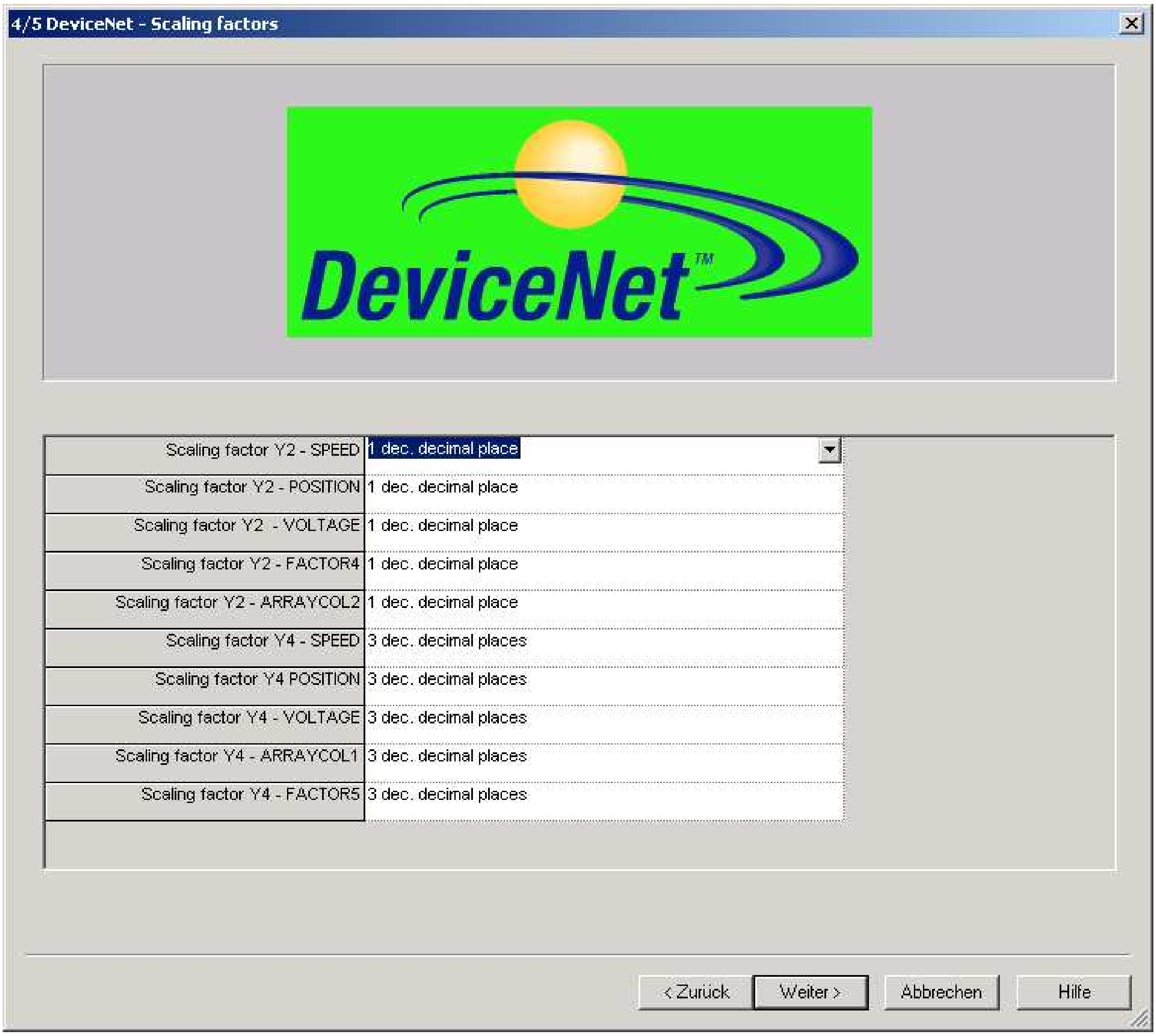


3/5 DeviceNet - Configuration input messages Compax3 -> PLC

Input message 1	Statusword [1000.3] 16Bit	Selection
Input message 2	LastError [550.1] 16Bit	Selection
Input message 3	Position actual value [680.5] 32Bit	Selection
Input message 4	NOT CONFIGURED	Selection

Output Messages - Words = 4

3.2.4. Scaling factors



4/5 DeviceNet - Scaling factors

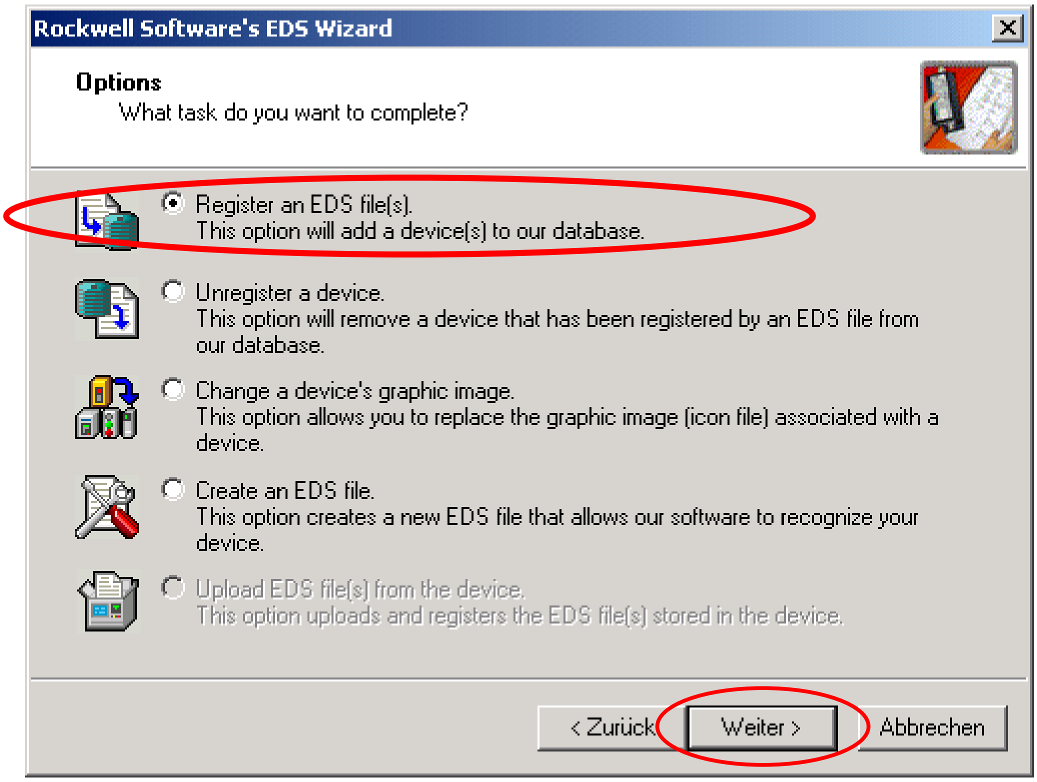
Scaling factor Y2 - SPEED	1 dec. decimal place
Scaling factor Y2 - POSITION	1 dec. decimal place
Scaling factor Y2 - VOLTAGE	1 dec. decimal place
Scaling factor Y2 - FACTOR4	1 dec. decimal place
Scaling factor Y2 - ARRAYCOL2	1 dec. decimal place
Scaling factor Y4 - SPEED	3 dec. decimal places
Scaling factor Y4 POSITION	3 dec. decimal places
Scaling factor Y4 - VOLTAGE	3 dec. decimal places
Scaling factor Y4 - ARRAYCOL1	3 dec. decimal places
Scaling factor Y4 - FACTOR5	3 dec. decimal places

4. Setting up the DeviceNet scanner

A working RSLinx communication path is required !

4.1. Adding the Compax3 EDS file to RSNetWorx

In order to use Compax3 with RSNetWorx the Compax3 EDS (electronic data sheet) has to be included to the library pool by using the EDS wizard.



Rockwell Software's EDS Wizard

Options
What task do you want to complete?

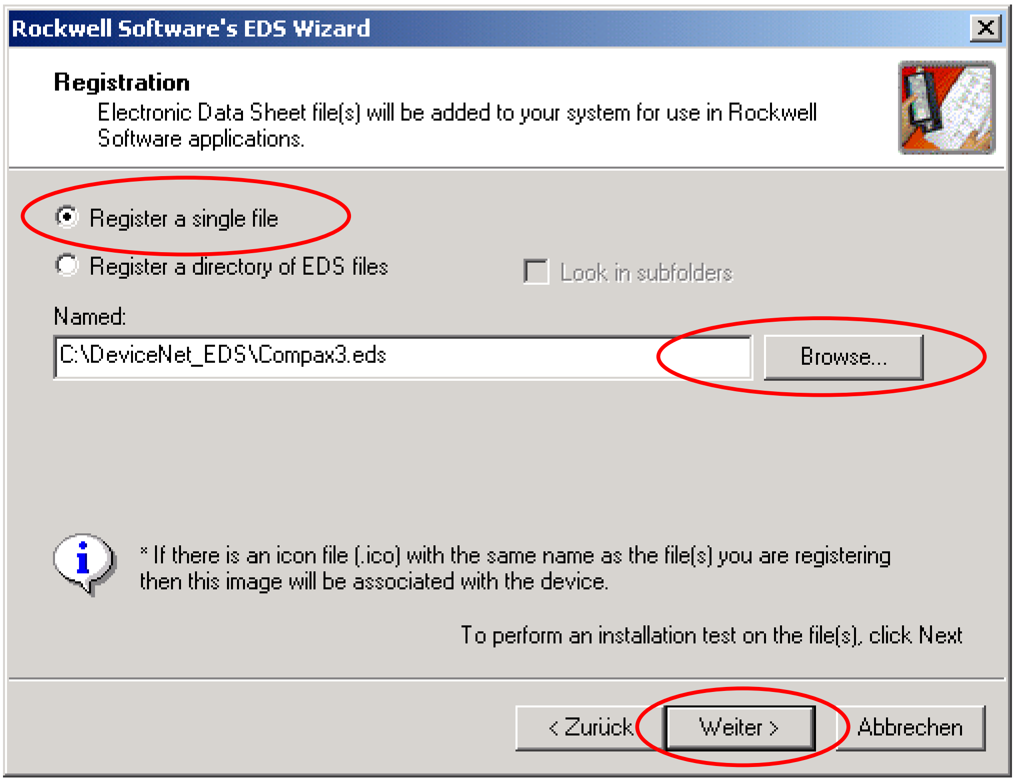
● Register an EDS file(s).
This option will add a device(s) to our database.

○ Unregister a device.
This option will remove a device that has been registered by an EDS file from our database.

○ Change a device's graphic image.
This option allows you to replace the graphic image (icon file) associated with a device.

○ Create an EDS file.
This option creates a new EDS file that allows our software to recognize your device.

○ Upload EDS file(s) from the device.
This option uploads and registers the EDS file(s) stored in the device.



Rockwell Software's EDS Wizard

Registration

Electronic Data Sheet file(s) will be added to your system for use in Rockwell Software applications.

● Register a single file

○ Register a directory of EDS files

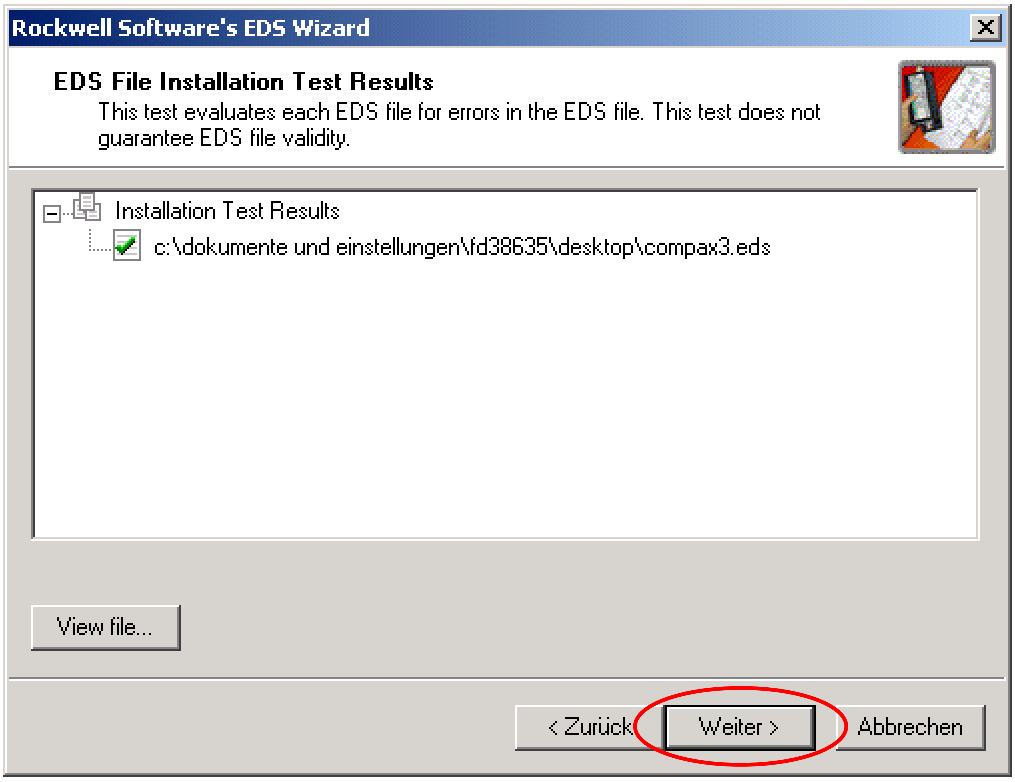
□ Look in subfolders

Named:

C:\DeviceNet_EDS\Compax3.eds

* If there is an icon file (.ico) with the same name as the file(s) you are registering then this image will be associated with the device.

To perform an installation test on the file(s), click Next



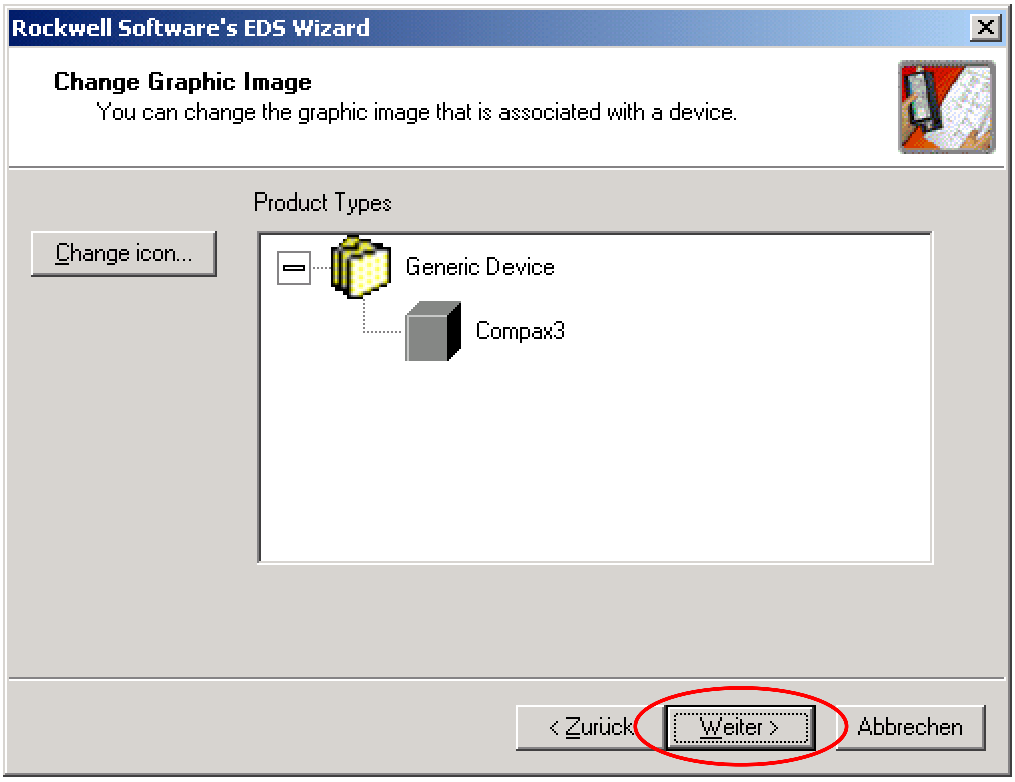
Rockwell Software's EDS Wizard

EDS File Installation Test Results

This test evaluates each EDS file for errors in the EDS file. This test does not guarantee EDS file validity.

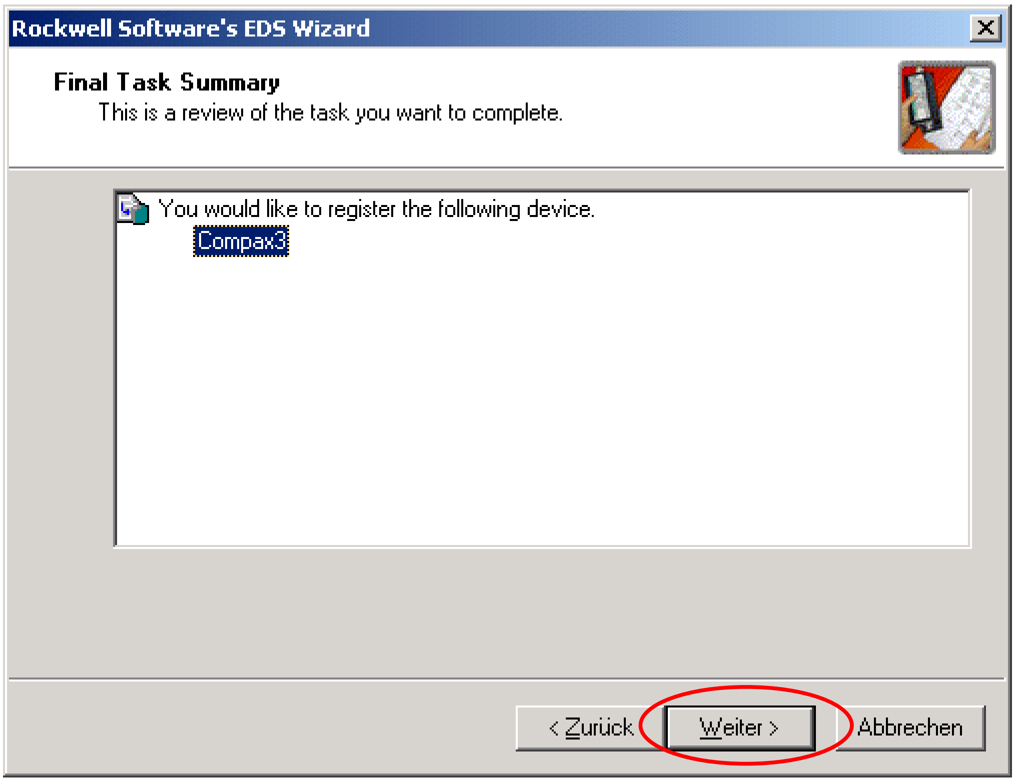
Installation Test Results

☑ c:\dokumente und einstellungen\fd38635\desktop\compax3.eds



Change Graphic Image

You can change the graphic image that is associated with a device.



Final Task Summary

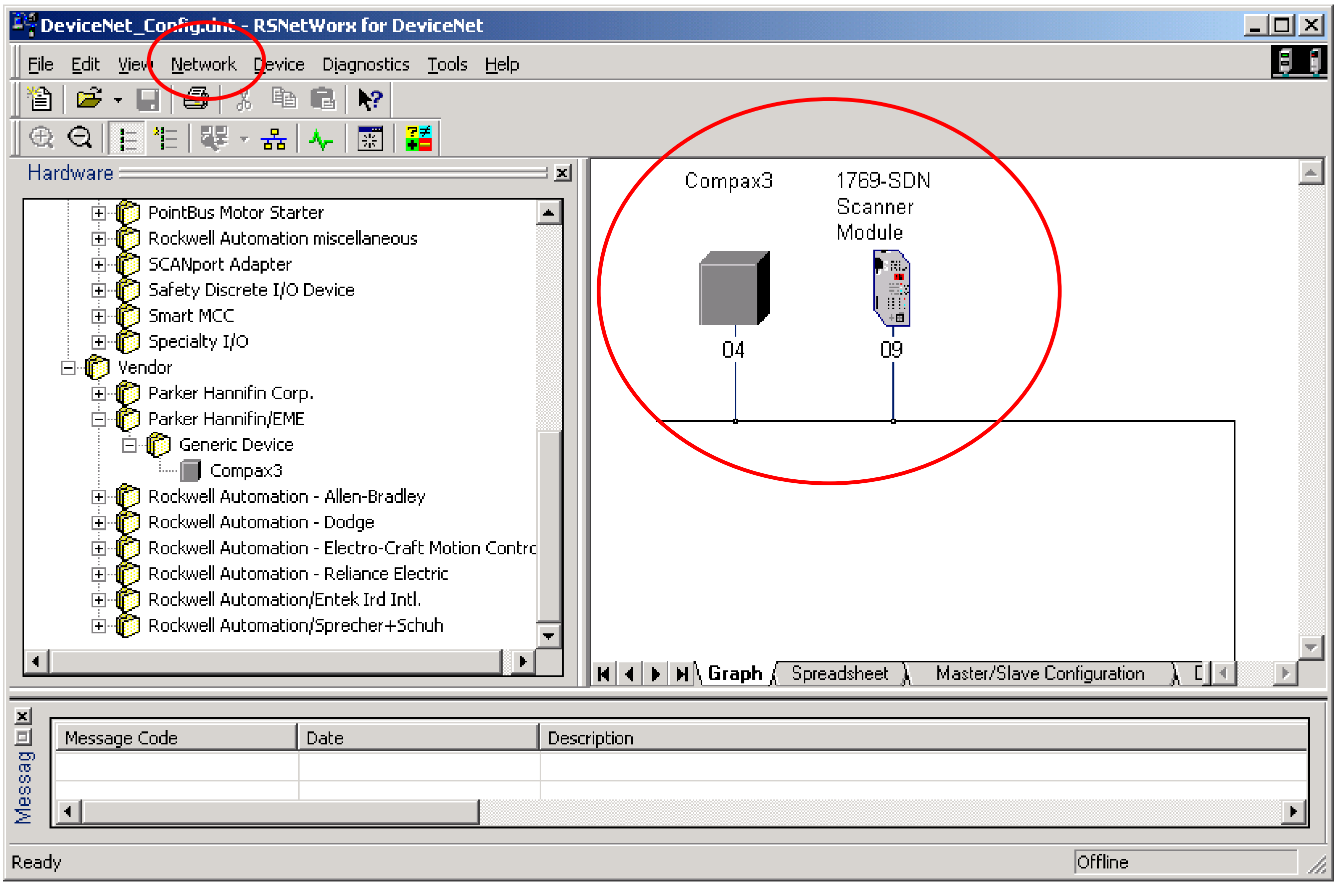
This is a review of the task you want to complete.

You would like to register the following device.

Compax3

4.2. Network configuration

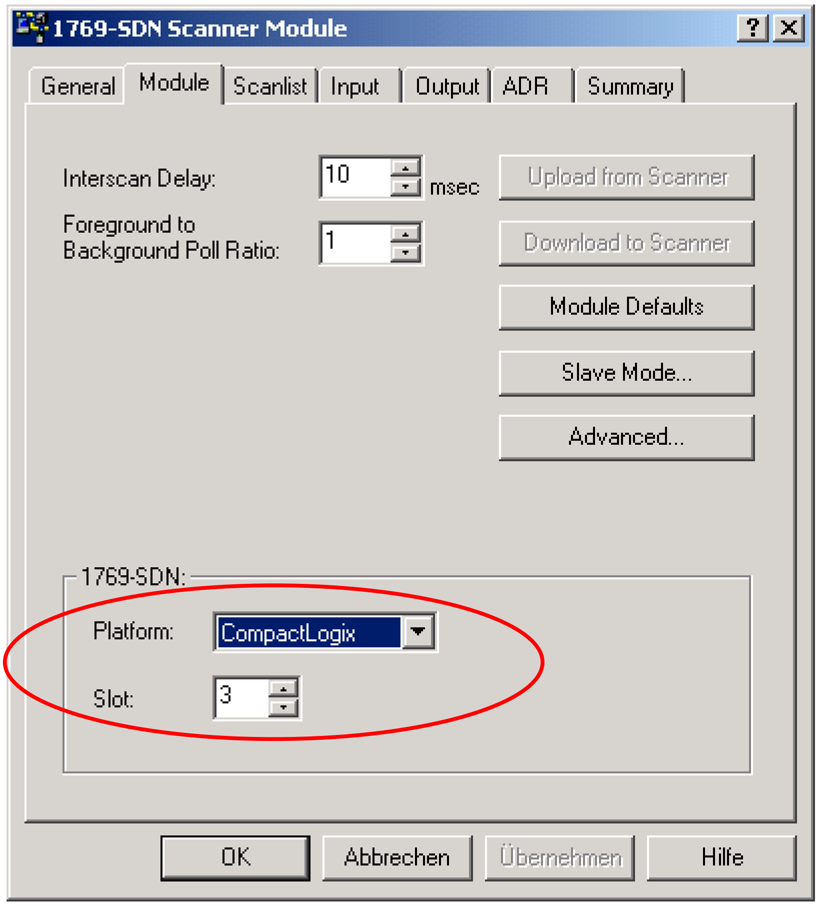
The easiest way to configure the network is to perform an online identification
(Menu Network -> Online).
As a result the devices found on the network should be showing up in the Graph window.


DeviceNet_Config.dnt - RSNetWorx for DeviceNet
File Edit View Network Device Diagnostics Tools Help
Hardware
PointBus Motor Starter
Rockwell Automation miscellaneous
SCANport Adapter
Safety Discrete I/O Device
Smart MCC
Specialty I/O
Vendor
Parker Hannifin Corp.
Parker Hannifin/EME
Generic Device
Compax3
Rockwell Automation - Allen-Bradley
Rockwell Automation - Dodge
Rockwell Automation - Electro-Craft Motion Contrc
Rockwell Automation - Reliance Electric
Rockwell Automation/Entek Ird Intl.
Rockwell Automation/Sprecher+Schuh
Compax3
1769-SDN Scanner Module
04
09
Graph
Spreadsheet
Master/Slave Configuration
Message Code
Date
Description
Messag
Ready
Offline

4.3. Scanner setup

By clicking the Scanner icon in the Graph window the Scanner properties dialog shows up.

Choose the Module tab and make sure the Platform and Slot settings correspond to your hardware configuration.



1769-SDN Scanner Module

Interscan Delay: 10 msec

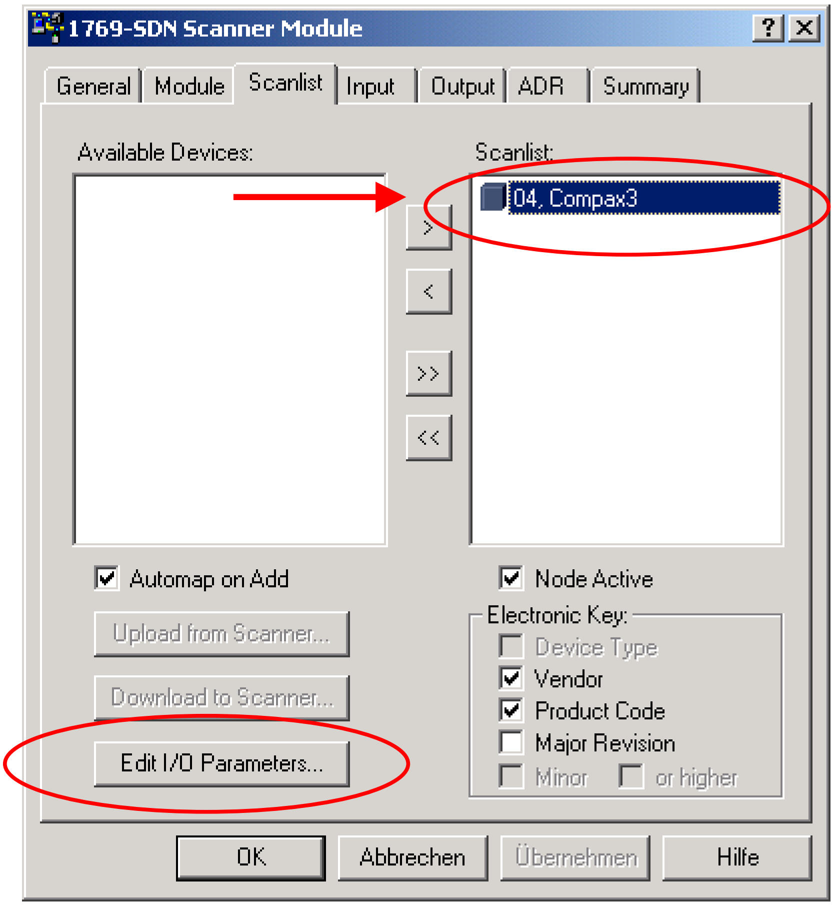
Foreground to Background Poll Ratio: 1

1769-SDN:

Platform: CompactLogix

Slot: 3

Choose the Scanlist tab and move the Compax3 device from Available Devices to the Scanlist and click on the Edit I/O Parameters button.


1769-SDN Scanner Module

General | Module | Scanlist | Input | Output | ADR | Summary

Available Devices:

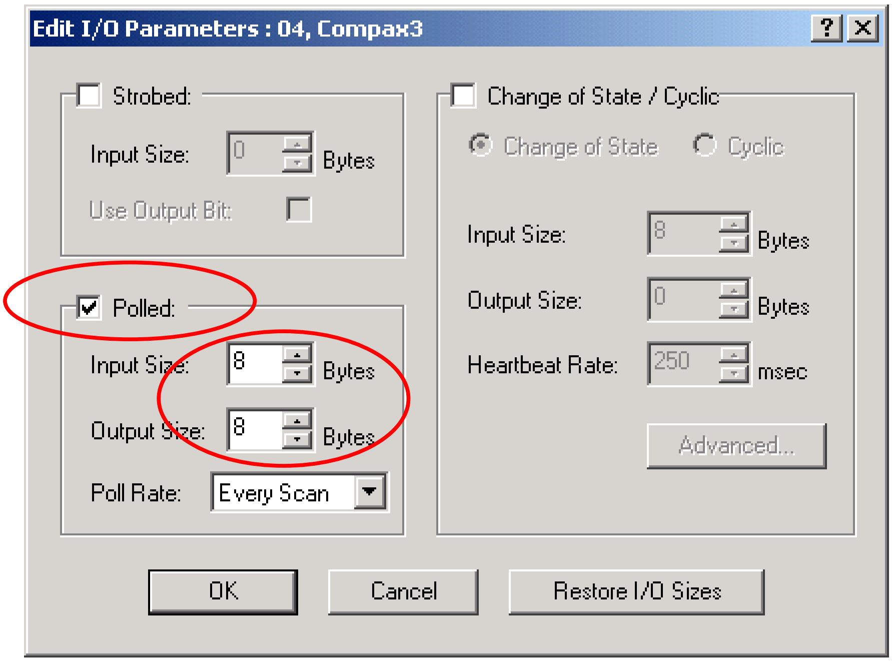
Scanlist:
04, Compax3

☑ Automap on Add

☑ Node Active

Electronic Key:
☐ Device Type
☑ Vendor
☑ Product Code
☐ Major Revision
☐ Minor ☐ or higher

In the I/O Parameters dialog the transmission mode for the process data has to be selected (this example uses Polled I/O data).
Afterwards it has to be made sure the Input and Output size of the polled data equals the process data that has been configured in the Compax3 DeviceNet wizard!



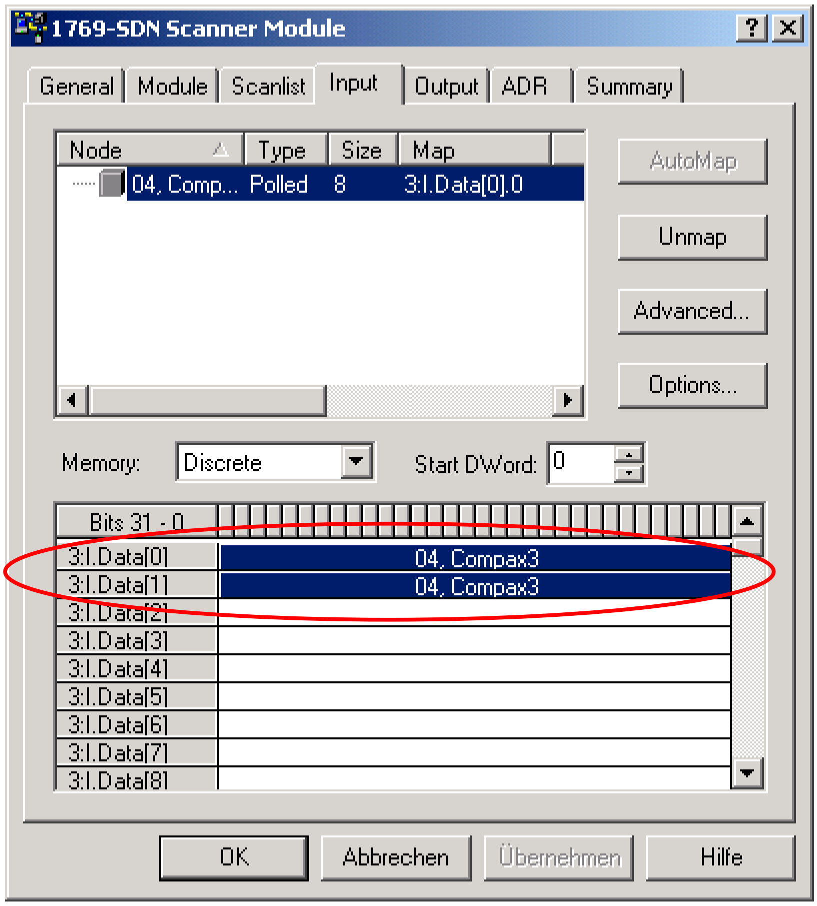
Edit I/O Parameters : 04, Compax3

□ Strobed:
Input Size: 0 Bytes
Use Output Bit: □

☑ Polled:
Input Size: 8 Bytes
Output Size: 8 Bytes
Poll Rate: Every Scan

□ Change of State / Cyclic
● Change of State ○ Cyclic
Input Size: 8 Bytes
Output Size: 0 Bytes
Heartbeat Rate: 250 msec

Finally the location of the Compax3 process data within the process image of the PLC has to be defined (Input and Output tab).



1769-SDN Scanner Module

Node	Type	Size	Map
04, Comp...	Polled	8	3:I.Data[0].0

Memory: Discrete

Start DWord: 0

Bits 31 - 0	
3:I.Data[0]	04, Compax3
3:I.Data[1]	04, Compax3
3:I.Data[2]	
3:I.Data[3]	
3:I.Data[4]	
3:I.Data[5]	
3:I.Data[6]	
3:I.Data[7]	
3:I.Data[8]	

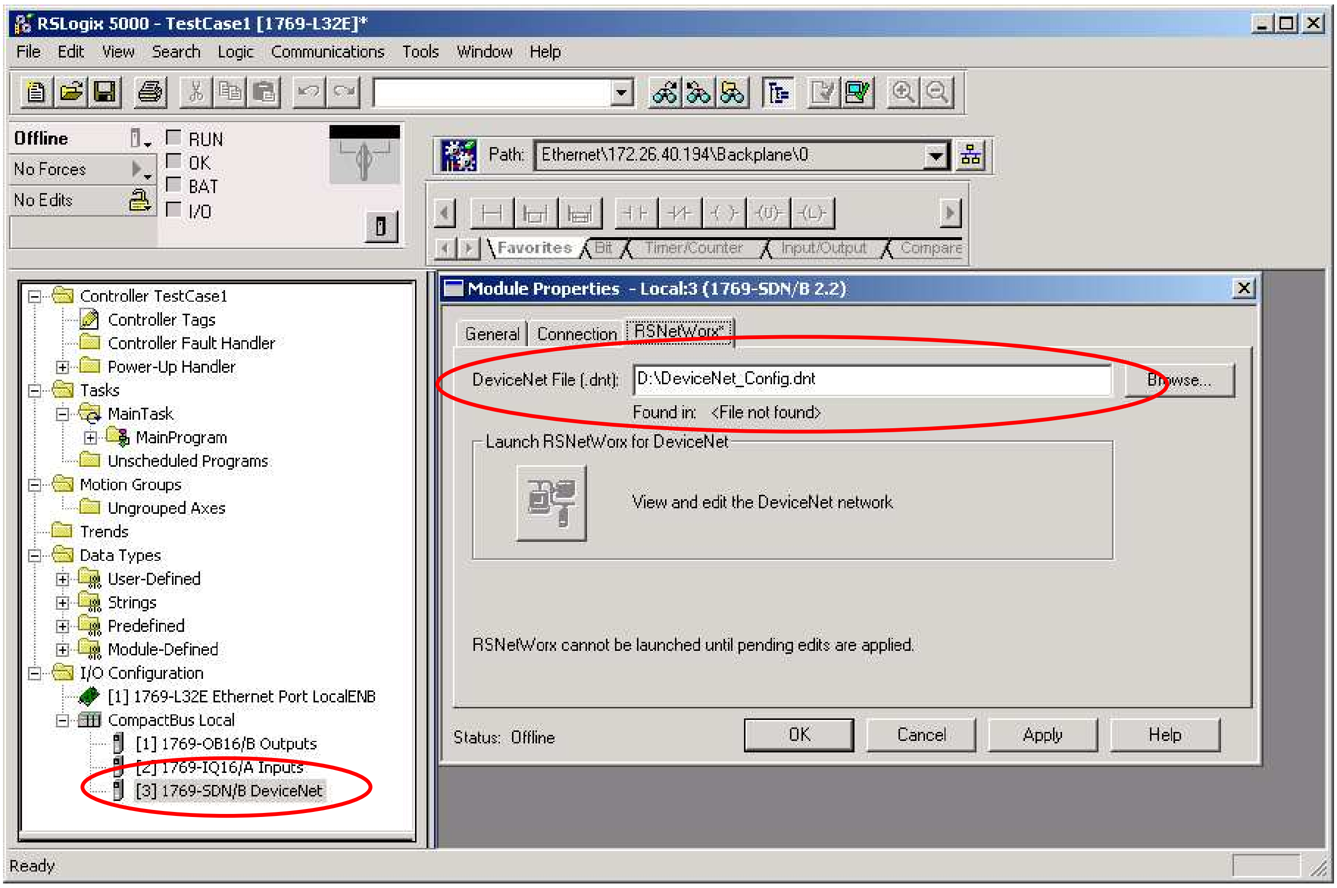
In this example the Input and Output data is located in the first two elements of the input and output process data array (Data[0] and Data[1]).

The RSNetworx configuration is now finished and should be saved to a file that will be included into the RSLogix project later on.

5. RSLogix configuration and application example

5.1. Including the RSNetworx configuration file into the RSLogix project.

Select the DeviceNet scanner from the local CompactBus and select the RSNetworx configuration file.



Path: Ethernet\172.26.40.194\Backplane\0

DeviceNet File (.dnt): D:\DeviceNet_Config.dnt

Found in: <File not found>

View and edit the DeviceNet network

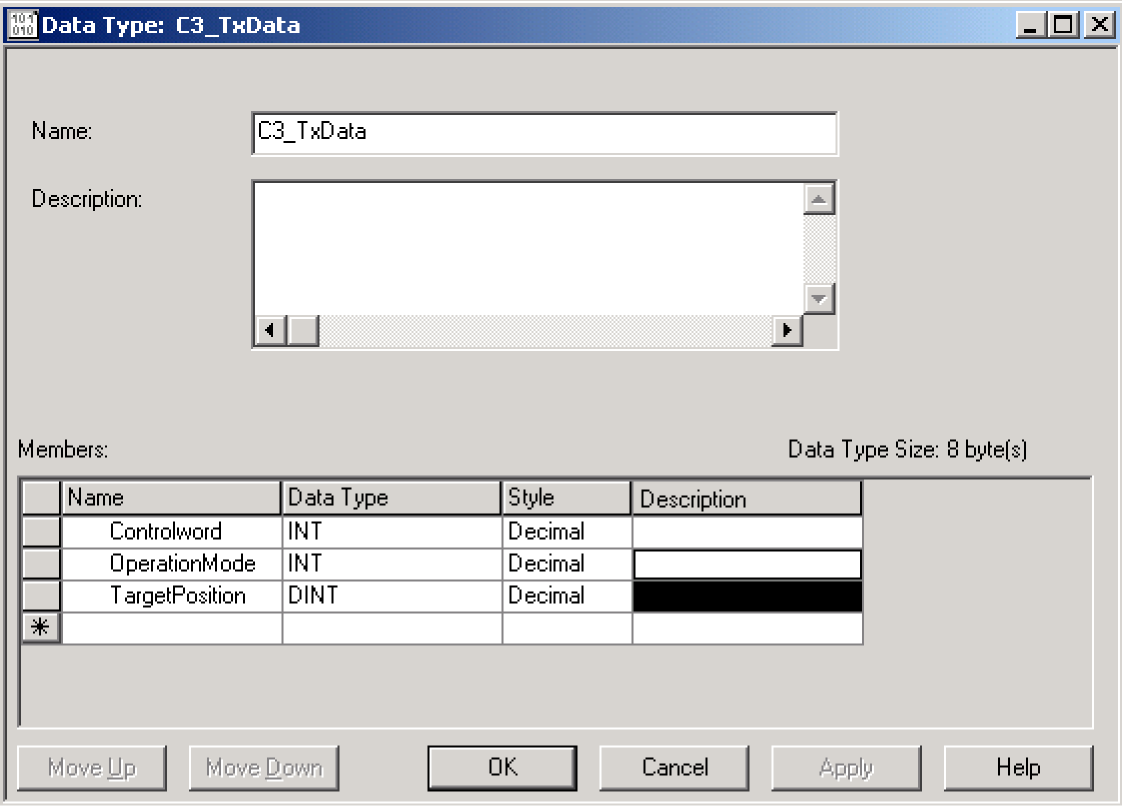
RSNetWorx cannot be launched until pending edits are applied.

Status: Offline

5.2. Creating User-Defined data types for easy handling of the Compax3 process data

The elements of the data structures to be defined must match the definition of the process data made in chapter 3.1 !

a.) add a new User-Defined data type called C3_TxData which encapsulates the data transferred from the PLC to Compax3.



Name: C3_TxData

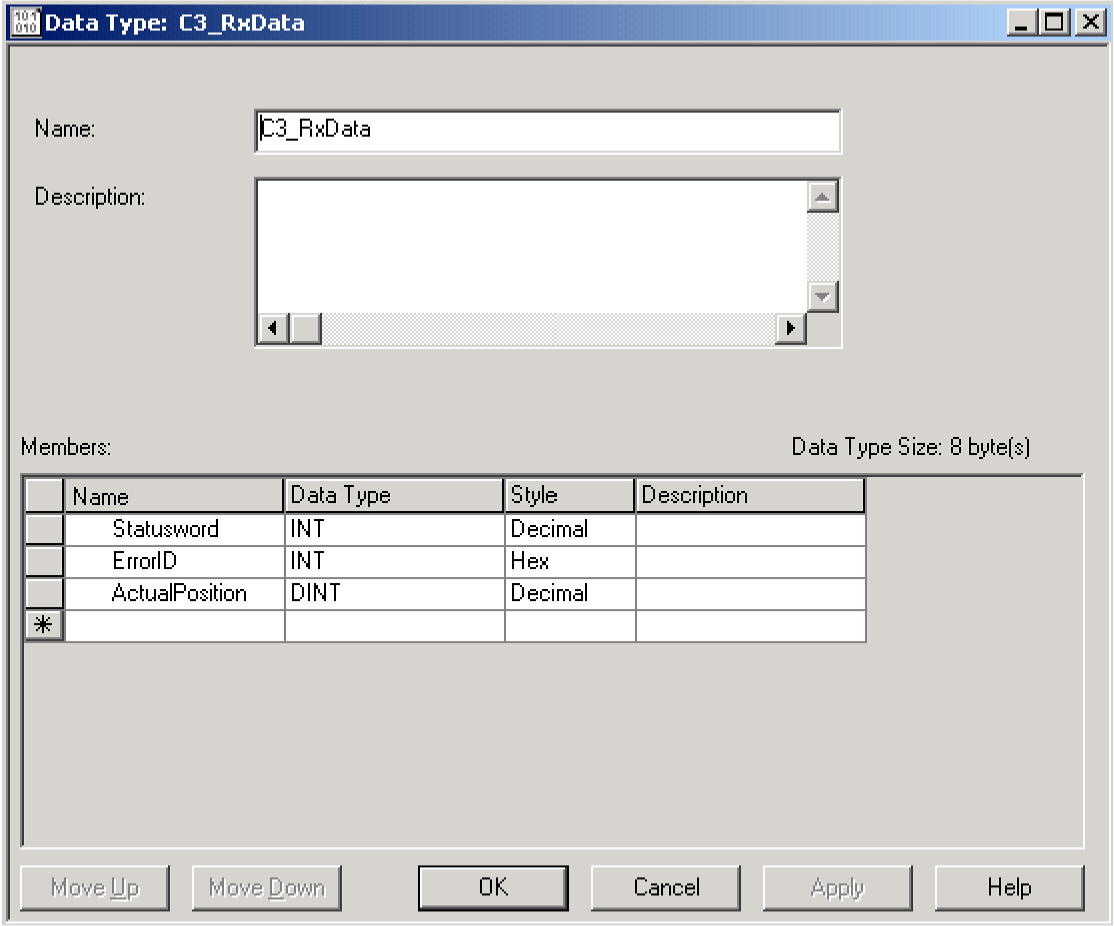
Description:

Members:

Data Type Size: 8 byte(s)

Name	Data Type	Style	Description
Controlword	INT	Decimal	
OperationMode	INT	Decimal	
TargetPosition	DINT	Decimal	

b.) add a new User-Defined data type called C3_RxData which encapsulates the data transferred from Compax3 to the PLC.



Name: C3_RxData

Description:

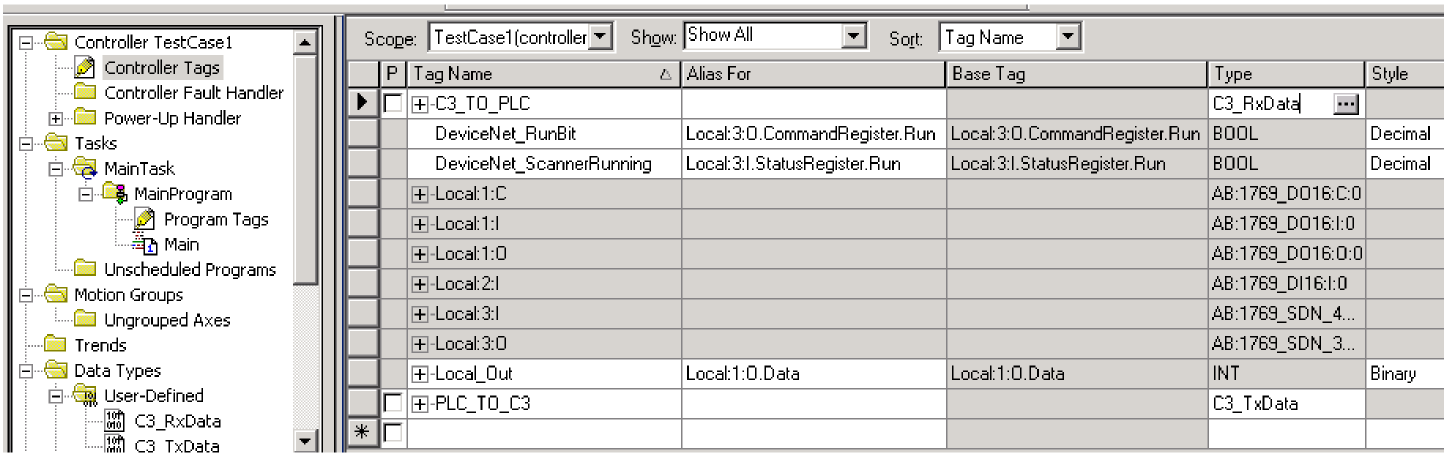
Members: Data Type Size: 8 byte(s)

Name	Data Type	Style	Description
Statusword	INT	Decimal	
ErrorID	INT	Hex	
ActualPosition	DINT	Decimal	

5.3. Creating the required Controller Tags

Open the Controller Tags window to create new Tags of the type C3_RxData and C3_TxData.

Additionally a Tag called DeviceNet_RunBit and a Tag called DeviceNet_ScannerRunning should be created to have control of the scanner from within the PLC program.



Scope: TestCase1(controller Show: Show All Sort: Tag Name

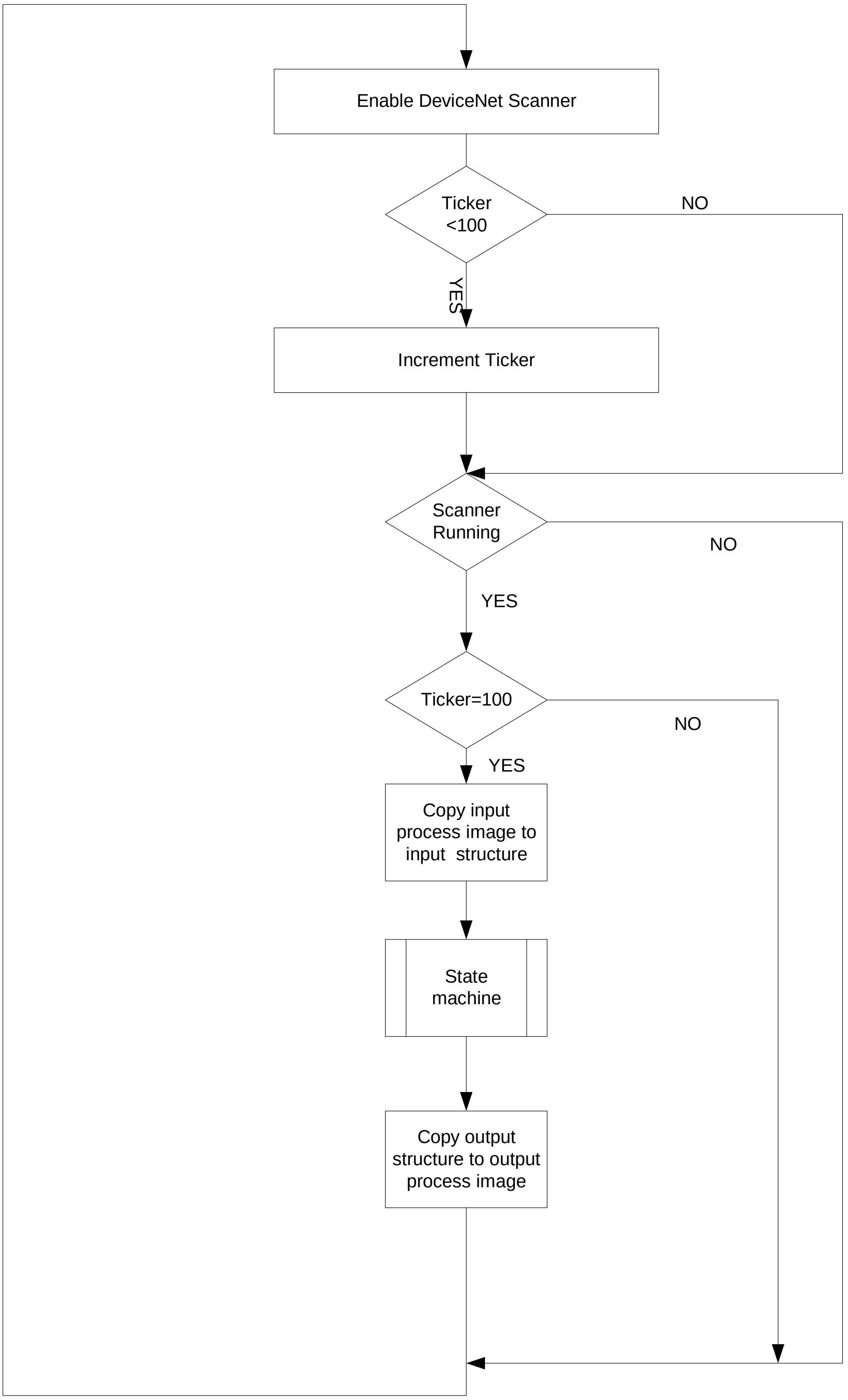
P	Tag Name	Alias For	Base Tag	Type	Style
□	⊞-C3_TO_PLC			C3_RxData	
	DeviceNet_RunBit	Local:3:O.CommandRegister.Run	Local:3:O.CommandRegister.Run	BOOL	Decimal
	DeviceNet_ScannerRunning	Local:3:I.StatusRegister.Run	Local:3:I.StatusRegister.Run	BOOL	Decimal
	⊞-Local:1:C			AB:1769_DO16:C:0	
	⊞-Local:1:I			AB:1769_DO16:I:0	
	⊞-Local:1:O			AB:1769_DO16:O:0	
	⊞-Local:2:I			AB:1769_DI16:I:0	
	⊞-Local:3:I			AB:1769_SDN_4...	
	⊞-Local:3:O			AB:1769_SDN_3...	
	⊞-Local_Out	Local:1:O.Data	Local:1:O.Data	INT	Binary
□	⊞-PLC_TO_C3			C3_TxData	
□					

5.4. Example program

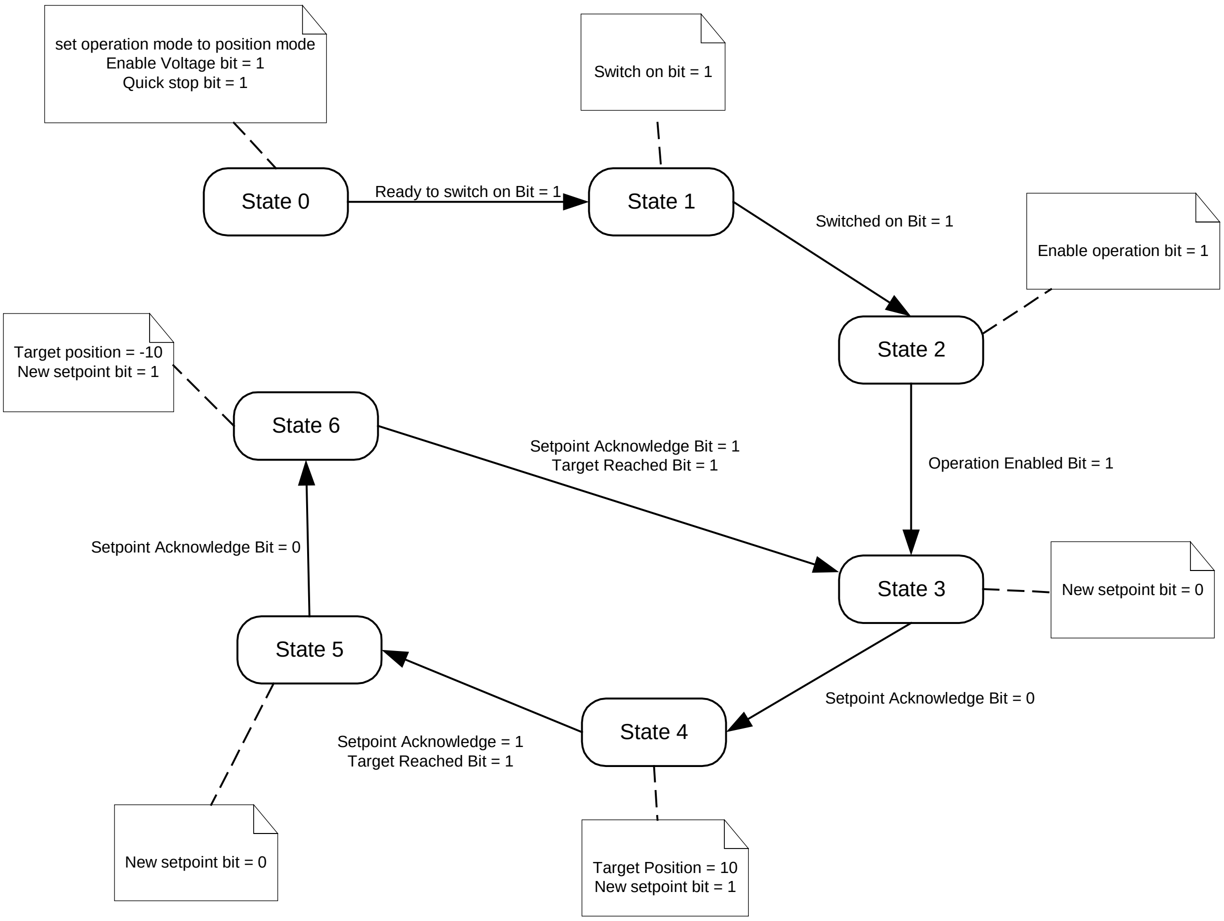
The following program explains how to handle the process data and shows how to enable the drive and move cyclical between two target positions.

In order to understand the program it is necessary to understand the principles of the I22T11 state machine and the handling of the controlword and statusword.

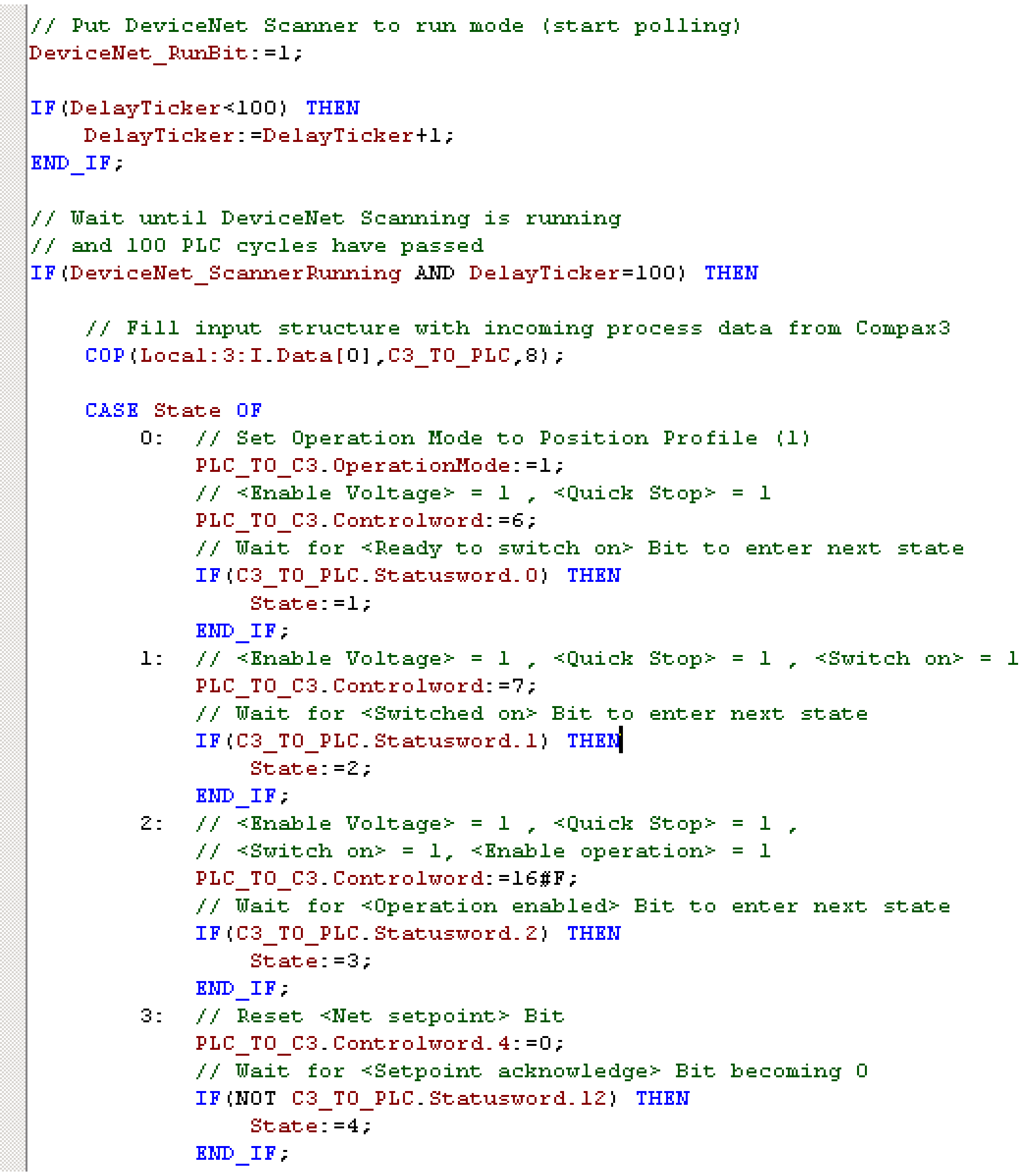
5.4.1. Flow chart



5.4.2. State diagram of state machine sub module



5.4.3. Application source code



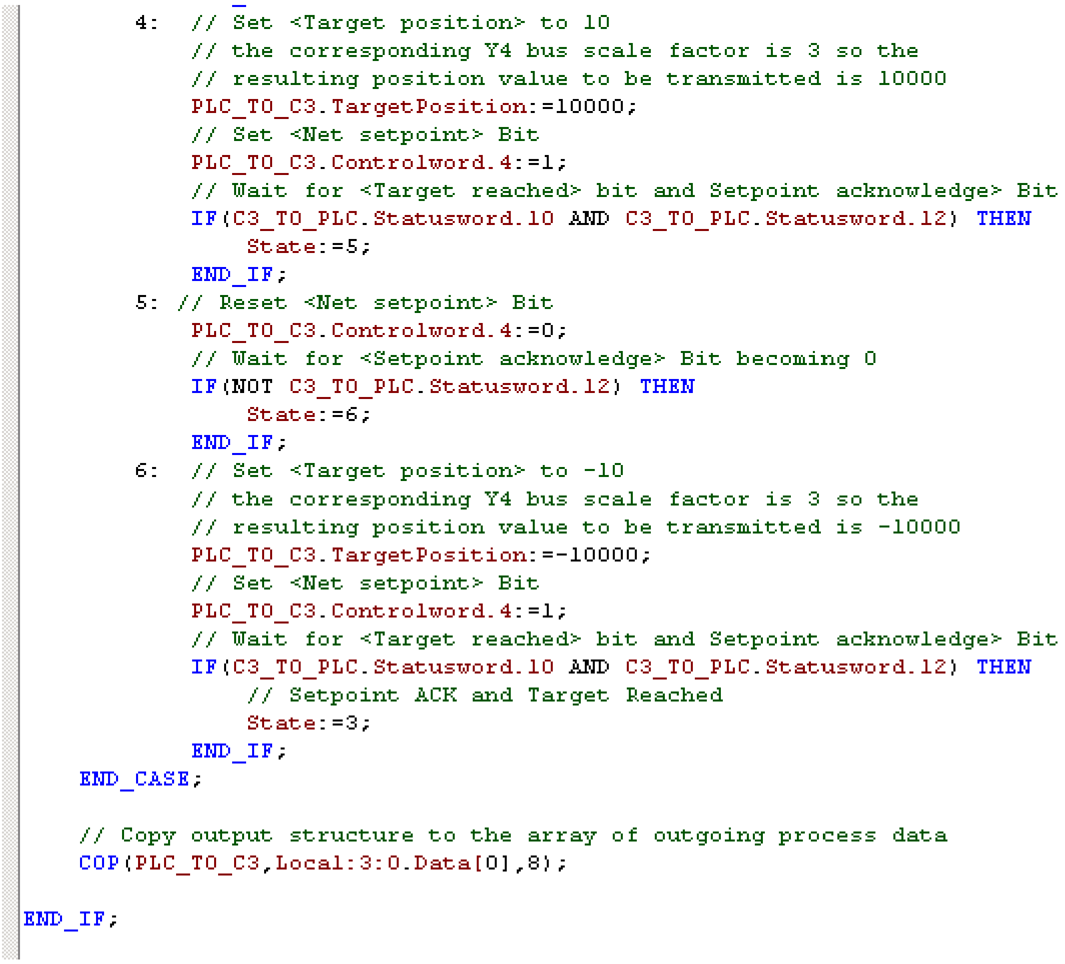
```
// Put DeviceNet Scanner to run mode (start polling)
DeviceNet_RunBit:=1;

IF(DelayTicker<100) THEN
    DelayTicker:=DelayTicker+1;
END_IF;

// Wait until DeviceNet Scanning is running
// and 100 PLC cycles have passed
IF(DeviceNet_ScannerRunning AND DelayTicker=100) THEN

    // Fill input structure with incoming process data from Compax3
    COP(Local:3:I.Data[0],C3_TO_PLC,8);

    CASE State OF
        0:  // Set Operation Mode to Position Profile (1)
            PLC_TO_C3.OperationMode:=1;
            // <Enable Voltage> = 1 , <Quick Stop> = 1
            PLC_TO_C3.Controlword:=6;
            // Wait for <Ready to switch on> Bit to enter next state
            IF(C3_TO_PLC.Statusword.0) THEN
                State:=1;
            END_IF;
        1:  // <Enable Voltage> = 1 , <Quick Stop> = 1 , <Switch on> = 1
            PLC_TO_C3.Controlword:=7;
            // Wait for <Switched on> Bit to enter next state
            IF(C3_TO_PLC.Statusword.1) THEN
                State:=2;
            END_IF;
        2:  // <Enable Voltage> = 1 , <Quick Stop> = 1 ,
            // <Switch on> = 1, <Enable operation> = 1
            PLC_TO_C3.Controlword:=16#F;
            // Wait for <Operation enabled> Bit to enter next state
            IF(C3_TO_PLC.Statusword.2) THEN
                State:=3;
            END_IF;
        3:  // Reset <Net setpoint> Bit
            PLC_TO_C3.Controlword.4:=0;
            // Wait for <Setpoint acknowledge> Bit becoming 0
            IF(NOT C3_TO_PLC.Statusword.12) THEN
                State:=4;
            END_IF;
```



```
        4:  // Set <Target position> to 10
            // the corresponding Y4 bus scale factor is 3 so the
            // resulting position value to be transmitted is 10000
            PLC_TO_C3.TargetPosition:=10000;
            // Set <Net setpoint> Bit
            PLC_TO_C3.Controlword.4:=1;
            // Wait for <Target reached> bit and Setpoint acknowledge> Bit
            IF(C3_TO_PLC.Statusword.10 AND C3_TO_PLC.Statusword.12) THEN
                State:=5;
            END_IF;
        5: // Reset <Net setpoint> Bit
            PLC_TO_C3.Controlword.4:=0;
            // Wait for <Setpoint acknowledge> Bit becoming 0
            IF(NOT C3_TO_PLC.Statusword.12) THEN
                State:=6;
            END_IF;
        6:  // Set <Target position> to -10
            // the corresponding Y4 bus scale factor is 3 so the
            // resulting position value to be transmitted is -10000
            PLC_TO_C3.TargetPosition:=-10000;
            // Set <Net setpoint> Bit
            PLC_TO_C3.Controlword.4:=1;
            // Wait for <Target reached> bit and Setpoint acknowledge> Bit
            IF(C3_TO_PLC.Statusword.10 AND C3_TO_PLC.Statusword.12) THEN
                // Setpoint ACK and Target Reached
                State:=3;
            END_IF;
    END_CASE;

    // Copy output structure to the array of outgoing process data
    COP(PLC_TO_C3,Local:3:O.Data[0],8);

END_IF;
```