

Access CANopen-Devices using the CANwizard®

Introducing the CANwizard® made by BÖHNKE + PARTNER.
A tool for analyzing and configuring of CANopen networks.

Roy Schneider

BÖHNKE + PARTNER

GmbH Steuerungssysteme

(State 07.08.2013)

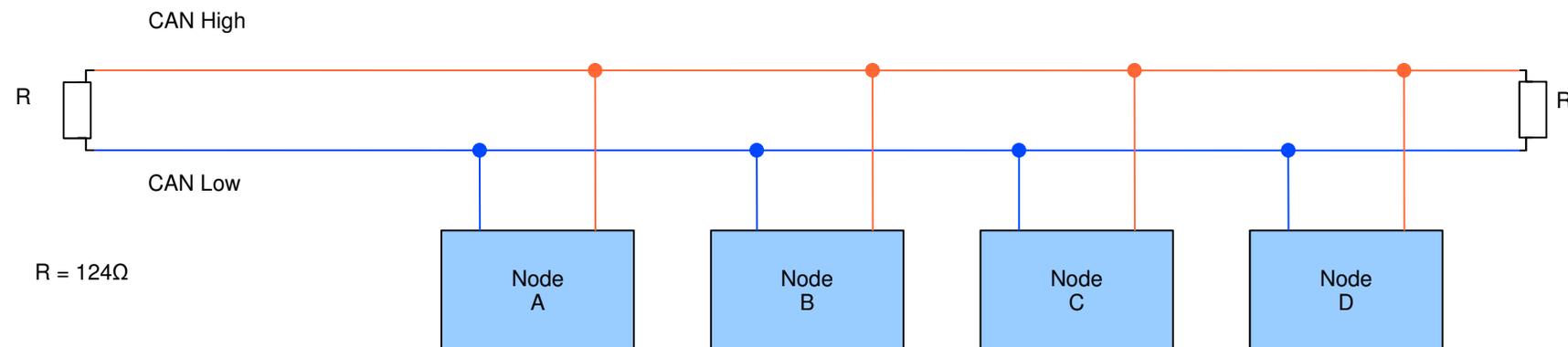
www.boehnkepartner.de

CANwizard®

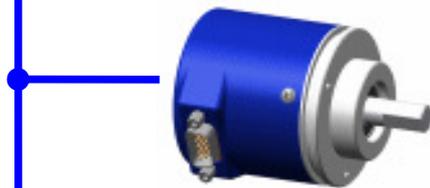
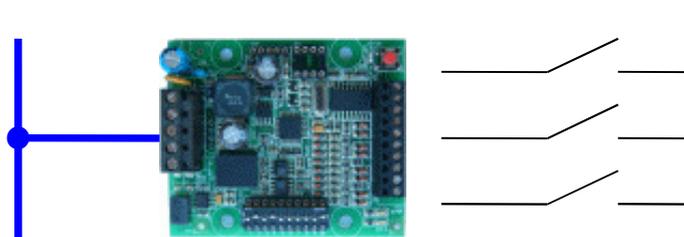
- CANopen – the base of the CANwizard®
- Bus systems are necessary for modern industrial machines.
- Safety, real-time capability and multi-master capability are specific characteristics of the CAN-bus.
- For the CAN-bus exists different higher protocols.
We successfully use CANopen!

- Application
- The application profile for lifts CiA DSP-417 was developed by a group of lift component vendors.
- The CANwizard[®] was originally developed to provide the technicians a powerful tools.
- The components used in a CANopen lift should be accessible and configurable without special CANopen know-how.

- Basics of the CAN-Bus
- Every communication bus has to be terminated.
- All nodes access the bus using simple common rules.



● Basics of the CAN-Bus



● Principle Schematics



CAP-01 CAN Shaft Board (application profile 417)
Application Profile for Lift-Control Systems

Network Management: not available

Rescan Node
Select EDS-File

Manufacturer Information
Device Name: CAP-01 Lift I/O Panel Unit (BÖHNKE + PARTNER GmbH)
Hardwareversion: CAP-01
Softwareversion: 1.0.0 (Mar 1 2010 08:12:49)
EDS-File: cap-01.eds

Basic Settings I/O Terminals

Type	Description
R1 Output	Gray code control, Term 1, lift 1
R2 Output	Gray code control, Term 2, lift 1
R3 Output	Key lock 1 acknowledge, lift 1, car
R4 Output	Key lock 2 acknowledge, lift 1, car
R5 Output	Key lock 5 acknowledge, lift 1, car
R6 Output	Out of order, lift 1
R7 Unused	
R8 Output	Hall lantern, downward, lift 1, floor

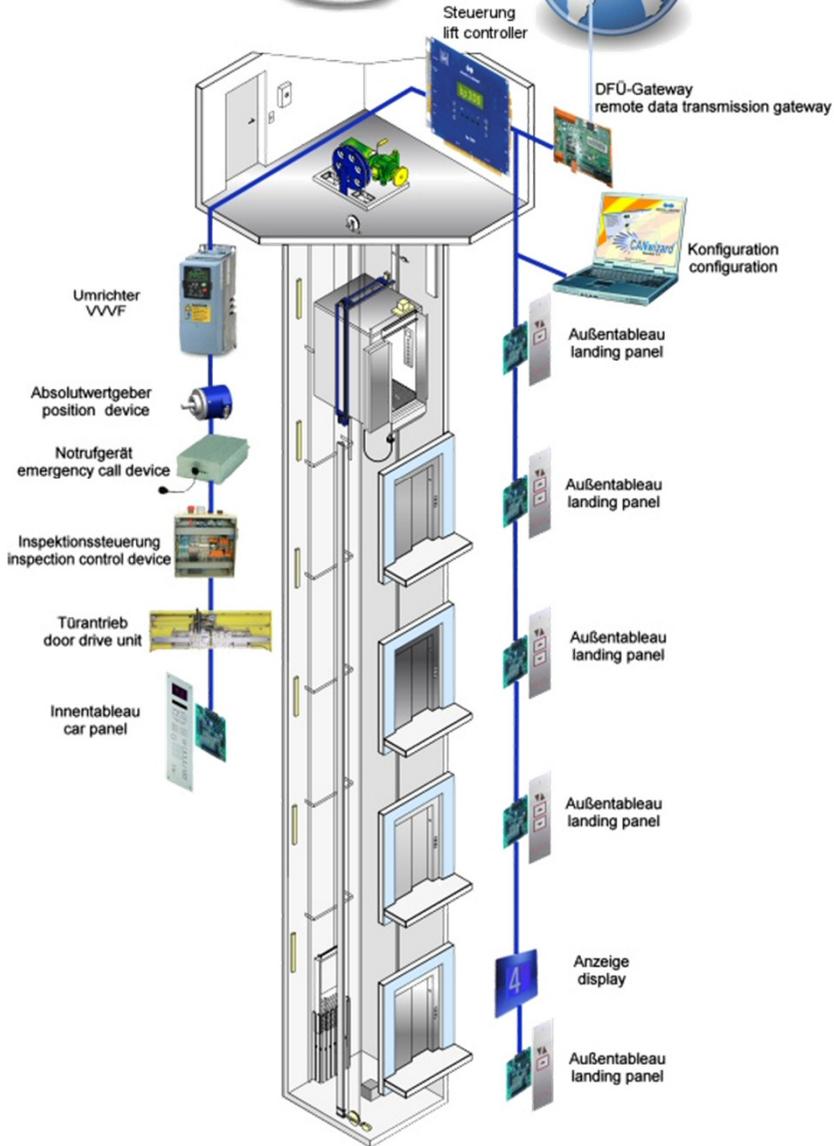
Print Write settings to the device Switch to profile view



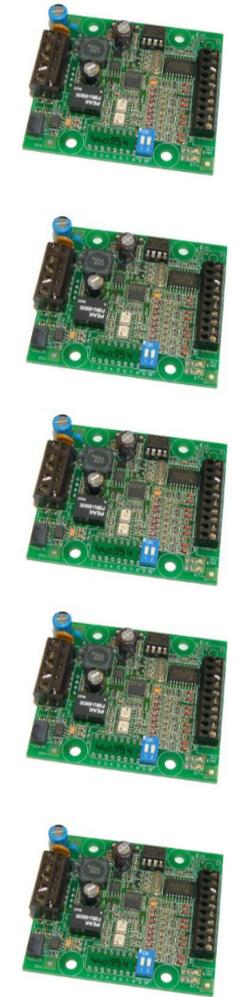
Installation Schematics

Machine Room

Shaft

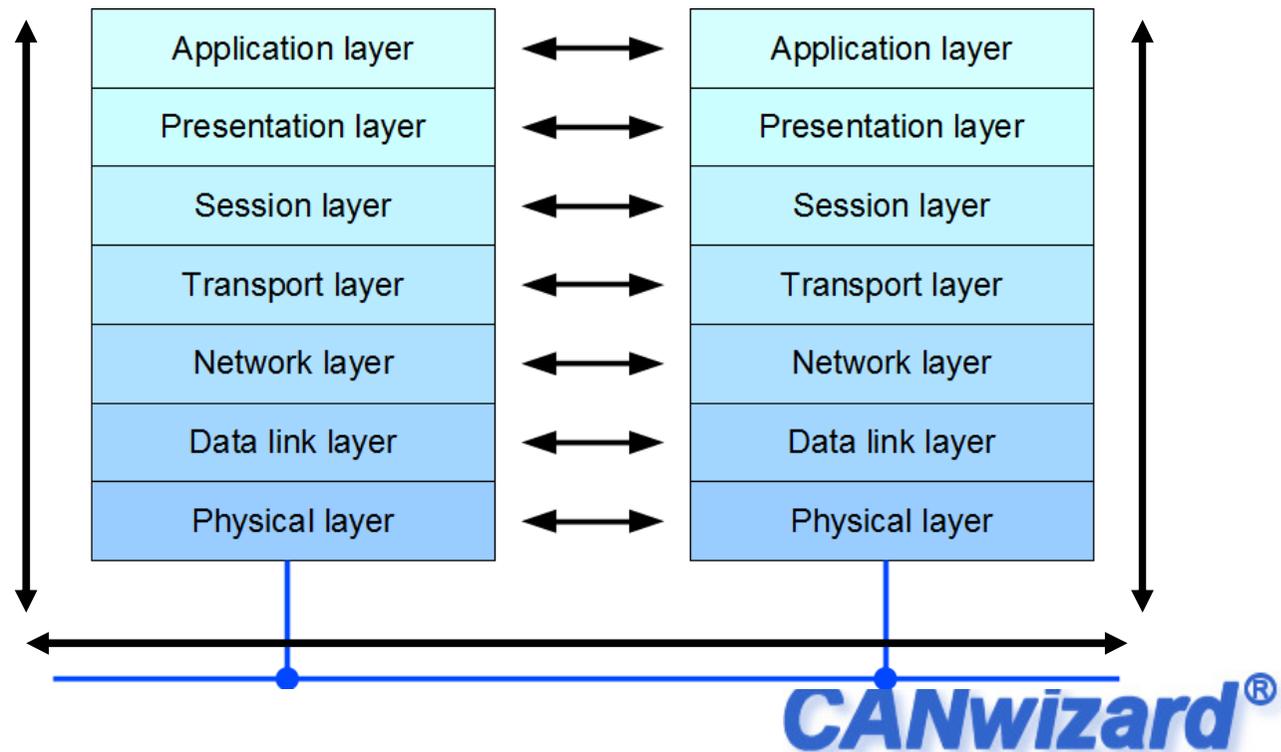


Car/Cabin



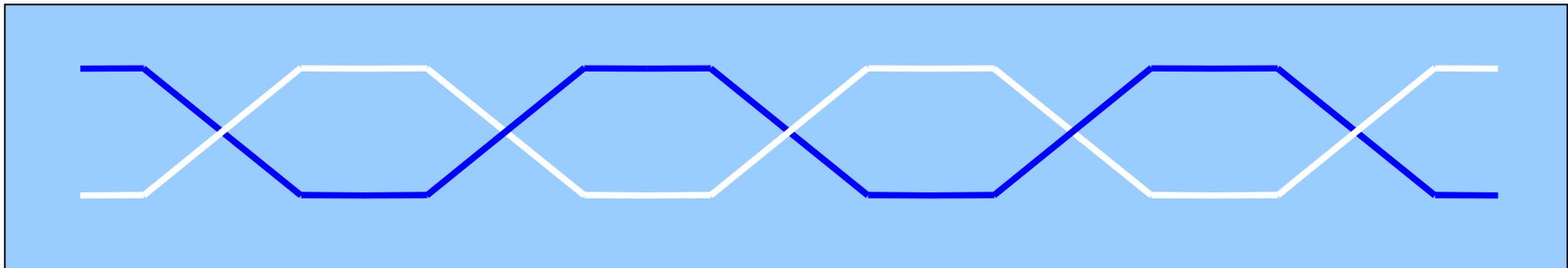
● Basics of the CAN-Bus

- The OSI model is a prescription of characterizing the functions of a communications system in terms of abstraction layers.



● Physical Layer

- The CAN bus uses a difference signal, i.e. the actual data signal is transferred via two lines inverted to each other.

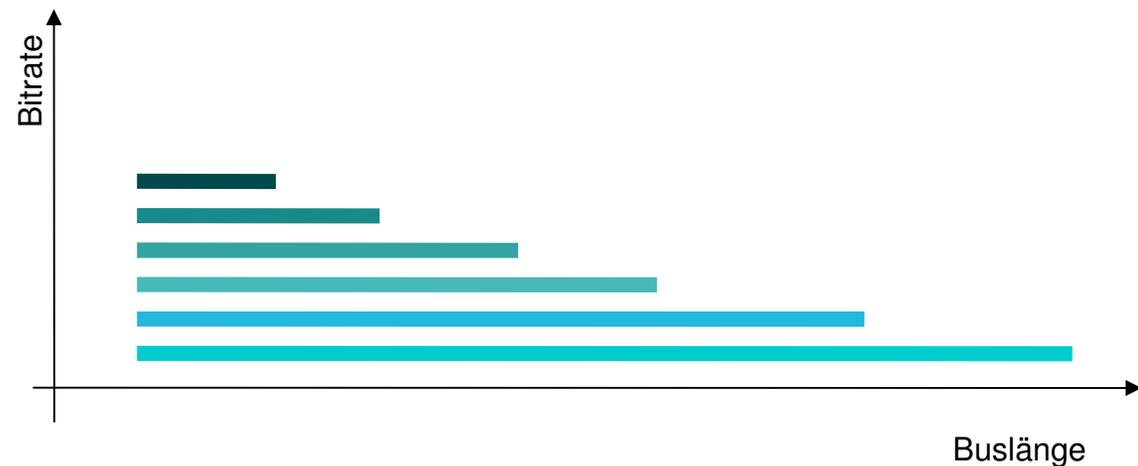


- Using twisted pair cabling to make sure, that possible interference affect both cable in the same way. So that the difference of voltage stays the same.

● Physical Layer

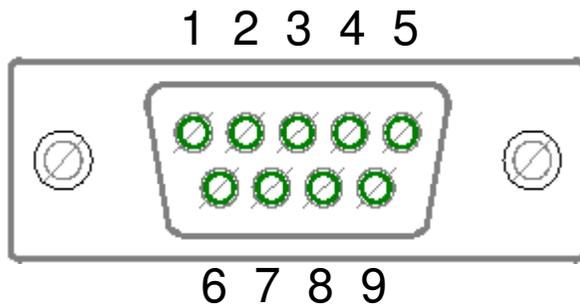
- The maximum transmission speed is related to the length of the bus cable.

Bitrate [kBit/s]	Bus cable length [m]
10	6700
20	3300
50	1300
125	530
250	250 <i>(real etwa 200m)</i>
500	130
1000	40



● Physical Layer

- The 9-pin SUB-D connector is widely used.



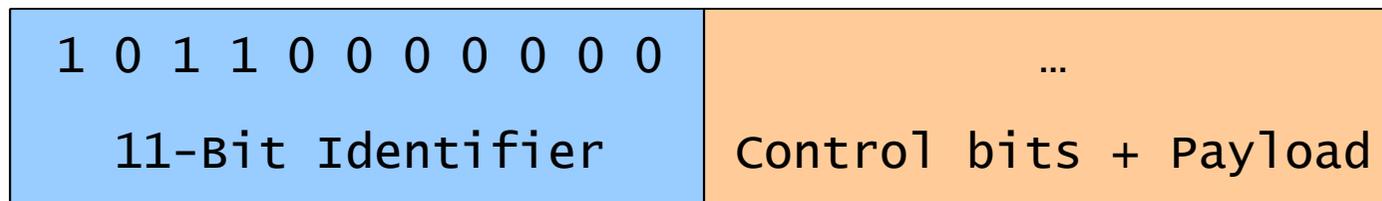
Pin	Signal
1	unused
2	Bus CAN Low
3	External Power 0V
4	unused
5	Shield
6	External Power GND
7	Bus CAN High
8	unused
9	External Power +24V
Case	Shield

● Physical Layer

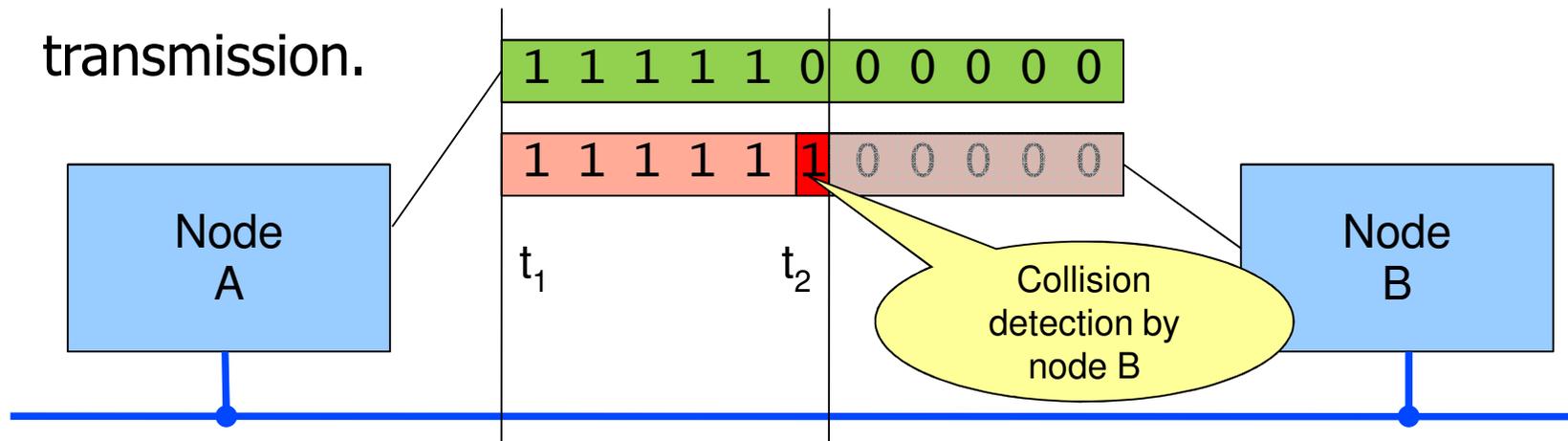
- The logical state 0 corresponds to the electrical state „high“ and is dominant to the logical state 1 corresponding to the electrical state „low“.

Logical Signal	CAN-High	CAN-Low
0 – dominant $\Delta U > 1,5V$	Output is turned on and the electrical level is set to VCC.	Output is turned on and the electrical level is set to GND.
1 – recessive, high resistance, $\Delta U < 1V$	Output disabled.	Output disabled.

- Network layer
- Determinist rules for accessing the bus by using an identifier as prefix of every message sent.



- Network layer
- The identifier containing the first trailing zero overwrites electrically the other identifier. Each identifier bit is read back (verified) after writing. Using this method the node using a lower priority identifier can detect the higher one and stops transmission.

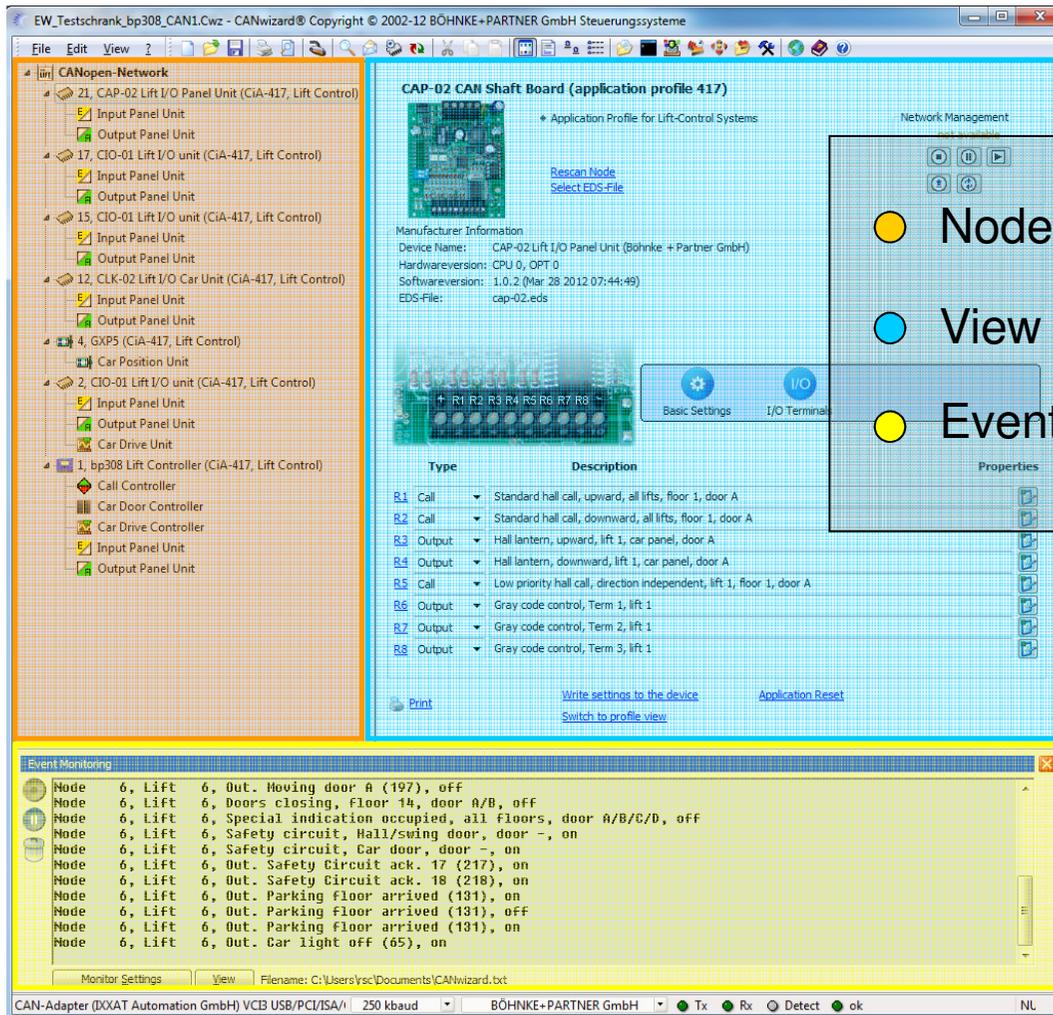


- Upper layers
- Implementation of higher and specialized protocols, like CANopen.
- Providing services for configuring and parameterizing (SDO – „Service Data Objects“)
- Providing services for network management (NMT – „Network Management“)
- Providing services for process data objects (PDO – „Process Data Objects“)

CANwizard®

- The software CANwizard® is a tool for configuring and parameterizing of CANopen-networks.
- The program contains special features regarding the application profile CiA-417 (Lift Control).
- It is a tool for the assembly fitter, the technician and the developer as well.
- Web site: <http://www.canwizard.de>

Using the Software



The screenshot displays the CANwizard software interface. The main window is titled "EW_Testschrank_bp308_CAN1.Cwz - CANwizard® Copyright © 2002-12 BÖHNKE+PARTNER GmbH Steuerungssysteme".

Node Tree (Left Panel): A hierarchical tree structure showing the network configuration. The selected node is "1. bp308 Lift Controller (CIA-417, Lift Control)".

View of the node selected (Main Panel): The selected node is displayed in detail. The title is "CAP-02 CAN Shaft Board (application profile 417)". It includes manufacturer information, device name, hardware version, software version, and EDS file. A table lists the node's properties:

Type	Description
R1 Call	Standard hall call, upward, all lifts, floor 1, door A
R2 Call	Standard hall call, downward, all lifts, floor 1, door A
R3 Output	Hall lantern, upward, lift 1, car panel, door A
R4 Output	Hall lantern, downward, lift 1, car panel, door A
R5 Call	Low priority hall call, direction independent, lift 1, floor 1, door A
R6 Output	Gray code control, Term 1, lift 1
R7 Output	Gray code control, Term 2, lift 1
R8 Output	Gray code control, Term 3, lift 1

Event Monitoring (Bottom Panel): A window showing a list of events. The events are as follows:

Node	Event	Status
6, Lift	Out. Moving door A (197)	off
6, Lift	Doors closing, floor 14, door A/B	off
6, Lift	Special indication occupied, all floors, door A/B/C/D	off
6, Lift	Safety circuit, Hall/swing door, door -	on
6, Lift	Safety circuit, Car door, door -	on
6, Lift	Out. Safety Circuit ack. 17 (217)	on
6, Lift	Out. Safety Circuit ack. 18 (218)	on
6, Lift	Out. Parking floor arrived (131)	on
6, Lift	Out. Parking floor arrived (131)	off
6, Lift	Out. Parking floor arrived (131)	on
6, Lift	Out. Car light off (65)	on

- Node Tree
- View of the node selected
- Event Monitor

● Scanning a Network - SDO

Browses the bus for installed and active CANopen nodes.



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<http://www.canwizard.de>



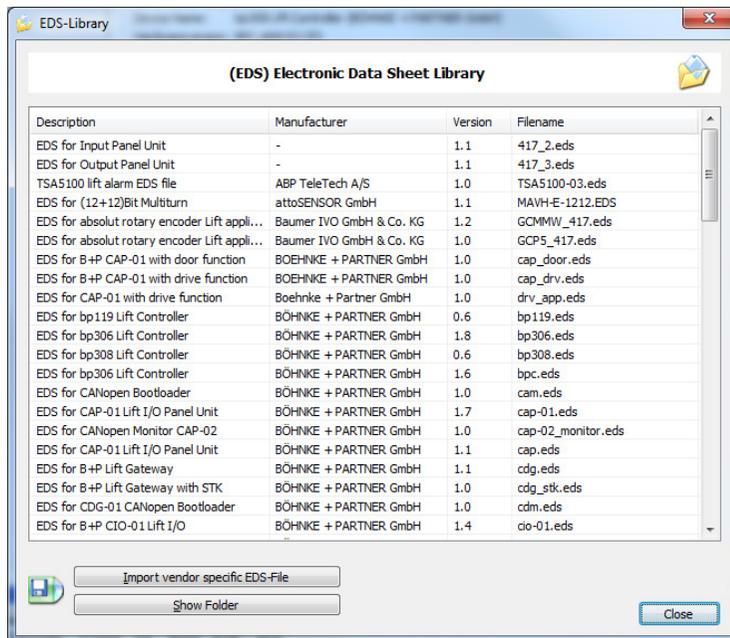
- Scanning a Network - SDO
- The objects containing the vendor id, the product code and the used device or profile number is read out of the object dictionary first.
- The program then automatically searches for the best fitting eds (Electronic Data Sheet) file that can be found at the EDS-library.
- If the correct EDS file was found, the whole object dictionary using the content of the found EDS file is read out and locally stored at the program.

- Electronic Datasheet - EDS
- Contains all the objects and it's description, really supported by the device (mandatory and optional objects).
- Contains information about the vendor, the product, the revision and the author, including time/date of the last modification.
- Describes the data types of the objects and the minimum and maximum and default values. It also contains information about the access mode (read only, read/write or write only).

Using the Software

● Electronic Datasheet - EDS

Shows a list of eds-files that are locally stored in the installation.

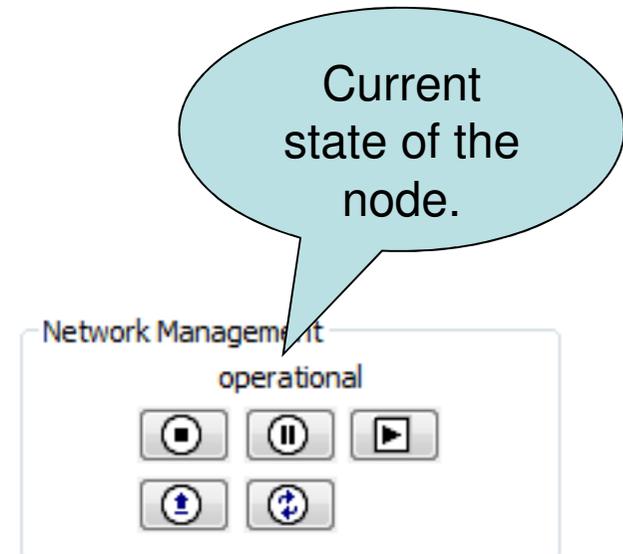


[1000]
ParameterName=Device type
ObjectType=0x7
DataType=0x7
AccessType=ro
DefaultValue=417
LowLimit=
HighLimit=
PDOMapping=0

[1001]
ParameterName=Error register
ObjectType=0x7
DataType=0x5
AccessType=ro
DefaultValue=
LowLimit=
HighLimit=
PDOMapping=0

- Network Management - NMT
- Every CANopen node at the bus has its own internal state.

CANopen State (Green LED)	Description
boot up (LED short flash)	The device starts up. No SDO or PDO communication is available.
stopped (LED is off)	No SDO or PDO communication is available. The device reacts on NMT-commands.
preoperational (LED is blinking)	The device can be accessed by SDO but will not send (produce) any PDO messages.
operational (LED constant on)	The device sends (produces) PDO data and can be accessed by SDO communication.



- Network Management - NMT
- Every CANopen node at the bus has its own error state.

CANopen Error (red LED)	Description
LED short flashing	The error counter have reached the «Warning» level. Please check bus termination!
LED is flickering	Auto baud-Mode. If this hold on, please check that the node is connected to the bus.
Constantly turned on	The node is «bus off». Please check if CAN low and CAN high is not mixed up and make sure the bus is not short-circuited.

● Network Management - NMT



-  „Stop Remote Node“ – Requests the node to enter the „stopped“ state. No SDO or PDO communication is available after this.

-  „Enter Preoperational“ – Requests the node to enter the „preoperational“ state. No more PDO's will be send.

-  „Start Remote Node“ – Requests the node to enter the „operational“ state. The node can be accessed by SDO and is allowed to produce PDO's.

● Network Management - NMT



 „Reset Node“ – Triggers an application reset.

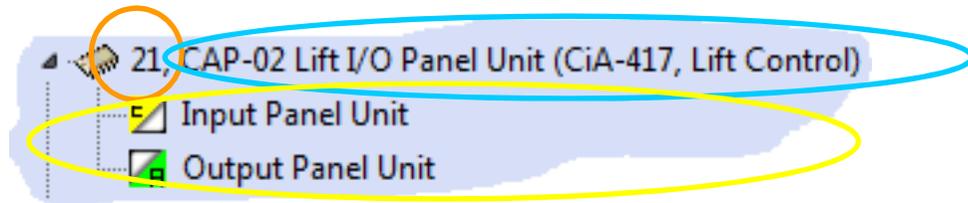
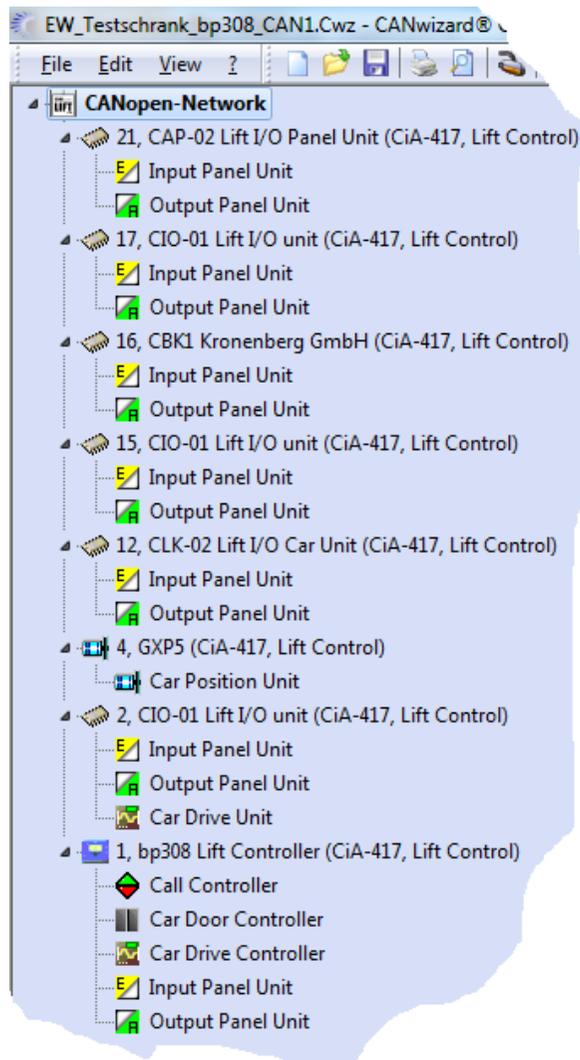
This may cause the firmware to restart as well.



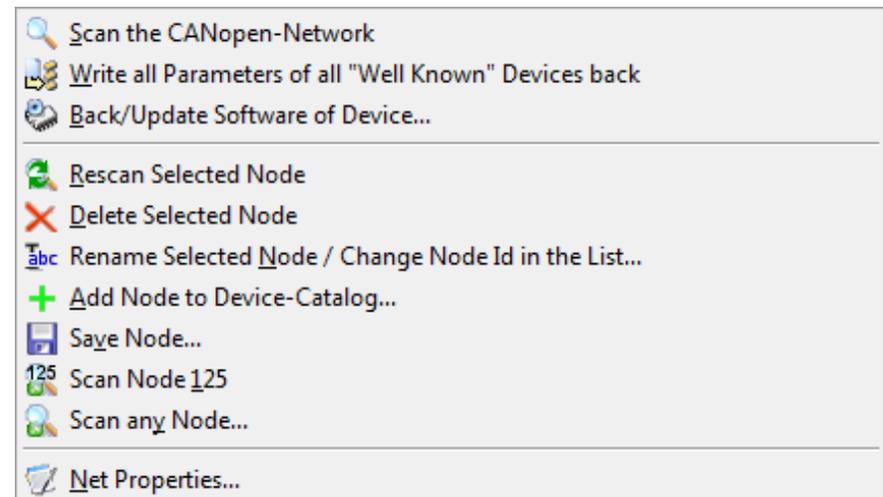
„Reset Communication“ – Node will reset it's communication and resets the error counters related, as well.

Using the Software

Node List



- Node Id
- Name of the node (and profile)
- Implemented virtual devices
Role (Function), that the node implements.



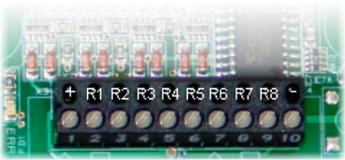
Using the Software

● Node view (Dialog view)

CAP-02 CAN Shaft Board (application profile 417)
◆ Application Profile for Lift-Control Systems


[Rescan Node](#)
[Select EDS-File](#)

Manufacturer Information
Device Name: CAP-02 Lift I/O Panel Unit (Böhne + Partner GmbH)
Hardwareversion: CPU 0, OPT 0
Softwareversion: 1.0.2 (Mar 28 2012 07:44:49)
EDS-File: cap-02.eds

 + R1 R2 R3 R4 R5 R6 R7 R8

 Basic Settings  I/O Terminals

Basic Settings
Node-ID: 21 (16-124 or -1 for the default node-id behavior)
Call Acknowledge: No flashing call acknowledge
Attached Lifts: 1 2 3 4 5 6 7 8
Attached Floor: car panel
Attached Doors: A B C D
EEPROM: OK
Impuls Selection Call: 2.5 [s]

1.) [Write Parameters](#) 2.) [Reset CAP-02](#)

1.) [Write Parameters](#) 2.) [Reset CAP-02](#)

[Print](#) [Write settings to the device](#) [Application Reset](#)
[Switch to profile view](#)

Using the Software

● Node view (Dialog view)

CAP-02 CAN Shaft Board (application profile 417)



◆ Application Profile for Lift-Control Systems

[Rescan Node](#)
[Select EDS-File](#)

Manufacturer Information

Device Name: CAP-02 Lift I/O Panel Unit (Böhnke + Partner GmbH)
Hardwareversion: CPU 0, OPT 0
Softwareversion: 1.0.2 (Mar 28 2012 07:44:49)
EDS-File: cap-02.eds



Basic Settings I/O Terminals

Type	Description	Properties
R1 Call	Standard hall call, upward, all lifts, floor 1, door A	
R2 Call	Standard hall call, downward, all lifts, floor 1, door A	
R3 Output	Hall lantern, upward, lift 1, car panel, door A	
R4 Output	Hall lantern, downward, lift 1, car panel, door A	
R5 Call	Low priority hall call, direction independent, lift 1, floor 1, door A	
R6 Output	Gray code control, Term 1, lift 1	
R7 Output	Gray code control, Term 2, lift 1	
R8 Output	Gray code control, Term 3, lift 1	

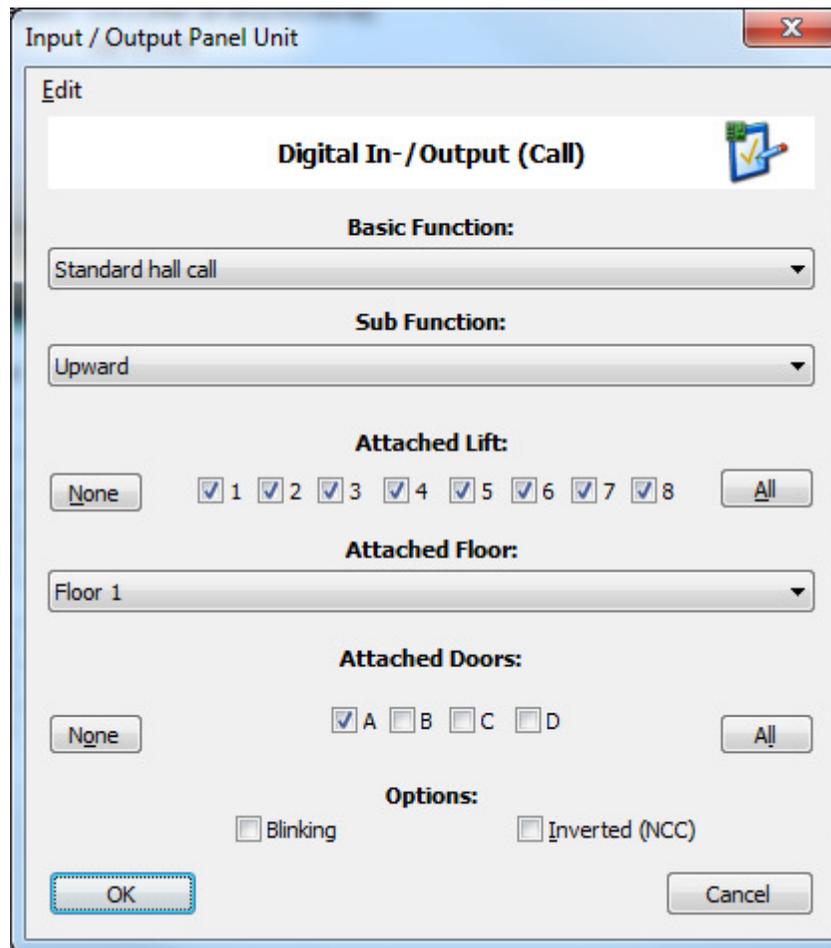
R1	Call	Standard hall call, upward, all lifts, floor 1, door A	
R2	Call	Standard hall call, downward, all lifts, floor 1, door A	
R3	Output	Hall lantern, upward, lift 1, car panel, door A	
R4	Output	Hall lantern, downward, lift 1, car panel, door A	
R5	Call	Low priority hall call, direction independent, lift 1, floor 1, door A	
R6	Output	Gray code control, Term 1, lift 1	
R7	Output	Gray code control, Term 2, lift 1	
R8	Output	Gray code control, Term 3, lift 1	

Property Dialog

Print [Write settings to the device](#) [Application Reset](#)
[Switch to profile view](#)

- Node view (Dialog view) – Property Dialog

- In-/Output codes are standardized
- Vendor independent.
- That is CiA-417!



Input / Output Panel Unit

Edit

Digital In-/Output (Call)

Basic Function:
Standard hall call

Sub Function:
Upward

Attached Lift:
None 1 2 3 4 5 6 7 8 All

Attached Floor:
Floor 1

Attached Doors:
None A B C D All

Options:
 Blinking Inverted (NCC)

OK Cancel

Using the Software

More node views (Profile View)

CAP-02 CAN Shaft Board (application profile 417)
◆ Application Profile for Lift-Control Systems


[Rescan Node](#)
[Select EDS-File](#)

Network Management
not available


Manufacturer Information
Device Name: CAP-02 Lift I/O Panel Unit (Böhnke + Partner GmbH)
Hardwareversion: CPU 0, OPT 0
Softwareversion: 1.0.2 (Mar 28 2012 07:44:49)
EDS-File: cap-02.eds

Mapped Virtual Devices:

Virtual Device	Number	Name
Virtual device type 1	2	Input Panel Unit
Virtual device type 2	3	Output Panel Unit

Identity Object	read only	4
Vendor ID	read only	0x000000F8
Product code	read only	0x00000111
Revision number	read only	0x00000001
Serial number	read only	0x01133003

Communication Profile Area

Object	Attribut	Content	Description
Device type	read only	0x000001A1	
Error register	read only	0x00	
Identity Object	read only	4	
Vendor ID	read only	0x000000F8	
Product code	read only	0x00000111	
Revision number	read only	0x00000001	
Serial number	read only	0x01133003	
Status register	read, write	0x00000002	
Device name	read only (constant)	CAP-02 Lift I/O Panel Unit	
Hardware version	read only (constant)	CPU 0, OPT 0	
Software version	read only (constant)	1.0.2 (Mar 28 2012 07:44:49)	

 [Print](#) [Write objects to the object dictionary](#) [Switch to object view](#)
[Store all parameters to non-volatile memory](#) [Application Reset](#)

● More node views (Object View)

Name	Index	Code	Subindices
Device type	0x1000	VAR	1
Error register	0x1001	VAR	1
Status register	0x1002	VAR	1
Device name	0x1008	VAR	1
Hardware version	0x1009	VAR	1
Software version	0x100A	VAR	1
Store parameters	0x1010	ARRAY	2
Restore default parameters	0x1011	ARRAY	2
Consumer heartbeat time	0x1016	ARRAY	9
Producer heartbeat time	0x1017	VAR	1
Identity Object	0x1018	ARRAY	5
1st receive PDO parameters	0x1500	RECORD	3
2nd receive PDO parameters	0x1510	RECORD	3
3rd receive PDO parameters	0x1520	RECORD	3
4th receive PDO parameters	0x1530	RECORD	3
5th receive PDO parameters	0x1540	RECORD	3
6th receive PDO parameters	0x1550	RECORD	3
7th receive PDO parameters	0x1560	RECORD	3
8th receive PDO parameters	0x1570	RECORD	3
1st receive PDO mapping	0x1700	ARRAY	2
2nd receive PDO mapping	0x1710	ARRAY	2
3rd receive PDO mapping	0x1720	ARRAY	2
4th receive PDO mapping	0x1730	ARRAY	2
5th receive PDO mapping	0x1740	ARRAY	2
6th receive PDO mapping	0x1750	ARRAY	2
7th receive PDO mapping	0x1760	ARRAY	2
8th receive PDO mapping	0x1770	ARRAY	2
1st transmit PDO parameters	0x1881	RECORD	3
1st Transmit PDO Mapping	0x1A81	ARRAY	2
Node-ID	0x2000	VAR	1
Baudrate	0x2001	VAR	1
DIP switch	0x2002	VAR	1
Password	0x2010	VAR	1
FFPROM	0x2040	RECORD	4

Node 21, CAP-02 Lift I/O Panel Unit (CiA-417, Lift Control)

Device name

Object Number: 0x1008 Access Type: const
Sub Index: 0x00 Object Name: Device name
Object Code: VAR
Object Type: VISIBLE_STRING

Offset	Content	Hex Dump	Integer
00000000	43 41 58 20 30 32 20 4C	CAP-02 L	
00000008	69 65 74 20 49 2F 4F 20	ift I/O	
00000010	00 00 00 00 00 00 00 00	Panel Un	
00000018	00 00 00 00	it	

Content String View:
CAP-02 Lift I/O Panel Unit

Write Data to Object

File Name: Browse

Ascii:

Hex:

Dec: Write

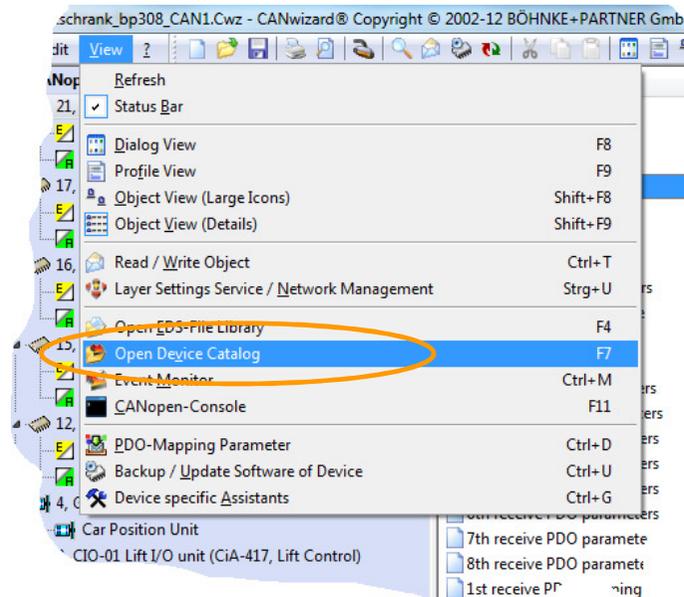
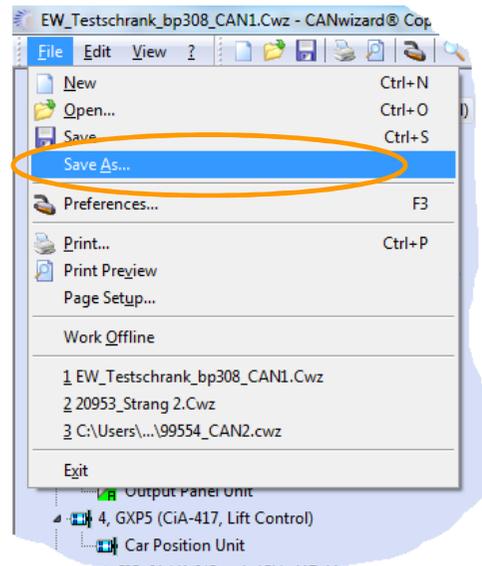
Close

- The object dictionary consists of a lot of elements, each representing an information unit.
- Every object is a member of a data type, e. g. Visible Strings or Integer (signed or unsigned).

Using the Software

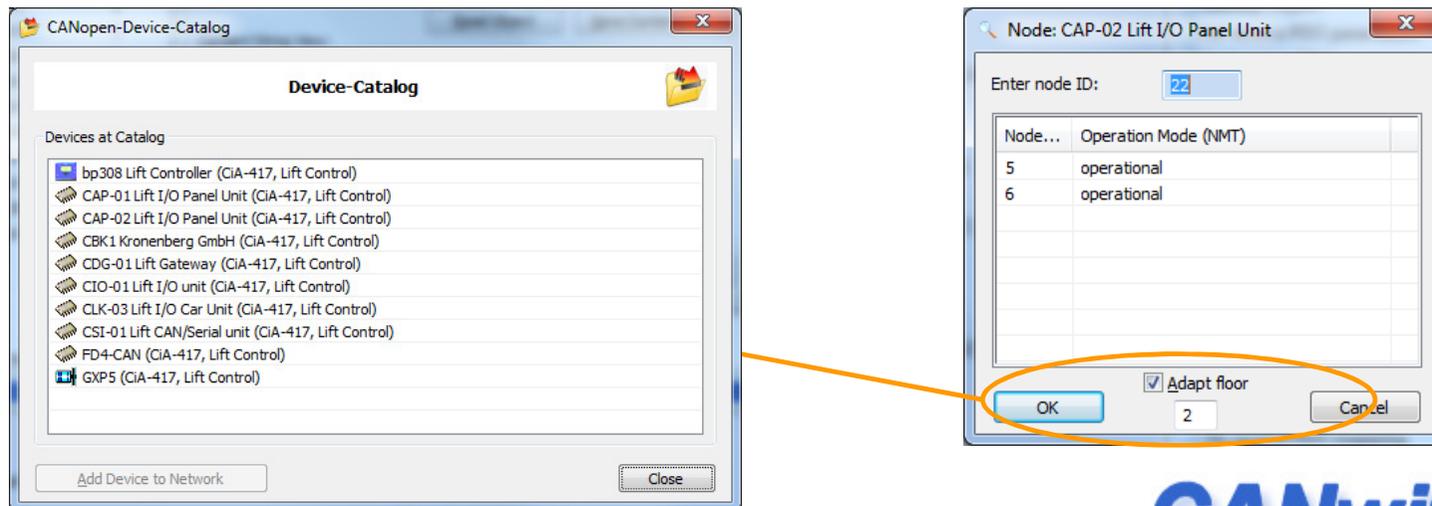
- More node views (Object View)
- The CANwizard® stores the object dictionary for each node, when creating or writing a “.cwz”-file.

This is the same, if a node is stored at the Device Catalog.



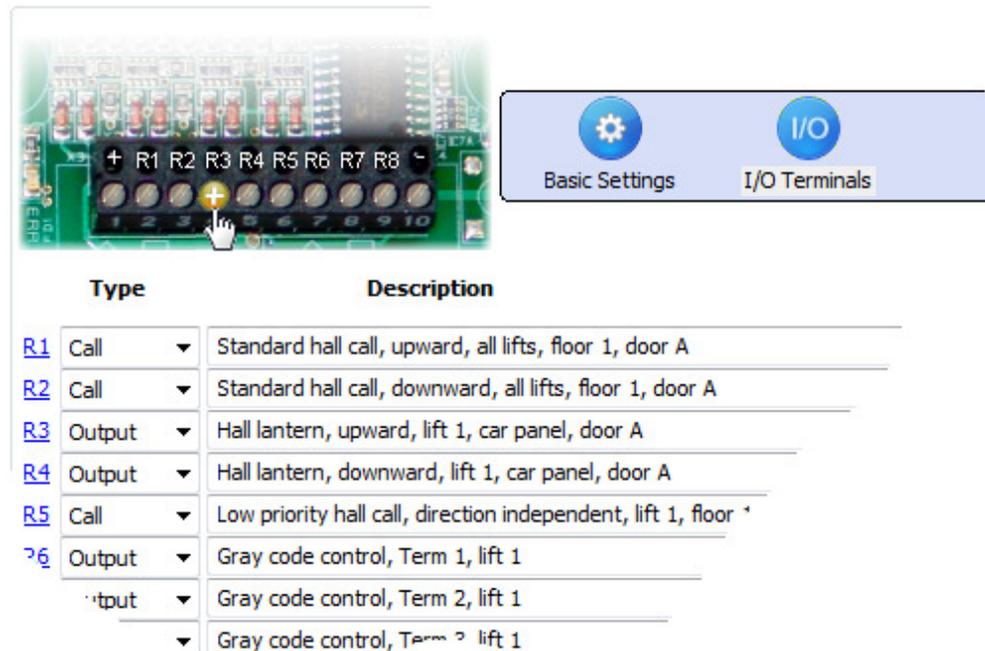
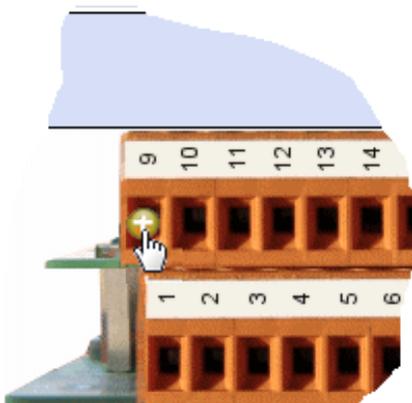
Using the Software

- Device Catalog
- The device catalog can be used to store „ready to use“ parameterized node templates.
- If a node is “drag’n’dropped” from the catalog to the node tree, the CANwizard[®] automatically adapt floor depended signals, by using the common node-id schemata.



Using the Software

- Setting Inputs/Outputs manually
- For testing purposes, inputs and outputs can directly be manipulated with some mouse clicks, if supported by the node.
- This functionality can be used for testing display outputs for example.

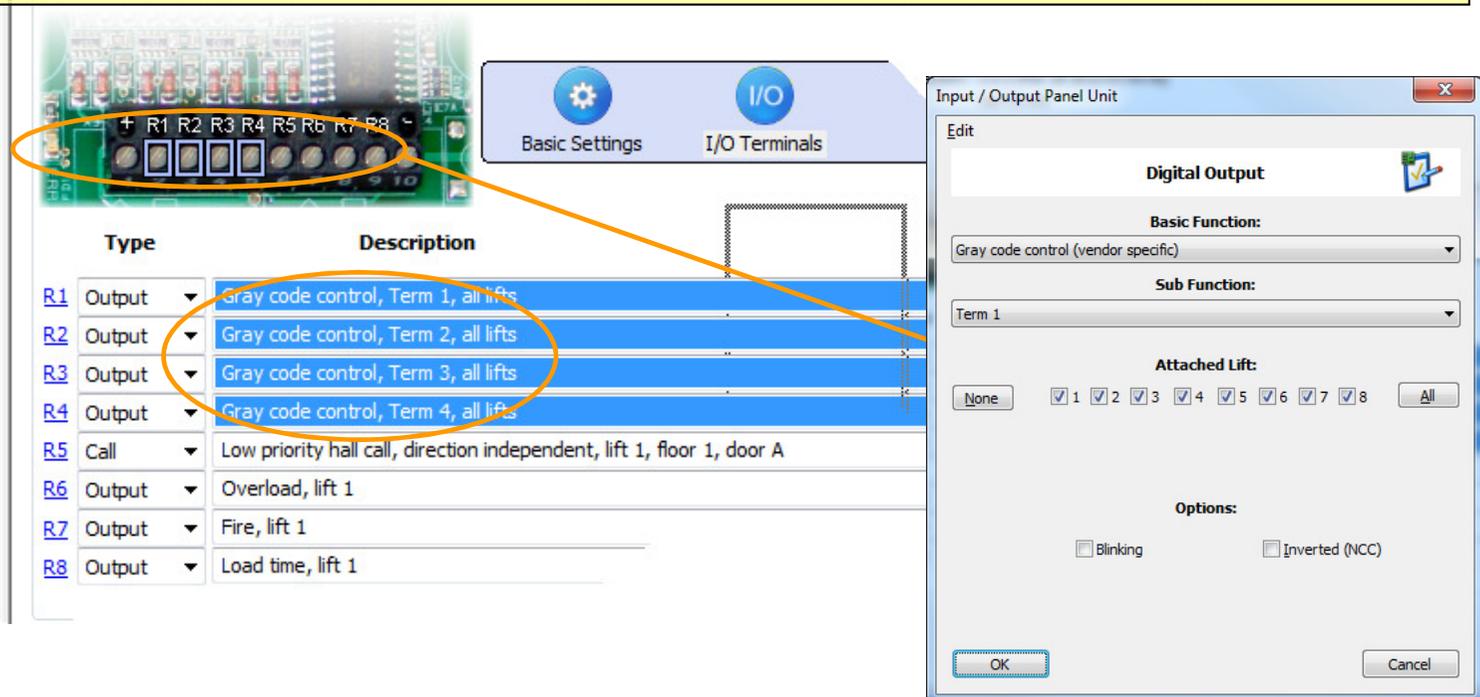


The screenshot shows the CANwizard software interface. At the top, there is a terminal block with terminals labeled R1 through R8. A mouse cursor is clicking on terminal R3. To the right of the terminal block are two buttons: "Basic Settings" (with a gear icon) and "I/O Terminals" (with an "I/O" icon). Below the terminal block is a table with two columns: "Type" and "Description".

Type	Description
R1 Call	Standard hall call, upward, all lifts, floor 1, door A
R2 Call	Standard hall call, downward, all lifts, floor 1, door A
R3 Output	Hall lantern, upward, lift 1, car panel, door A
R4 Output	Hall lantern, downward, lift 1, car panel, door A
R5 Call	Low priority hall call, direction independent, lift 1, floor 1
R6 Output	Gray code control, Term 1, lift 1
Output	Gray code control, Term 2, lift 1
Output	Gray code control, Term 3, lift 1

● Multi-Selection of Signals

- Using mouse input one or more signals can be accessed together (multi selection). This can be done by holding down the “SHIFT” or “CTRL” key and clicking on the terminal labels, e. g. „R1“. Alternatively a “Tracker-Rectangle” can be used for selecting one or more signals together.

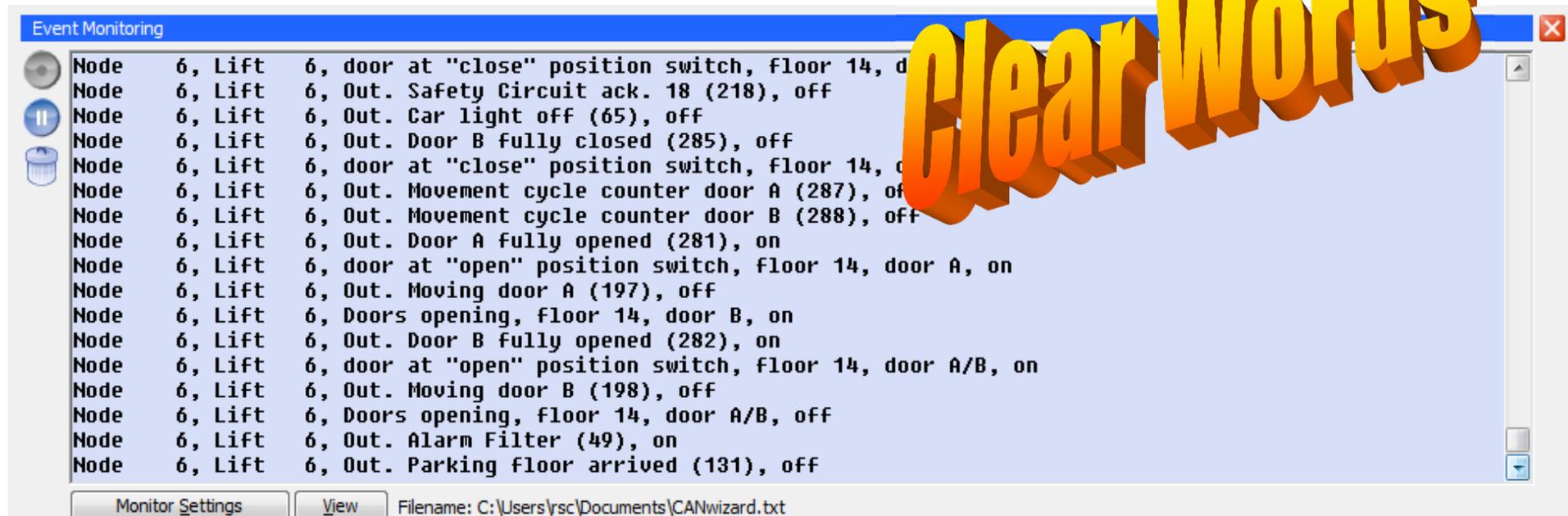


The screenshot displays the software interface for configuring I/O terminals. On the left, a terminal block is shown with terminals R1 through R8. An orange circle highlights terminals R1, R2, R3, and R4. Below the terminal block is a table with two columns: 'Type' and 'Description'. The rows for R1 through R4 are highlighted in blue, indicating they are selected. To the right, the 'Input / Output Panel Unit' configuration window is open, showing the 'Digital Output' settings. The 'Basic Function' is set to 'Gray code control (vendor specific)' and the 'Sub Function' is set to 'Term 1'. The 'Attached Lift' section shows checkboxes for terminals 1 through 8, all of which are checked. The 'Options' section includes checkboxes for 'Blinking' and 'Inverted (NCC)'. The 'OK' and 'Cancel' buttons are visible at the bottom of the window.

Type	Description	
R1	Output	Gray code control, Term 1, all lifts
R2	Output	Gray code control, Term 2, all lifts
R3	Output	Gray code control, Term 3, all lifts
R4	Output	Gray code control, Term 4, all lifts
R5	Call	Low priority hall call, direction independent, lift 1, floor 1, door A
R6	Output	Overload, lift 1
R7	Output	Fire, lift 1
R8	Output	Load time, lift 1

CANopen-Tool CANwizard®

- All events can be logged in clear words.
- The log-file has an time stamp for each event.

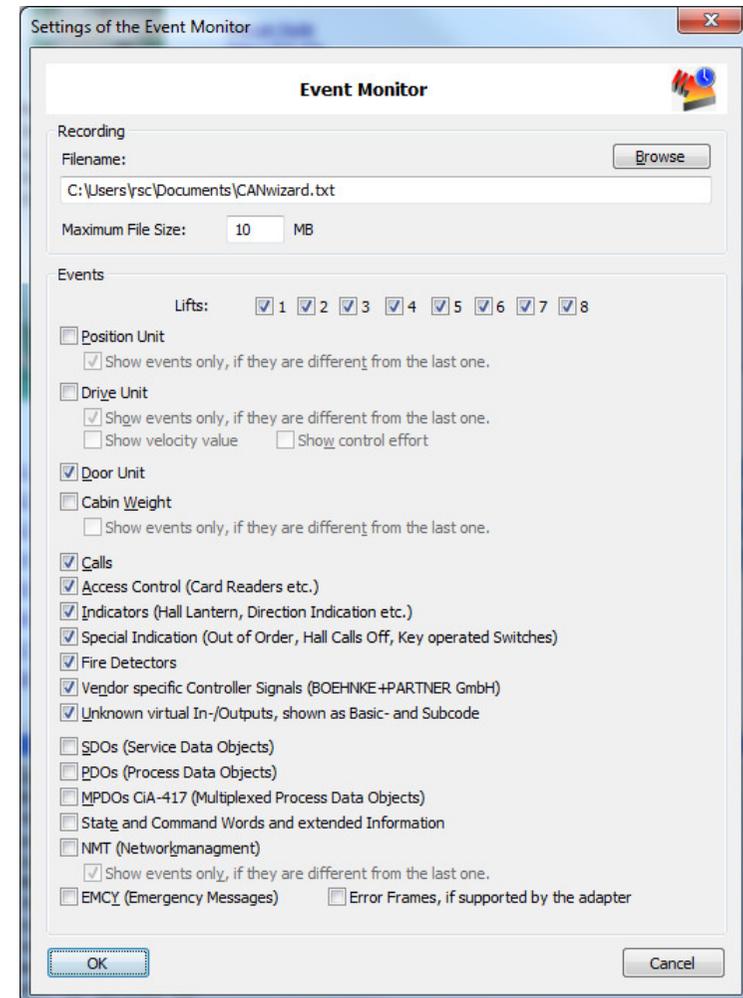


CANopen-Tool CANwizard[®]

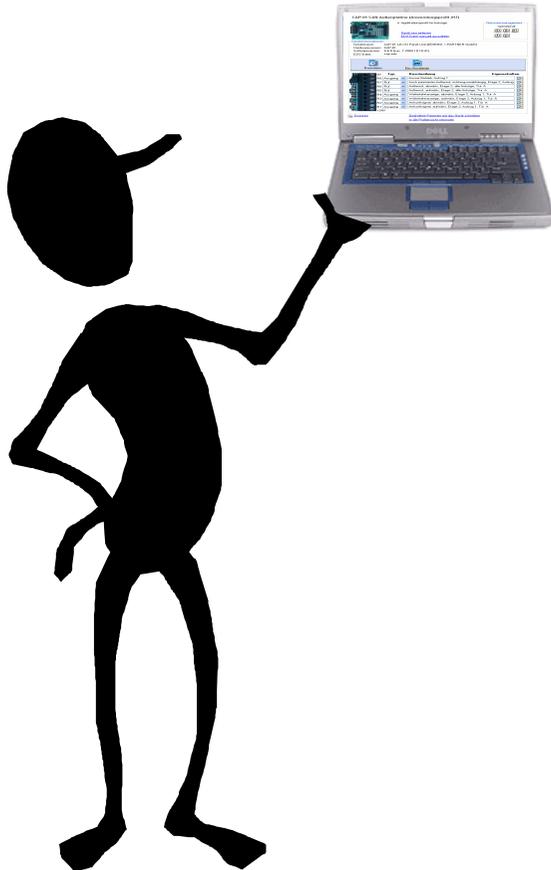
- For error diagnostics, the data and the corresponding lifts can be setup, that will be logged.

Lifts: 1 2 3 4 5 6 7 8

- C**alls
- A**ccess Control (Card Readers etc.)
- I**ndicators (Hall Lantern, Direction Indication etc.)
- S**pecial Indication (Out of Order, Hall Calls Off, Key operated Switches)
- F**ire Detectors
- V**endor specific Controller Signals (BOEHNKE+PARTNER GmbH)
- U**nknown virtual In-/Outputs, shown as Basic- and Subcode



PC-CAN-Adapter



State of the technology



Windows[®] Vista[®]
Seven[®] kompatibel



z. B. IXXAT, PEAK, SYSTec, Vector

Additional requests/suggestions

- It would be nice, if...
- It is absolutely necessary, that ...
- Please consider, this ...



END



Thank you for
listening.

