Product description V2.1
combo control 1xx and 2xx familiy

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Content:

1. Foreword

This manual contains text, figures and explanations regarding the correct installation and operation of the control panel. You must read and understand this manual before installing and operating the devices.

If you have any questions regarding the installation, application and operation of the panel, please contact the elrest customer hotline

Phone.: +49 (0)7021/92025-33
Fax: +49 (0)7021/92025-29
E-mail:hotline@elrest.de or your responsible agent.

This manual is subject to change. Changes may be made without notice.

2. Safety Guidelines and Protection Measures

This manual was written to be used by trained and competent personnel. The qualification is defined by the European directives for machinery, low voltage and EMC. At voltages above the safety extra-low voltage, the visio control panel may only be connected and installed by an electrical technician.

All national directives and relevant applicable safety regulations must be observed. Tampering with or modifying the device will invalidate the warranty.

This manual contains different symbols which draw attention to specific kinds of information. They are used to provide the operating personnel with the necessary information relating to the safety and protection measures. Each time the symbol appears, the relevant notice must be read.

Indicates an immediate danger that could cause physical injury and damage to property.

Indicates a possible danger that could cause physical injury and damage to property.

Under no circumstances will **elrest Automationssysteme GmbH** be liable or responsible for any consequential damage that may arise as a result of the improper installation or use of the devices or the accessories.

All the examples and illustrations included in this manual are intended solely as aids to understanding the text. Responsibility cannot be accepted for the accuracy of the operating procedures shown. elrest Automationssysteme GmbH accepts no responsibility for product applications based on the illustrative examples (e.g. in eStudio Demo).

Due to the large variety of possible applications for these devices, the user is responsible for carrying out all adjustments to suit his or her specific application.

In the event of failure of circuit components, appropriate safety systems must be used to ensure that peripheral equipment connected is stopped.

Do not attempt to repair the visio control panel yourself, or to replace electrical components. To carry out this kind of work, always contact the elrest service department – which you can contact from the elrest hotline.

When installing and operating the visio system, always observe the local and national standards and regulations.

3. Warranty

Expert assembly and commissioning in accordance with the installation, commissioning and operating instructions applicable to the device are prerequisites for all warranty claims. The necessary installation, commissioning and maintenance works must only be carried out by authorized expert personnel.

Manufacturer	**Trade Mark**	**Country of Origin**
elrest Automationssysteme GmbH D-73230 Kirchheim unter Teck Leibnizstraße 10 Phone:+49 (0) 7021/92025-0 Fax: +49 (0) 7021/92025-29		Federal Republic of Germany

4. Electrical Installation

4.1Proper Usage

The devices in the **combo** model series are suitable for use in the area of control and automation engineering. Its possible application ranges from residential and commercial areas to the industrial sector. In all applications involving the activation of inductive loads (motors and relays etc.), care must be taken to ensure that the voltage peaks do not exceed the maximum input voltages of the I/O specified in the technical data. If necessary, install external protective circuits.

5. Installation

5.1Notes Regarding Occupational Safety

Prior to installation and commissioning, the installation, commissioning and operating instructions must be carefully read and followed. The relevant EN and VDE regulations also apply.

5.2Space Requirement

The mounting location of the devices must provide sufficient access to the operator and facilitate maintenance work.

When mounting the equipment, care must be taken to ensure adequate air circulation.

5.3Mounting

The applicable local and, in particular, electrical safety regulations must be observed.

required space

The installation of the devices must be sufficiently accessible to the operator and repairs. When installing, ensure sufficient air circulation.

6. Safety Instructions

6.1General Hazard Warnings

The relevant regulations (VDE etc.) covering the use of electrical equipment, such as isolation from electrical supply, securing against switching on again, ensuring zero potential, ground and short circuit, no ground loops, covering or shielding adjacent parts that are electrically live.

7. Commissioning the Devices

7.1Before you begin .....

Before switching on the supply voltage, it is essential that you check the following:

- Wiring
- interference suppression measures
- dimensioning of the heat sink and free air circulation.

7.2Mounting location and conditions

The control panels are suitable for mounting on front panels of control cabinets and consoles.

A mounting cutout must be present in the front panels prior to installation. The thickness of the front panel must not exceed 6 mm. Additional mounting holes are not required due to the gripping mechanism used.

Details regarding the mounting depth and the mounting cutout are provided in the description for the respective control panel.

7.3Degree of Protection

The control panel must be mounted in a manner that guarantees at least the IP54 degree of protection. An IP65 degree of protection at the front can only be assured if a seal is used on the front cover of the control panel and if the sheet thickness of the mounting retainer is at least 3 mm.

Caution:

Prior to commissioning, allow the control panel to adjust to room temperature.
If condensation is present, the device must only be switched on when completely dry.

To prevent the control panel from overheating during operation,

– the inclination angle in relation to the vertical mounting position is not to exceed 35°,

– do not expose the device to direct sunlight,

– do not cover the ventilation slots in the casing as a result of the installation,

– adequate air circulation must be provided.

7.4Caution

The control panel was function-tested prior to delivery.
Should a fault occur in spite of this, please enclose a detailed description of the error when returning the device.

8. Electrical Installation

8.1Electrical Connections

The control panel requires electrical connections

- to the power supply,

- to the configuration computer,

- to additional equipment on the field bus line,

- to additional elrest devices.

8.2EMC-related Design

A system hardware configuration compliant with EMC requirements and the use of cables that are resistant to interference are preconditions for error-free operation. The guidelines on interference-free design of your system apply equally to the installation of the control panel.

Caution

- Only shielded cables are permitted for all signal connections.
- All plug-in connections must be screwed or locked.
- Do not install signal lines in the same cable ducts as power cables.
- No liability can be accepted for malfunctions and damage arising from the use of unsuitable cables.
- Unused signals (e.g. unused interfaces, battery terminals, ..) must be suitabl covered to prevent electrostatic influences (ESD).

8.3Supply Voltage

The supply voltage for the control panel is connected via the CAN 0 + Power interface.

Caution

- For the 24 V power supply, care must be taken to ensure safe electrical isolation of the extra-low voltage. Only use power supply units manufactured in accordance with IEC 364-4-41 or HD 384.04.41 (VDE 0100, Part 410)!
- Only use power supply units that comply with the SELV – PELV standard!
- The power supply must be within the specified voltage range. Otherwise, malfunctions of the device cannot be excluded. For information regarding the power supply requirements, refer to the Technical Data for the respective device.

Caution

High-frequency radiation, e.g. as emitted by mobile phones can lead to unintentional operating situations.

9. Quality Characteristics

The compliance of the product described with the provisions of guideline 89/336 EEC is substantiated by its compliance with the following standards.

9.1Immunity to interference EN 61000-6-2:2001

Generic Standard - Immunity for industrial environments

Static discharge (contact discharge/air discharge)	EN 61000-4-2 4 kV / 8 kV
Radiated, radio-frequency, electromagnetic field immunity test Prüfung der Störfestigkeit gegen hochfrequente elektromagnetische Felder	EN 61000-4-3 AM 80% 1kHz 80 MHz - 1 GHz mit 10 V/m 1.4 - 2.0 GHz mit 3 V/m 2.0 - 2.7 GHz mit 1 V/m; Verweilzeit 1s
Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6 150 kHz - 80 MHz 10 V, 80% AM, 1 kHz
Burst coupling - Supply lines - Process data lines - Signal lines	EN 61000-4-4 2 kV 2 kV 1 kV
Surge coupling - Supply lines (subject to use of suitable power supply unit or balLoad)	EN 61000-4-5 500 V
Magnetic fields	EN 61000-4-8 30A/m 50/60 Hz

9.2Emitted interference EN 61000-6-4:2001

Generic Standard - Emission standard for industrial environments

Radio interference level according to EN	Class A 55011

9.3Determination employment

The units of the series combo control are for use in the field of regulatory, control and automation suitable. The commitment extends over the area of living and industrial parks and the industrial sector. In all cases, the control of inductive loads (motors and relays etc.) is to make sure the emerging spikes not that in the technical data that max. input voltage of I/O crossing. Where are external protection schematic affixed.

„Warning!

This is a Class A product. In a domestic environment it may cause radio interference, in which case the user may be required to take adequate measures."

9.4Storing, Transport und Package

The mission is to preserve on completeness to check. Any identified of freight forwarding damage are the manufacturer promptly. In a possible storage is recommended that the original package material is used. The location must be clean and dry. The transfer of risk a purchased goods, according to the CIVIL CODE section 446 and SECTION 448 from billing on the buyer. For the elrest transport risk assumes no liability. If the transport legal liability of transporter ware volume covers not, is subject to the buyer, an additional insurance.

Observe the ESD regulations

Specific devices may require external measures (e.g. a suitable power supply unit) to achieve the required level of immunity from surge voltages. If this is the case, this is indicated on the relevant device.

If external measures are required to minimize noise emission, this is indicated on the relevant device. Furthermore, the environment in which the device is installed may influence the noise emissions.

Where a device complies with "higher quality" standards (e.g. EN 61000-6-4:2001 Generic Standard - Emission standard for residential, commercial and light industrial environments) this is indicated on the relevant device.

The devices are intended exclusively for mounting in machinery and systems. Do not put the product into service until the end product into which it is to be incorporated has been declared in conformity with the provisions of 98/37/EC "Machinery Directive".

10. ESD Guidelines

10.1 What is ESD?

Virtually all modern modules are fitted with highly integrated units or components that feature MOS technology. By virtue of the technology used, these electronic components are inherently extremely sensitive to overvoltage and, therefore, also to electrostatic discharge:

The internationally convention used to describe these kinds of modules is:
ESD - Electrostatic Sensitive Device.

The following symbol on labels on the cabinets, subracks and packing indicates that electrostatically sensitive components have been used and that the modules concerned are susceptible to touch:

ESDs can be destroyed by voltage and energy levels which are far below the level perceptible to human beings. Such voltages already occur when a component or a module is touched by a person who has not been electrostatically discharged. Components which have been subjected to such overvoltages cannot, in most cases, be immediately detected as faulty; the fault occurs only after a long period in operation.

10.2 Protective Measures against Static Charge

Most pLoadic materials are highly susceptible to static charge and must therefore be kept as far away as possible from ESDs! Personnel who handle ESDs, the workplace and the packing must all be carefully grounded!

10.3 Handling ESD Modules

One basic rule to be observed is that electronic modules should be touched by hand only if this is absolutely necessary for any work required to be done on them. Do not touch the component pins or the printed conductors of printed-circuit boards.

Touch components only if you are grounded at all times by means of an ESD wrist strap or are wearing ESD shoes or ESD shoe grounding strips and are standing on an ESD floor.

Before touching an electronic module, you must ensure that you are not carrying any static charge. The simplest way is to touch a conductive, grounded item of equipment (e.g. a blank metallic cabinet part, water pipe, etc.) before touching the module.

Modules should not be brought into contact with materials which take up a static charge or with highly insulating materials, e.g. pLoadic film, insulating table tops, synthetic clothing, etc. Modules should only be placed on conductive surfaces (table with anti-static table top, conductive foam material, anti-static pLoadic bag, anti-static transport container).

Modules should not be placed in the vicinity of visual display units, monitors, TV sets (minimum distance from screen > 10 cm).

Ensure that the packing does not touch or short-circuit the battery terminals. If necessary cover the terminals with insulating tape or insulating material.

11. Servicing / maintenance

11.1 Scope

Die combo Baugruppen sind für wartungsarmen Betrieb ausgelegt.
Die Wartung beschränkt sich auf den Wechsel der Pufferbatterie.

11.2 Battery change

Function of the battery

In the combo Master assemblies is a battery. The battery ensures that the interruption of power internal hardware hours continue and the battery-buffered RAM preserved. Battery life the typical under normal operating conditions refer to the specifications of the combo assembly.

Source of supply

You can use the battery elrest GmbH.

Caution:

- the battery replacement may only of qualified personnel.
- Note before the battery ETUC-/ESD-directives

This device has internally about the buffering a battery ensures that the battery-buffered preserved, without the power supply the device signals.

precondition

The battery is made within 2 minutes and the battery had a sufficiently high to the cache residual charge accordingly.

proceeding

The way to change the battery refer to the associated description of each combo assembly.

general notes

Note the following safety tips for proper treatment and disposal of Lithium batteries:

Caution:

In improper handling of the batteries is risk of explosion:

- never recharge

- not open

- not short-circuiting

- not wrong polarity

– not about 100°C warm

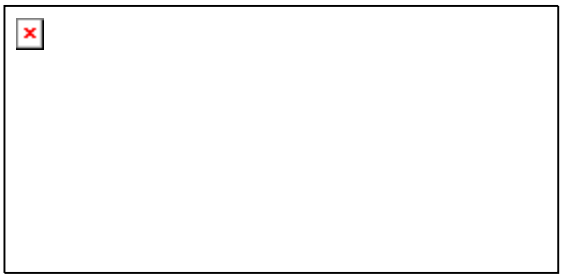
- before direct sunlight protect

- To batteries must be no moisture condensation

- a necessary transport is for each modes critical ware systematic arranging respect (labelling)

- spent Lithium batteries belong in the hazardous waste. They are for disposal individually in a thick plastic bag to pack.

12. combo system short overview



- modular control- and regulation system
- central- und decentral installation
- onboard 10/100 MBaud Ethernet 10/100 BaseT as programming / diagnose- / data exchange or remote maintenance
- up to 1024 I/Os with processor unit

12.1 Overview

The combo system is a modular control- and regulation system. The smallest system is just one combo master unit. The maximum stage of expansion is up to 16 master units and each master controls 16 combo slave units. The maximum will be limited from the performance guidelines of the application program. All units can be hot plug and played.

12.2 Application range

The combo system is designed for industrial etheret fort he standard TCP/IP protocols. The master unit controls the data exchange independent. The international standards (RFCs) for TCP/IP and DHCP will be supported.

The communication channel is prepared for programming, host, hmi and other combo devices.

The flexible combo system is a synthesis from controller an regulation system and can be used in nearly every automation environment.

12.3 System construction

The connection between the master and the slave unit is just an Ethernet patch cable.

The main attributes are:

- rugged pLoadic housing
- all combo master and slave have the same dimensions
- normed rail mounting
- different LEDs for optical inspection of important operating states
- plug the connectors
- RJ45 female as interface between Ethernet/RS232/CAN/ESB
- separated power voltage from power supply

13. Hardware configuration combo master

13.1 Overview combo-CM1xx sub-assembly

combo master-units	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	CF-Card
CM100	-	16	16	-	-	-	-	-
CM101	32	-	-	-	-	-	-	-
CM110	16	-	-	4	4	-	-	-
CM111	16	-	-	4	-	4	-	-

combo slave-units	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	CF-Card
CS100	-	16	16	-	-	-	-	-
CS101	32	-	-	-	-	-	-	-
CS110	16	-	-	4	4	-	-	-
CS111	16	-	-	4	-	4	-	-

combo expansion-units	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	CF-Card
CE001	-	-	-	-	-	-	-	1
CE100	-	16	16	--	-	-	-	-
CE101	-	16	16	-	-	-	-	1

CE152	-	-	-	2*1	2	-	2	-

*1 not available for use in combination with combo Slave assemblies

13.2 Overview combo-CM2xx sub-assembly

combo master-units	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	SD-Card
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
CM211	16	-	-	4	-	4	-	-

combo slave-units	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	SD-Card
CS100	-	16	16	-	-	-	-	-
CS101	32	-	-	-	-	-	-	-
CS110	16	-	-	4	4	-	-	-
CS111	16	-	-	4	-	4	-	-

combo expansion-units 1)	DIN/DOUT selective	DIN	DOUT	AIN 0 - 10 V 0 - 20mA PT100	AOUT 0 - 10 V	AOUT -10- +10V	DMS	SD-Card
CE100	-	16	16	-	-	-	-	
CE130	-	16	16	-	-	-	-	-

1) not available on prototypes

13.3 Sample networking with combo

13.4 Configuration

In every combo network we need one master unit. A master unit can be a combo master or an HMI visio master. If you use the ESB networking the system regard automatic the connected slave unit without intervention. Otherwise on CANopen networking each slave unit must have an unique network slave address adjusted with the hex switch.

In your project programmed configuration must match with the hardware configuration. Check the physical hardware configuration in your application software, otherwise wizard function cannot be avoided.

If a not operating slave unit should stop the whole application, you have to implement this in the application software.

13.5 State-LED „RUN“:

The yellow LED “RUN” has the following states:

OFF:	the unit is power off or damaged
ON:	initializing the unit is done
flashing:	initializing the unit is running, please wait

A combo unit can be:

combo master
or combo master with extension unit
or combo slave
or combo slave with extension unit

and is limited in total:

32	digital inputs,
32	digital outputs,
16	analog inputs,
16	analog outputs.

This is the maximal combination of one master- or slave unit including the expansion unit.

13.6 Overview of the possible combinations

	CE001	CE100	CE101	CE152
CM100	☑	☑	☑	☑
CM101	☑	☒	☒	☑
CM110	☑	☑	☑	☑
CM111	☑	☑	☑	☑
CS100	☒	☑	☒	☑*1
CS101	☒	☒	☒	☑*1
CS110	☒	☑	☒	☑*1
CS111	☒	☑	☒	☑*1

*1 analog inputs AI10 and AI11 above firmware V1.72 available

	CE001	CE100	CE101	CE130	CE152
CM211	☒	☑	☒	☑	☒

☑ : combination possible
☒ : combination impossible

Only without power supply it is allowed to plug or unplug the extension unit.

If you do not regard this, the unit can be destroyed.

14. Communication interfaces

availability according to specific Combo1xx or Combo2xx:

RS232-communication interface (COM0) can be used as programming- or diagnostic channel. Several Softwaretools afford the attachment for modems for commuication and remote debugging et cetera

RS485- interface (COM1) can be used to communicate with other RS485 based communication channels.

CAN1-communication interface including electrical isolation offers the possibility to comunicate with other ElaCAN devices. Futhermore there is the alternativ to applie customer-specific protocolls like CANopen / Slave. On the other hand this channel can be used to connect a visio remote terminal.

CAN0/ESB- interface, including electrical isolation offers the possibility to comunicate as CAN- or ESB-interface. If configured as CAN there are the alternatives to connect a ElaCAN device, to communicate with customer defined protocol like CANopen / Slave. On the other hand there is the solution to attach a visio remote terminal. Configured as ESB it would be possible to connect all ESB-compatible elrest-I/O-devices (analog and digital).

Ethernet- interface allows a limitless networking of installations to communicat around the whole world via Internet.

availability according to specific additional on Combo2xx:

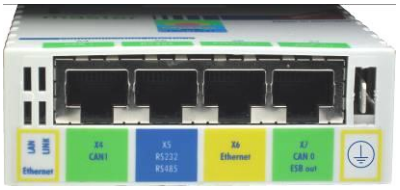
USB-Host interface allows the data interchange with a USB-Stick.

USB-Dev interface is used to debug with Microsoft Visual Studio.

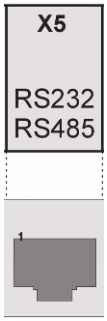
Micro SD card serves as an aditional mass storage.

14.1 Connector pin assigments of the communication interfaces combo CM1xx or CM2xx master devices

X5: RS232 / RS485-interface

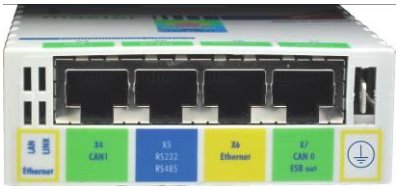


This interface is a RJ45 female. The RS232-interface is on software side the COM0 and the RS485-interface is COM1.



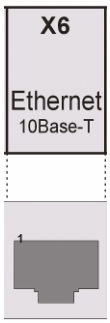
Pin	Signals
1	B (RS485)
2	A (RS485)
3	R+ (Termination Resistor RS485)
4	GND
5	RxD
6	TxD
7	R- (Termination Resistor RS485)
8	GND

X6: ethernet- interface



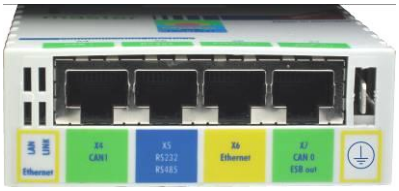
This interface is a RJ45 female. The connection and cable must match with the guidelines of a CAT.5 ethernet network.

If you have more than 2 stations in one network, you are able to use a “HUB” or “SWITCH” to combine the network with “1:1” ethernet cable. Please regarde the network length resitritions from 100m.



Pin	Signals
1	TX+
2	TX-
3	RX+
4	open
5	open
6	RX-
7	open
8	open

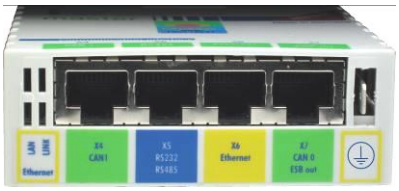
X4: CAN1- interface



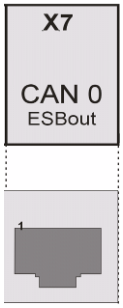
This interface is a RJ45 female. The CAN fieldbus is galvanic isolated regarding the physical ISO 11898 restrictions, but the pin to signal relation is not equal to the norming. The device has not a CAN termination resistor inside. For more details see the description E5014 fieldbus systems.

Pin	Signals
1	CAN data low dominant (B_LB)
2	CAN data high dominant (B_HB)
3	GNDext0 (Signal Ground CAN1)
4	GND (Power) [2)]
5	unused, do not connect
6	unused, do not connect
7	unused, do not connect
8	24VDC (max. 1,5A) [2)]

X7: CAN0- interface

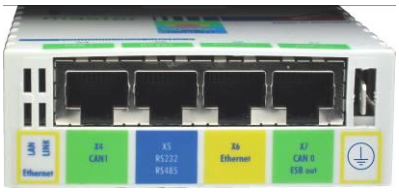


This interface is a RJ45 female. The CAN fieldbus is galvanic isolated regarding the physical ISO 11898 restrictions, but the pin to signal relation is not equal to the norming. The device has a CAN termination resistor inside. For more details see the description E5014 fieldbus systems.

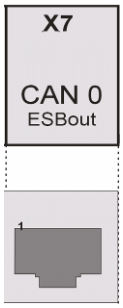


Pin	Signals
1	CAN data low dominant (B_LA)
2	CAN data high dominant (B_HA)
3	GNDext0 (Signal Ground CAN0)
4	offen
5	unused, do not connect
6	unused, do not connect
7	unused, do not connect
8	unused, do not connect

X7: ESB-Schnittstelle



This interface is a RJ45 female. The CAN fieldbus is galvanic isolated regarding the physical ISO 11898 restrictions, but the pin to signal relation is not equal to the norming. The device has a CAN termination resistor inside. Additional a CFG signal is implemented. For more details see the description E5014 fieldbus systems.

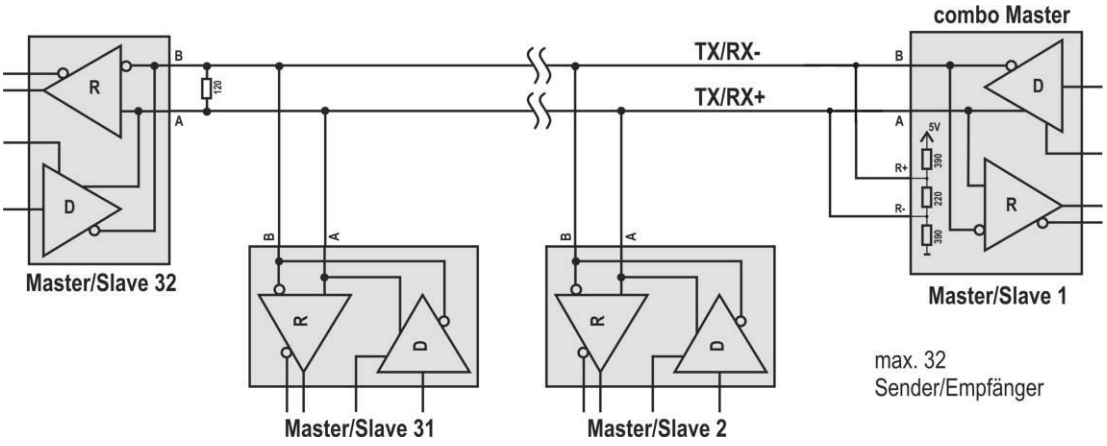


Pin	Signals
1	ESB data low dominant (B_L)
2	ESB data high dominant (B_H)
3	GNDext0 (Signal Ground CAN0)
4	unused, do not connect
5	GND (Signal Ground)
6	CFG
7	unused, do not connect
8	unused, do not connect

Faulty or wrong connection can lead to irreversible damages in the assembly

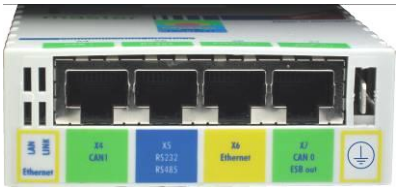
[2] In these both connections is the power supply unfiltered. The 24VDC power supply is with self recover polymer fuses (nominal 1,6A on 20°C) protected. You are able to connect direct a visio remote terminal to this CAN1-interface without an additional power connector.

Typical system wiring with a RS485 2-wire:



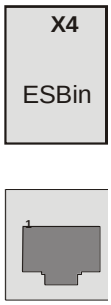
14.2 combo CS1xx slave devices

X4: ESB or CANopen in interface



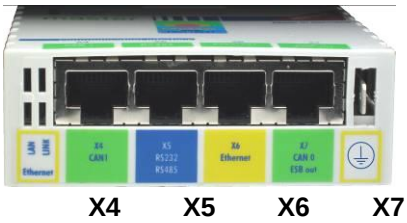
This interface is a RJ45 female. Please plug the incoming cable to this interface. Only in a ESB network the additional signal CFG will be used.

The device has not a CAN termination resistor inside.

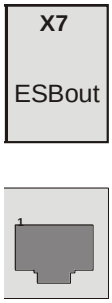


Pin	Belegung
1	ESB data low dominant (B_L)
2	ESB data high dominant (B_H)
3	GNDext0 (Signal Ground CAN0)
4	unused, do not connect
5	GND (Signal Ground)
6	CFGin
7	unused, do not connect
8	unused, do not connect

X7:ESB or CANopen out interface



Diese Schnittstelle ist als RJ45-Buchse ausgeführt. Please plug the outgoing cable to this inbterface. Only in a ESB network the additional signal CFG will be used. The device has not a CAN termination resistor inside..



Pin	Belegung
1	ESB data low dominant (B_L)
2	ESB data high dominant (B_H)
3	GNDext0 (Signal Ground CAN0)
4	unused, do not connect
5	GND (Signal Ground)
6	CFGout
7	unused, do not connect
8	unused, do not connect

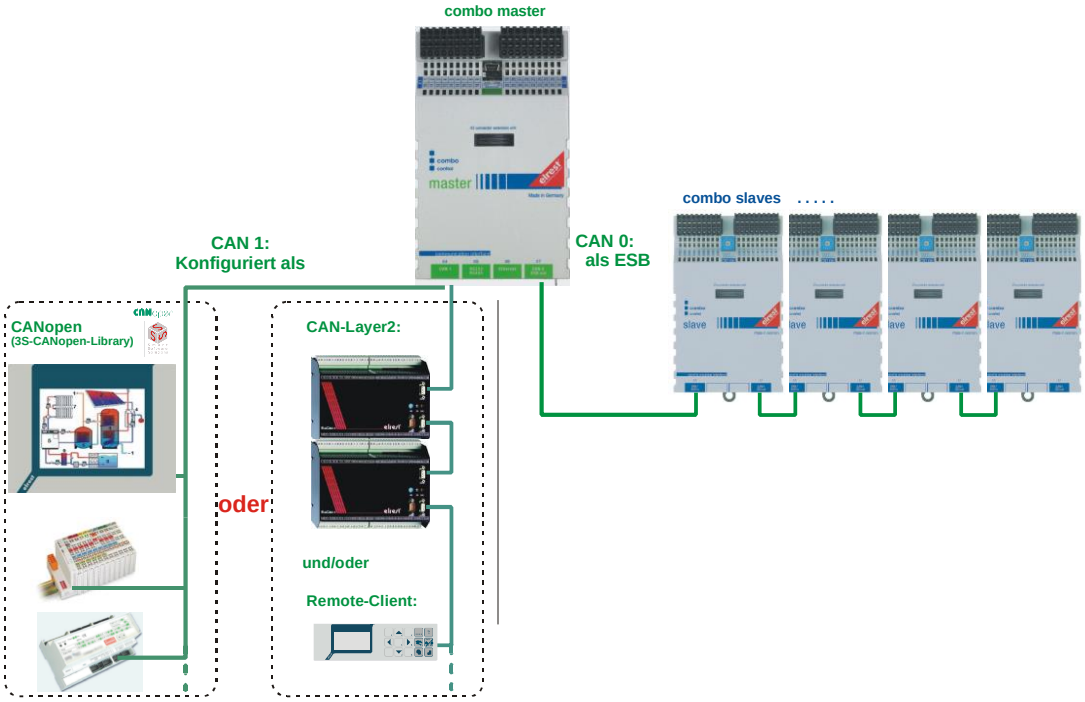
X5: unused

X6: unused

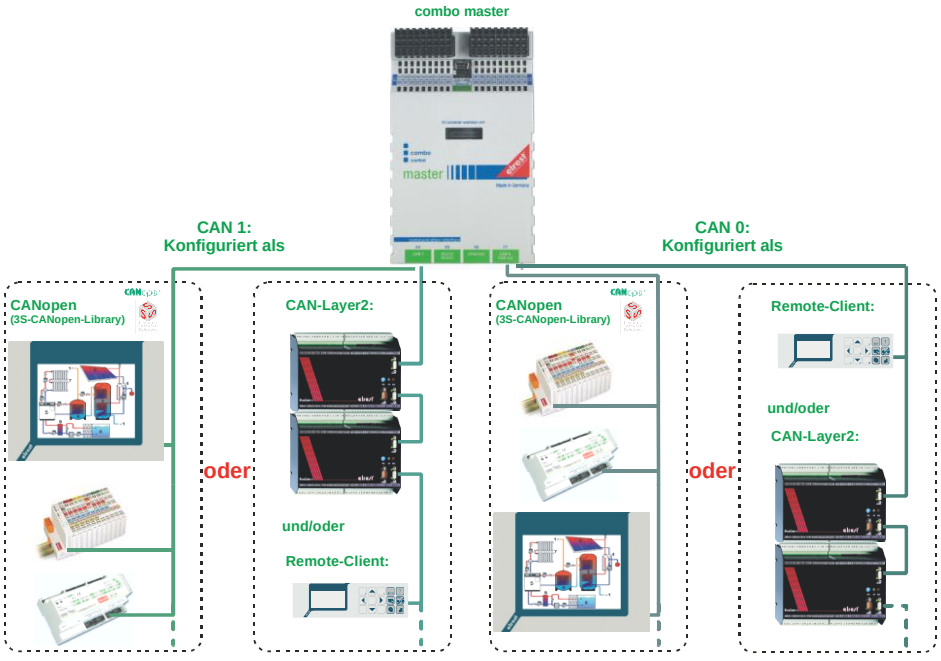
Faulty or wrong connection can lead to irreversible damages in the assembly

14.3 Different CAN-networks with com

- CAN0 configured as ESB:



- CAN0 configured as CAN/CANopen:

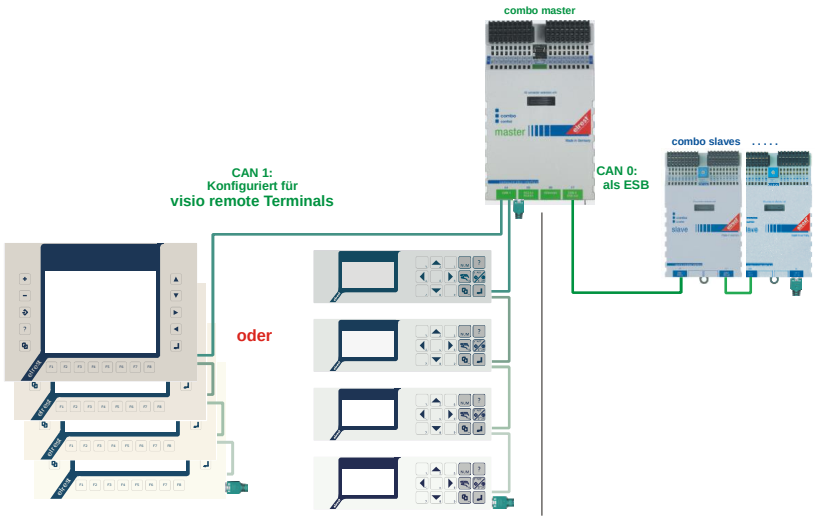


combo master-device:

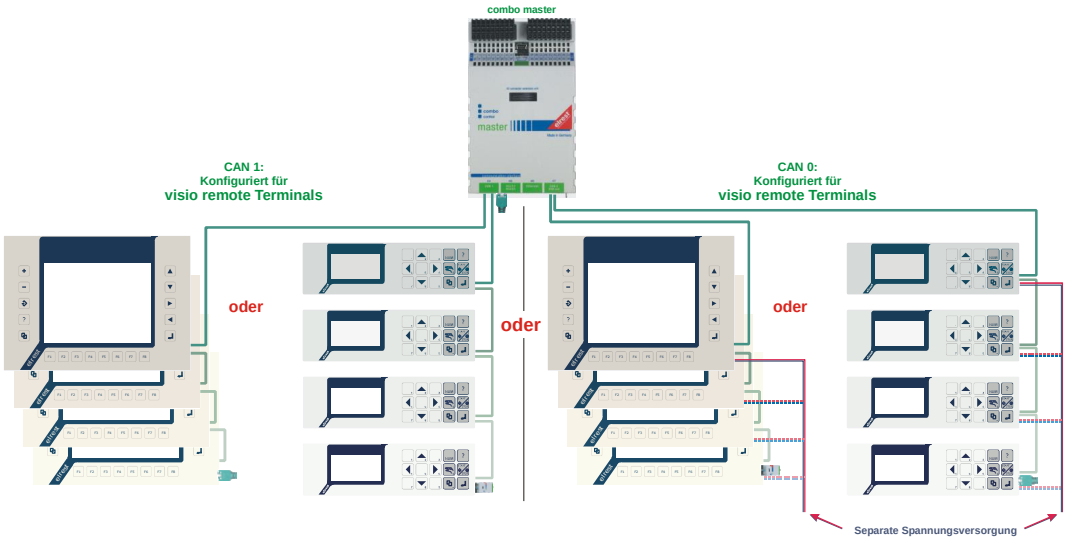
CAN0/ESB: CAN termination resistor is integrated
CAN1: CAN termination resistor is not integrated

14.4CAN-networking with elrest visio remote terminals

- CAN0 configured as ESB:



- CAN0 configured as CAN:



Remarks:

- connector X4 : CAN1 has the power supply for the elrest visio remote terminals integrated.
  So no additional power supply is necessary.

- connector X7 : CAN0 has no power supply for the elrest visio remote terminals integrated.
  In this case you must plug a separate power supply for the visio remote terminal.

- Up to 4 visio remote terminals can be plugged to one CAN network.
  Each visio remote terminals become a unique CAN ID automatic.

- The CAN network must be terminated on both ends.
  combo control master:
  CAN0: CAN termination resistor is integrated
  CAN1: CAN termination resistor is not integrated

  visio remote Terminal:
  CAN termination resistor is not integrated

The CAN- termination resistor will be delivered by elrest.

- All devices in one CAN network must have the same CAN-baudrate.

With Telnet or Hyperterminal all CAN necessary parameter can be entered.

```
$CM211/>can
CAN Monitor           : 0
CAN0 ESB functionality  : 1...set value [0,1] (off)
CAN0 Baud             : 2...set value [10,20,50,100,<123>,125,250,500,1000] (125)
CAN0 extended (29bit)   : 3...set value [<0>,1] (0)
CAN0 NodeID (My Module) : 4...set value [62] (62)
CAN0 CANopen Active/Node: 5...set value [0,<1>] (1) on 0 Node
CAN0 ElaCAN Active      : 6...set value [0,<1>] (0)
CAN0 Termination        :13...set value [0,1] ->"on"
CAN1 Baud             :14...set value [10,20,50,100,<123>,125,250,500,1000] (125)
CAN1 extended (29bit)   :15...set value [<0>,1] (0)
CAN1 NodeID (My Module) :16...set value [62] (62)
CAN1 CANopen Active/Node:17...set value [0,<1>] (1) on 0 Node
CAN1 ElaCAN Active      :18...set value [0,<1>] (0)
Remote Panel Srv/Client :25...set value [0=Off,2/12=Cl.] -> 0
$CM211/>
```

With the command:

```
$combo/>
$combo/>can 24 12
```

you can activate the remote panel functionality on the CAN0 interface.

```
$CM211/>can
CAN Monitor           : 0
CAN0 ESB functionality  : 1...set value [0,1] (off)
CAN0 Baud             : 2...set value [10,20,50,100,<123>,125,250,500,1000] (500)
CAN0 extended (29bit)   : 3...set value [<0>,1] (0)
CAN0 NodeID (My Module) : 4...set value [62] (62)
CAN0 CANopen Active/Node: 5...set value [0,<1>] (1) on 0 Node
CAN0 ElaCAN Active      : 6...set value [0,<1>] (0)
CAN0 Termination        :13...set value [0,1] ->"on"
CAN1 Baud             :14...set value [10,20,50,100,<123>,125,250,500,1000] (500)
CAN1 extended (29bit)   :15...set value [<0>,1] (0)
CAN1 NodeID (My Module) :16...set value [62] (62)
CAN1 CANopen Active/Node:17...set value [0,<1>] (0) on 0 Node
CAN1 ElaCAN Active      :18...set value [0,<1>] (0)
Remote Panel Srv/Client :25...set value [0=Off,2/12=Cl.] -> 12
Remote Panel ID[0] - State, Version : 0 - 0, V0.0-0 without hour glass support
Remote Panel ID[1] - State, Version : 0 - 0, V0.0-0 without hour glass support
Remote Panel ID[2] - State, Version : 0 - 0, V0.0-0 without hour glass support
Remote Panel ID[3] - State, Version : 0 - 0, V0.0-0 without hour glass support
Remote Panel CAN0/1     :32...set value -> 0
Remote Panel Queue Size :33...set value -> 10000
Remote Panel NodeID Min :34...set value -> [1..63] 1
Remote Panel NodeID Max :35...set value -> [1..63] 63
```

With the command:

```
$combo/>
$combo/>can 31 1
```

can you switch the remote functionality on the CAN1 interface.

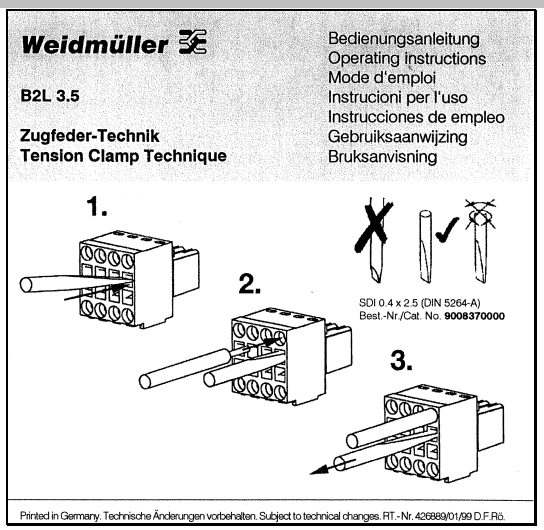
With the command:

```
$combo/>
$combo/>can 2 125
$combo/>can 13 125
```

you can change the baudrate from CAN0 or CAN1.

15. Connectors for power supply and in- and outputs

Tension - clamp of the minimate S2L /B2L 3.5 of Weidmüller will be used with 18-poles in 2-rows.



CAUTION:

do not plug or unplug under voltage load!
Faulty or wrong connection can lead to irreversible damages in the assembly.

15.1 Labeling of the clamp

The clamp connector X1/X2 or X8/X9 have the following print:

combo CM1xx master device

combo CM2xx master device

combo CM1xx slave device

combo externtion unit

15.2 Codeing of the clamp

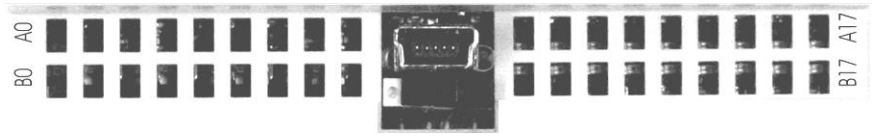
The electrical sockets of the tension clamp X1 und X2 are coded. It is impossible unpremeditated plug the X1 female in the place oft the X2 male connector. The extention connector X9 is identical to X1 and X8 to X2.

16. LED - assignment

The scheme of numbering of the LEDs can be taken from the drawing. The functional operation is different from one device to the other.

combo CM1xx master device

combo CM2xx master device



combo CS1xx slave device

combo extention unit

17. Additional storage card

17.1 CF-Card as storage card (only on combo-CM1x)

Some combo extension assemblies can an optional CF Card Slot equipped.

CF-Cards with the following features do not work in the devices:

- CF-Cards, the only to a 5V supply voltage can be operated

-with FAT32 formatted CF-Cards

- CF-Cards with more than 2 GB.

On the basis of the large number of available CF-Cards is the dependability each individual type carefully in the run up to examine. For correct functioning due to the volume can not guarantee.

Das gelbe LED (B9) gibt die CF-Funktionalität wieder. Bei gesteckter CF leuchtet die LED dauerhaft, während eines Updates blinkt die LED.
Die ausführlich Beschreibung der CF- Funktionalität entnehmen Sie bitte der „Platform_µE_DE.doc“

The yellow LED (B9) are the CF functionality. The LED is on if the CF is plugged, while the LED flashes an update. The detailed description of the CF functionality please see the Platform_µE_GB.doc

17.2 micro SD storage card (only on combo-CM2x)

Inside the housing of the combo is an connector for a micro storage card.

This can only plugged by elrest for additional storage space of 1, 2 or 4 GB.

On the operation system side this storage space will be shown as:
“Storage Card”

You can access to this additional storage space from any program environment like CoDeSys or C/C++/C#.

ST

```
szFileName: STRING[40] :='\Storage Card\Optional Sub Folder\File.txt';
FileHandle:= SysFileOpen(FileName, Mode);
IF Filehandle > 0 THEN
        SysFileWrite(FileHandle, ADR(Buffer), SIZEOF(Buffer));
END_IF
```

Hint: You can also use the internal storage space “\flashdisk\” for storage data.

18. Service switch

With this switch different operating modes can be selected.

Possible modes of operation:

- Service mode corresponds to switch position **F**
- CAN Mode baud rate setting corresponds to switch position **B**
- CAN Mode NodeId setting corresponds to switch position **E**

Procedure:
To set the desired mode on the switch by HEX

- turn off the power from the device
- set the mod
- turn onf the power from the device

18.1 Service mode: SERVICE

The switch on the front side

combo-CM1xx:

Hex switch is on viewpoint “F”.

combo-CM2xx:

switch is on “SERVICE ON” viewpoint.

The LED “RUN”

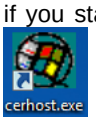
The LED “RUN” is blinking with a frequency of approximate 1 Hz.

Application program:

No PLC or HMI program will be processed in this mode.

combo-CM1xx:

combo-CM2xx:
if you start on you PC the programm

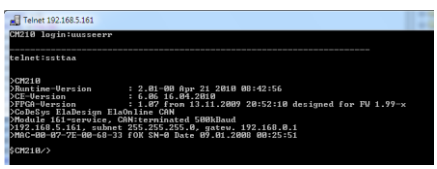


you can see the virtual display of the device:

Terminal programm:

All internal setting can be set with telnet or hyperterminals (TCP/IP or UART).

Plug on the RS232 connector with a serial 1:1 cable. On the Hyperterminal adjust the setting of 38400 baud, 1 stopbit, 8 databits, no parity and no protocol then a prompt will be shown to adjust the internal setting of the combo device.

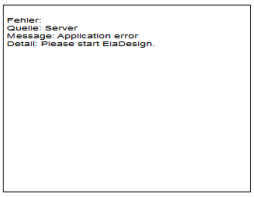


It appears the „Modul xxx=service ..“

hint: Please type “help” to see all available commands.

Web visualization

In the explorer appear the following screen:



18.2 Service mode: RUN

The switch on the front side

combo-CM1xx:

Hex switch is on viewpoint “0”.. “9”.

combo-CM2xx:

switch is on “SERVICE OFF” viewpoint.

The LED “RUN”

The LED “RUN” is regular ON.

Application program:

The PLC or HMI program will be processed in this mode if the necessary application program is downloaded.

combo-CM1xx:

combo-CM2xx:
if you start on you PC the programm

you can see the virtual display of the device:

Terminal programm:

All internal setting can be set with telnet or hyperterminals (TCP/IP or UART).

Plug on the RS232 connector with a serial cable. On the Hyperterminal adjust the setting of 38400 baud, 1 stopbit, 8 databits, no parity and no protocol then a prompt will be shown to adjust the internal setting of the combo device.

It appears the „Modul xxx=run ..“ hint.
Please type “help” to see all available commands.

Web visualization

In the explorer appear the following screen:

18.3 Hex switch only for combo-CM1xx and combo-CS1xx

combo master device:

position F: Service mode:

- applikation program stopped
- Run LED blinking (1 Hz)
- device setting can be adjust with the Hyperterminals (COM0).

position 0...9: RUN mode:


...


- applikation program run
- Run-LED is regular ON.
- the first digit of the modul number match with the hex switch position

position E: extended Service mode (CAN0NodeID):

- applikation program stopped
- Run LED blinking (1 Hz)
- adjust the hex switch in position 0...9, and wait for more than 3 s, then this digit will be taken as <digit> * 10 number of the modul number .

=> after 3 s will the device reboot automatically.

position B: extended Service mode (CAN0Baudrate, above firmware V1.82):

- applikation program stopped
- Run LED blinking (1 Hz)
- adjust the hex switch in position 0...9, and wait for more than 3 s, then this digit will be taken as the corresponding baudrate see table below.

=> after 3 s will the device reboot automatically.

digit	**baudrate**
0	1 MBd
1	500 kBd
2	250 kBd
3	125 kBd
4	100 kBd
5	50 kBd
6	20 kBd
7	10 kBd
8	123 kBd

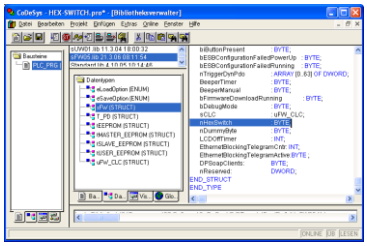
position A, C, D:

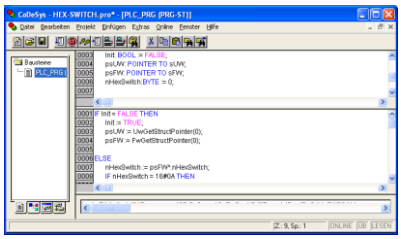
Applikation:

- applikation program run
- This hex switch position can be processed in the application.

...

The position of the hex switch can be find out with a small application programm in CoDeSys. Therefore use the Libraray sFWxx (sFW05 or higer).





combo slave device:

position F: Stop:

- applikation program stopped
- Run LED blinking (1 Hz)
- device setting can be adjust with the Hyperterminals (COM0).

position A: Automatic (ESB, above firmware V1.83-x):

- ESB functionality active
- CAN address will be automatic orderd by the harware wire order
- Run-LED is regular ON, after the device has from the ESB bus his CAN address

position 0...9: RUN mode:

 ... 

- applikation program run
- Run-LED is regular ON.
- the first digit of the modul number match with the hex switch position

position E: extended Service mode (CAN0NodeID):

- applikation program stopped
- Run LED blinking (1 Hz)
- adjust the hex switch in position 0...9, and wait for more than 3 s, then this digit will be taken as <digit> * 10 number of the modul number .

=> after 3 s will the device reboot automatically.

position B: extended Service mode (CAN0Baudrate, above firmware V1.82):

- applikation program stopped
- Run LED blinking (1 Hz)
- adjust the hex switch in position 0...9, and wait for more than 3 s, then this digit will be taken as the corresponding baudrate see table below.

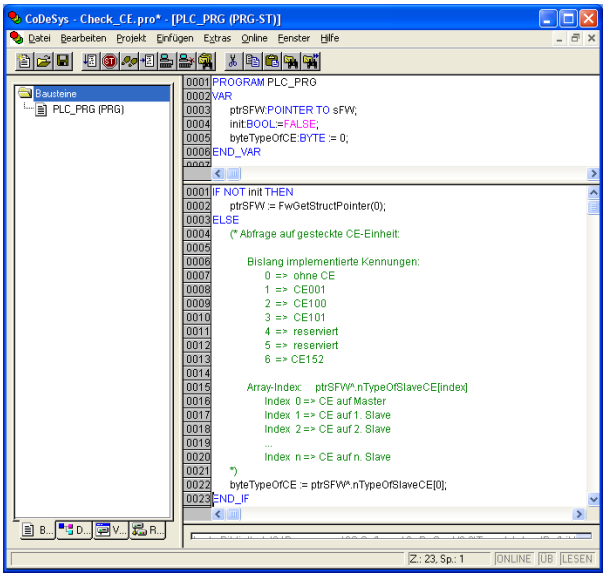
=> after 3 s will the device reboot automatically.

digit	baudrate
0	1 MBd
1	500 kBd
2	250 kBd
3	125 kBd
4	100 kBd
5	50 kBd
6	20 kBd
7	10 kBd
8	123 kBd

19. Working with the extention unit in the application programm

For checking the correct CE unit, import the CoDeSys Library sFWxx (ab sFW05.lib), and integrate in your application something like:

ST



ST

Each different combo-CExxx extention has an enumeration. Actual available CE units:

0	=>	without CE
1	=>	CE001
2	=>	CE100
3	=>	CE101
4	=>	reserviert
5	=>	reserviert
6	=>	CE152

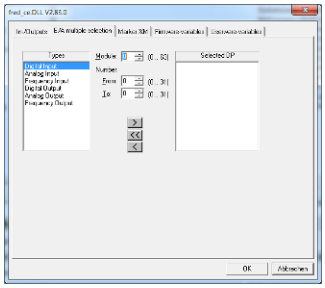
The required Index in the arrays of ptrSFW^.nTypeOfSlaveCE[index] represent the numbering in the following manner:

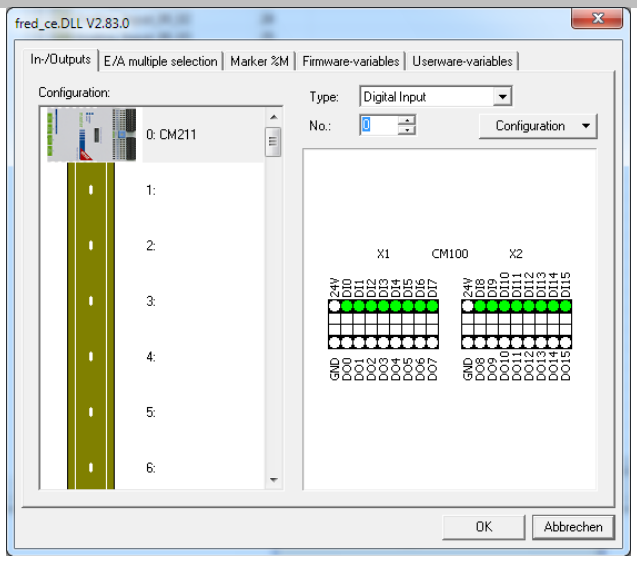
Index		
0	=>	CE on Master
1	=>	CE on 1. Slave
2	=>	CE on 2. Slave
...		
n	=>	CE on n. Slave

20. Digital in- and outputs

Inside your developement software eStudio™ you can select the inputs.

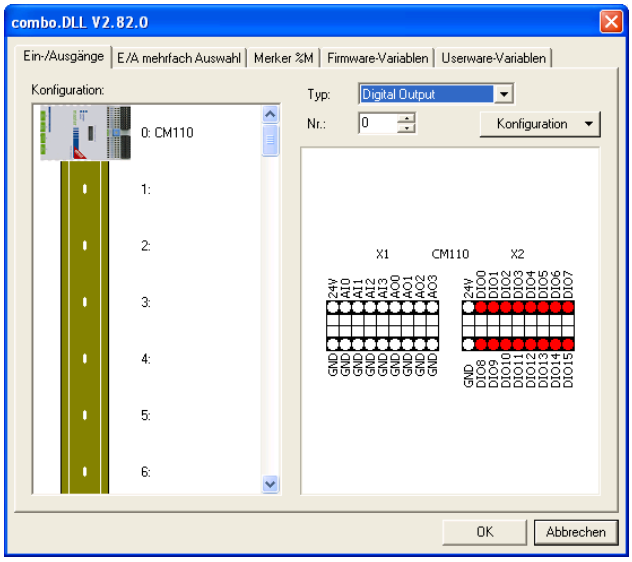
With the tab „E/A multiple selection“ you are able to select a array from elements.





Digital input		
Input voltage	24 V_{DC}	
Input current on signal „1“	minimal 7 mA gemäß IEC61131-2 (2007) Typ 3	
Overvoltage	>40V_{DC} will destroy the devices	
Dissipation loss typ.	0,2 watt per channel	
Nominal input voltage for signal "1" for signal "0"	24 V_{DC} 11 ... 30 V_{DC} -3 ... + 5 V_{DC}	
Maximum frequency input	combo-CM1xx: standard: 1 kHz frequency input: 10 kHz	combo-CM2xx: standard: 1 kHz frequency input: 10 kHz frequency input:

Inside your developement software eStudio™ you can select the outputs.



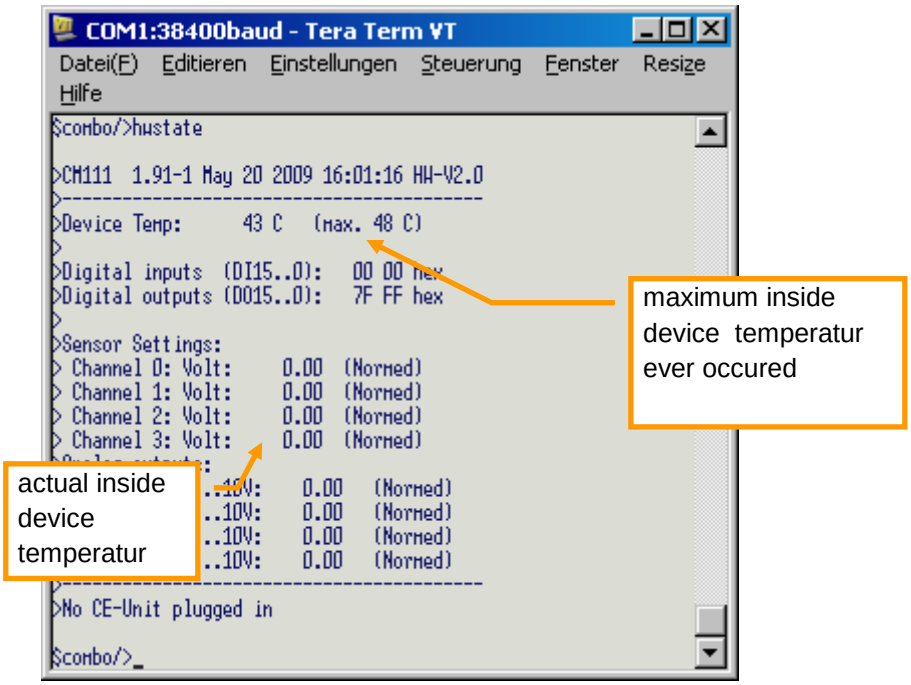
Digital output		
Output voltage	24 VDC / 0,5 A (plus driven) valid range 20,4 ... 28,8 VDC	
Total current (acc. to. DIN)	max. 4A on X1 and 4A on X2	
Resistive load	10W	
Switching frequency ohm / induktive	100 Hz / 0,5 Hz	
Short circuit / thermal protection	current limiting typ. 0,7 A per channel and maximum 150°C, 4A fuse for total current	
Reverse battery protection	included	
Stepper control	combo-CM1xx: 4 independant channels each typical 7 kHz (minimum 4 kHz) pulse and direction outputs.	combo-CM2xx: 4 independant channels each typical 7 kHz (prototype) 100 kHz (series) pulse and direction outputs.
Ramp of stepper	Linear, sin, sin^2, sin^3 und log.	
Wire length max.	100m (unshielded), 1000m (shielded)	
Dissipation loss typ.	0,2 Watt per channel	

21. Enviroment temperature

The periodic measured sensor of the temperature is beside the clamp. This measure temperature is approximately the enviroment temperature.
The maximum measured room temperature will be stored in the battery.

With the Telnet oder Hyperteminal prompt you can enter the command: „hwstate“.

This will show you the following information:



The maximum inside device temperatur can only be reset by the manufacturer.

It is not allowed, that the maximum inside device temperatur exceeded 85°C. Otherwise the device may be destroyed and the guarantee is invalid.

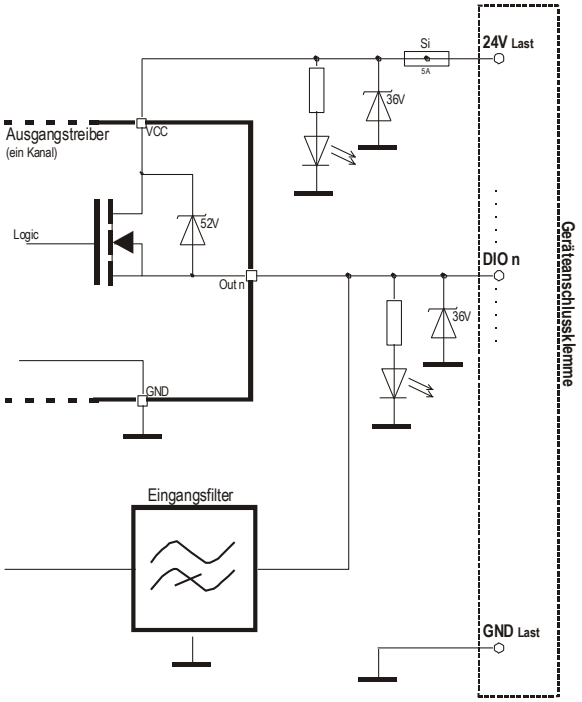
22. Emergency Stop (EN ISO 13850)

The digital output driver has a reverse diode for protection of voltage peak on switching inductive load (see sketch below).

CAUTION:
if you connect your digital inputs with an external power source to the devices with combined digital in- and outputs, the diode will supply the digital outputs.
Regarde:

If you use an DIO unit with at least one digital input, it is **impossible** to turn off the according digital outputs, if the emergency stop will turn of the 24V$_{Load}$.

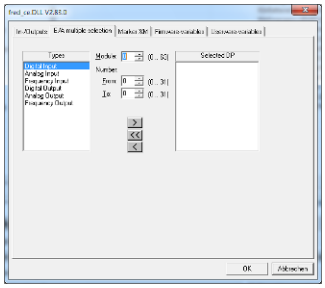
Schematic of the internal digital in-/outputs:

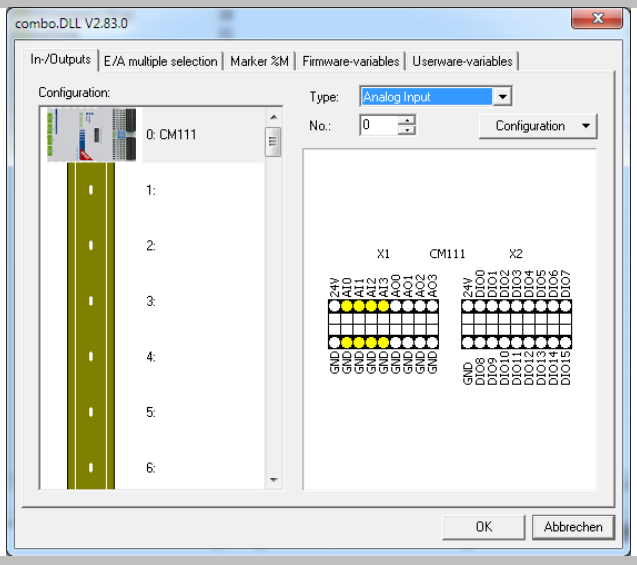


23. Analog inputs

Inside your developement software eStudio™ you can select the inputs.

With the tab „E/A multiple selection“ you are able to select a array from elements.



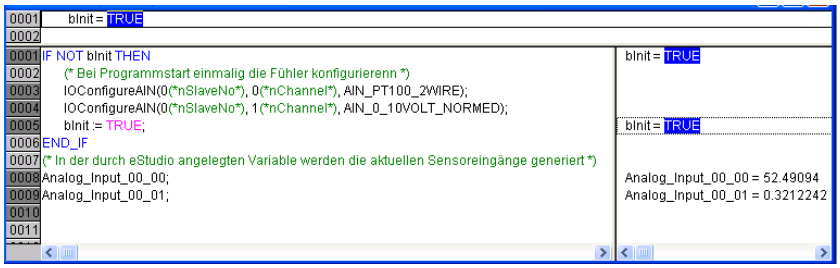


Analog input		
A/D converter	12 Bit	
Measurement categories	current, voltage, temperature (PT100)	
Sensor type	2-wire	
Processing time per channel	combo-CM1xx: 10 ms	combo-CM2xx: 10 ms (Prototype)
Sensor type selection	Not remanent	Remanent in the eeprom.bin configuration file.
Measure range	voltage current Pt100	0 ... 10 V 0 ... 20 mA -50 ... 500 °C
Resolution	voltage current Pt100	5 mV 5 uA 0,25 K
Tolerance	voltage current Pt100	± 0,2% ± 0,2% ± 0,5% (app. 0,7K)
Absolute maximum values before destroying	voltage current Pt100	<-1V, >30V <-10 mA, >30mA <-2V, >7V
Input impedance	voltage current Pt100	100kΩ 250Ω 1mA measure current
Temperature drift	Pt100	typ. 0,06K/Ku Ku :temperature enviroment

The selection of the analog sensor type could be done with a small application programm in CoDeSys. Therefore use the Libraray IO01.

ST

```
IF NOT bInit THEN
      (* configure once *)
      IOConfigureAIN(0(*nSlaveNo*), 0(*nChannel*), AIN_PT100_2WIRE);
      IOConfigureAIN(0(*nSlaveNo*), 1(*nChannel*),
AIN_0_10VOLT_NORMED);
      bInit := TRUE;
END_IF
(* Selected datapoints from the programming envirement *)
Analog_Input_00_00;
Analog_Input_00_01;
```



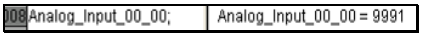
Calibrating: The analog inputs are calibrated in the following manner:

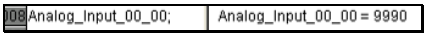
- voltage or current inputs are normed:

0...10 V equates 0... 1
0...20 mA equates 0... 1

- the temperature inputs are calibrated in °C. If you want °F units please use the CoDeSys macros for converting.

Special values:

9991.0 

range under flow (e.g. shorten input on PT100)
9990.0 

range over flow (e.g. open input on PT100)

9995.0 This channel is not calibrated.

Valid sensor types:

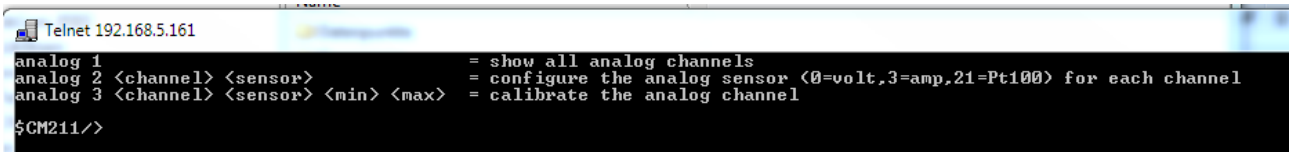
	CM11x/CS11x	CM21x	CE15x
AIN_0_10VOLT_NORMED	X	X	X
AIN_0_20mA_NORMED	X	X	X
AIN_PT100_2WIRE	X	X	

It is not allowed to use the analog input above 10VDC. The internal clamping diode will be destroyed on higher input voltage.

The cycle time of the thread “IOs” decidedly the speed of analog processing. Default is 10ms.

23.1 Calibration of the analog inputs (only on combo-CM2xx)

With the Telnet or Hyperteminal (TCP/IP) application, you are able to calibrate each analog channel. For high precision application it is important to recalibrate every year.

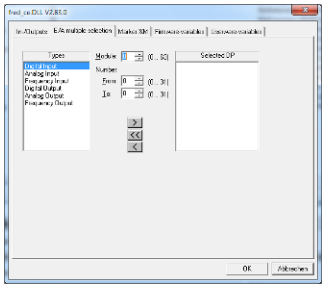


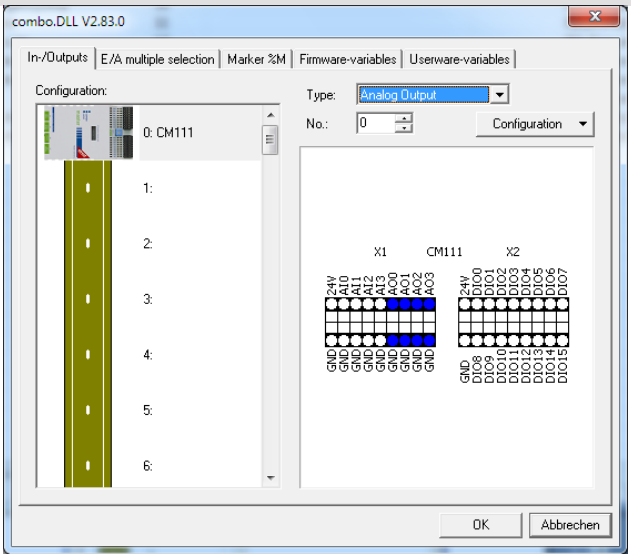
With the command “analog 3 ...” you are able to recalibrate. The calibration result will be stored in the eeprom.bin file.

24. Analog outputs

Inside your developement software eStudio™ you can select the outputs.

With the tab „E/A multiple selection“ you are able to select a array from elements.





Analog output		
A/D converter	12 Bit	
Measurement categories	current 0 … 20 mA, voltage 0 .. 10V, voltage -10V … 10V	
Sensor type	2-wire	
Sensor type selection	combo-CM1xx: Not remanent	combo-CM2xx: Remanent in the eeprom.bin configuration file.

The selection of the analog output could be done with a small application programm in CoDeSys. Therefore use the Libraray IO01.

ST

```
IF NOT bInit THEN
        (* Bei Programmstart einmalig die Fühler konfigurieren *)
        (* wird solange durchlaufen, bis alle Fühler korrekt initialisiert sind *)
        bInit := IOConfigureAIN(0(*nSlaveNo*), 0(*nChannel*), AIN_0_10VOLT_NORMED);
        if bInit THEN
                bInit := IOConfigureAOUT(0(*nSlaveNo*), 1(*nChannel*),
AOUT_0_10VOLT_NORMED);
        END_IF
ELSE (* Ablauf nach Initialisierung *)
        ....
        Analog_Output_00_01 := 0.5;   (* 5V am analogen Ausgang 1 *)
END_IF
```

Calibrating: The analog outputs are in the following manner:

analog outputs types normed range of value	**output**	
AOUT_0_10VOLT_NORMED	0...1 0...1	0...10V ...10V
AOUT_M10_10VOLT_NORMED	-1...1	-10...10V
AOUT_0...20mA_NORMED	0...1	0...20mA

Valid analog outputs types:

	CMx10	**CMx11**
AOUT_0_10VOLT_NORMED	**X**	**X**
AOUT_M10_10VOLT_NORMED	-	**X**
AOUT_0...20mA_NORMED	-	-

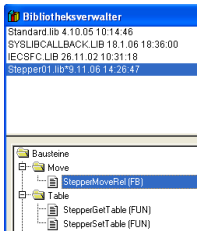
During the initalizing phase the analog output represent the minimum value.

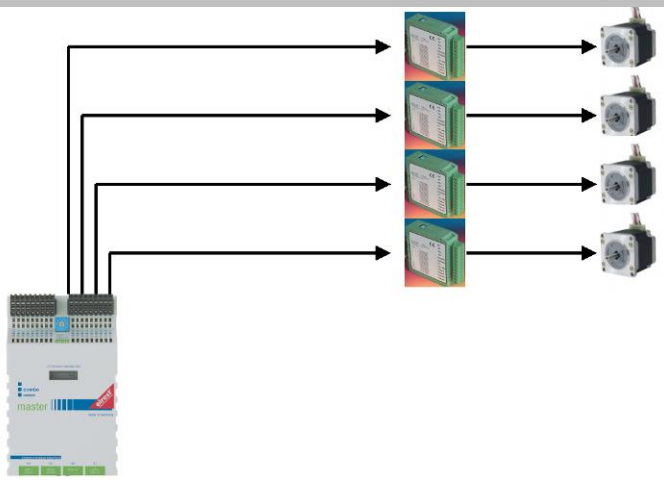
25. Stepper motor

The combo-CM1xx can direct control 1 to 4 stepper motors and the combo-CM2xx can direct control 1 to 8 stepper motors.

With 2 wires (pulse, direction) you are able to control a stepper motor amplifier (drive-SAxxx).

With the CoDeSys Library Stepper03.lib the relative movement of the stepper can easy be done.





There is a fix order between the used Variable „byStepper“ and the physical outputs.

```
FUNCTION_BLOCK StepperMoveRel
VAR_INPUT
    byStepper:BYTE:=0;          (*Stepper 0..MAX of this device *)
```

	Counter inputs/ Encoder inputs	stepper
CM100	DI8…DI15	DO8…DO15
CM101	DI8…DI15	DO24…DO31
CM110 / CM111	DI0…DI7	DO8…DO15
CM210 / CM211	DI0…DI7	DO8…DO15

	stepper „byStepper“ [0..3]	pulse	direction
CM100	0	DO8	DO9
	1	DO10	DO11
	2	DO12	DO13
	3	DO14	DO15
CM101	0	DO24	DO25
	1	DO26	DO27
	2	DO28	DO29
	3	DO30	DO31
CM110 / CM111	0	DO8	DO9
	1	DO10	DO11
	2	DO12	DO13
	3	DO14	DO15
CM210 / CM211	0	DO8	DO9
	1	DO10	DO11
	2	DO12	DO13
	3	DO14	DO15
	4	DO0	DO1
	5	DO2	DO3
	6	DO4	DO5
	7	DO6	DO7

Remark:
The unused stepper outputs can be used in your application.

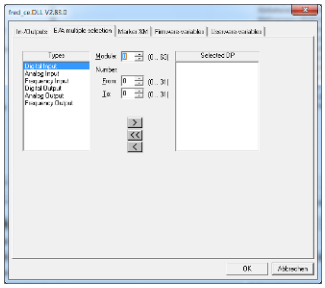
On the combo-CM1xx hardware the stepper function is solved in software and has influence of the application software. Typical not more than 10..15% CPU load.
On the combo-CM2xx hardware the stepper function is solved im FPGA and this has no influence of the application software.

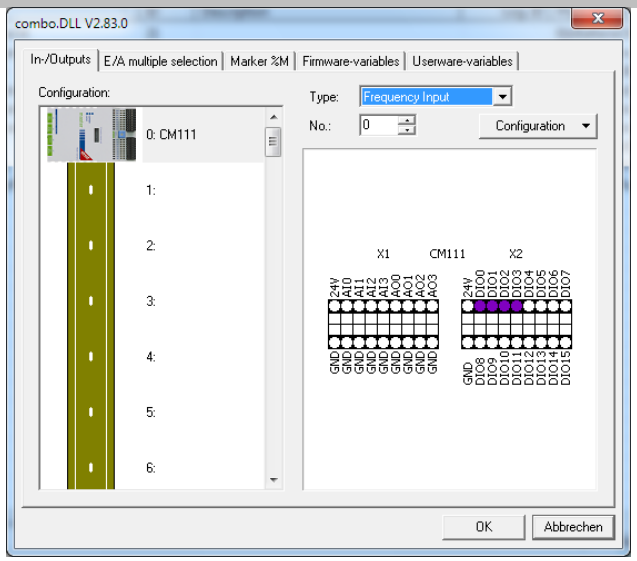
Amplifier for the stepper motor						
derivative	Input voltage [V]	Phase current [A]	[Steps/Rev]	Current controller	control	
drive-SA102	24..36V_{DC}	2,5	200 … 1600	2Q	pulse, direction	
drive-SA206	35...80 V_{DC} 25...55 V_{AC}	6	200 … 1600	2Q	pulse, direction	
drive-SA308	70...160 V_{DC} 50...115 V_{AC}	8,5	200 … 10000	4Q resonance-decreasing	pulse, direction	

26. frequency- and counter inputs

Inside your developement software eStudio™ you can select the inputs.

With the tab „E/A multiple selection“ you are able to select a array from elements.

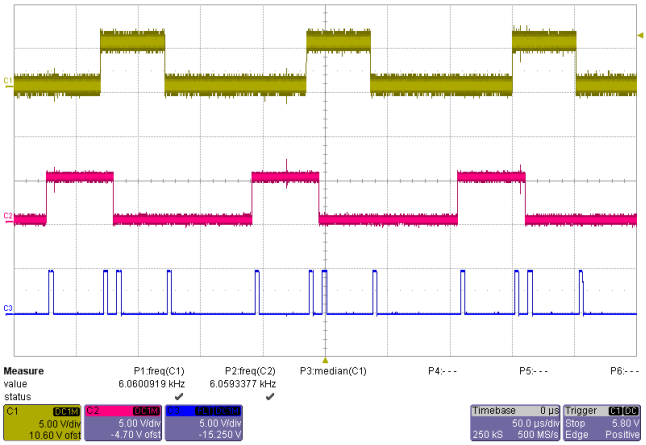




The selection of the frequency or counter functionality could be done with a small application programm in CoDeSys. Therefore use the Libraray IO01.

- FIN_OFF
  frequency measuring off
- FIN_FREQUENCY_INPUT
  frequency measuring, see technical description for range
- FIN_COUNTER_INPUT
  counter measuring TACT/DIRECTION
- FIN_QUADCOUNT
  quad counter measuring with A-B-encoder
- FIN_DUALCOUNT
  dual counter measuring with A-B-encoder
- FIN_SINGLECOUNT
  single counter measuring with A-B-encoder

Frequency or counter input		
Frequency input	combo-CM1xx / CS1xx: 10 kHz,	combo-CM2xx: 10 kHz
Filtering	combo-CM1xx: hardware filter fix frequency	combo-CM2xx: FIR filter solved in FPGA, adjustable from 10 Hz to maximum frequency.



The frequency inputs are not supported on the ESB network.
See chapter „CANopen and combo slave CS1xx“ for more details (above firmware V1.91) about the CAN network and frequency inputs.

Der Level on the direction inputs will determine the counting direction:

Level	
„High“	UP-Counter
„Low“	DOWN-Counter

ST

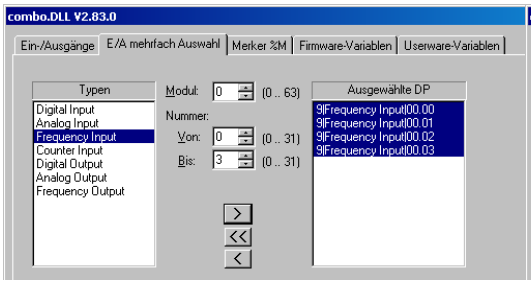
```
CASE wMode OF
        1 :     IOConfigureFIN(0(*nSlaveNo*), 0(*nChannel*), FIN_QUADCOUNT);
        2 :     IOConfigureFIN(0(*nSlaveNo*), 0(*nChannel*), FIN_FREQUENCY_INPUT);
                IOConfigureFIN(0(*nSlaveNo*), 1(*nChannel*), FIN_FREQUENCY_INPUT);
        3 :     IOConfigureFIN(0(*nSlaveNo*), 0(*nChannel*), FIN_COUNTER_INPUT);
                IOConfigureFIN(0(*nSlaveNo*), 1(*nChannel*), FIN_COUNTER_INPUT);
        4 :     IOConfigureFIN(0(*nSlaveNo*), 0(*nChannel*), FIN_COUNTER_INPUT);
                IOConfigureFIN(0(*nSlaveNo*), 1(*nChannel*), FIN_FREQUENCY_INPUT);
                IOConfigureFIN(0(*nSlaveNo*), 2(*nChannel*), FIN_COUNTER_INPUT);
                IOConfigureFIN(0(*nSlaveNo*), 3(*nChannel*), FIN_FREQUENCY_INPUT);
END_CASE;
```

frequency:

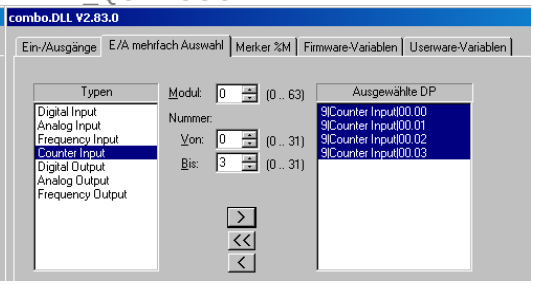
The time base for frequency inputs is 1s, this equates to SI-unit [Hz].

Select the datapoints fort he different modes of frequency:

FIN_FREQUENCY_INPUT



FIN_COUNTER_INPUT
FIN_QUADCOUNT

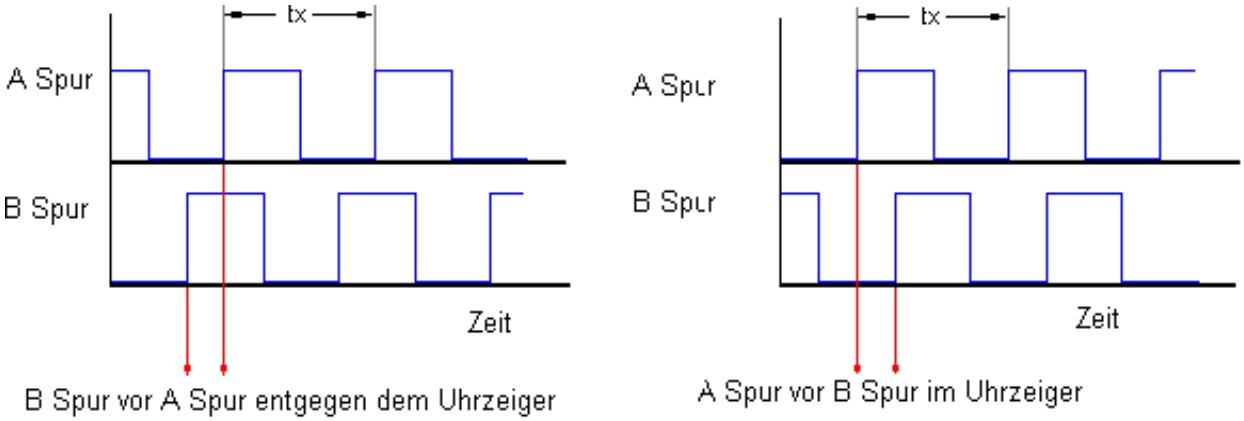


26.1 Order the digital inputs to the different modes

	Channel (*nChannel*)	Frequency input FIN_FREQUENCY_INPUT	Counter input FIN_COUNTER_INPUT		Quadcount - input FIN_QUADCOUNT	
			Pulse /	Direction	Line A /	L ine B
CM100 / CM101	0	DI8 X2.20	DI8 X2.20	DI12 X2.33	DI8 X2.20	DI9 X2.21
	1	DI9 X2.21	DI9 X2.21	DI13 X2.34	-	
	2	DI10 X2.22	DI10 X2.22	DI14 X2.35	DI10 X2.22	DI11 X2.23
	3	DI11 X2.23	DI11 X2.23	DI15 X2.36	-	
CM110 / CM111	0	DI0 X2.20	DI0 X2.20	DI4 X2.24	DI0 X2.20	DI1 X2.21
	1	DI1 X2.21	DI1 X2.21	DI5 X2.25	-	
	2	DI2 X2.22	DI2 X2.22	DI6 X2.26	DI2 X2.22	DI3 X2.23
	3	DI3 X2.23	DI3 X2.23	DI7 X2.27	-	
CM210 / CM211	0	DI8 X2.29	DI8 X2.29	DI9 X2.30	DI8 X2.29	DI9 X2.30
	1	DI10 X2.31	DI10 X2.31	DI11 X2.32	DI10 X2.31	DI11 X2.32
	2	DI12 X2.33	DI12 X2.33	DI13 X2.34	DI12 X2.33	DI13 X2.34
	3	DI14 X2.35	DI14 X2.35	DI15 X2.36	DI14 X2.35	DI15 X2.36
	4	DI0 X2.20	DI0 X2.20	DI1 X2.21	DI0 X2.20	DI1 X2.21
	5	DI2 X2.22	DI2 X2.22	DI3 X2.23	DI2 X2.22	DI3 X2.23
	6	DI4 X2.24	DI4 X2.24	DI5 X2.25	DI4 X2.24	DI5 X2.25
	7	DI6 X2.26	DI6 X2.26	DI7 X2.27	DI6 X2.26	DI7 X2.27

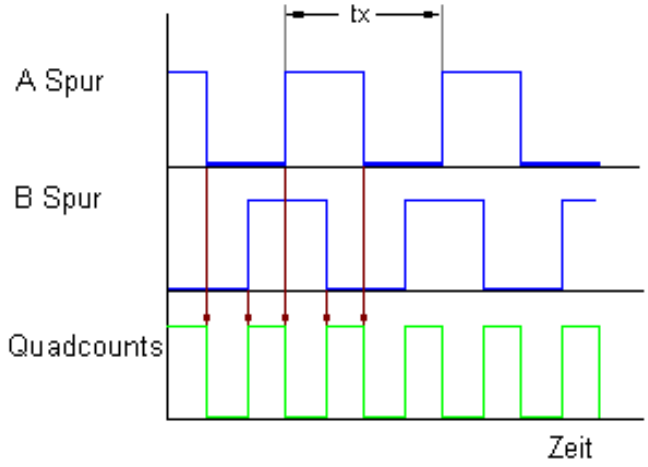
Incremental Encoder

From the Incremental Encoder speed and direction will be generated. We support single track systems and dual track systems. A single track systems have just one pulse input without direction. A dual track systems have a pulse Line A and Line B with 90° phase shift. A three track system has an additional input to indicate the zero position.



Quadcounts

Instead of the signal level we will count the rising and falling slope. The resolution will be increased and the noise reduction.



27. Performance

27.1 CoDeSys instructions

A special CoDeSys benchmark application program measure the performance of the different CPU.

	combo-CM710	combo-CM2xx	combo-CM1xx
10.000 Loops	Intel Celeron 1.0 GHz	ARM9 400 MHz	Infineon 40 MHz
BOOL	15 ms	137 ms	6340 ms
BYTE	15 ms	139 ms	6270 ms
INT	16 ms	141 ms	6280 ms
DINT	16 ms	122 ms	10400 ms
REAL	15 ms	2792 ms	-
MIXED	16 ms	456 ms	-

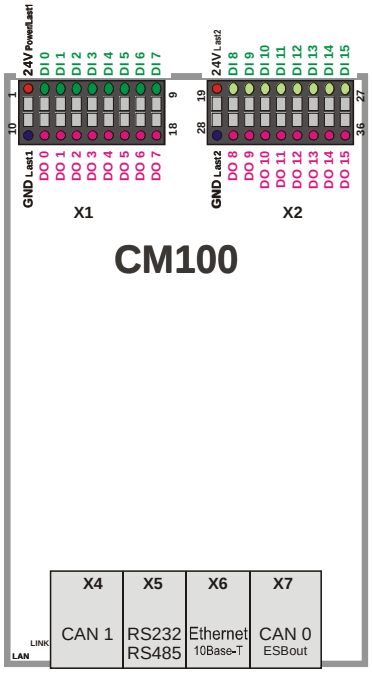
28. combo control master CM1xx

Compact combo master I/O module with integrated soft SPC
Freely programmable acc. to IEC 61131-3/CoDeSys
Up to 32 digital I/O- signals or 16 digital und 8 analogue I/O-signals within one module
Expandable by
pluggable combo CE extension modules
combo CS slave modules
Onboard interface for programming, diagnostic and communication
Ethernet, CAN, RS232/485
Remote maintenance over modem and Ethernet
Integrated webserver
Visualization possibilities by
visio terminals and control panels
visio web – via Internet Explorer
viso PDA– via WLAN

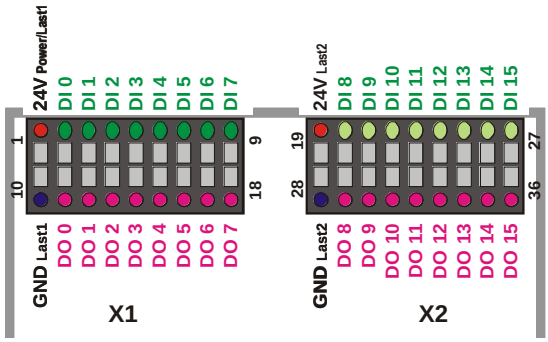
Processor	16 Bit Infineon XC16X
Memory	2 MB RAM, 4 MB Flash , 2 kByte EEprom
External Memory	USB-Stick on USB-Host
Operating system	µE
PLC programming	IEC61131-3 / CoDeSys
Onboard interface	1 x CAN0 acc. to ISO 1898 galvanically isolated (RJ45) (ESB or CANopen) 1 x Ethernet 10 BaseT (RJ45) 1 x RS232 / RS485 (RJ45) 1 x CAN1 acc. to ISO 1898 galvanically isolated (RJ45)
Optional Interface	Combo extension module
Ethernet TCP/IP-Stack	HTTP Web Server, SMTP Email, FTP Filetransfer, TCP-Modbus
Diagnostic	LEDs for operating and status messages; LED Power;
Casing	PLoadic casing
Supply voltage	24 VDC (18...30 VDC, 3 W)
Power consumption	5 W
Inverse-polarity protection	yes
Battery supply	RTC, SRAM
Livetime of battery	typical 2 years
Mechanical consolidation acc. to VDE 160:	3 axis; 10 ... 55 Hz, amplitude 0,075 mm
Vibration resistance according to EN 50155	5 ... 100 Hz, amplitude 2 mm, acceleration 4m/s²

Assembly	Rest assembly on DIN rail according to DIN EN 60715
Color	Light grey RAL 7035
EMC tests	EN61000-6-2, EN61000-6-4
Protection class	II nach DIN EN 61140
Degree of protection	IP 20 nach DIN 40050
Attachment	Snap in mounting on rail DIN50022
Weight approx.	app. 200 g
Storage temperature	0 to 60°C
Operating temperature	0° to 50°C
Relative humidity	max. 90 % (without condensation)
Mechanical dimension in mm (B x H x T)	app. 80 x 130 x 28,5

28.1 Pin assignement of combo CM100



Anschlussklemmen:



X1:

X1.1: 24V Power
Power supply of the device

X1.10 GND Power
Power supply of the device

X1.2...9: DI0...7
Digital inputs

X1.11...18: DO0...7
Digital outputs

X2:

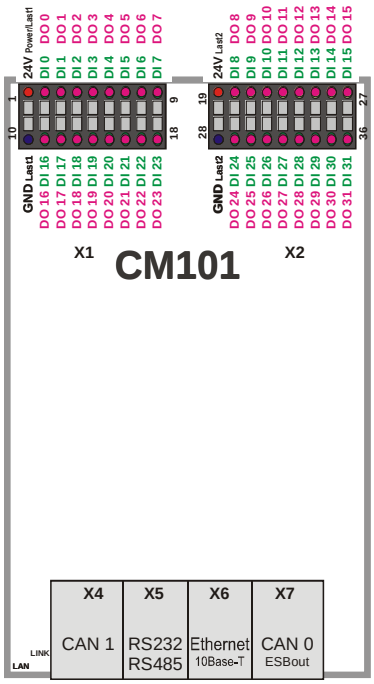
X2.19: 24V Load
Power supply for the digital outputs
(DO0...15, controlled with a 5A- smooth fuse)

X2.28: GND
Potential GND for digital inputs

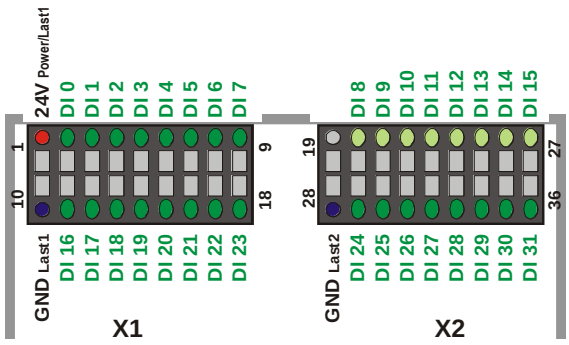
X2.20...27: DI8...15
Digital inputs

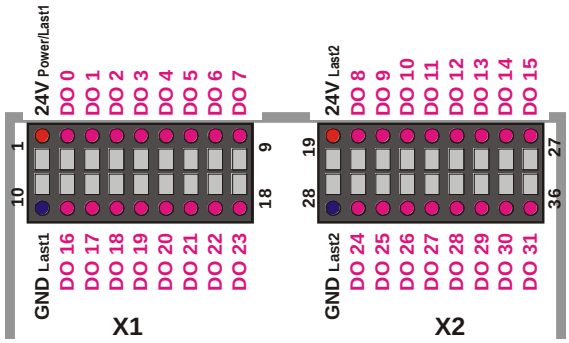
X2.29...36: DO8...15
Digital outputs

28.2 Pin assignement of combo CM101



Anschlussklemmen:





X1:

X1.1: 24V Power/Last1
Power supply for the digital outputs
(DO0...7, 8…15, controlled with a 5A- smooth fuse)

X1.2...9: DI0...7, DO0...7;
Digital inputs or digital outputs

X1.11...18: DI16...23, DO16...23
Digital inputs or digital outputs

X1.10: GND Last1
Potential GND for digital inputs (DI0..7, 16...23)

X2:

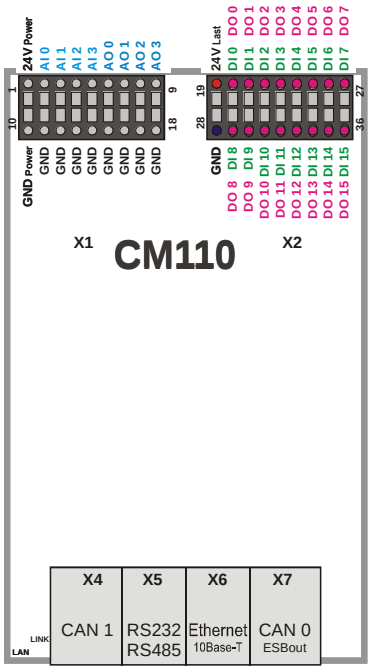
X2.19: 24V Load2
Power supply for the digital outputs
(DO8..15, 24...31, controlled with a 5A- smooth fuse)

X2.20...27: DI8...15; DO8...15
Digital inputs or digital outputs

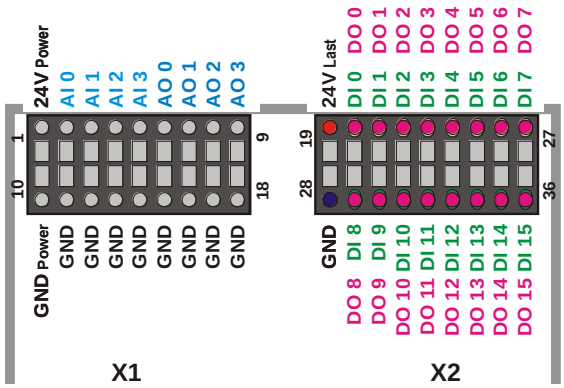
X2.29...36: DI24...31; DO24...31
Digital inputs or digital outputs

X2.28: GND Load2
Potential GND for digital inputs (DI8..15, 24...31)

28.3 Pin assignement of combo CM110 / CM111



Anschlussklemmen:



X1:

X1.1: 24V Power
Power supply of the device, (controlled with a 5A- smooth fuse)

X1.10 GND Power
Power supply of the device

X1.11...18: GND
Potential GND for analog in- and outputs

X1.2...5 AI0...3
Analog inputs

X1.6...9 AO0...3
Analog outputs

X2:

X2.19: 24V Load
Power supply for the digital outputs (DO0...15, controlled with a 5A- smooth fuse)

X2.28: GND
Potential GND for digital inputs (DI0...15)

X2.20...27: DI0...7, DO0...7
Digital inputs or digital outputs

X2.29...36: DI8...15, DO8...15
Digital inputs or digital outputs

28.4LED-display CM1xx

Functionality:

A0: 24V Power (green)
Power supply exist

A9: 24V Load1 (green)
Power supply for digital outputs exist

A10 ... A17 und B10 ... B17 (green)

DI0...DI15:	Level digital input active
DO0...DO15:	Level digital output

B0: RUN

OFF:	device is deactivated of damaged
ON:	device run
blinking:	initialize the device or service mode

LAN (beside X3, green)
Ethernet data transfer active

LINK (beside X3, yellow)
Ethernet cable connected

29. combo control master CM2xx

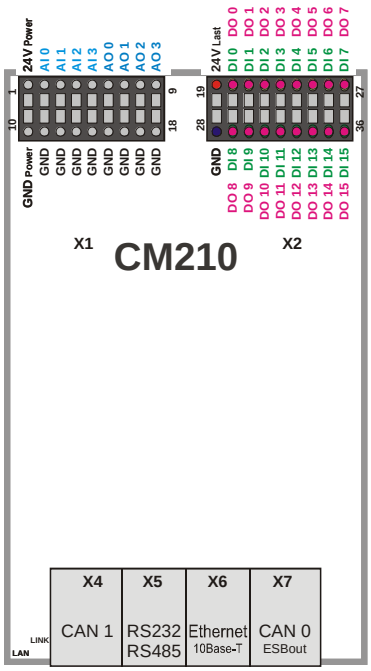
Compact combo master I/O module with integrated soft SPC
Freely programmable acc. to IEC 61131-3/CoDeSys
Up to 32 digital I/O- signals or 16 digital und 8 analogue I/O-signals within one module
Expandable by
pluggable combo CE extension modules
combo CS slave modules
Onboard interface for programming, diagnostic and communication
Ethernet, CAN, RS232/485
Remote maintenance over modem and Ethernet
Integrated webserver
Visualization possibilities by
visio terminals and control panels
visio web – via Internet Explorer
viso PDA– via WLAN

Processor	32 Bit ARM9 RISC CPU 400 MHz
Memory	64 MB DRAM, 128 MB (**optional** 256 MB) Flash 1 MB SRAM battery-buffered
External Memory	USB-Stick on USB-Host
Internal additional storage	micro SD-Card
Operating system	Microsoft Windows embedded CE 6.0 basic
PLC programming	IEC61131-3 / CoDeSys
Onboard interface	1 x CAN0 acc. to ISO 1898 galvanically isolated (RJ45) (ESB or CANopen) 1 x Ethernet 10/100 BaseT (RJ45) 1 x RS232 / RS485 (RJ45) 1 x CAN1 acc. to ISO 1898 galvanically isolated (RJ45) 1 x USB 2.0 Host
Optional Interface	Combo extension module
Ethernet TCP/IP-Stack	HTTP Web Server, SMTP Email, FTP Filetransfer, TCP-Modbus
Diagnostic	LEDs for operating and status messages; LED Power;
Casing	PLoadic casing
Supply voltage	24 VDC (18...30 VDC, 3 W)
Power consumption	5 W
Inverse-polarity protection	yes
Battery supply	RTC, SRAM
Livetime of battery	typical 2 years

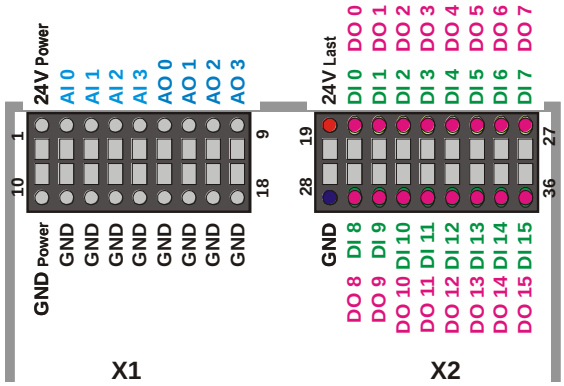
Mechanical consolidation acc. to VDE	3 axis; 10 ... 55 Hz, amplitude 0,075 mm
Vibration resistance according to EN	5 ... 100 Hz, amplitude 2 mm, acceleration 4m/s²
Assembly	Rest assembly on DIN rail according to DIN EN 60715 Main assembly direction: vertical
Color	Light grey RAL 7035
EMC tests	EN61000-6-2, EN61000-6-4
Protection class	II nach DIN EN 61140
Degree of protection	IP 20 nach DIN 40050
Attachment	Snap in mounting on rail DIN50022
Weight approx.	app. 150 g
Storage temperature	0 to 60°C
Operating temperature	0° to 50°C
Relative humidity	max. 90 % (without condensation)
Mechanical dimension in mm (B x H x T)	app. 80 x 130 x 28,5

(1 At 30%-pulse ratio of digital outputs; max. 45 °C at 50% pulse ratio

29.1 Pin assignement of combo CM210 / CM211



Conection terminals:



X1:

X1.1: 24V Power
Power supply of the device, (controlled with a 5A- smooth fuse)

X1.10 GND Power
Power supply of the device

X1.11...18: GND
Potential GND for analog in- and outputs

X1.2...5 AI0...3
Analog inputs

X1.6...9 AO0...3
Analog outputs

X2:

X2.19: 24V Load
Power supply for the digital outputs (DO0...15, controlled with a 5A- smooth fuse)

X2.28: GND
Potential GND for digital inputs (DI0...15)

X2.20...27: DI0...7, DO0...7
Digital inputs or digital outputs

X2.29...36: DI8...15, DO8...15
Digital inputs or digital outputs

29.2 LED-display CM2xx

Functionality:

A0: 24V Power (green)
Power supply exist

A9: 24V Load1 (green)
Power supply for digital outputs exist

A10 …A17 und B10 ... B17 (green)
DI0...DI15: Level digital input active
DO0...DO15: Level digital output

B0: RUN
OFF: device is deactivated of damaged
ON: device run
blinking: initialize the device

LAN (beside X3, green)
Ethernet data transfer active

LINK (beside X3, yellow)
Ethernet cable connected

30. combo slave CS1xx

Compact slave I/O module

Up to 32 digital I/O- signals or 16 digital und 8 analogue I/O-signals within one module

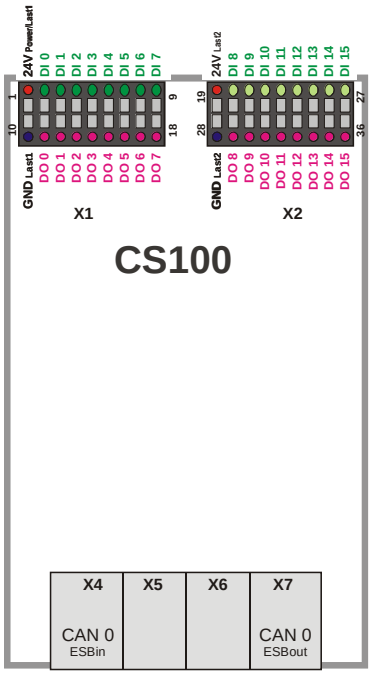
Expandable by

pluggable combo CE extension modules

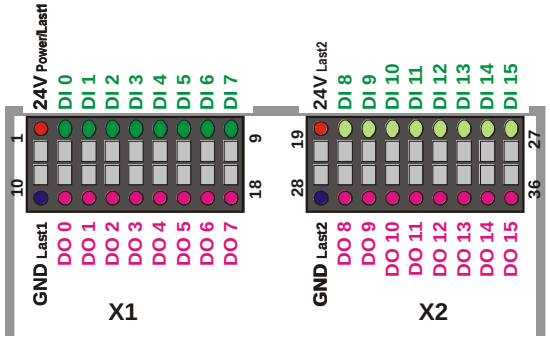
CAN or CANopen

Onboard interface	1 x CAN0/ESBin (RJ45), 1 x CAN0/ESBout (RJ45)
Optional Interface	Combo extension module
Diagnostic	LEDs for operating and status messages; LED Power;
Casing	PLoadic casing
Supply voltage	24 VDC (18...30 VDC, 3 W)
Power consumption	5 W
Inverse-polarity protection	yes
Mechanical consolidation acc. to VDE 160:	3 axis; 10 ... 55 Hz, amplitude 0,075 mm
Vibration resistance according to EN	5 ... 100 Hz, amplitude 2 mm, acceleration 4m/s²
Assembly	Rest assembly on DIN rail according to DIN EN 60715 Main assembly direction: vertical
Color	Light grey RAL 7035
EMC tests	EN61000-6-2, EN61000-6-4
Protection class	II nach DIN EN 61140
Degree of protection	IP 20 nach DIN 40050
Attachment	Snap in mounting on rail DIN50022
Weight approx.	app. 200 g
Storage temperature	0 to 60°C
Operating temperature	0° to 50°C
Relative humidity	max. 90 % (without condensation)
Mechanical dimension in mm (B x H x T)	app. 80 x 130 x 28,5

30.1 Pin assignement of combo CS100



Anschlussklemmen:



X1:

X1.1: 24V Power
Power supply of the device

X1.10 GND Power
Power supply of the device

X1.2...9: DI0...7
Digital inputs

X1.11...18: DO0...7
Digital outputs

X2:

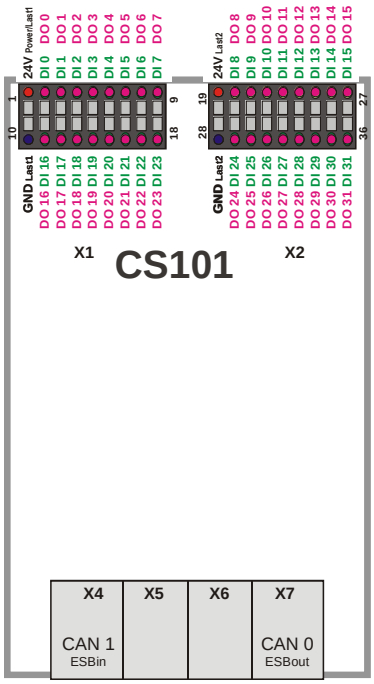
X2.19: 24V Load
Power supply for the digital outputs
(DO0...15, controlled with a 5A- smooth fuse)

X2.28: GND
Potential GND for digital inputs

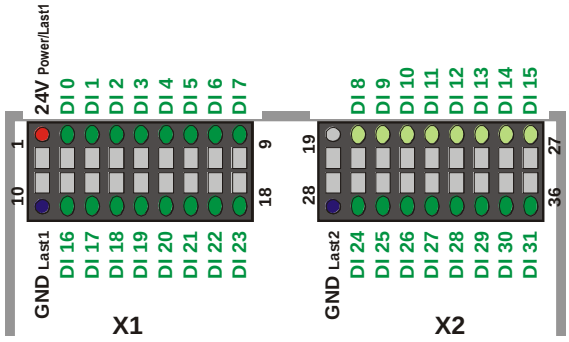
X2.20...27: DI8...15
Digital inputs

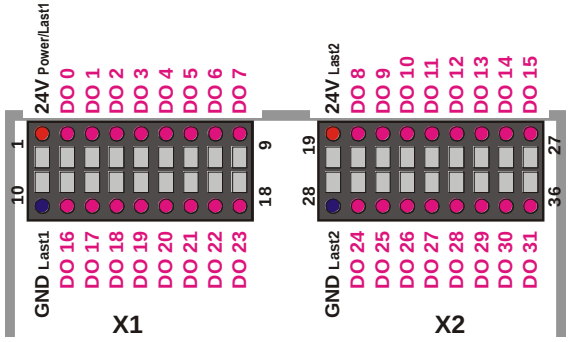
X2.29...36: DO8...15
Digital outputs

30.2 Pin assignement of combo CS101



Anschlussklemmen:





X1:

X1.1: 24V Power/Last1
Power supply for the digital outputs
(DO0...7, 8…15, controlled with a 5A- smooth fuse)

X1.2...9: DI0...7, DO0...7;
Digital inputs or digital outputs

X1.11...18: DI16...23, DO16...23
Digital inputs or digital outputs

X1.10: GND Last1
Potential GND for digital inputs (DI0..7, 16...23)

X2:

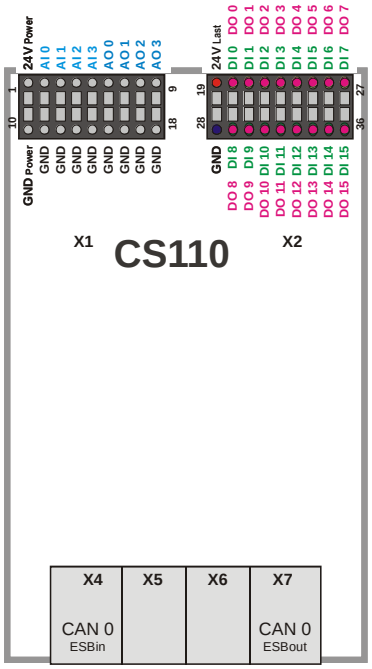
X2.19: 24V Load2
Power supply for the digital outputs
(DO8..15, 24...31, controlled with a 5A- smooth fuse)

X2.20...27: DI8...15; DO8...15
Digital inputs or digital outputs

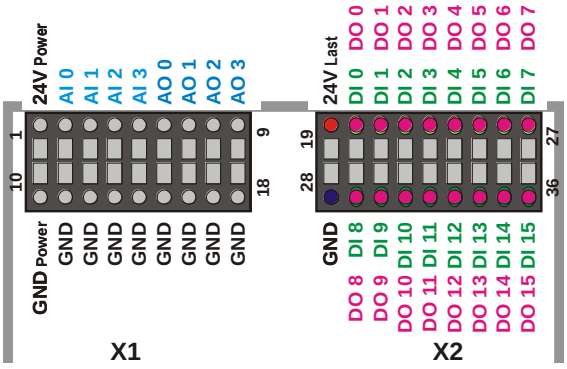
X2.29...36: DI24...31; DO24...31
Digital inputs or digital outputs

X2.28: GND Load2
Potential GND for digital inputs (DI8..15, 24...31)

30.3 Pin assignement of combo CS110 / CS111



Anschlussklemmen:



X1:

X1.1: 24V Power
Power supply of the device, (controlled with a 5A-smooth fuse)

X1.10 GND Power
Power supply of the device

X1.11...18: GND
Potential GND for analog in- and outputs

X1.2...5 AI0...3
Analog inputs

X1.6...9 AO0...3
Analog outputs

X2:

X2.19: 24V Load
Power supply for the digital outputs (DO0...15, controlled with a 5A- smooth fuse)

X2.28: GND
Potential GND for digital inputs (DI0...15)

X2.20...27: DI0...7, DO0...7
Digital inputs or digital outputs

X2.29...36: DI8...15, DO8...15
Digital inputs or digital outputs

30.4 Analog inputs CS110 / CS111

The following settings are available:

AIN 0:	AIN_0_10VOLT_NORMED
AIN 1:	AIN_0_10VOLT_NORMED
AIN 2:	AIN_0_10VOLT_NORMED
AIN 3:	AIN_0_10VOLT_NORMED

30.5 Analog outputs CM110

The following settings are available:

AOUT 0:	AOUT_0_10VOLT_NORMED
AOUT 1:	AOUT_0_10VOLT_NORMED
AOUT 2:	AOUT_0_10VOLT_NORMED
AOUT 3:	AOUT_0_10VOLT_NORMED

30.6 Analog outputs CM111

The following settings are available:

AOUT 0:	AOUT_M10_10VOLT_NORMED
AOUT 1:	AOUT_M10_10VOLT_NORMED
AOUT 2:	AOUT_M10_10VOLT_NORMED
AOUT 3:	AOUT_M10_10VOLT_NORMED

31. combo extention CE1xx

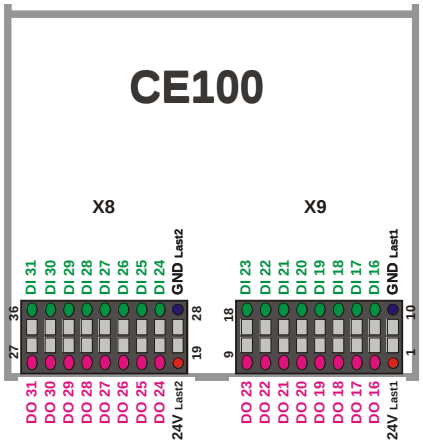
Extention modul for combo master or slave

Storage extention with CF card

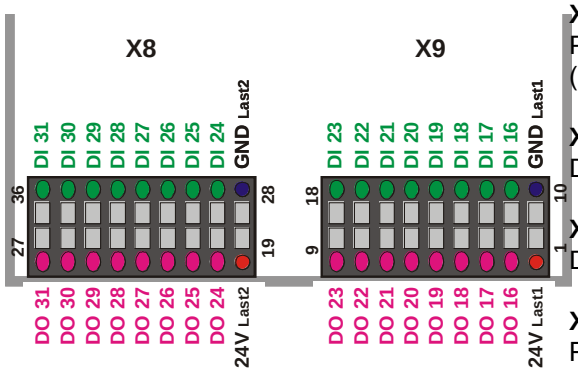
Up to 32 digital I/O- signals or 16 digital und 8 analogue I/O-signals within one module

Onboard interface	Combo extension
Diagnostic	LEDs for operating and status messages; LED Power;
Casing	Plastic casing
Supply voltage	24 VDC (18...30 VDC, 3 W)
Power consumption	5 W
Inverse-polarity protection	yes
Color	Light grey RAL 7035
EMC tests	EN61000-6-2, EN61000-6-4
Protection class	II nach DIN EN 61140
Degree of protection	IP 20 nach DIN 40050
Weight approx.	app. 100 g
Storage temperature	0 to 60°C
Operating temperature	0° to 50°C
Relative humidity	max. 90 % (without condensation)
Mechanical dimension in mm (B x H x T)	app. 80 x 130 x 28,5

31.1 Pin assignement of combo CE100



Anschlussklemmen:



X8:

X8.19: 24V Last2
Power supply for the digital outputs
(DO24…31, controlled with a 5A- smooth fuse)

X8.29...36: DI24...31
Digital inputs

X8.20...27: DO24...31
Digital outputs

X8.28: GND Last2
Potential GND for digital outputs (DO24…31)

X9:

X9.1: 24V Last1
Power supply for the digital outputs
(DO16…23, controlled with a 5A- smooth fuse)

X9.11...18: DI16...23
Digital inputs

X9.2...9: DO16...23
Digital outputs

X9.10: GND Last1
Potential GND for digital outputs (DO16…23)

Funktion:

C17: 24V Last1 (grün)
Versorgungsspannung für digitale Ausgänge
(DO16...23) vorhanden

C10: 24V Last2 (grün)
Versorgungsspannung für digitale Ausgänge
(DO24...31) vorhanden

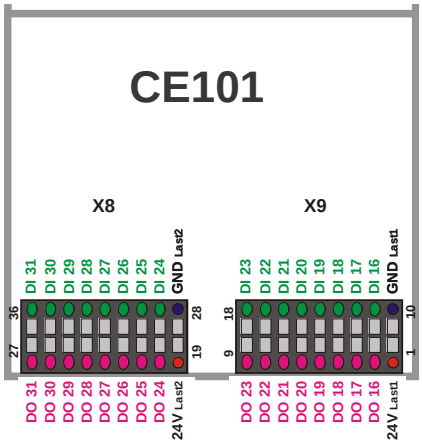
D16 ... D9 (grün)
DO16...23: Pegel digitaler Ausgang

D7 ... D0 (grün)
DO24...31: Pegel digitaler Ausgang

C16 ... C9 (grün)
DI16...23: Pegel digitaler Eingang aktiv

C7 ... C0 (grün)
DI24...31: Pegel digitaler Eingang aktiv

31.2 Pin assignement of combo CE101



X8:

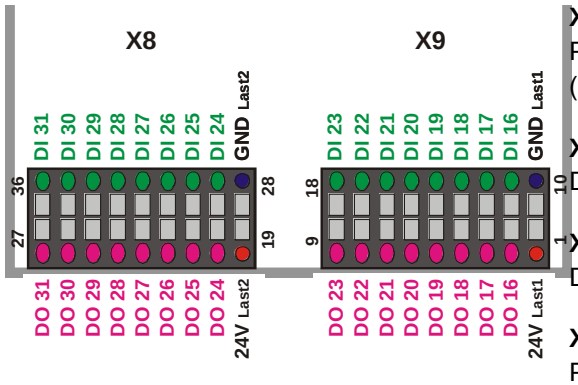
X8.19: 24V Last2
Power supply for the digital in- and outputs
(DIO24…31, controlled with a 5A- smooth fuse)

X8.29...36: DI24...31
Digital inputs

X8.20...27: DO24...31
Digital outputs

X8.28: GND Last2
Potential GND for digital outputs (DIO24…31)

Anschlussklemmen:



X9:

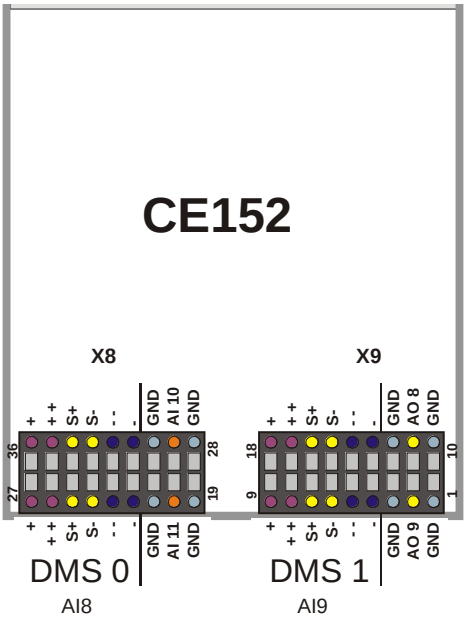
X9.1: 24V Last1
Power supply for the digital in- and outputs
(DIO16…23, controlled with a 5A- smooth fuse)

X9.11...18: DI16...23
Digital inputs

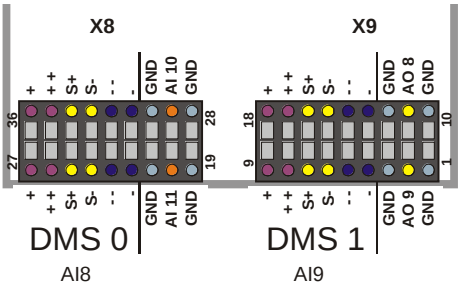
X9.2...9: DO16...23
Digital outputs

X9.10: GND Last1
Potential GND for digital in- and outputs (DIO16…23)

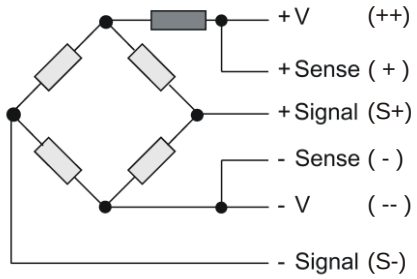
31.3 Pin assignement of combo CE152



Anschlussklemmen:



connection diagram **DMS:**



X8:

X8.29: AI10 [*1]
analoger Eingang

X8.20: AI11 [*1]
analoger Eingang

X8.19

X8.21

X8.28

X8.30: GND:
Bezugspotential für analoge Eingänge

X8.22...27

X8.31...36: DMS 0:
Eingang für DMS / Loadcell (AI8)
(Ausgangsspannung 5V, Ausgangsstrom max. 30 mA)

X9:

X9.11: AO8
analoger Ausgang

X9.2: AO9
analoger Ausgang

X9.1

X9.3

X9.10

X9.11: GND:
Bezugspotential für analoge Ausgänge

X9.4...9

X9.13...18: DMS 1:
Eingang für DMS / Loadcell (AI9)
(Ausgangsspannung 5V, Ausgangsstrom max. 30 mA)

[*1] available only for use in combination with combo master assemblies

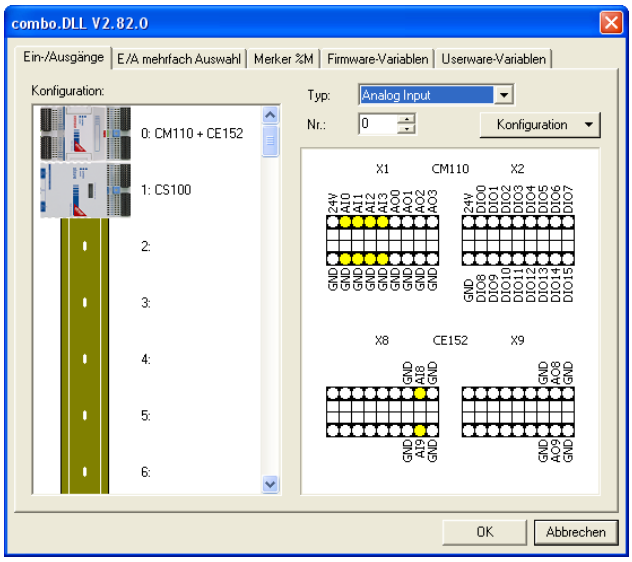
functionality:

no LED available

Analog DMS input AI8 and AI9	
A/D converter	24 Bit
Measurement categories	DMS
Sensor type	6-wire
Sampling rate	100 ms
Maximun differential input voltage	10 mV
Analog input AI10 and AI11	
A/D converter	12 Bit
Measurement categories	current, voltage
Sensor type	2-wire
Sampling rate	100 ms

Within eStudio can individually chosen the analog inputs. When CE152 are the analog inputs:

AI8	DMS0
AI9	DMS1
AI10 *1	0…10V oder 0…20mA
AI11 *1	0…10V oder 0…20mA available



Available only for use in combination with combo master assemblies.
Since it is to configurable analog inputs is a configuration CoDeSys mandatory. Sensor types are in the analog inputs the following types available:

AIN 8: DMS (100)
AIN 9: DMS (100)
AIN10: AIN_0_10VOLT_NORMED or AIN_0_20mA_NORMED
AIN11: AIN_0_10VOLT_NORMED or AIN_0_20mA_NORMED

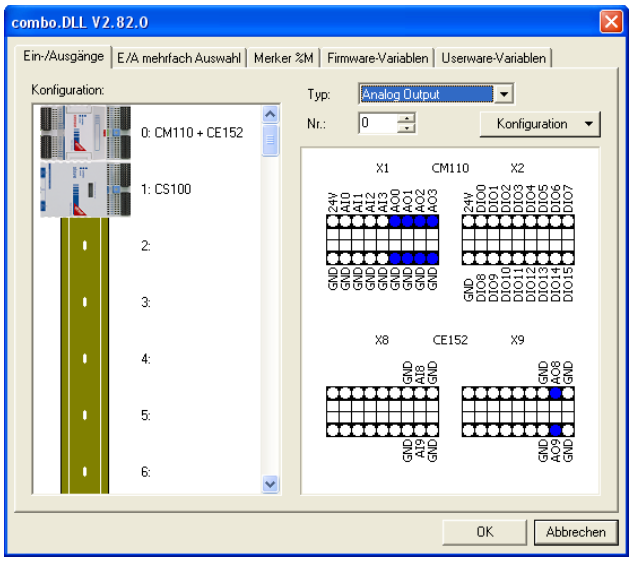
ST

```
IF NOT init THEN
        IOConfigureAIN (0, 8, 100 (*AIN8_DMS*));
        IOConfigureAIN (0, 9,  100 (*AIN9_DMS*));
        IOConfigureAIN (0, 10, AIN_0_10VOLT_NORMED);
        IOConfigureAIN (0, 11, AIN_0_20mA_NORMED);
        init := TRUE;
END_IF
Analog_Input_00_08;
Analog_Input_00_09;
Analog_Input_00_10;
Analog_Input_00_11;
```

Analog output	
D/A converter	12 Bit
Output signals	0...10 V, 0...20mA

Within the analog outputs eStudio individually selected. When the analog outputs CE152:

AO8
AO9 0…10V or 0…20mA available



Since it is to configurable analog inputs is a configuration CoDeSys mandatory. As sensor types are in the analog outputs following types available:

AOUT 8: AOUT_0_10VOLT_NORMED or AOUT_0_20mA_NORMED
AOUT 9: AOUT_0_10VOLT_NORMED or AOUT_0_20mA_NORMED

ST

```
IF NOT init THEN
        IOConfigureAOUT(0, 8, AOUT_0_10VOLT_NORMED);
        IOConfigureAOUT(0, 9, AOUT_0_20mA_NORMED);
        …
        init := TRUE;
END_IF
 Analog_Output_00_08 := 0.5; (* AO8 = 5V *)
Analog_Output_00_09 := 0.5; (* AO9 = 10 mA *)
```

31.4 Calibration weighing cell CE152

Because the signals a weighing cell (Loadcell) on a large degree, on the application, the weighing cell, and the mounting situation depend, must be the appropriate inputs on the ground must be calibrated.

With the following code you are able to calibrate:
(IOConfigViaSDOREAL from the library IO01.lib)

ST

Lower calibration point:

DMS0:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 112** (*SDONr*)**, 0.0** (*weight lower point on master*)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 36** (*SDONr*)**, 0.0** (*weight lower point on slave*)**);**

DMS1:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 114** (*SDONr*)**, 0.0** (*weight lower point on master *)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 37** (*SDONr*)**, 0.0** (*weight lower point on slave *)**);**

ST

```
(* ------ DMS0 --------------------------------*)
IF StartKalibMinDMS0 = TRUE THEN
        IOConfigViaSDOREAL(0, 112, DMS0_KALIBMin);
        StartKalibMinDMS0 := FALSE;
END_IF

(* ------ DMS1 --------------------------------*)
IF StartKalibMinDMS1 = TRUE THEN
        IOConfigViaSDOREAL(0, 114, DMS1_KALIBMin);
        StartKalibMinDMS1 := FALSE;
END_IF
```

Upper calibration point:

DMS0:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 113** (*SDONr*)**, 10.0** (*weight upper point on master *)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 38** (*SDONr*)**, 10.0** (*weight upper point on slave *)**);**

DMS1:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 115** (*SDONr*)**, 10.0** (*weight upper point on master *)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 39** (*SDONr*)**, 10.0** (*weight upper point on slave *)**);**

ST

```
(* ------ DMS0 ---------------------------------*)
IF StartKalibMaxDMS0 = TRUE THEN
        IOConfigViaSDOREAL(0, 113, DMS0_KALIBMax);
        StartKalibMaxDMS0 := FALSE;
END_IF

(* ------ DMS1 ---------------------------------*)
IF StartKalibMaxDMS1 = TRUE THEN
        IOConfigViaSDOREAL(0, 115, DMS1_KALIBMax);
        StartKalibMaxDMS1 := FALSE;
END_IF
…
```

31.5 Zero Adjustment of the weight unit CE152 on a combo master device

With the following instructions is a zero adjustment of Wiegeeinheit possible:

(IOConfigViaSDOREAL from library IO01.lib)

ST

When the zero adjustment with the current Offset calibration value scoring. This is a previously successfully implemented calibration necessary. The changed in control and are thus saved after a voltage available again interruption.

DMS0:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 128** (*SDONr*)**, 0.0** (*not relevant on master*)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 40** (*SDONr*)**, 0.0** (*not relevant on slave *)**);**

DMS1:
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 132** (*SDONr*)**, 10.0** (*weight upper point on master *)**);**
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 41** (*SDONr*)**, 10.0** (*weight upper point on slave*)**);**

ST

```
(* ------ DMS0 ---------------------------------*)
IF StartTaraDMS0 = TRUE THEN
        IOConfigViaSDOREAL(0, 128, 0.0);
        StartTaraDMS0 := FALSE;
END_IF

(* ------ DMS1 ---------------------------------*)
IF StartTaraDMS1 = TRUE THEN
        IOConfigViaSDOREAL(0, 132, 0.0);
        StartTaraDMS1 := FALSE;
END_IF
```

31.6 Calibration of the analog inputs AI10 and AI11 on the CE152

available only for use in combination with combo master assemblies

With the following instructions is a zero adjustment of Wiegeeinheit possible:

(IOConfigViaSDOREAL from library IO01.lib)

ST

The analog inputs and AI10 AI11 are factory calibrated and are usually not need further calibration. However, if necessary once a calibration, this may, as described below.

Lower calibration point:

AI10 sensor type: AIN_0_10VOLT_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 4** (*SDONr*)**, 0.0** (*lower calibration point *)**);**

AI10 sensor type: AIN_0_20mA_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*), 20 (*SDONr*), 0.0 (*lower calibration point *));

AI11 sensor type: AIN_0_10VOLT_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 6** (*SDONr*)**, 0.0** (*lower calibration point *)**);**

AI11 sensor type: AIN_0_20mA_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*), 22 (*SDONr*), 0.0 (*lower calibration point *));

Upper calibration point:

AI10 sensor type: AIN_0_10VOLT_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 5** (*SDONr*)**, 1.0** (*upper calibration point*)**);**

AI10 sensor type: AIN_0_20mA_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*), 21 (*SDONr*), 1.0 (*upper calibration point *));

AI11 sensor type: AIN_0_10VOLT_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*)**, 7** (*SDONr*)**, 1.0** (*upper calibration point *)**);**

AI11 sensor type: AIN_0_20mA_NORMED
IOConfigViaSDOREAL(0 (*nSlaveNo*), 23 (*SDONr*), 1.0 (*upper calibration point *));

ST

```
(* ---- AIN10 (Spannung)----------------------*)
IF StartCalAI10uMin = TRUE THEN
        IOConfigViaSDOREAL(0, 4, AIN10_U_CALIB_MIN);
        StartCalAI10uMin := FALSE;
END_IF
IF StartCalAI10uMax = TRUE THEN
        IOConfigViaSDOREAL(0, 5, AIN10_U_CALIB_MAX);
        StartCalAI10uMax := FALSE;
END_IF
(* ---- AIN11 (Strom)-------------------------*)
IF StartCalAI11iMin = TRUE THEN
        IOConfigViaSDOREAL(0, 22,  AIN11_I_CALIB_MIN);
        StartCalAI11iMin := FALSE;
END_IF
IF StartCalAI11iMax = TRUE THEN
        IOConfigViaSDOREAL(0, 23, AIN11_I_CALIB_MAX);
        StartCalAI11iMax := FALSE;
END_IF
```

32. CANopen und combo Slave-Device CS1xx

32.1 CANopen introduction

CANopen is a widely used CAN application layer, developed by the CAN in Automation association, and which has meanwhile been adopted for international standardisation.

Device Model

CANopen consists of the protocol definitions (communication profile) and of the device profiles that standardise

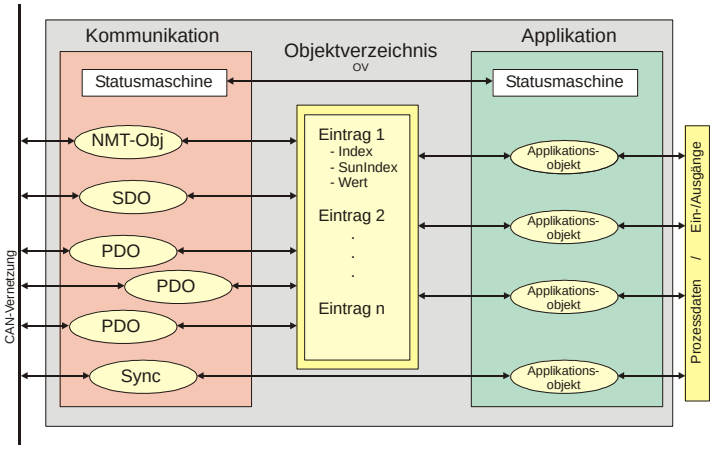
the data contents for the various device classes. Process data objects (PDO).are used for fast communication

of input and output data. The CANopen device parameters and process data are stored in a structured object

directory. Any data in this object directory is accessed via service data objects (SDO). There are, additionally, a

few special objects (such as telegram types) for network management (NMT), synchronisation, error messages

and so on.



basic structure of object dictionary

Index	Beschreibung
0000h	Nicht verwendet
0001h – 001Fh	Statische Datentypen
0020h – 003Fh	Komplexe Datentypen
0040h – 005Fh	Herstellerspezifische komplexe Datentypen
0060h – 007Fh	Geräteprofil-spezifische statische Datentypen
0080h – 009Fh	Geräteprofil-spezifische komplexe Datentypen
00A0h – 025Fh	Reserviert für weitere Geräteprofil-spezifische Datentypen
0260h – 0FFFh	Reserviert
1000h – 1FFFh	Kommunikationsprofil
2000h – 5FFFh	Hersteller-spezifischer Bereich
6000h – 9FFFh	Standardisierte Geräteprofile
A000h - BFFFh	Standardisierte Interfaceprofile
C000h - FFFFh	Reserviert

Method of communication

CANopen defines a number of communication classes for the input and output data (process data objects):

- Event driven:
  Telegrams are sent as soon as their contents have changed. This means that the process image as a whole is not continuously transmitted, only its changes.
- cyclic synchronous:
  A SYNC telegram causes the modules to accept the output data that was previously received, and to send new input data.
- requested:
  A CAN data request telegram causes the modules to send their input data.

The desired communication type is set by the "Transmission Type" parameter

Device Profile

The combo slave CANopen devices support all types of I/O communication, and correspond to the device profile for digital and analog input/output modules (DS401). The default mapping has not been adapted to the profile version DS401 V2 because of the downward compatibility.

Transmission Rates

Seven transmission rates from 10 kbaud up to 1 Mbaud are available for different bus lengths. The effective utilization of the bus bandwidth allows CANopen to achieve short system reaction times at relatively low data rates.

Topology

CAN is based on a linear topology. The number of devices participating in each network is logically limited by CANopen to 128, but physically the present generation of drivers allows up to 64 nodes in one network segment. The maximum possible size of the network for any particular data rate is limited by the signal transit time required on the bus medium. For 1 Mbaud, for instance, the network may extend 25 m, whereas at 50 kbaud the network may reach up to 1000 m. At low data rates the size of the network can be increased by repeaters, which also allow the construction of tree structures.

Bus access procedures

CAN utilises the Carrier Sense Multiple Access (CSMA) procedure, i.e. all participating devices have the same right of access to the bus and may access it as soon as it is free (multi-master bus access). The exchange of messages is thus not device-oriented but message-oriented. This means that every message is unambiguously marked with a prioritised identifier. In order to avoid collisions on the bus when messages are sent by different devices, a bit-wise bus arbitration is carried out at the start of the data transmission. The bus arbitration assigns bus bandwidth to the messages in the sequence of their priority. At the end of the prioritisation phase only one bus device occupies the bus, collisions are avoided and the bandwidth is optimally exploited.

Configuration and parameterization

The eStudio allows all the CANopen parameters to be set conveniently. An "eds" file (an electronic data sheet) is available on the elrest website (www.elrest.de) for the parameterisation of elrest CANopen devices using configuration tools from other manufacturers.

Certification

The elrest CANopen devices have a powerful implementation of the protocol, and are not certified by CiA, the CAN in Automation association.

32.2 CANopen configuration

The combo slave devices have a diverse configuration- and adjustment. The effort of configuration is minimal, because nearly every parameter is available with meaningful default values. This default settings fulfil the most application requirements.

Address (CANNodeID)

Before first execution oft he combo slave device the node number (CANNodeID) must be set. Therefore you can use the hex switch on top of the device. (see capture hex sevice switch).
The CANNodeID is adjustable in the range from 0 to 63, whereas the number 0 is not supported. The zehner digit equates the hex switch.
Each node number must be unique in a CAN network.

CAN baud rate

Before first execution oft he combo slave device the baud rate must be set. Therefore you can use the hex switch on top of the device. (see capture hex sevice switch).
All CAN devices in one network needs the save baud rate setting.

PDO parameter

- PDO-identifier
  the default identifier distribution of CANopen has 4 receive PDO (RxPDOs) and 4 send PDO (TxPDO). This can mutch to e.g. 32 digital in- and outputs and 12 analog in- and outputs.

- PDO-communication method
  The method of communication can be set individual for each object to event driven, cyclic synchronous or requested.

- PDO-mapping
  At startup will the in- and output datat mapped to the PDO (default mapping).
  The default mapping can be change on runtime see object 0x1600ff resp. 0x1A00ff.

- Heartbeat/Guarding
  The device answer with or without special nodeguarding requirements. If the device should send automatic state informantions (heartbeat) or the device should react to lost master, the corresponding parameter (Guarding: object 0x100Cff ; Heartbeat: object 0x1016ff) must be set.

- SDO
  A list of all over CAN achievable parameter will be located in the object dictionary. This objects can be processed with SDO access.

Configuration files

In the configuration file (Electronic Data Sheet, eds) are all settings an parameter listed. The eds files can be readed by special configuration tools. The structure ans syntax of the eds-file is defined in the CiA DSP 306.

The eds-files of the combo devices is available from our homepage (www.elrest.de) or on the eStuido installation CD.

Configuration of third partie devices

With the CANopen interface a wide range of PLC, embedded controls and industrial PC are available. With the eds file it should be easy to configure an combo device under an other development platform.

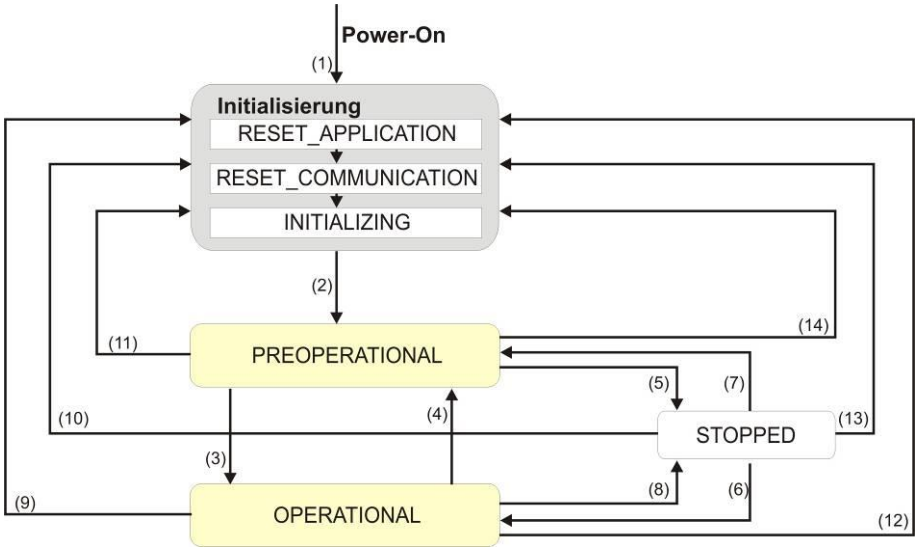
32.3 Network management

Easy Boot-Up

CANopen support a very easy boot up of distributed networks. The device start after initialization in the state *Pre-Operational*. In this state the access to SDO with default values is allowed. The device can be configured the other values than the default.

For starting the device is only one CAN message necessary: Start_Remote_Node: Identifier *0*, two data bytes: 0x01, 0x00. The Node will come tot he sate: *Operational*.

State diagram of an CANopen device:



(1)	Power-On
(2)	Initialisierung beendet
(3),(6)	Start-Remote-Node Indication
(4),(7)	Enter Preoperational Indication
(5),(8)	Stop Remote Node Indication
(9),(10),(11)	Reset Communication Indication
(12),(13),(14)	Reset Application Indication
(3),(6)	Start-Remote-Node Indication

PREOPERATIONAL

After the initialization oft he combo slave device, the device is automatic in the state PREOPERATIONAL. In this state is SDO transfer allowed. The PDO are still inactive.

OPERATIONAL

In this state the PDO are active. From state OPERATIONAL the device can change back to the state PREOPERATIONAL if additional configuration is necessary.

STOPPED

In the state STOPPED is no communication to the slave devices possible. Only network management services (NMT) are possible.

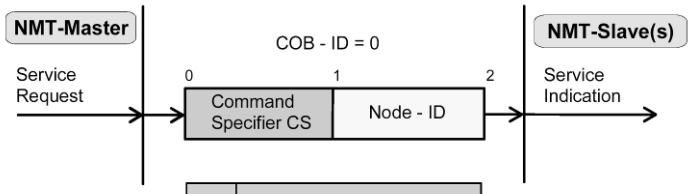
State change

In the CANopen specification is for NMT service of device node control reserved the identifier 0h. The addressing of node is inside of the message a special byte.

The following NMT services are available:

- Stop_Remote_Node
- Start_Remote_Node
- Enter_Preoperational
- Reset_Node
- Reset_Communication

Protocol of NMT services:



CS	Dienst
1	Start_Remote_Node
2	Stop_Remote_Node
128	Enter_Preoperational-State
129	Reset_Node
130	Reset_Communication

Node-ID Kontenidentifizierung
(Node-ID = 0: Alle Knoten)

The following table give a overview of all CANopen states changes and the corresponding commands (command specifier from the NMT master telegram).

State change	Command Specifier cs	explanation
(1)	-	The initalizing state will be entered automaticlly.
(2)	-	After initalizing the status **PREOPERATIONAL** will be automaticlly reached. The Boot-Up-messeage will be sent.
(3), (6)	cs = 1 = 0x01	**Start_Remote_Node** Start the device, enable the outputs and start the PDO transmission.
(4), (7)	cs = 128 = 0x80	**Enter_Preoperational** Stop the PDO-transmission, SDO still active.
(5), (8)	cs = 2 = 0x02	**Stop_Remote_Node** Outputs change in error mode, SDO and PDO is disconnected.
(9), (10), (11)	cs = 129 = 0x81	**Reset_Node** Reset will be done. All object are reset to default value.
(12), (13), (14)	cs = 130 = 0x82	**Reset_Communication** Reset of communication will be done. All objects 0x1000 - 0x1FFF will be reset to default value.

Boot-Up message

After the initialisation phase and the self test, the bus coupler sends the boot-up message, a CAN message with one data byte (0) and the identifier of the guarding or heartbeat message: CAN-ID = 0x700 + Node-ID. In this way temporary failure of a module during operation (e.g. due to a voltage interruption), or a module that is switched on at a later stage, can be reliably detected, even without Node Guarding. The sendr can be determined from the message identifier (see default identifier distribution).
It is also possible, with the aid of the boot-up message, to recognise the nodes present in the network at startup with a simple CAN monitor, without having to make write access to the bus (such as a scan of the network by reading out parameter 0x1000).
Finally, the boot-up message communicates the end of the initialisation phase; the bus coupler signals that it can now be configured or started.

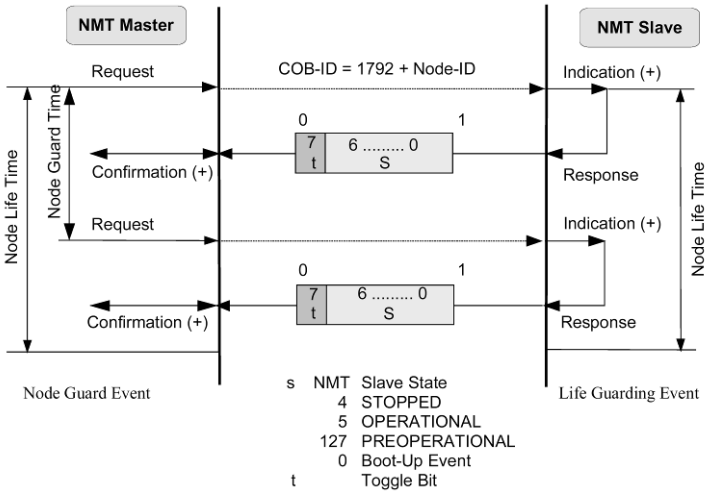
Node Monitoring

Heartbeat and guarding mechanisms are available to monitor failures in the CANopen network. These are of particular importance for CANopen, since modules do not regularly speak in the event-driven mode of operation.
In the case of "guarding", the devices are cyclically interrogated about their status by means of a data request telegram (remote frame), whereas with "heartbeat" the nodes transmit their status on their own initiative.

Node Guarding and Life Guarding

Node Guarding is used to monitor the non-central peripheral modules, while they themselves can use Life Guarding to detect the failure of the guarding master. Guarding involves the master sending remote frames (remote transmit requests) to the guarding identifier of the slaves that are to be monitored. These reply with the guarding message. This contains the slave's status code and a toggle bit that has to change after every message. If either the status or the toggle bit do not agree with that expected by the NMT master, or if there is no answer at all, the master assumes that there is a slave fault.

CANopen Node-Guarding protocol:



The toggle bit (t) transmitted in the first guarding telegram has the value 0. After this, the bit must change (toggle) in every guarding telegram so that the loss of a telegram can be detected. The node uses the remaining seven bits to transmit its network status (s):

The Node Life-Time will be calculated from the parameter Guard-Time (Object 0x100C) and Life-Time-Factor (Object 0x100D):

Life-Time = Guard-Time x Life-Time-Factor

If one of the two parameters "0" is (Default setting), is no supervision of the Masters (no Life Guarding).

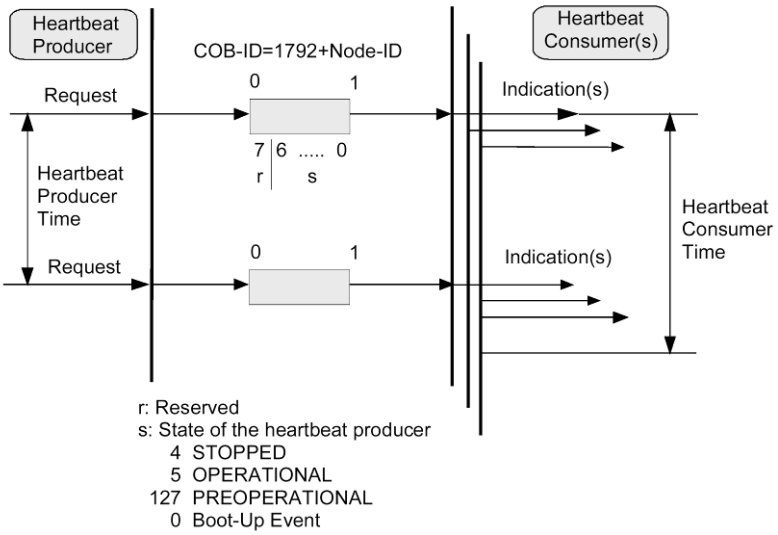
Example

The guarding message for node 27 (0x1B) must be requested by a remote frame having identifier 0x71B (1819dec). If the node is Operational, the first data byte of the answer message alternates between 0x05 and 0x85, whereas in the Pre-Operational state it alternates between 0x7F and 0xFF.

Heartbeat

In the heart beat procedure, each node transmits its status message cyclically on its own initiative. There is therefore no need to use remote frames, and the bus is less heavily loaded than under the guarding procedure. The master also regularly transmits its heartbeat telegram, so that the slaves are also able to detect failure of the master.

CANopen heart beat protocol:



The coadministration both methods of node supervision is not allowed. If the heartbeat producer time value of nonzero configured, the Heartbeat protocol.

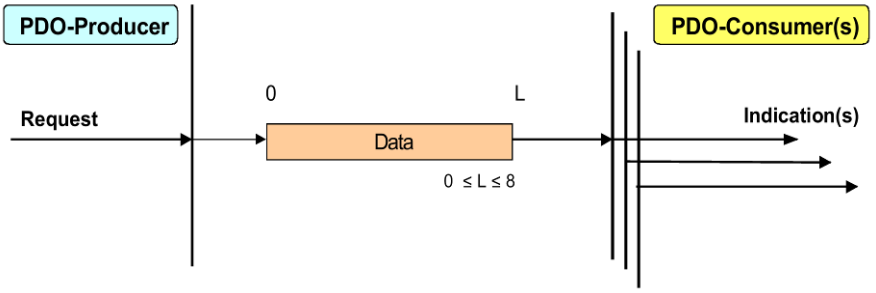
32.4PDO

Introduction

Many fieldbus systems is constantly the whole process image transfer - mostly more or less cyclical. CANopen is not on this principle of communication limited, because of the Multi-CAN Master Buszugriffsregelung also offers other opportunities.

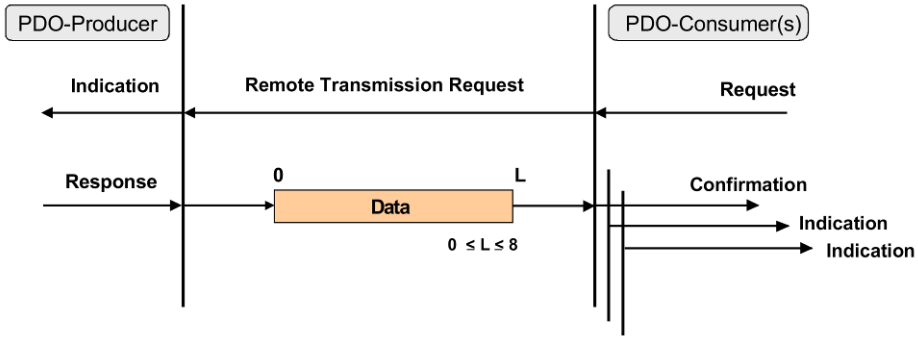
Process data objects represent the actual mechanism for the transfer of process data (application-objects). A PDO is sent by a Producer and one or more Consumern received. A PDO-Producer sent process data can be high 8 Byte. The transfer of PDOs is unconfirmed and requires the PDO clearly assigned CAN-message identifier. The importance of the transmitted data will by the used CAN-message identifier as well as the one PDO assigned PDO-Mapping defined. Since the identification of a PDOs clearly about the message identifier is made and the data content exclusively from utilizable data exists, the transmission of PDOs thus without additional protocol overhead.

CANopen heart beat protocol:

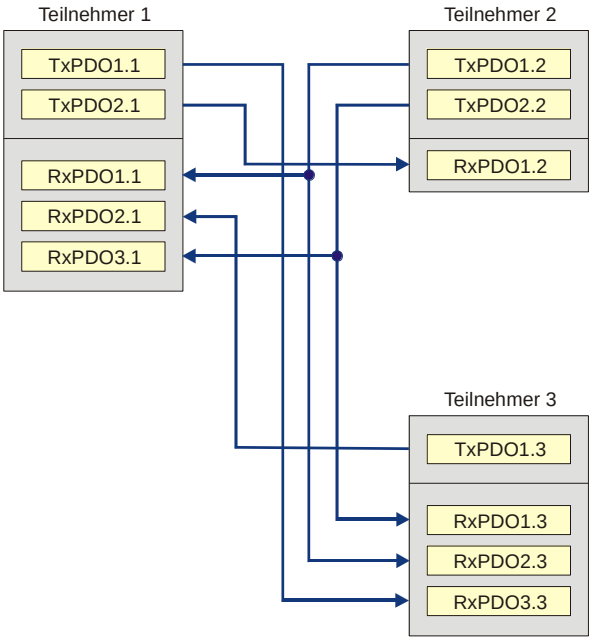


Likewise, the PDOs by sending a PDO-Producer Datenanforderungsnachricht (using a Remote Transmission Request, RTR) under the message identifier requested PDO by a Consumer to be done.

CANopen heart beat protocol:



The transfer of PDOs takes the form of broadcast messages according to the CAN-protocol. On PDOs are therefore any communication structures between the participants in a network feasible. Next picture shows a sample with PDOs possible communications infrastructure.
This is a participant 1 producer of TxPDO1.1 and TxPDO2.1 and together with participants 3 Consumer of TxPDO1.2 and TxPDO2.2.



The administration of PDOs occurs both on the PDO-Producer as well as the PDO-Consumer site in two structures per PDO (PDO Communication parameters or PDO Mapping parameters). These structures are located within the Object dictionaryses and are generally in the system initialisation about SDO-requests configured.

Communication parameter

The PDOs can depending on Applikationsanforderung with different Communication parametern (Transmission Type) mark. The Transmission Type for a PDOs defined as the transfer of PDOs at a PDO-Producer triggered. In addition to an event-oriented or abfragegesteuerten transfer of PDOs is in the practical application of distributed systems often also the transfer after expiry of a certain time interval and the possibility of network-wide synchron collection and distribution of process data. CANopen supports these requirements by modes. In addition, in principle between asynchronous and synchronous transfer differences.
While sending an asynchronous transfer PDOs and data transfer to the application process immediately after the emergence of assigned event or the delivery of the PDOs by the Consumer, find send transmission and data transfer to the application of the synchronous transfer only after the previous receiving a so-called SYNC object instead.
A synchronous PDO only once after the arrival of a synchronization objects, we speak transferred from a azyklisch synchronous PDO (receiving a SYNC-object as well as an amendment of the data pictured on the PDO object). On the other hand, you have a PDO, which each after a certain number of synchronization objects transferred, as cyclically-synchronous PDO.
Like all CANopen-parameters are also those in Object dictionary of the device. This can be accessed Servicedatenobjecte. The parameters of the RxPDOs are Index 0x1400 (RxPDO1) and following up to 512 RxPDOs are possible (range if index 0x15FF). According to find the entries for the TxPDOs in Index 0x1800 (TxPDO1) to 0x19FF (TxPDO512).

PDO identifier

The most important communication parameters of a PDOs is the CAN-Identifier (also Communication Object Identifier, COB-ID). It is used to identify the data and determine their priority when bus access. For each CAN-data telegram should only a send node (Producer) give; there CAN BE all messages in Broadcast procedure sends a telegram as described by unlimeted node name received (Consumer).

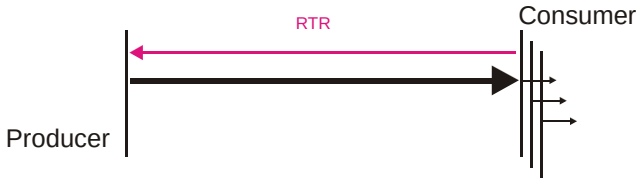
A node can therefore his Eingangsinformation several Busteilnehmern simultaneously available - even without passing through a logical Busmaster. Of the identifiers is in the communications SubIndex 1 parameter set. He is as 32-Bit value encoded, where the niederwertigsten 11 Bits (Bit 0...10) the actual Identifier. Combo Slave assemblies do not support 29 Bit identifier (CAN 2.0B).

PDO communication overview

CANopen offers various possibilities, the process data transfer.

event driven

Polling with remote frames



Sync cyclic / acyclic

Event driven

The ”event” is the alteration of an input value, the data being transmitted immediately after this change. The event-driven flow can make optimal use of the bus bandwidth, since instead of the whole process image it is only the changes in it that are transmitted. A short reaction time is achieved at the same time, since when an input value changes it is not necessary to wait for the next interrogation from a master. As from CANopen Version 4 it is possible to combine the event driven type of communication with a cyclic update. Even if an event has not just occurred, event driven TxPDOs are sent after the event timer has elapsed. If an event does occur, the event timer is reset. For RxPDOs the event timer is used as a watchdog in order to monitor the arrival of event driven PDOs . If a PDO does not arrive within a set period of time, the bus node adopts the error state.

Polled

The PDOs can also be polled by data request telegrams (remote frames). In this way it is possible to get the input process image of event-driven inputs onto the bus, even when they do not change, for instance through a monitoring or diagnostic device brought into the network while it is running. The time behaviour of remote frame and answer telegrams depends on what CAN controller is in use (Fig. 8). Components with full integrated message filtering ("FullCAN") usually answer a data request telegram immediately, transmitting data that is waiting in the appropriate transmit buffer - it is the responsibility of the application to see that the data there is continuously updated. CAN controllers with simple message filtering ("BasicCAN") on the other hand pass the request on to the application which can now compose the telegram with the latest data. This does take longer, but does mean that the data is "fresh". Beckhoff use CAN controllers following the principle of Basic CAN. Since this device behaviour is usually not transparent to the user, and because there are CAN controllers still in use that do not support remote frames at all, polled communication can only with reservation be recommended for operative running.

Synchronised

It is not only for drive applications that it is worthwhile to synchronise the determination of the input information and the setting the outputs. For this purpose CANopen provides the SYNC object, a CAN telegram of high priority but containing no user data, whose reception is used by the synchronised nodes as a trigger for reading the inputs or for setting the outputs.

PDO transmission types: Parameterisation

The PDO transmission type parameter specifies how the transmission of the PDO is triggered, or how received PDOs are handled.

Transmission mode	Zyklisch	Azyklisch	Synchron	Asynchron	Nur RTR
0		X	X		
1-240	X		X		
241-251	- reserviert -				
252			X		X
253				X	X
254, 255				X	

The type of transmission is parameterised for RxPDOs in the objects at 0x1400ff, subindex 2, and for TxPDOs in the objects at 0x1800ff, subindex 2.

Acyclic Synchronous

PDOs of transmission type 0 function synchronously, but not cyclically. An RxPDO is only evaluated after the next SYNC telegram has been received. In this way, for instance, axis groups can be given new target positions one after another, but these positions only become valid at the next SYNC - without the need to be constantly outputting reference points. A device whose TxPDO is configured for transmission type 0 acquires its input data when it receives the SYNC (synchronous process image) and then transmits it if the data correspond to an event (such as a change in input) having occurred. Transmission type 0 thus combines transmission for reasons that are event driven with a time for transmission (and, as far as possible, sampling) and processing given by the reception of "SYNC".

Cyclic Synchronous

In transmission types 1-240 the PDO is transmitted cyclically: after every ”nth” SYNC (n = 1...240). Since transmission types can be combined on a device as well as in the network, it is possible, for example, for a fast cycle to be agreed for digital inputs (n = 1), whereas the data for analog inputs is transmitted in a slower cycle (e.g. n = 10). RxPDOs do not generally distinguish between transmission types 0...240: a PDO that has been received is set to valid when the next SYNC is received. The cycle time (SYNC rate) can be monitored (object 0x1006), so that if the SYNC fails the device reacts in accordance with the definition in the device profile, andswitches, for example, its outputs into the fault state. The FC510x PC cards support cyclic synchronous transmission types completely: transmitting the SYNC telegram is coupled to the linked task, so that new input data is available every time the task begins. The card will recognise the absence of a synchronous PDO, and will report it to the application.

Only RTR

Transmission types 252 and 253 apply to process data objects that are transmitted exclusively on request by a remote frame. 252 is synchronous: when the SYNC is received the process data is acquired. It is only transmitted on request. 253 is asynchronous. The data here is acquired continuously, and transmitted on request. This type of transmission is not generally recommended, because fetching input data from some CAN controllers is only partially supported. Because, furthermore, the CAN controllers sometimes answer remote frames automatically (without first requesting up-to-date input data), there are circumstances in which it is questionable whether the polled data is up-to-date. Transmission types 252 and 253 are for this reason not supported by the elrest combo.

Asynchronous

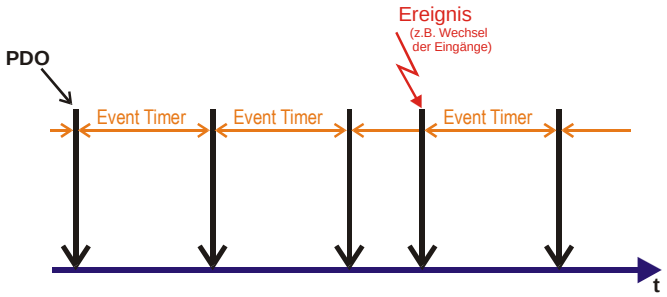
The transmission types 254 + 255 are asynchronous, but may also be event-driven. In transmission type 254, the event is specific to the manufacturer, whereas for type 255 it is defined in the device profile. In the simplest case, the event is the change of an input value - this means that every change in the value is transmitted.The asynchronous transmission type can be coupled with the event timer, thus also providing input data when no event has just occurred.

Inhibit time

The ”inhibit time” parameter can be used to implement a ”transmit filter” that does not increase the reaction time for relatively new input alterations, but is active for changes that follow immediately afterwards. The inhibit time (transmit delay time) specifies the minimum length of time that must be allowed to elapse between the transmission of two of the same telegrams. If the inhibit time is used, the maximum bus loading can be determined, so that the worst case latency can then be found.

Event Timer

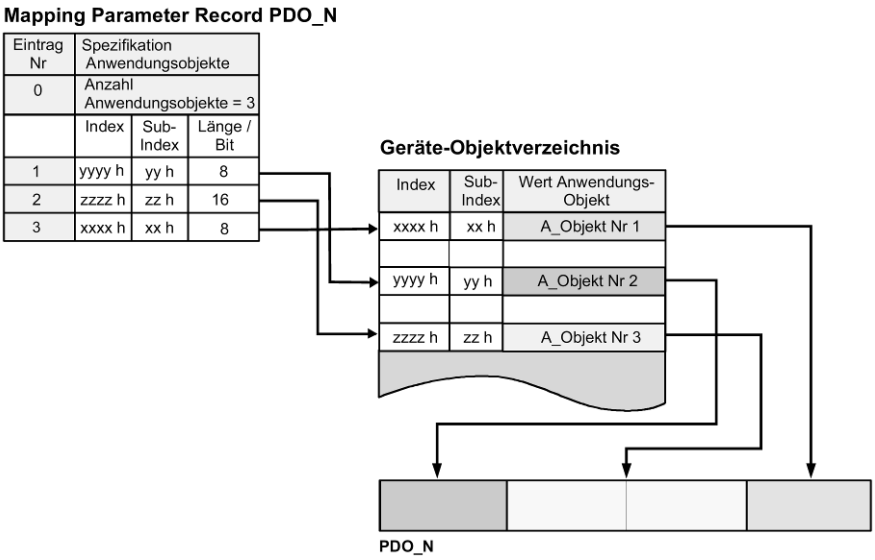
An event timer for transmit PDOs can be specified by subindex 5 in the communication parameters. Expiry of this timer is treated as an additional event for the corresponding PDO, so that the PDO will then be transmitted. If the application event occurs during a timer period, it will also be transmitted, and the timer is reset.



In the case of receive PDOs, the timer is used to set a watchdog interval for the PDO: the application is informed if no corresponding PDO has been received within the set period. The combo can in this way monitor each individual PDO. Notes on PDO Parameterisation

PDO Mapping

PDO mapping refers to mapping of the application objects (real time data) from the object directory to the process data objects. The CANopen device profile provide a default mapping for every device type, and this is appropriate for most applications. Thus the default mapping for digital I/O simply represents the inputs and outputs in their physical sequence in the transmit and receive process data objects. The default PDOs for drives contain 2 bytes each of a control and status word and a set or actual value for the relevant axis. The current mapping can be read by means of corresponding entries in the object directory. These are known as the mapping tables. The first location in the mapping table (sub-index 0) contains the number of mapped objects that are listed after it. The tables are located in the object directory at index 0x1600ff for the RxPDOs and at 0x1A00ff for the TxPDOs.



Digital and analog input/output modules: Read out the I/O number

The current number of digital and analog inputs and outputs can be determined or verified by reading out the corresponding application objects in the object directory::

Parameter	Adresse im Object dictionary
Count of digital input bytes	Index 0x6000, SubIndex 0
Count digital output bytes	Index 0x6200, SubIndex 0
Count analog inputs	Index 0x6401, SubIndex 0
Count analog outputs	Index 0x6411, SubIndex 0

Variable mapping

As a rule, the default mapping of the process data objects already satisfies the requirements. For special types of application the mapping can nevertheless be altered: the Beckhoff CANopen Bus Couplers, for instance, thus support variable mapping, in which the application objects (input and output data) can be freely allocated to the PDOs. The mapping tables must be configured for this: as from Version 4 of CANopen, only the following procedure is permitted, and must be followed precisely:

1. First delete the PDO (set 0x1400ff, or 0x1800ff, subindex 1, bit 31 to "1")

2. Set subindex 0 in the mapping parameters (0x1600ff or 0x1A00ff) to "0”

3. Change mapping entries (0x1600ff or 0x1A00ff, SI 1..8)

4. Set subindex 0 in the mapping parameters to the valid value. The device then checks the entries for consistency.

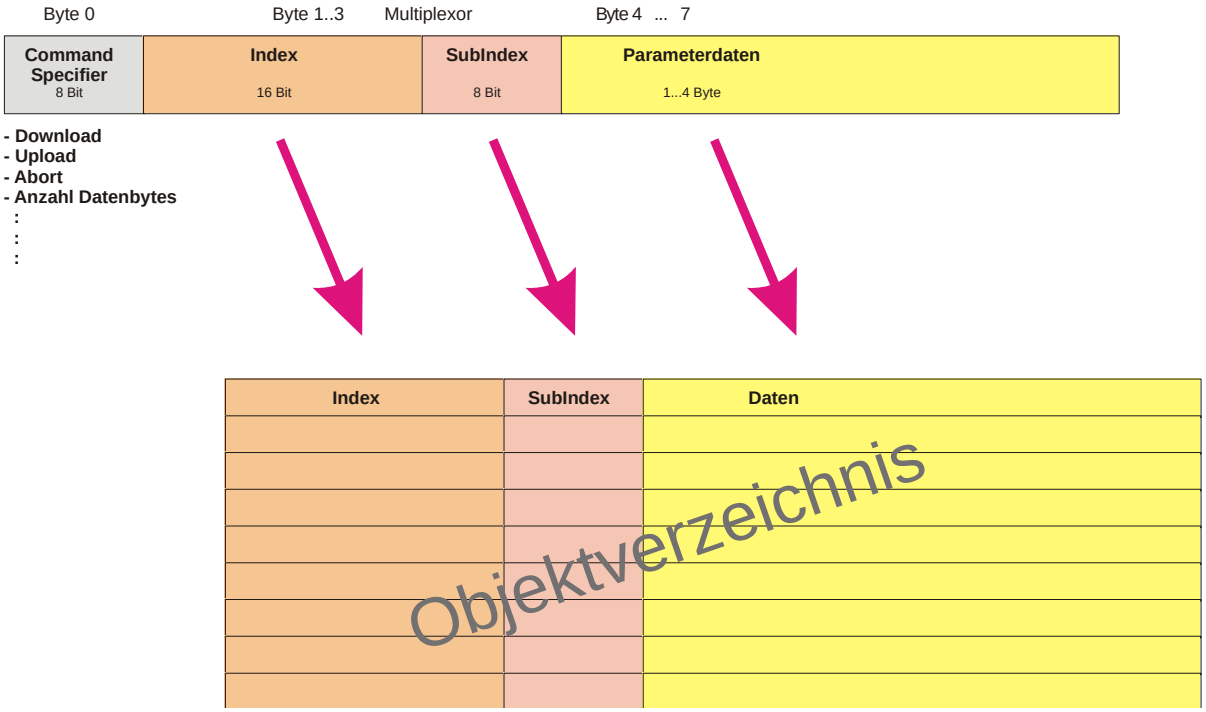
5. Create PDO by entering the identifier (0x1400ff or 0x1800ff, subindex 1).

Dummy Mapping

A further feature of CANopen is the mapping of placeholders, or dummy entries. The data type entries stored in the object directory, which do not themselves have data, are used as placeholders. If such entries are contained in the mapping table, the corresponding data from the device is not evaluated. In this way, for instance, a number of drives can be supplied with new set values using a single CAN telegram, or outputs on a number of nodes can be set simultaneously, even in event-driven mode.

32.5 SDO

The parameters listed in the object directory are read and written by means of service data objects. These SDOs are multiplexed domains, i.e. structures of any size that have a multiplexer (address). The multiplexer consists of a 16-bit index and an 8-bit sub-index that address the corresponding entries in the object directory.



The CANopen bus couplers are servers for the SDO, which means that at the request of a client (e.g. of the IPC or the PLC) they make data available (upload), or they receive data from the client (download). This involves a handshake between the client and the server. When the size of the parameter to be transferred is not more than 4 bytes, a single handshake is sufficient (one telegram pair): For a download, the client sends the data together with its index and sub-index, and the server confirms reception. For an upload, the client requests the data by transmitting the index and sub-index of the desired parameter, and the server sends the parameter (including index and sub-index) in its answer telegram. The same pair of identifiers is used for both upload and download. The telegrams, which are always 8 bytes long, encode the various services in the first data byte. All parameters with the exception of objects 1008h, 1009h and 100Ah (device name, hardware and software versions) are only at most 4 bytes long, so this description is restricted to transmission in expedited transfer.

The structure of the SDO telegrams is described below.

Client -> Server, Upload Request

11-bit Identifier	8 Byte user data							
0x600 (=1536dez) + Node-ID	0x40	Index0	Index1	SubIdx	0x00	0x00	0x00	0x00

Parameters	Explanation
Index0	Index Low-Byte (Unsigned16, LSB)
Index1	Index High-Byte (Unsigned16, MSB)
SubIdx	SubIndex (Unsigned8)

Client -> Server, Upload Response

11-bit Identifier	8 Byte user data							
0x580 (=1408dez) + Node-ID	0x4x	Index0	Index1	SubIdx	Data0	Data1	Data2	Data3

Parameters	Explanation
Index0	Index Low-Byte (Unsigned16, LSB)
Index1	Index High-Byte (Unsigned16, MSB)
SubIdx	SubIndex (Unsigned8)
Data0	Data Low-Byte (LLSB)
Data3	Data High-Byte (MMSB)

Parameter of data type Unsigned8 will be transmitted im Byte Data0, Parameter oft type Unsigned16 in Data0 and Data1. The number of valid arguments in the first Databyte (0x4x CAN-coded as follows):

Anzahl Parameter-Bytes	**1**	**2**	**3**	**4**
First CAN-Datenbyte	0x4F	0x4B	0x47	0x43

Client -> Server, Download Request

11-bit Identifier	8 Byte user data							
0x600 (=1536dez) + Node-ID	0x22	Index0	Index1	SubIdx	Data0	Data1	Data2	Data3

Parameters	Explanation
Index0	Index Low-Byte (Unsigned16, LSB)
Index1	Index High-Byte (Unsigned16, MSB)

SubIdx	SubIndex (Unsigned8)
Data0	Data Low-Low-Byte (LLSB)
Data3	Data High-High-Byte (MMSB)

It is optionally possible to give the number of valid parameter data bytes in the first CAN data byte

Count of Parameter-Bytes	1	2	3	4
First CAN-Datenbyte	0x2F	0x2B	0x27	0x23

This is, however, not generally necessary, since only the less significant data bytes up to the length of the object directory entry that is to be written are evaluated. A download of data up to 4 bytes in length can therefore always be achieved in elrest bus nodes with 22h in the first CAN data byte.

Client -> Server, Download Response

11-bit Identifier	8 Byte user data							
0x580 (=1408dez) + Node-ID	0x60	Index0	Index1	SubIdx	Data0	Data1	Data2	Data3

Parameters	Explanation
Index0	Index Low-Byte (Unsigned16, LSB)
Index1	Index High-Byte (Unsigned16, MSB)
SubIdx	SubIndex (Unsigned8)

Abortion of Parameter Communication

Parameter communication is interrupted if it is faulty. The client or server send an SDO telegram with the following structure for this purpose:

11-bit Identifier	8 Byte user data							
0x580(Client) oder 0x600(Server) + Node-ID	0x80	Index0	Index1	SubIdx	Error0	Error1	Error2	Error3

Parameters	Explanation
Index0	Index Low-Byte (Unsigned16, LSB)
Index1	Index High-Byte (Unsigned16, MSB)
SubIdx	SubIndex (Unsigned8)
Error0	SDO Fehler-Code Low-Low-Byte (LLSB)
Error3	SDO Fehler-Code High-High-Byte (MMSB)

List of SDO error codes (reason for abortion of the SDO transfer):

SDO Fehler-Code	Erläuterung
0x05 03 00 00	Toggle bit not changed
0x05 04 00 01	SDO command specifier invalid or unknown
0x06 01 00 00	Access to this object is not supported
0x06 01 00 02	Attempt to write to a Read_Only parameter
0x06 02 00 00	The object is not found in the object directory
0x06 04 00 41	The object can not be mapped into the PDO
0x06 04 00 42	The number and/or length of mapped objects would exceed the PDO length
0x06 04 00 43	General parameter incompatibility
0x06 04 00 47	General internal error in device
0x06 06 00 00	Access interrupted due to hardware error
0x06 07 00 10	Data type or parameter length do not agree or are unknown
0x06 07 00 12	Data type does not agree, parameter length too great
0x06 07 00 13	Data type does not agree, parameter length too short
0x06 09 00 11	Subindex not present
0x06 09 00 30	General value range error
0x06 09 00 31	Value range error: parameter value too great
0x06 09 00 32	Value range error: parameter value too small
0x06 0A 00 23	Resource not available
0x08 00 00 21	Access not possible due to local application
0x08 00 00 22	Access not possible due to current device status

32.6 Identifier

Default-Identifier

CANopen provides for the main Kommunikationsobjecte Default Identifier, from the 7-Bit node address (Node-ID) and a 4-Bit Code to Function follows drift. For Broadcast objects, the Node-ID 0.
Thus following Default Identifier:

Broadcast-Objects

Object	Funktion	Function Code	corresponding COB ID		Object für Comm. Parameter/ Mapping
			hex	dez	
NMT	Boot-Up	0	0x00	0	- / -
SYNC	synchronization	1	0x80	128	0x1005 + 0x1006 / -

Peer-to-Peer-Objecte

object	**function**	**Function Code**	**resultierende COB ID**		**Object für Comm. Parameter / Mapping**
			hex	dez	
Emergency	state / error	1	0x81 - 0xFF	129 - 255	- / -
PDO1 (tx)	dig. Eingänge	11	0x181 - 0x1FF	385 - 511	0x1800 / 0x1A00
PDO1 (rx)	digital output	100	0x201 - 0x27F	513 - 639	0x1400 / 0x1600
PDO2 (tx)	analog input	101	0x281 - 0x2FF	641 - 767	0x1801 / 0x1A01
PDO2 (rx)	analog output	110	0x301 - 0x37F	769 - 895	0x1401 / 0x1601
PDO3 (tx)	analog input*	111	0x381 - 0x3FF	897 - 1023	0x1802 / 0x1A02
PDO3 (rx)	analog output*	1000	0x401 - 0x47F	1025 - 1151	0x1402 / 0x1602
PDO4 (tx)	analog input*	1001	0x481 - 0x4FF	1153 - 1279	0x1803 / 0x1A03

PDO4 (rx)	analog output*	1010	0x501 - 0x57F	1281 - 1407	0x1403 / 0x1603
SDO (tx)	Parameter	1011	0x581 - 0x5FF	1409 - 1535	- / -
SDO (rx)	Parameter	1100	0x601 - 0x67F	1537 - 1663	- / -
Guarding	Life-/Node-guarding, Heartbeat, Boot-Up Nachricht	1110	0x701- 0x77F	1793 - 1919	(0x100C, 0x100D, 0x100E, 0x1016, 0x1017)

32.7 Object dictionary

Strcture of object dictionary

The CANopen object dictionary is for the combo Slave assembly relevant CANopen objects. The object dictionary is in three different areas divided:

Communication profile
(Index 0x1000 - 0x1FFF).
Contains the description of any specific parameters for the communication.

manufactor profile
(Index 0x2000 - 0x5FFF).
Contains the Description proprietary entries.

Standard device profile
(0x6000 - 0x9FFF).
Contains objects for the device profile after DS-401.

Structure of the object dictionary:

Index	Beschreibung
0000h	Nicht verwendet
0001h – 001Fh	Statische Datentypen
0020h – 003Fh	Komplexe Datentypen
0040h – 005Fh	Herstellerspezifische komplexe Datentypen
0060h – 007Fh	Geräteprofil-spezifische statische Datentypen
0080h – 009Fh	Geräteprofil-spezifische komplexe Datentypen
00A0h – 025Fh	Reserviert für weitere Geräteprofil-spezifische Datentypen
0260h – 0FFFh	Reserviert
1000h – 1FFFh	Kommunikationsprofil
2000h – 5FFFh	Hersteller-spezifischer Bereich
6000h – 9FFFh	Standardisierte Geräteprofile
A000h - BFFFh	Standardisierte Interfaceprofile
C000h - FFFFh	Reserviert

Every entry in a object dictionary is thrue a 16-Bit Index marked. If an object from many components (e.g. Object_type Array or Record), are the components of an eight-Bit-Subindex. The Objectname describes the function of object, the datatype attribute specified the type of entry. On the access attribute is that an entry specified only read, write or read and write.

Communication area

In this area of Object dictionaryses are all the communication of the assembly essential parameters and objects. In the field 0x1000 - 0x1018 are different, general kommunikationsspezifische parameters (e.g. the device name). The communication parameters (e.g. The Receive Identifier) are in the field PDOs 0x1400 - 0x140F (plus SubIndex). The parameters of the Mapping Receive PDOs stand in the area of 0x1600 - 0x160F (plus SubIndex). The Mappingparameter contain the references to the Application objecte, in the PDOs mapped and the Datawidth of the corresponding object (see also section PDO-Mapping).
The communication and Mapping parameters of the Transmit PDOs stand in the fields 0x1800 - 0x180F bzw. 0x1A00 - 0x1A0F.

Manufactorer area

In this area can be found entries, the specific to the combo Slave-assembly, e.g. :

- data object fort he complete handling of analog in- and outputs

- ….

Standardized device profile

In the standardized Geräteprofilbereich CANopen device profile DS-401 Version 1 supports. For analog inputs are functions are available to communicate in the event-oriented mode to adapt and Applikationsanforderungen Busload to minimize:

- Delta function

- event control activate / deactivate

Objec

Following is a list of objects that are of combo Slave assemblies would support.

Parameter	Index
Device type	0x1000
Error register	0x1001
Error storage	0x1003
Sync-Identifier	0x1005
Device name	0x1008
Hardware-Version	0x1009
Software-Version	0x100A
Node number	0x100B
Guard Time	0x100C
Life Time Factor	0x100D
Emergency Identifier	0x1014
Producer Heartbeat Time	0x1017
Device identification (Identity Object)	0x1018
Server SDO Parameter	0x1200
Communication parameter 1.-4.	0x1400 - 0x1403
Mapping 1.-4. RxPDO	0x1600 - 0x1603
Communication parameter 1.-4.	0x1800 - 0x1803
Mapping 1.-4. TxPDO	0x1A00 - 0x1A03
Digital input	0x6000
Digital output	0x6200
Analog input	0x6401
Analog output	0x6411
Event control, Analog input	0x6423
Delta function, Analog input	0x6426

Sensor type, analog input	0x5010
Sensor type, analog output	0x5011
Scaling factor, analog input	0x5012
Scaling factor, analog output	0x5013
Calibration value max., analog input	0x5020
Calibration value min., analog input	0x5021
Tara-comand, analog input	0x5022
configuration counter- / frequency inputs *	0x5030
Counter value (on counter mode) *	0x5035
Frequency (on frequency mode) *	0x5036

* above firmware V1.91

32.8 Description of object and data

Device type

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1000	0	Device Type	Unsigned32	ro	N	0x00000000	Information to device type

The 32 Bit value in two 16 Bit fields:

MSB	LSB
Additional Information	Device profile-Number
0000 0000 0000 wxyz	0x191 (401dez)

The Additional Information includes all information of signal from the device (in-/outputs):

z = 1 means:device has digital input,
y = 1 means: device has digital output,
x = 1 means: device has analog input,
w = 1 means: device has analog output.

The type of device provides only a rough classification of the device. Each combo Slave Device supports all kinds of inputs and outputs because those have combo Extension Modules can be expanded => always 0x00 0F 01 91.

Error register

Index	Sub Index	Name	Typ	Attrb	Map.	Default-Wert	Description
x1001	0	Error Register	Unsigned8	ro	N	0x00	Error register

The 8Bit-value is decoded:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
ManufSpec.	reserved	reserved	Comm.	reserved	reserved	reserved	Generic

ManufSpec.: Manufactor specific error, will be more specific object 1003.

Comm.: error (Overrun CAN)

Generic : Not a specified error occurred closer (Flag, in any error set)

Error storage

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1003	0	Predefined error field	Unsigned8	rw	N	0x00	Object 1003h contains a description of the device errors - SubIndex 0 the number of stored error conditions.
	1	Actual error	Unsigned32	ro	N	--	Load occured error
	…	…	…	--	…	…	…
	10	Standard error field	Unsigned32	ro	N	--	Maximun 10 errors will be stored.

The 32 Bit value in two 16 Bit fields:

MSB	LSB
Additional Information	Error Code

The Additional Code contains the Error Trigger (see Emergency-object) and thus a detailed error-description.

New mistakes will SubIndex 1 saved, and all other SubIndices will be increments. By writing a 0 on SubIndex 0, the entire error storage deleted.

If no error since the Power On occurred, there is only object 0x1003 Subindex 0 with registered 0. By a Reset the Fehlerspeicher deleted. As usual, the LSB CANopen first and the MSB Load.

Sync-Identifier

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1005	0	COB-ID Sync Message	Unsigned32	rw	N	0x80000008	Identifier der Sync-Nachricht

The lower 11 Bit of the 32-Bit value include the Identifier (0x80=128dez). Bit 30 informs, whether the device that transmits (SYNC telegram 1) or not (0). The CANopen I/O devices received the SYNC telegram, accordingly, Bit 30=0. i Bit 31 is for downstream compatibility without description.

Device name

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1008	0	Manufacturer Device Name	Visible String	ro	N	„elrest Automations-systeme GmbH“	Device name oft he node

Since the returned value larger 4 Bytes is segmented SDO protocol for the transfer.

Hardware-Version

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1009	0	Manufacturer Hardware-Version	Visible String	ro	N	„0.1“	Hardware-version oft he device

Since the returned value larger 4 Bytes is segmented SDO protocol for the transfer.

Software-Version

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x100A	0	Manufacturer Software-Version	Visible String	ro	N	„0.1“	Software- version oft he device

Since the returned value larger 4 Bytes is segmented SDO protocol for the transfer.

Guard-Time

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x100C	0	Guard-Time [ms]	Unsigned16	ro	N	0	Distance between two Guard telegrams. by NMT-Master or configuration tool.

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x100D	0	Life Time Factor	Unsigned8	ro	N	0	Life Time Factor x Guard Time = Life Time (Watchdog für Life Guarding)

If not within the Life Time Guarding telegram was received, the nodes in the error state. If Life Time Factor and/or Guard Time = 0, so the nodes no Lifeguarding, can nevertheless will monitor the Master (Node Guarding).

Life Time Factor

Emergency Identifier

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1014	0	COB-ID Emergency	Unsigned32	rw	N	0x00000000 + NodeID	Indentifier of the emergency telegram

The lower 11 Bit of the 32-Bit value include the Identifier (0x80=128dez). On the MSBit can be set if the device that Emergency-telegram sends (1) or not (0).

Producer Heartbeat Time

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1017	0	Producer Heartbeat Time [ms]	Unsigned16	rw	N	0	Time (in ms) between 2 heartbeat telegram

Device recorgnizing (Identity object)

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1018	0	Count of elements Identity Object	Unsigned8	ro	N	4	The Identity Object contains general information on the nature and implementation of the device.
	1	Vendor ID	Unsigned32	ro	N	0x00000032	manufactorer: elrest => 50
	2	Product Code	Unsigned32	ro	N	0x00000000	Device ID, depending on design
	3	Revisions-number	Unsigned32	ro	N	0x00000000	Version number
	4	Serial Number	Unsigned32	ro	N	0x00000000	Serial number

The 32 Bit value in two 16 Bit fields:

MSB			LSB		
Product Code CE1xx			Product Code CS1xx		
Product Code CE1xx	dez	hex	Product Code CS1xx	dez	hex
CE100	100	0x64	CS100	100	0x64
CE101	101	0x65	CS101	101	0x65
CE150	150	0x96	CS110	110	0x6E
CS152	152	0x98	CS111	111	0x6F

Server SDO Parameter

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1200	0	Count of elements	Unsigned8	ro	N	2	Communication parameter des Server SDOs. SubIndex0: Count of elements
	1	COB ID Client=>Server	Unsigned32	ro	N	0x00000600 + Node-ID des Client	COB-ID RxSDO (Client => Server)
	2	COB ID Server=>Client	Unsigned32	ro	N	0x00000600 + Node-ID	COB-ID TxSDO (Client => Server)

For reasons of backwards in object dictionary.

Communication parameter 1. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1400	0	Count of Elements	Unsigned8	ro	N	5	Communication parameter from the 1. receive-PDOs (RxPDO1). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000200 + Node-ID	COB-ID (Communication Object Identifier) RxPDO1
	2	Transmission Type	Unsigned8	rw	N	255	transmission mode PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	on RxPDOs without description
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer: Time for monitoring (Watchdog) to the reception-PDOs.

Subindex 1 (COB-ID):

The lower 11 Bit the 32-Bit value (Bits 0-10) CAN Identifier, MSBit (Bit 31) provides information, whether the PDO currently exists (0) or not (1), Bit 30 indicating whether a RTR access to this PDO permitted (0) or not (1). It is not allowed, the Identifier (Bit 0-10) to change, while the object exists (Bit 31=0). The Subindex 2 contains the bearer (see Introduction PDOs).

Communication parameter 2. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1401	0	Count of elements	Unsigned8	ro	N	5	Communication parameter from the 2. Receive-PDOs (RxPDO2). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000300 + Node-ID	COB-ID (Communication Object Identifier) RxPDO2
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	RxPDOs without Description
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer: Time for monitoring (Watchdog) of the receive-PDOs

Communication parameter 3. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1402	0	Count of elements	Unsigned8	ro	N	5	Communication parameter from the 3. Receive-PDOs (RxPDO3). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000400 + Node-ID	COB-ID (Communication Object Identifier) RxPDO3
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	bei RxPDOs without Description
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer: Time for monitoring (Watchdog) des Receive-PDOs

Communication parameter 4. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1403	0	Count of elements	Unsigned8	ro	N	5	Communication parameter des 4. Receive-PDOs (RxPDO4). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000500 + Node-ID	COB-ID (Communication Object Identifier) RxPDO4
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode des PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	RxPDOs without Description
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer: Time for monitoring (Watchdog) of the receive-PDOs

Mapping-Parameter 1. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1600	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter des 1. Receive-PDOs (RxPDO1). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x62000108	1. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x62000208	2. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x62000308	3. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x62000408	4. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The first Receive PDO (RxPDO1) is by Default for digital data. Whatever the number of actual outputs all 32 maximum per combo Slave Device available outputs mapped.

Mapping changes:

The Mapping modifying following order followed (from CANopen Version 4 mandatory):

- PDO delete (Bit 31 in Identifier entry (the communications Subindex1) to 1 parameter)

- Mapping disable (Subindex 0 Mapping to 0 Blogpost)

- Mapping entries (Subindices 1 ... 8)

- Mapping enable (Subindex 0 Mapping entry in the correct number of mapped objects)

- PDO stocks (Bit 31 in Identifier Subindex 1) Entry (the communications to 0 parameter)

Mapping-Parameter 2. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1601	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter des 2. Receive-PDOs (RxPDO2). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64110110	1. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64110210	2. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64110310	3. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64110410	4. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The second Receive PDO (RxPDO2) is by Default for analog output. Whatever the number of actual outputs are on the first RxPDO2 4 outputs (outputs 0 - 3) mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Mapping-Parameter 3. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1602	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter des 3. Receive-PDOs (RxPDO3). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64110510	1. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64110610	2. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64110710	3. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64110810	4. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The third Receive PDO (RxPDO3) is by Default for analog output. Whatever the number of actually existing outputs are on RxPDO3 the outputs 4 - 7 mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Mapping-Parameter 4. RxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1603	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter des 4. Receive-PDOs (RxPDO4). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64110910	1. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64110A10	2. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64110B10	3. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64110C10	4. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The fourth Receive PDO (RxPDO4) is by Default for analog output. Whatever the number of actually existing outputs are on RxPDO4 the outputs 8 - 11 mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Communication parameter 1. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1800	0	Count of elements	Unsigned8	ro	N	5	Communication parameter des 1. Send-PDOs (TxPDO1). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000180 + Node-ID	COB-ID (Communication Object Identifier) TxPDO1
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode des PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	Wiederholungsverzögerung [Wert x 100µs]
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer

Subindex 1 (COB-ID):

The lower 11 Bit the 32-Bit value (Bits 0-10) CAN Identifier, MSBit (Bit 31) provides information, whether the PDO currently exists (0) or not (1), Bit 30 indicating whether a RTR access to this PDO permitted (0) or not (1).

It is not allowed, the Identifier (Bit 0-10) to change, while the object exists (Bit 31=0).

Communication parameter 2. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1801	0	Count of elements	Unsigned8	ro	N	5	Communication parameter des 2. Send-PDOs (TxPDO2). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000280 + Node-ID	COB-ID (Communication Object Identifier) TxPDO2
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode des PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	Retries Delay time [Value x 100µs]
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer [ms]

The second Send PDO is by Default for analog input and configured for event-driven transmission (Transmission Type 255). The event control must first be activated (see object 0x6423).

Communication parameter 3. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1802	0	Count of elements	Unsigned8	ro	N	5	Communication parameter des 3. Send-PDOs (TxPDO3). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000380 + Node-ID	COB-ID (Communication Object Identifier) TxPDO3
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode des PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	Wiederholungsverzögerung [Wert x 100µs]
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer

The third Send PDO is by Default for analog input and configured for event-driven transmission (Transmission Type 255). The event control must first be activated (see object 0x6423).

Communication parameter 4. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1803	0	Count of elements	Unsigned8	ro	N	5	Communication parameter des 4. Send-PDOs (TxPDO4). SubIndex0: Count of elements
	1	COB ID	Unsigned32	rw	N	0x00000480 + Node-ID	COB-ID (Communication Object Identifier) TxPDO4
	2	Transmission Type	Unsigned8	rw	N	255	Transmission mode des PDOs
	3	Inhibit Time	Unsigned16	rw	N	0	Wiederholungsverzögerung [Wert x 100µs]
	4	--	Unsigned8	rw	N	-	unused
	5	Event Timer	Unsigned16	rw	N	0	Event Timer

The fourth Send PDO is by Default for analog input and configured for event-driven transmission (Transmission Type 255). The event control must first be activated (see object 0x6423).

Mapping-Parameter 1. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1A00	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter des 1. Send-PDOs (TxPDO1). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x60000108	1. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x60000208	2. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x60000308	3. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x60000408	4. mapped Application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The first Send PDO (TxPDO1) is by Default for digital input data. Whatever the number of actual inputs are all 32 maximum per combo Slave Device available inputs on TxPDO1 mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Mapping-Parameter 2. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1A01	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter of the 2. Send-PDOs (TxPDO2). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64010110	1. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64010210	2. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64010310	3. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64010410	4. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The second Send PDO (TxPDO2) is by Default for analog input. Whatever the number of actual inputs are on the first TxPDO2 4 inputs (inputs 0 - 3) mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Mapping-Parameter 3. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1A02	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter of the 3. Send-PDOs (TxPDO3). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64010510	1. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64010610	2. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64010710	3. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64010810	4. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The third Send PDO (TxPDO3) is by Default for analog input. Whatever the number of actual inputs are the inputs on TxPDO3 4 - 7 mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Mapping-Parameter 4. TxPDO

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x1A03	0	Count of elements	Unsigned8	ro	N	4	Mapping-Parameter of the 4. Send-PDOs (TxPDO4). SubIndex0: Count of elements
	1	1. mapped object	Unsigned32	rw	N	0x64010910	1. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	2	2. mapped object	Unsigned32	rw	N	0x64010A10	2. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	3	3. mapped object	Unsigned32	rw	N	0x64010B10	3. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width
	4	4. mapped object	Unsigned32	rw	N	0x64010C10	4. mapped application object: 2 Byte: Index 1 Byte: SubIndex 1 Byte: Bit width

The fourth Send PDO (TxPDO3) is by Default for analog input. Whatever the number of actual inputs are the inputs on TxPDO3 8 - 11 mapped.

At the Mapping to change must be a certain order followed (see object Index 0x1600).

Digital input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6000	0	Count of elements	Unsigned8	ro	N	4	Count of digital 8 Bit – input blocks
	1	1. Input block	Unsigned8	ro	Y	0x00	1. Input block (DI0…DI7)
	2	2. Input block	Unsigned8	ro	Y	0x00	2. Input block (DI8…DI15)
	3	3. Input block	Unsigned8	ro	Y	0x00	3. Input block (DI16…DI23)
	4	4. Input block	Unsigned8	ro	Y	0x00	4. Input block (DI24…DI31)

By Default every modification of a value leads in the event-oriented PDO send telegram.

Even if the combo Slave-Device (with/without CExxx) not all the inputs available, all 32 possible exits to the above Application objecte illustrated.

Digital output

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6200	0	Count of elements	Unsigned8	ro	N	4	Count of digital 8 Bit – output blocks
	1	1. Output block	Unsigned8	rw	Y	0x00	1. Output block (DO0…DO7)
	2	2. Output block	Unsigned8	rw	Y	0x00	2. Output block (DO8…DO15)
	3	3. Output block	Unsigned8	rw	Y	0x00	3. Output block (DO16…DO23)
	4	4. Output block	Unsigned8	rw	Y	0x00	4. Output block (DO24…DO31)

Even if the combo Slave-Device (with/without CExxx) not to provide all outputs, all 32 digital outputs on possible Application objecte shown above.

Analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6401	0	Count of elements	Unsigned8	ro	N	16	Count of analog input blocks
	1	1.Input channel	Signed16	ro	Y	0x0000	1. analog input channel AI0
	2	2.Input channel	Signed16	ro	Y	0x0000	2. analog input channel AI1
	…						
	15	15.Input channel	Signed16	ro	Y	0x0000	15. analog input channel AI14
	16	16.Input channel	Signed16	ro	Y	0x0000	16. analog input channel AI15

Even if the combo Slave-Device (with/without CExxx) not all inputs available, all 16 possible analog inputs to the above Application objecte illustrated.

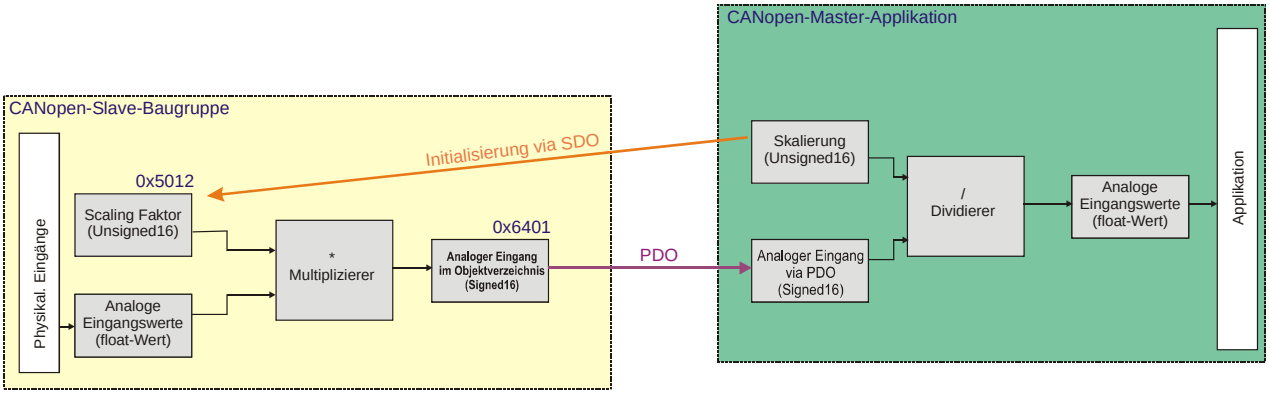
The analog signals will be in dependence of the scale factor (see object Index 0x5012) displayed.

The values of the analog input channels are geräteintern as floats identified. Depending on type identification ergegen different ranges:

Sensor type	Range of input	Range of value
AIN_0_10VOLT_NORMED	0 … 10V	0,0 … 1,0
AIN_0_20mA_NORMED	0 … 20 mA	0,0 … 1,0
AIN_PT100_2WIRE	-30,0 … 500,0 °C	-30,0 … 500,0
DMS	Depent on calibration	Depent on calibration

In order to ensure that the Application objecten the dissolution of the generated values are not reduced, the geräteintern determined values (floats) with a defined factor (Scaling Factor) multiplied (see object index 0x5012) and then the Application objecten (Signed16) assigned.

The relevant channel dependant factor to consider when initializing the combo Slave Device of the CANopen Masterapplikation set. It is to be noted that no overflow of the Datenbereichs (Signed16). This factor should be implied in the evaluation of the analog sensor taken into account.



Analog output

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6411	0	Count of elements	Unsigned8	ro	N	16	Count of analog output blocks
	1	1. Analog channel	Signed16	rw	Y	0x0000	1. analog output AO0
	2	2. Analog channel	Signed16	rw	Y	0x0000	2. analog output AO1
	…						
	15	15. Analog channel	Signed16	rw	Y	0x0000	15. analog output AO14
	16	16. Analog channel	Signed16	rw	Y	0x0000	16. analog output AO15

Even if the combo Slave-Device (with/without CExxx) not to provide all outputs, all 16 possible analog outputs to the above Application objecte illustrated.

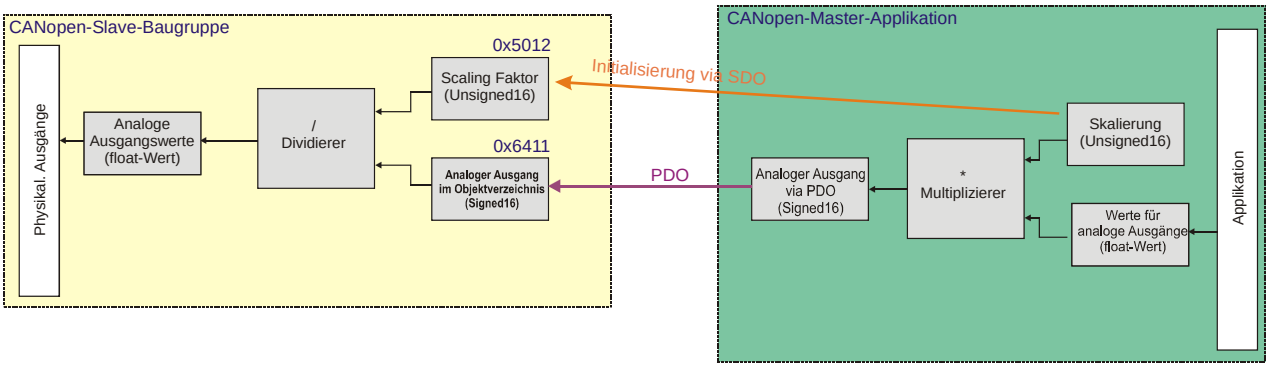
The analog signals will be in dependence of the scale factor (see object Index 0x5013) displayed.

The values of the analog channels are internal of the device as floats processed. Depending on analog output type identification exist different output ranges:

Sensor type	Output range	Range of value
AOUT_M10_10VOLT_NORMED	-10 … 10V	-1,0 … 1,0
AOUT_0_20mA_NORMED	0 … 20 mA	0,0 … 1,0
AOUT_0_10VOLT_NORMED	0 … 10 V	0,0 … 1,0

To ensure that the transfer to the Application objects the dissolution of the resulting not reduced values be transmitted values (to a defined Signed16) factor (Scaling Factor) multiplied (see object Index 0x5013). In combo Slave-Device, the Application objecte from the Object dictionary by the earlier in the object 0x5013 defined value (Unsigned16) divided, so that the above range.

The relevant channel dependend factor to consider when initializing the combo Slave Device of the CANopen master applikation set. It is to be noted that no overflow of the data range (Signed16). This factor should be implied in the default values for the analog outputs.



Event control Analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6423	0	Global Interrupt Enable	Boolean	rw	N	0 (FALSE)	Enables ereignisgestreuerte sending PDOs with analog inputs

After CANopen are analog input in TxPDO2..4, by Default on the Transmission Type event-driven (255) konfiguruert, but an amendment to a event (Eingangswertes) on the event control in the object 0x6423 deactivated to prevent the bus with analog signals overload.

It is appropriate to the Analog traffic the PDOs either by synchronous communication or by using the Event timer to control. The event-oriented operation, the Analog Sendverhalten PDOs before activating by setting time Inhibit 0x1800ff, Subindex object (3), and/or delta function (Object 0x6426) parameterised

Delta function analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x6426	0	Count of elements	Unsigned8	ro	N	16	Count of analog input channels
	1	Delta 1. Input channel	Unsigned16	rw	N	0x0000	Delta 1. analog input
	2	Delta 2. Input channel	Unsigned16	rw	N	0x0000	Delta 2. analog input
	…						
	15	Delta 15. Input channel	Unsigned16	rw	N	0x0000	Delta 15. analog input
	16	Delta 16. Input channel	Unsigned16	rw	N	0x0000	Delta 16. analog input

Values unequal 0 activate the Deltafunktion for the assigned channel. A PDO will then be discontinued, if the value since the Load send by more than the Deltawert changed. In addition, the event control enabled (Object 0x6423). The format corresponds to the analog inputs (Delta value: only positive values).

Sensor type Analog input

The analog inputs the combo Slave Devicen are configurable. This means that any analog Input channel assigned a type identification. This desired type identification must be in the object 0x5010 entered.

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5010	0	Count of elements	Unsigned8	ro	N	16	Count od analog input channels
	1	Sensor type 1. Input channel	Unsigned16	rw	N	55	Sensor type 1. analog input
	2	Sensor type 2. Input channel	Unsigned16	rw	N	55	Sensor type 2. analog input
	15	Sensor type 15. Input channel	Unsigned16	rw	N	55	Sensor type 15. analog input
	16	Sensor type 16. Input channel	Unsigned16	rw	N	55	Sensor type 16. analog input

The following sensor types are availabel:

Sensor type	Value
AIN_0_10VOLT_NORMED	5
AIN_0_20mA_NORMED	6
AIN_PT100_2WIRE	21
DMS	100
AIN_OFF	55

Depending on the selected sensor type and the resulting range of signal, should the scaling (see object 0x5012) can be selected. No configurable inputs must have been a Sensor type unevenly AIN_OFF configured.

Sensor type Analog output

The analog outputs combo Slave device are configurable. This means that any analog output channel a sensor type must be assigned. This desired sensor type in the object 0x5011 entered.

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5011	0	Count of elements	Unsigned8	ro	N	16	Count of output channels
	1	Sensor type 1. Output channel	Unsigned16	rw	N	55	Sensor type 1. analog output
	2	Sensor type 2. Output channel	Unsigned16	rw	N	55	Sensor type 2. analog output
	…						
	15	Sensor type 15. Output channel	Unsigned16	rw	N	55	Sensor type 15. analog output
	16	Sensor type 16. Output channel	Unsigned16	rw	N	55	Sensor type 16. analog output

The following sensor types depending of the device type are availabel:

Sensor type	Wert
AOUT_M10_10VOLT_NORMED	51
AOUT_0_20mA_NORMED	52
AOUT_0_10VOLT_NORMED	54
AOUT_OFF	55

Depending on the selected sensor type and the resulting signalbereich, should the scaling (see object 0x5013) can be selected. No configurable outputs must have been a Sensor type unevenly AOUT_OFF configured will be done.

Scaling factor analog input

See description from Object 0x6401 (analog input).

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5012	0	Count of elements	Unsigned8	ro	N	16	Count of analog input channels
	1	Scaling factor 1. Input channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 1. analog input
	2	Scaling factor 2. Input channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 2. analog input
	…						
	15	Scaling factor 15. Input channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 15. analog input
	16	Scaling factor 16. Input channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 16. analog input

Scaling factor Analog output

See description from Object 0x6411 (analog input).

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5013	0	Count of elements	Unsigned8	ro	N	16	Count of analog output channels
	1	Scaling factor 1. Output channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 1. analog output
	2	Scaling factor 2. Output channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 2. analog output
	…						
	15	Scaling factor 15. Output channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 15. analog output
	16	Scaling factor 16. Output channel	Unsigned16	rw	N	1	Scaling factor (scaling factor) 16. analog output

In particular because the signals of a weighing cell (Loadcell) on a large degree, on the application, the weighing cell, and the mounting situation depend, must be the appropriate inputs on the ground must be calibrated. With the help of Objecte 0x5020 (minimum calibrated value), 0x5021 (maximum calibrated value) and 0x5022 (Tara) it is possible the analog input channels on the ground to calibrate. When SDO access to the Objecte the values related to the current measured as lower or upper point of calibration or for access to the Tara Object as zero incorporated.
This method is now available in the analog inputs of CE15x Device.

Set the lower calibration value for analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5020	0	Count of elements	Unsigned8	ro	N	16	Count of analog input channels
	1	Min. Calibration 1. Input channel	Real32	rw	N	0	lower calibration point 1 analog input
	2	Min. Calibration 2. Input channel	Real32	rw	N	0	lower calibration point 2 analog input
	…						
	15	Min. Calibration 15. Input channel	Real32	rw	N	0	lower calibration point 15 analog input
	16	Min. Calibration 16. Input channel	Real32	rw	N	0	lower calibration point 16 analog input

Set the upper calibration value for analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5021	0	Count of elements	Unsigned8	ro	N	16	Count of analog input channels
	1	Max. Calibration 1. Input channel	Real32	rw	N	0	Upper calibration point 1 analog input
	2	Max. Calibration 2. Input channel	Real32	rw	N	0	Upper calibration point 2 analog input
	…						
	15	Max. Calibration 15. Input channel	Real32	rw	N	0	Upper calibration point 15 analog input
	16	Max. Calibration 16. Input channel	Real32	rw	N	0	Upper calibration point 16 analog input

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5022	0	Count of elements	Unsigned8	ro	N	16	Number of existing analog input channels
	1	Tara 1. Input channel	Real32	rw	N	0	takeover Tara off 1. analogen Eingang
	2	Tara 2. Input channel	Real32	rw	N	0	takeover Tara off 2. analogen Eingang
	…						
	15	Tara 15. Input channel	Real32	rw	N	0	takeover Tara off 15. analogen Eingang
	16	Tara 16. Input channel	Real32	rw	N	0	takeover Tara off 16. analogen Eingang

When the zero punkt adjustment with the current offset calibration values scoring. This is a previously successfully implemented calibration necessary.
The revised figures in the control saved and are thus after a under voltage refraction again available.

Configuration of frequency or counter inputs

The frequency or counter inputs of the combo slave device are configurable. This means that each of the frequency or counter input can be assigned a special mode. See also chapter frequency and counter inputs. This desired sensor type must be in the object 0x5030 entered.

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5030	0	Count of elements	Unsigned8	ro	N	16	Count of frequency or counter inputs
	1	Operation mode 1. Input channel	Unsigned16	rw	N	55	Operation mode 1. frequency or counter input
	2	Operation mode 2. Input channel	Unsigned16	rw	N	55	Operation mode 2. frequency or counter input
	…						
	15	Operation mode 15. Input channel	Unsigned16	rw	N	55	Operation mode 15. frequency or counter input
	16	Operation mode 16. Input channel	Unsigned16	rw	N	55	Operation mode 16. frequency or counter input

Following modes are depending on Device possible:

Frequency input type	Wert
FIN_OFF	0
FIN_FREQUENCY_INPUT	1
FIN_COUNTER_INPUT	2
FIN_QUADCOUNT	3

counter inputs

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5035	0	Count of elements	Unsigned8	ro	N	16	Count of counter inputs
	1	1. Counter input	Unsigned32	rw	Y	0x00000000	Count digits 1. counter input
	2	2. Counter input	Unsigned32	rw	Y	0x00000000	Count digits 2. counter input
	…						
	15	15. Counter input	Unsigned32	rw	Y	0x00000000	Count digits 15. counter input
	16	16. Counter input	Unsigned32	rw	Y	0x00000000	Count digits 16. counter input

Even if the combo Slave Device not all counter inputs available, all 16 possible counter inputs to the above application object illustrated.

Frequency inputs

Index	Sub Index	Name	Typ	Attrb.	Map.	Default-Wert	Description
0x5036	0	Count of elements	Unsigned8	ro	N	16	Count of frequenzy inputs
	1	1. frequency input	Unsigned32	rw	Y	0x00000000	Count digits 1. frequency input
	2	2. frequency input	Unsigned32	rw	Y	0x00000000	Count digits 2. frequency input
	…						
	15	15. frequency input	Unsigned32	rw	Y	0x00000000	Count digits 15. frequency input
	16	16. frequency input	Unsigned32	rw	Y	0x00000000	Count digits 16. frequency input

Even if the combo Slave Device not all frequency inputs available, all 16 possible frequency inputs to the above Application objecte illustrated.

32.9 CANopen-LEDs

The two yellow LEDs (RUN/CAN-Error) shows the operating conditions of CANopen-communication. The RUN-LED shows the CANopen-Status, the CAN-Error-LED shows protocol error as well as the physical state of the bus.

The behavior is LED to the CANopen Empfehlung DRP303-3 CAN in Automation aligned.

RUN-LED

RUN	**Description**
blinking (1 s off, ca. 200 ms on)	Bus node is in the State Stopped. No communication with SDO or PDO possible.
Alteration blinking (200 ms on, 200 ms off)	Bus node is in the State Pre-Operational. The node was not yet started.
ON	Bud node is in state operative.

CAN-ERR-LED

CAN-ERR	Description
OFF	CAN Bus has no errors
1 x blinking (app. 200ms on, 1s off)	**CAN warning limit** overstep**.** To many Error Frames on the Bus. Wiring (e.g. termination resistor, shielding, cable, stubs) check. Other possible cause for exceeding the limits: no further warning participants in the network is available (e.g. the first launched node).
2 x blinking (app. 200ms on, 200ms off, halt 1s)	The guarding or heartbeat monitoring has been activated, it will not receive any guarding or heartbeat messages more. Requirement for guarding surveillance: Guard Time and Life Time Factor are > 0 Condition for heartbeat monitoring: Consumer Heartbeat >0. The bus coupler is Pre-Operational (PDOs off)
3 x blinking (app. 200ms on, 200ms off, halt 1s)	It is a synchronization errors. There were in the set observance (Object 0x1006 x 1,5) no Sync. telegram received. The bus node is Pre-Operational PDOs (off).
4 x blinking (app. 200ms on, 200ms off, halt 1s)	**Event Timer Fehler**: Within the set Event Time (0x1400ff Subindex 5) has no RxPDO received the coupler. The bus node is Pre-Operational PDOs (off).

33. Development with eStudio (Soft-SPS)

Application can be developed in this developement envirement:

CoDeSys (programming according IEC61131-3) above Version V2.3.9.3 (www.3s-software.com)

ElaDesign is the editor for all jobs around the HMI.

combo-CM1xx is programmable with eStudio V2.82 or higher.
combo-CM2xx is programmable with eStudio V2.83 SP2 or higher.

34. Developement with Microsoft Visual Studio 2008

Development of programms with Microsoft Visual Studio 2008 (2010 under Test).

34.1 USB connection between PC and combo

USB cable between PC (Host) and combo (Device) :

Windows XP

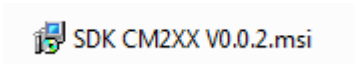
Make a connection with ActiveSync.

Windows 7

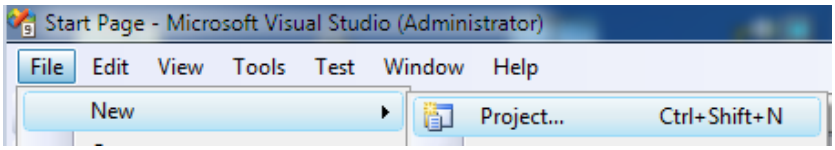
Make a connection with Windows Mobile Device Center :

34.2 Make an Windows CE application

Install the elrest SDK.



Start the Microsoft Visual Studio and make a new project.

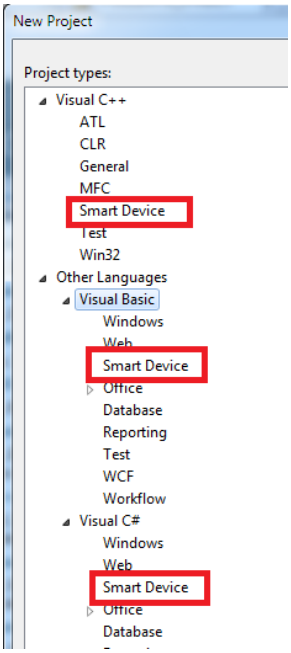


For a Smart Device you can choice the programming language :

C/C++

Visual Basic

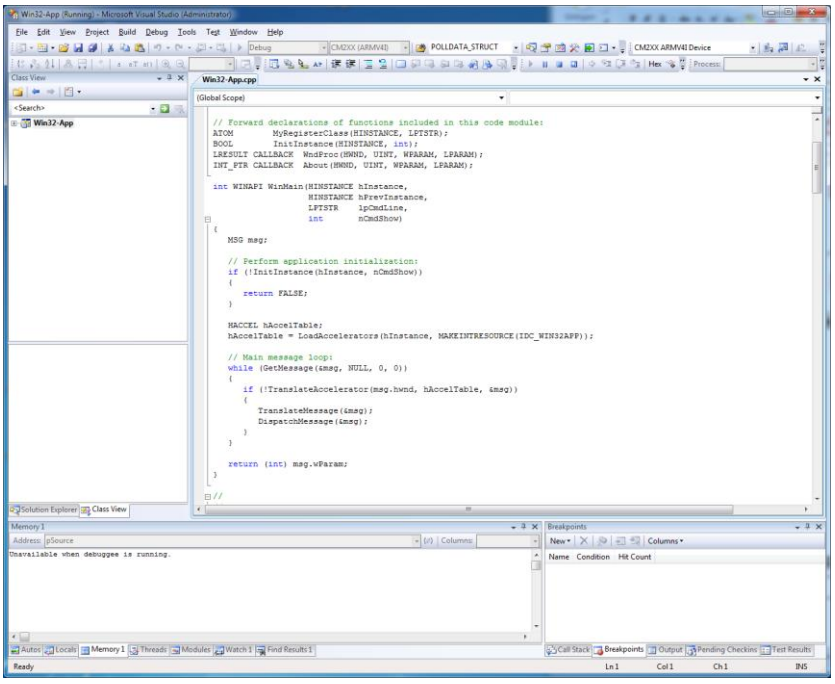
C#



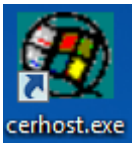
After your selection of the SDK :

„CM2XX ARMV4I Device“

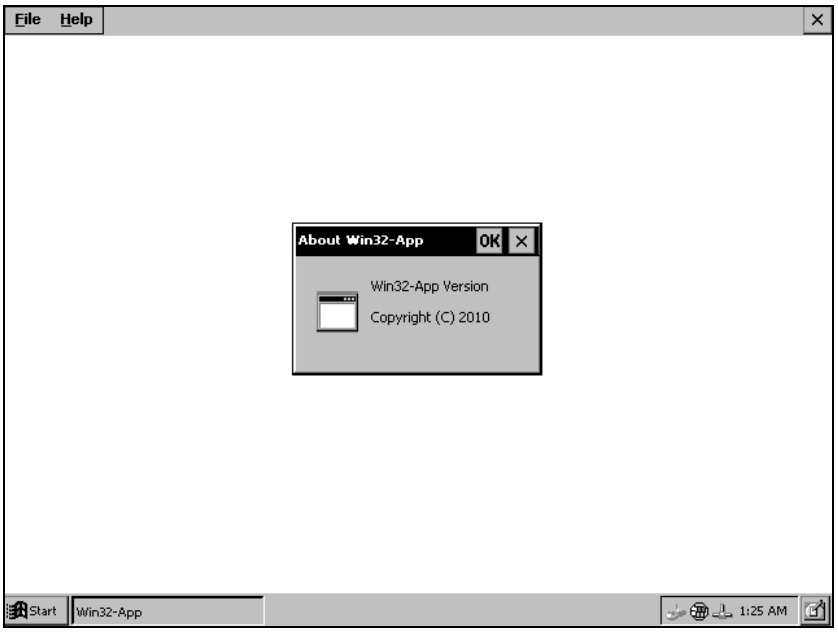
you can start your C++ application.



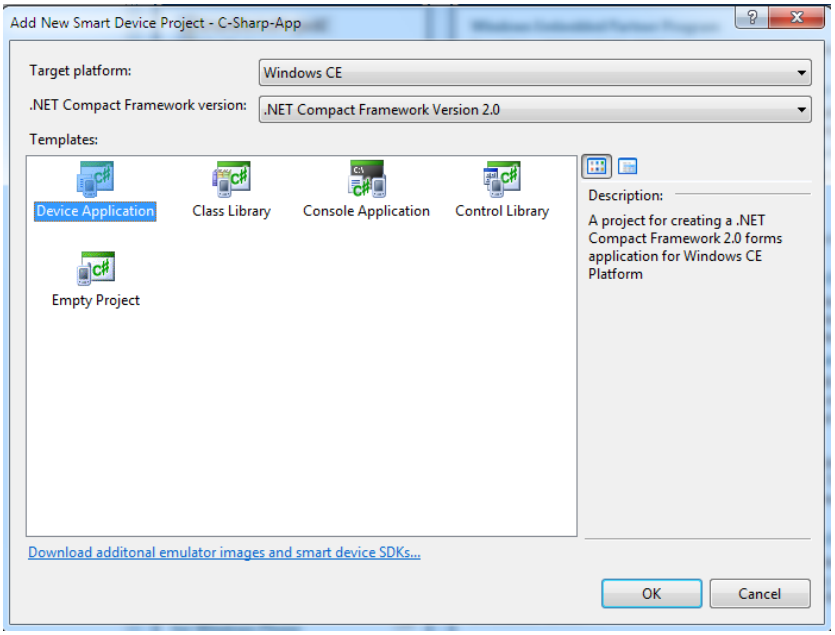
With the Microsoft tool :



You have access to the combo device.



With C# select the Windows CE , select Framework 2.0.



After your selection of the SDK :

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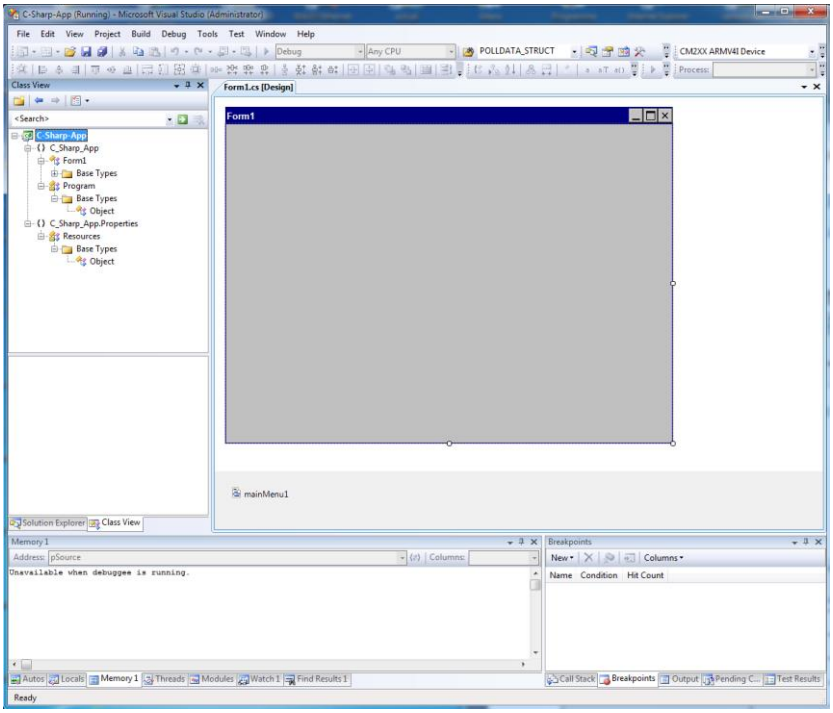
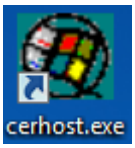
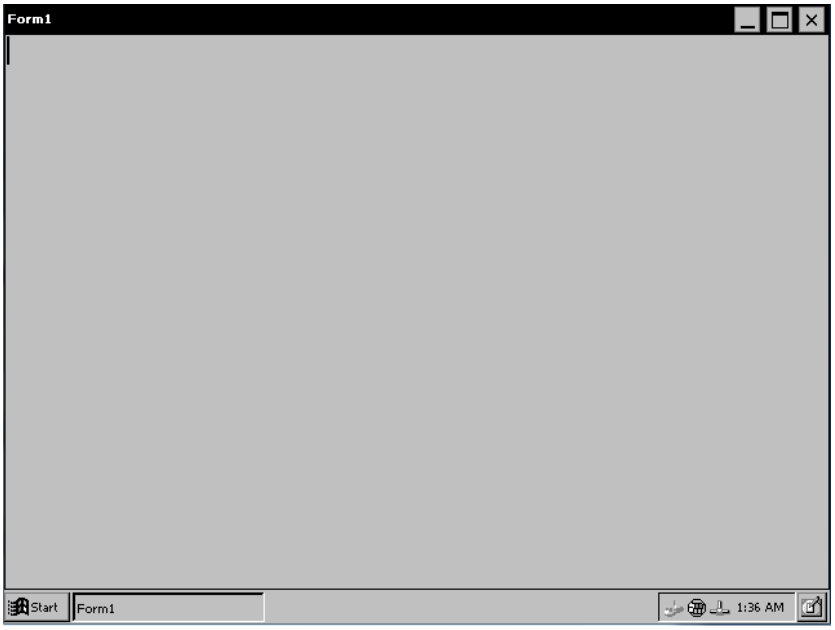
you can start your C# application.



With the Microsoft tool :



You have access to the combo device.



34.3 Interfaces of the Windows CE application

Under your Windows environment you have access to the following interfaces:

Ethernet ➔ socket

USB ➔ COMx

UART0 ➔ COM1

UART1 ➔ COM2

Micro SD card ➔ file

C#

```
private static Socket ConnectSocket(string server, int port)
    {
        Socket s = null;
        IPHostEntry hostEntry = null;

        // Get host related information.
        hostEntry = Dns.GetHostEntry(server);

        foreach(IPAddress address in hostEntry.AddressList)
        {
            IPEndPoint ipe = new IPEndPoint(address, port);
            Socket tempSocket =
                new Socket(ipe.AddressFamily, SocketType.Stream, ProtocolType.Tcp);

            tempSocket.Connect(ipe);

            if(tempSocket.Connected)
            {
                s = tempSocket;
                break;
            }
            else
            {
                continue;
            }
        }
        return s;
    }
```

C#

```
// comPort
com = new SerialPort("COM1", 19200);
com.ReadTimeout = 3000;
com.WriteTimeout = 3000;
com.Open();
```

C#

```
// File
```

Under your Windows environment you have access to the following interfaces:

For the following interfaces there is actual no support:

CAN0 and CAN1

service switch

digital in- and outputs

analog in- and outputs

stepper

frequency inputs

35. Developement with Java and Java Virtual Machine

For development on a Java Virtual Machine we support the CrE-ME software from NSI (http://nsicom.com). The runtime VM is designed for Win CE platforms. CrE-ME is compliant with J2ME/CDC PersonalProfile specification, which is based on JDK 1.3.1.

A developer of Java should compile his code with a Ja a compiler up till version JDK 1.5, as CrE-ME does not support the class-file format of JDK 1.6.

Further, the developer should stick to the CDC/Peronal Profile 1.0 API. We work together with Netbeans, which has a mechanism for enforcing this. I assume Eclipse has the same. In case of doubt, the developer can test-run his application with the CrE-ME emulator, which is part of the CrE-ME developer support kit, which can be downloaded from http://nsicom.com/Default.aspx?tabid=295.

If the application goes beyond the allowed API, the emulator throws an error. If things work on the emulator, it will work with actual CrE-ME.

35.1 Install and Test of Java Virtual Machine

The following steps must be done:

Copy the file "CrE-ME412_ARM_CE60_HPC.CAB" in the combo device folder :
\flashdisk\

Execute the "CrE-ME412_ARM_CE60_HPC.CAB"

Select as installation folder \flashdisk\
You have to type this path manually an confirm with ENTER

Restart the combo device with power off / on

With the Tool "\Flashdisk\SysExtras\Tools\RegSvrCEEx.exe" register "\flashdisk\creme\bin\cremepie"

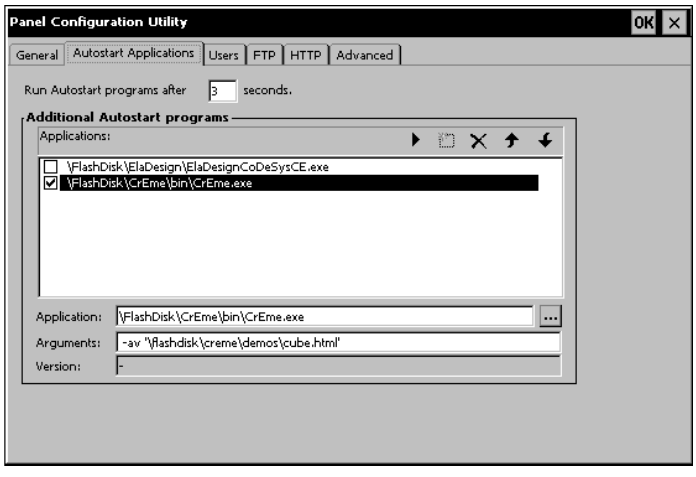
Store the setting with :

"Start -> Programs -> Utilities -> Save Registry"

Start the Panel Configuration Tool:

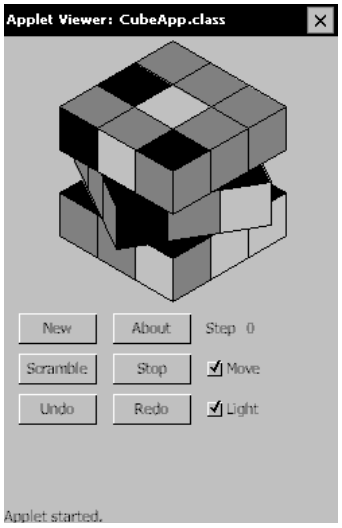
"Start -> Setting ->Control Panel", double click to “Panel Configuration”.

Make the autostart setting for the CrEme.exe with the arguments :



Restart the combo device with power off / on

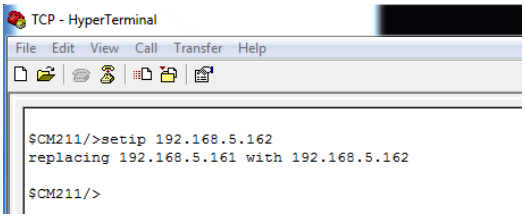
The test application will be startet automatically and show the following screen:



36. How to configure a combo master device

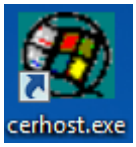
36.1 Enter the IP-address

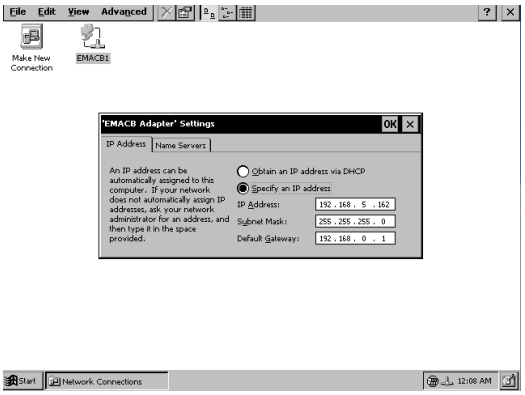
With the Telnet or Hyperterminal programm you can type the command:



Restart the device.
Hint: If you can not access to the device use the serial COM1 **in service mode**. Be shure to deactivate the DHCP before calling the command “setip”.

With the Microsoft programm:





Under Start➔Settings➔Network and Dial-Up Connections
you can enter the IP-address as well.

Restart the device.

36.2 Software download

The Software download is possible :

eStudio, ftp-Download

USB-Stick

you can update:

DEFAULT.* include the IEC Code

Resource.res include the HMI Code

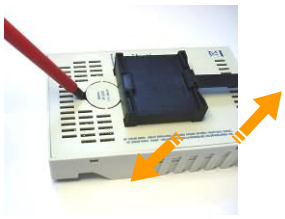
ElaDesignCoDeSysCE.exe equates the Runtime programm

36.3 DIN rail mounting

CAUTION:

The DIN rail holder must first press to one side of the housing, then press the other side.

36.4 Battery exchange



The battery (Type: CR2032) is on the rear side of the device. Regarde the following steps:

1. disconnect all power supply connections.

2. remove the battery pLoadic cover:

   Use a screw driver for removing the pLoadic cover.

CAUTION:

If the battery buffer data should be achieved, then you must insert the new battery within 2 minutes.
Regard the EGB-/ESD-guidlines carefully.

3. unlock the battery and remove the battery from the carrier.

4. insert the new battery (Typ: CR 2032).

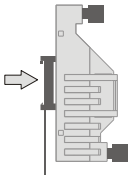
5. with a soft pressure the battery will snap in the carrier.

37. Mounting and demounting a combo device

First remove all power supply from the device before starting mounting or demounting.

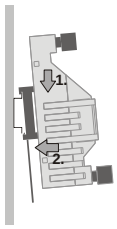
All technical specification based on vertical mounting, see drawings.

Mounting

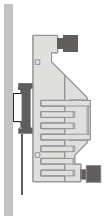


The device is designed for 35mm DIN rail according to DIN EN 60715.

The DIN rail holder must be snaped into the bottom of the housing

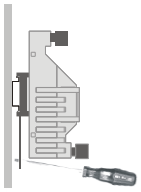


For mounting to the DIN rail suspend the DIN rail holder from top. Then press the lower side again the DIN rail and drag the pLoadic bar with your finger (see arrow on drawing).
The DIN rail holder must easy cap on the DIN rail.



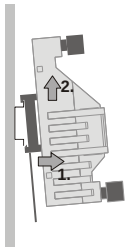
The device is mounted.

Demounting



First remove all connector.

For demounting use a screw driver or your finger to press the pLoadic bar against the housing.



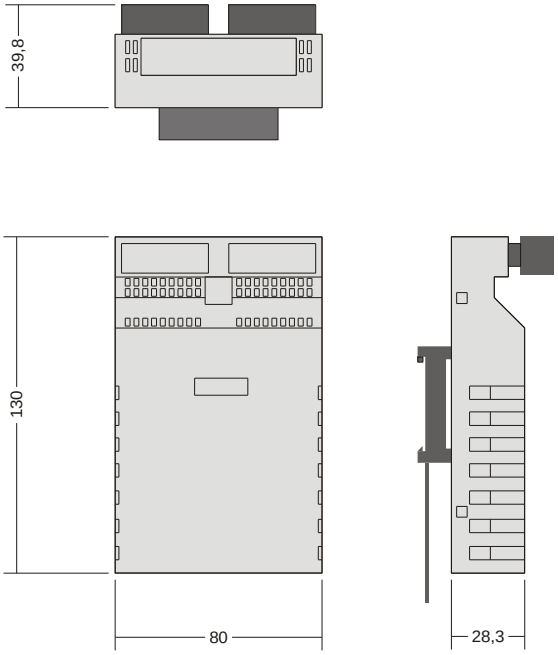
Pull the device from the DIN rail .

38. Housing

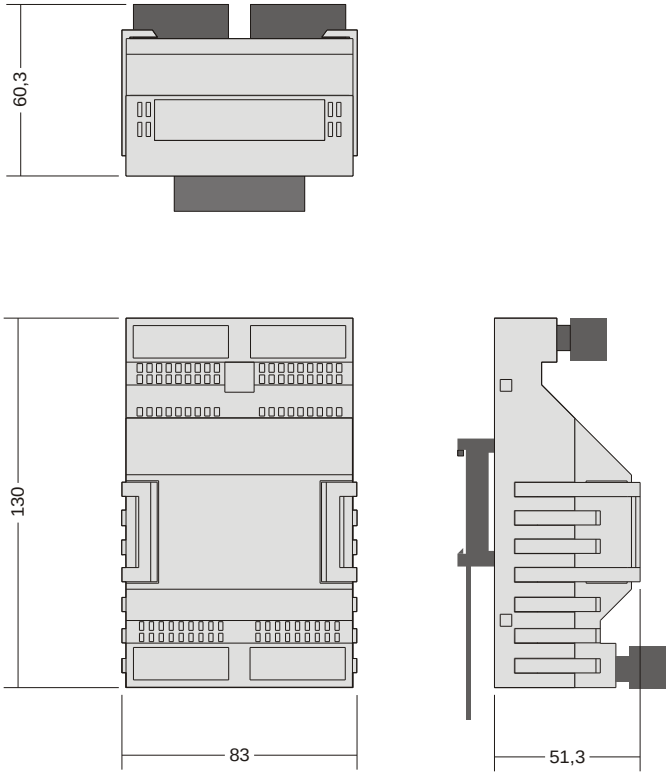
38.1 Dimensions:

(mm)

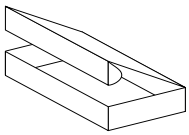
Base device:



Base device with extension unit



39. Packaging



The devices are packaged in a folding carton.

The packing unit is 1 item.

40. Storage and Transportation

All shipments received must be checked to ensure that the contents are complete. The forwarding company and the manufacturer must be notified immediately of any transport damage. If the equipment is temporarily stored, we recommend that the original packaging is used. The storage location must be clean and dry. All risks associated with purchased goods are transferred to the purchaser at the time of invoicing in accordance with German Civil Code § 446 and § 448. elrest accepts no liability for transportation risks. If the value of the goods is not covered by the carrier's liability of the forwarding company, the purchaser shall be responsible for securing additional transportation insurance.

41. Support

Hotline

For additional assistance and information, you can contact our hotline at the following times:

Mon-Fri: from 8.00- 12.00 and 13.00 to 16.30

Outside of these times,
you can contact us by e-mail or fax:

Phone: ++49 (0) 7021/92025-33
Fax: ++49 (0) 7021/92025-29
E-mail: hotline@elrest.de

Training and Workshops

We are happy to provide training or project-based workshops on elrest products.

For further information, please contact our sales department:

Phone: ++49 (0) 7021/92025-0

Fax: ++49 (0) 7021/92025-29

E-mail: vertrieb@elrest.de

42. History

date	name	chapter	changes
08.05.2006	Hi		First edit
01.12.2009	Hi		RS485
20.06.2010	GS		Combo-CM2xx included
22.09.2010	GS		Spezification of digital inputs changed.
26.03.2012	Du		Frequency input changed.
09.07.2012	Hi		combo system short overview / Sample networking with combo : change pictures