

QDIO-E 16/16/Z2 and QDIO-E 8/8/Z1

Distributed I/O

V.1.03



User Handbook

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Subject to technical changes.

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General Information on this Manual

Content:

This manual describes the QDIO-E 16/16/Z2, QDIO-E 8/8/Z1 and its modifications. The product-related information contained herein was up to date at the time of publication of this manual.

Completeness:

This manual is complete only in conjunction with the user manual entitled

'Introduction
to CANtrol Automation System'

and the product-related hardware or software user manuals required for the particular application.

Standards:

The CANtrol automation system, its components and its use are based on International Standard IEC 61131 Parts 1 to 4 (EN 61131 Parts 1 to 3 and Supplementary Sheet 1).
Supplementary Sheet 1 of EN 61131 (IEC 61131-4) entitled 'User Guidelines' is of particular importance for the user.

Order numbers:

Please see the relevant product overview in the 'Introduction to CANtrol Automation System' manual for a list of available products and their order numbers.

Ident. No.: 2810020

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1. General Instructions

1.1. Hazard Categories and Indications

The indications described below are used in connection with safety instructions you will need to observe for your own personal safety and the avoidance of damage to property.

These instructions are emphasised by bordering and/or shading and a bold-printed indication, their meaning being as follows:



Immediate danger

Failure to observe the information indicated by this warning will result in death, serious injury or extensive property damage.



Potential danger

Failure to observe the information indicated by this warning may result in death, serious injury or extensive property damage.



Danger

Failure to observe the information indicated by this warning may result in injury or property damage.



No hazard

Information indicated in this manner provides additional notes concerning the product.

1.2. Qualified users

Qualified users within the meaning of the safety instructions in this documentation are trained specialists who are authorised to commission, earth and mark equipment, systems and circuits in accordance with safety engineering standards and who as project planners and designers are familiar with the safety concepts of automation engineering.

1.3. Use as Prescribed

This is a modular automation system based on the CANbus, intended for industrial control applications within the medium to high performance range.

The automation system is designed for use within Overvoltage Category I (IEC 364-4-443) for the controlling and regulating of machinery and industrial processes in low-voltage installations in which the rated supply voltage does not exceed 1,000 VAC (50/60 Hz) or 1,500 VDC.

Qualified project planning and design, proper transport, storage, installation, use and careful maintenance are essential to the flawless and safe operation of the automation system.

The automation system may only be used within the scope of the data and applications specified in the present documentation and associated user manuals.

The automation system is to be used only as follows:

- as prescribed,
- in technically flawless condition,
- without arbitrary or unauthorised changes and
- exclusively by qualified users

The regulations of the German professional and trade associations, the German technical supervisory board (TÜV), the VDE (Association of German electricians) or other corresponding national bodies are to be observed.

Safety-oriented (fail-safe) systems

Particular measures are required in connection with the use of SPC in safety-oriented systems. If an SPC is to be used in a safety-oriented system, the user ought to seek the full advice of the SPC manufacturer in addition to observing any standards or guidelines on safety installations which may be available.



As with any electronic control system, the failure of particular components may result in uncontrolled and/or unpredictable operation.

All types of failure and the associated fuse systems are to be taken into account at system level. The advice of the SPC manufacturer should be sought if necessary.

2. QDIO-E 16/16/Z2 and QDIO-E 8/8/Z1

2.1. Overview

Order number	The order/item no. required for acquiring a replacement is to be found on the nameplate of the module.
Function	Extension module with digital inputs/outputs (I/O) and additional counter interfaces. The model is connected to a cell controller or dialog controller via the E-bus connector.
I/O	2 of the total of 16 or 8 digital inputs can be reconfigured to become faster counter inputs by means of the software interface. The output current for the 16 (8) digital inputs/outputs is 0.5 A maximum. A 3-pin connection system is provided for the inputs or I/Os.
Encoder connection	There are 2 or 1 additional encoder connection(s) on the module. It is configured in the form of a line driver input for differential RS422 signal levels.

An overview of the features

- 16 (8) digital inputs, 2 of which can be used as +24 V counter inputs
- 16 (8) digital, individually configurable inputs/outputs
- 2 (1) encoder input(s) (RS422)
- 1 RJ45 E-bus connection

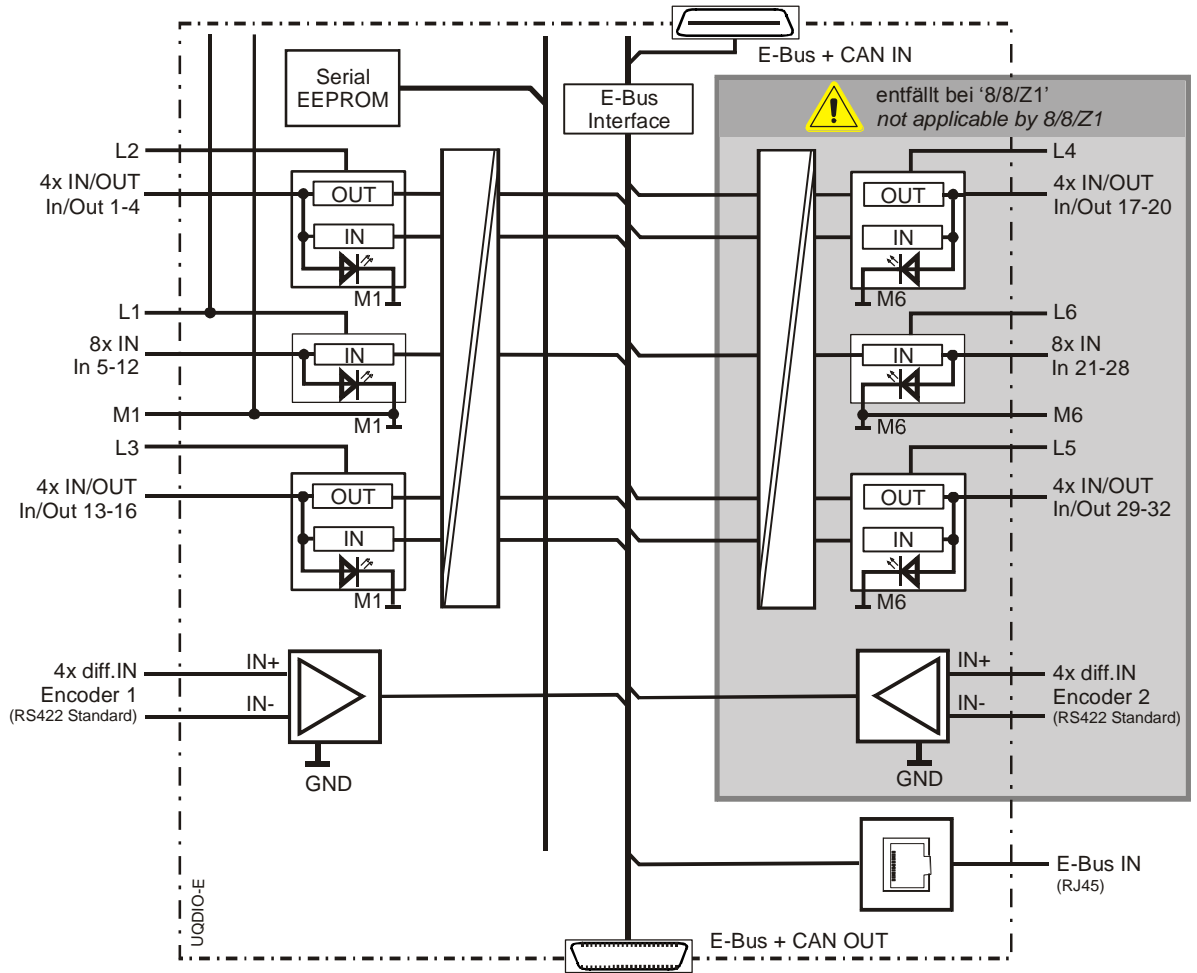
Material supplied The material supplied with the control module comprises:

- I/O module QDIO-E 16/16/Z2 or
- I/O module QDIO-E 8/8/Z1

2.2. Technical Data

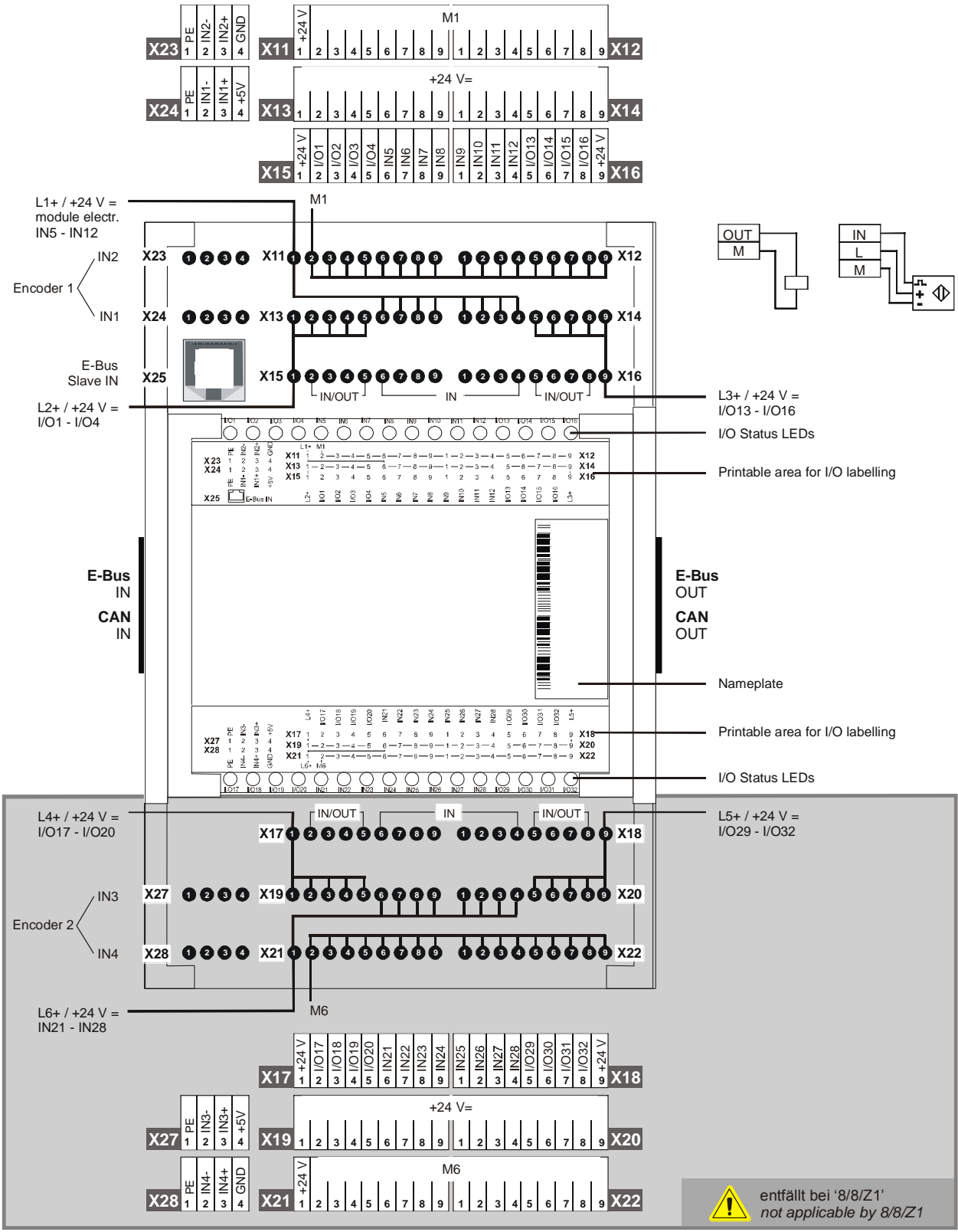
Module data		
Designation	QDIO-E 16/16/Z2	QDIO-E 8/8/Z1
Item-No.	203200200	203200100
Set of plugs (cage clamp)	201603500	201603400
Dimensions WxHxD [mm]	124 x 170 x 85,5 (modular size W = 113/118,5)	
Weight	ca. 500 g	
Mounting	mounting rail NS 35/7.5 EN 50022	
Operating temperature range	5°C to 50°C (no moisture condensation) convection-type cooling assured	
EMC, safety class, insulation test, degree of protection		
Noise immunity	EN 50081-2, industrial sector	
Emitted interference	EN 50082-2, industrial sector	
Safety class	III	
Insulation resistance	EN 61131-2; DC 500 V test voltage	
Degree of protection	IP20	
Supply voltage, power consumption		
Power supply module electronics (supply voltage)	SELV DC +7 V < 0.15 A (EN 61131-2). The controller provides this power supply via the E-bus connection.	
Power supply - digital I/Os	DC +24 V (EN 61131-2) distributed into 6 groups	
Power consumption without the encoder	typically 100 mA max. 130 mA	typically 75 mA max. 90 mA
Fuse	Depending on I/O load 10 A max.	
Electrical isolation	No	
Digital inputs/outputs (DIO)		
Number of inputs	16	8
	Up to 2 inputs can be used as +24V counter inputs. Counting frequency 5 kHz max. (inputs cannot be combined as encoders)	
Number of inputs/outputs	16	8
Output current	0,5 A	
Short-circuit protection	Yes	
Electrical isolation	Yes	
Connection method	Vertical 3-conductor or 2-conductor front wiring with clamped or screwed plug strips (not included in the scope of supply)	
Encoder inputs		
Number of encoders	2	1
Counting frequency	in the case of quadruple evaluation < 500 kHz	
Voltage level	Differential RS422	
Short circuit protection	Yes	
max. current consumption	50 mA	
Connection system	Vertical front wiring for screwed or clamped plug strips (not included in scope of supply)	
Controls and display facilities		
Display elements	Status display of digital I/O with one orange LED for each	
Interfaces		
Type of interfaces	E-bus	

2.3. Block Diagram



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2.4. Module Diagram and Connection Assignment



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2.5. Component Operation



Do not insert, apply, detach or touch connections when in operation!

Destruction or malfunctioning may otherwise occur. Disconnect all incoming supplies before working on CANtrol modules; including those of connected peripherals such as externally supplied sensors, programming devices, etc

2.5.1. Commissioning

Re-examine all connections for correct wiring and polarity before applying the supply voltage. Switch on supply voltage.

2.5.2. Functions Selection, Displays, Diagnostics

I/O status

Each input and output has its own yellow I/O-status LED which indicates the logic state of the input or output in question.

I/O status

LED- status	Logical status
input LED yellow ON	1 (HIGH, activated)
input LED yellow OFF	0 (LOW)
output LED yellow ON	1 (HIGH, activated)
output LED yellow OFF	0 (LOW)

2.5.3. E-bus

The E-bus is an extension bus for digital and analog extension modules. Up to 7 extension modules with a cell or dialog controller can be connected via the E-bus.



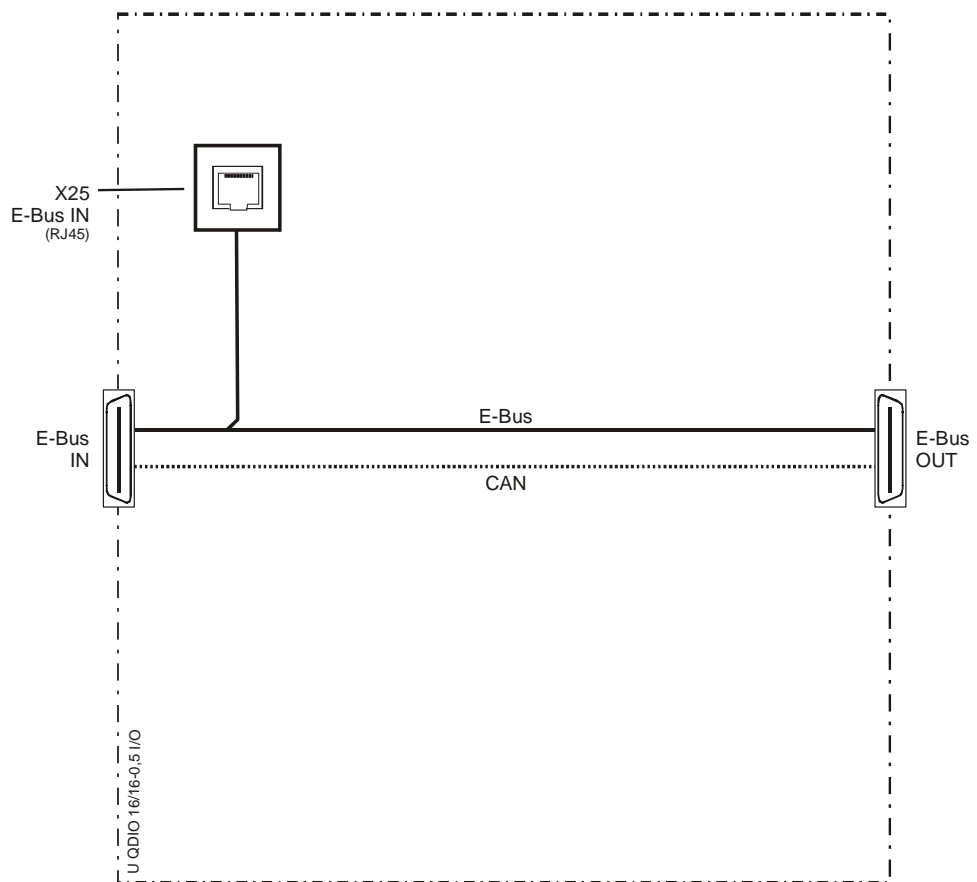
In view of the fact that the QDIO-E module acts logically like 2 extension modules, the number of physically feasible extension modules on the E-bus is reduced.

E-bus connections

The QDIO-E has 2 different E-bus connectors that are connected to one another internally. One is the RJ45 female connector (X25) with which the QDIO-E can be connected to a dialog counter by means of a cable. The other is the black plug-in connector on the left-hand side of the module (E-bus IN). It serves as a direct connection to a Q module.

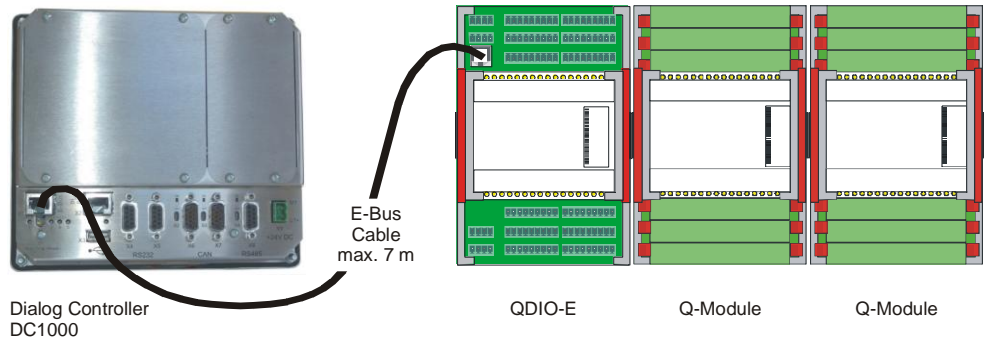
Further E-bus modules can be connected side-by-side to the E-bus by means of the E-bus OUT connector. They may only be connected side-by-side on the right-hand side.

E-Bus block diagram



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E-bus connection of DC1000 to QDIO-E



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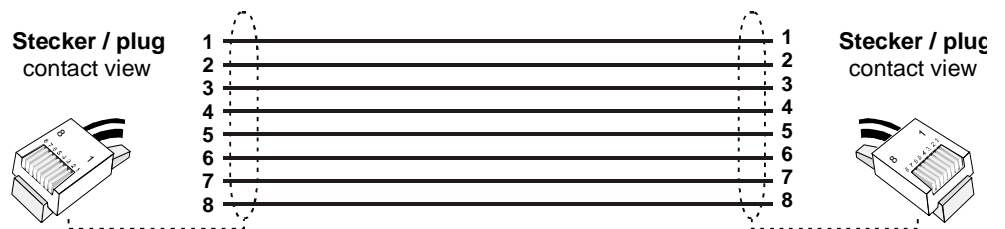
If the E-bus is to function correctly, only the first QDIO-E module may be connected via X25 E-bus IN.
 All other modules must be connected via the E-bus IN/OUT plug connector on the side.

E-bus connector cable An Ethernet patch cable (1:1 contacting) of the CAT 5 category is used for connecting a dialog controller to a QDIO-E via E-bus. The maximum permissible cable length is 7 m.



Risk of connection errors!
 Use this cable only for connecting a dialog controller to a QDIO-E module. If it is used with other RJ45 plug-in connectors, it may cause material damage.

Kabel Kategorie 5 (KAT.5) / Cable Kategorie 5 (CAT.5)
 Aderquerschnitt / core cross-section min. 0.22 mm³



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2.5.4. Counter interfaces

24 V counter inputs For slower counting functions the first two 24 V digital inputs can be configured as simple counter inputs via the software functions.
 Counting frequency: ≤ 5 kHz

Function	Input	Connector
Counter 0	IN 5	X15
Counter 1	IN 6	X15



For each fast counting input used one +24V process input less is available.

2.5.5. Encoder interface (differential)

Encoder input Up to 2 encoder connections are available.
 The connection levels are designed for line driver encoders with differential RS422 signals. Counting frequency in the case of quadruple evaluation <500 kHz

The RS422 pulses are processed directly in the I/O module. The current counting value is forwarded cyclically to the connected cell controller via the E-bus. The update time for the E-bus is 250 μ s and this is also the smallest time unit within which the counting value can be updated on the cell controller.

Encoder 1		Encoder 2	
Designation	Connector	Designation	Connector
PE	X23	PE	X28
IN2-	X23	IN4-	X28
IN2+	X23	IN4+	X23
GND	X23	GND	X28
PE	X24	PE	X27
IN1-	X24	IN3-	X27
IN1+	X24	IN3+	X27
+5V	X24	+5V	X27



Use only encoders with current requirements <50 mA !
 The module has no power supply of its own. Both the internal electronics and the connected encoders are supplied with power via the E-bus cable of the dialog controller. A maximum of 0.5 A is available there for all E-bus modules together and for all encoders connected to E-bus modules.
 As a rule, this current is sufficient to supply 7 E-bus modules and the encoders. However, if the limit is exceeded, this may result in malfunctioning of the E-bus and the modules connected to it or their incapacity to function at all. So pay attention to the power consumption of all E-bus modules and all consumers connected to them and only use encoders with a power consumption <50 mA.

3. Digital Inputs/Outputs 16/16+8/8 (3,81)

Outputs may also be connected to inputs without additional external load.

3.1. Grouping of Inputs/Outputs

The grouping facility permits formation of groups, separate power circuits, emergency off circuits, etc. as and when required.

Inputs/outputs can be supplied in groups as

- 2 input groups and
- 4 output / input groups

The **modular electronic circuit** for C modules is supplied together with input group 2 (Group 2) over connection terminals 1 (L1+) and 2 (M1).

The modular electronic circuit must be supplied with power in **any** cases, otherwise the modules will be inoperable.

Supply must be provided directly (unswitched) from the supply unit.

Inputs

Inputs (sensors) must be supplied directly from the supply unit.

Do not conduct the sensor supply through switched circuits.

Outputs

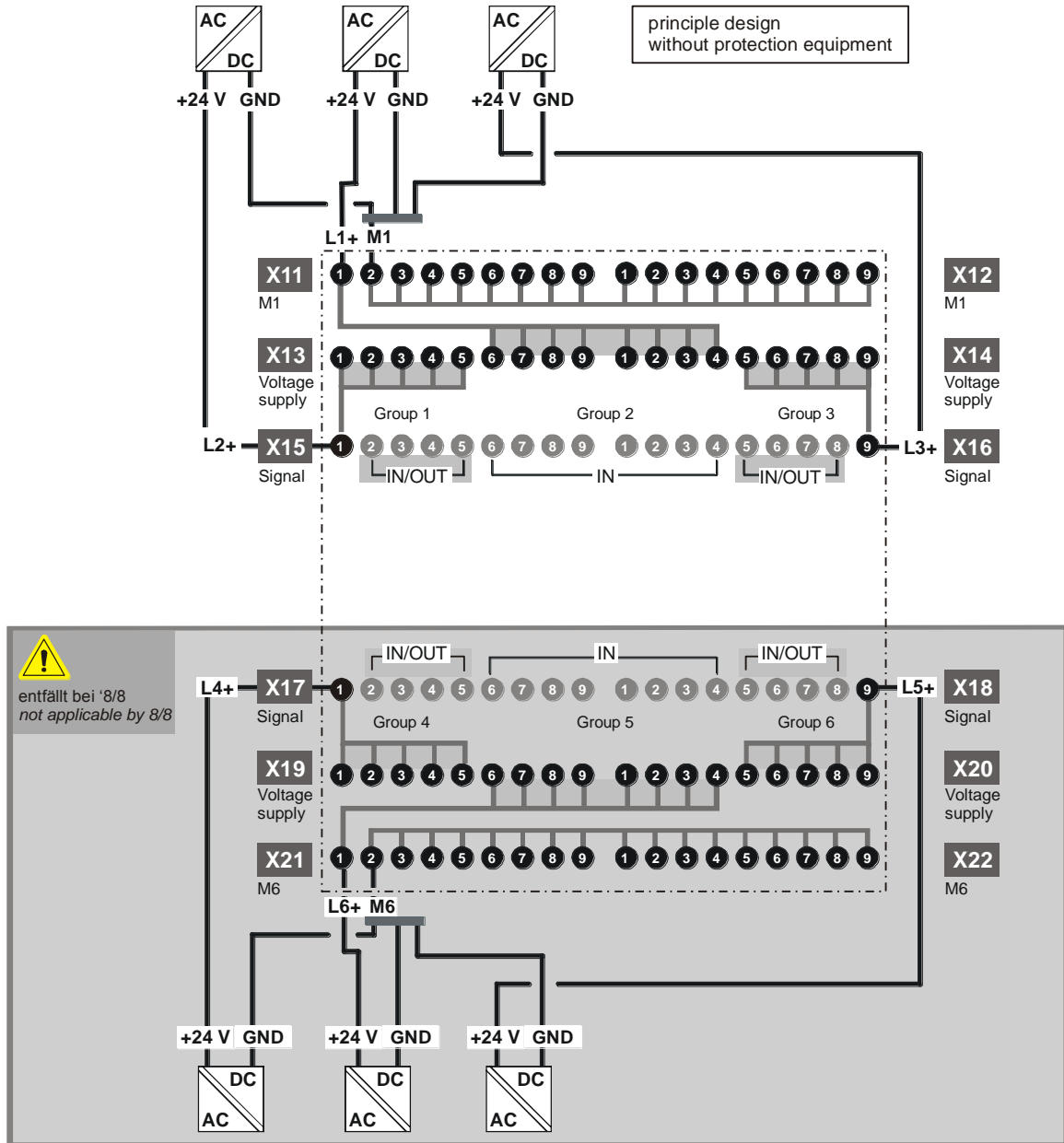
Output groups may be supplied through upstream switch elements (emergency off, manual switches, etc.).



Feedback could destroy the module and/or the sensors!

Otherwise, when group power supply is disconnected, connected sensors could produce a feedback over the output transistors. Always make sure the sensors are each supplied from the same power source as the module's associated I/O group.

3.1.1. Schematic Diagram of Input/Output Grouping



Group 1	IN / OUT 1-4	<i>Bemessungsspannung für erhöhte Isolation nach Rated voltage for increased isolation defined by EN 61131-2 0...50 V</i>
Group 2	IN 5-12	
Group 3	IN / OUT 13-16	
Group 4	IN / OUT 17-20	
Group 5	IN 21-28	
Group 6	IN / OUT 29-32	

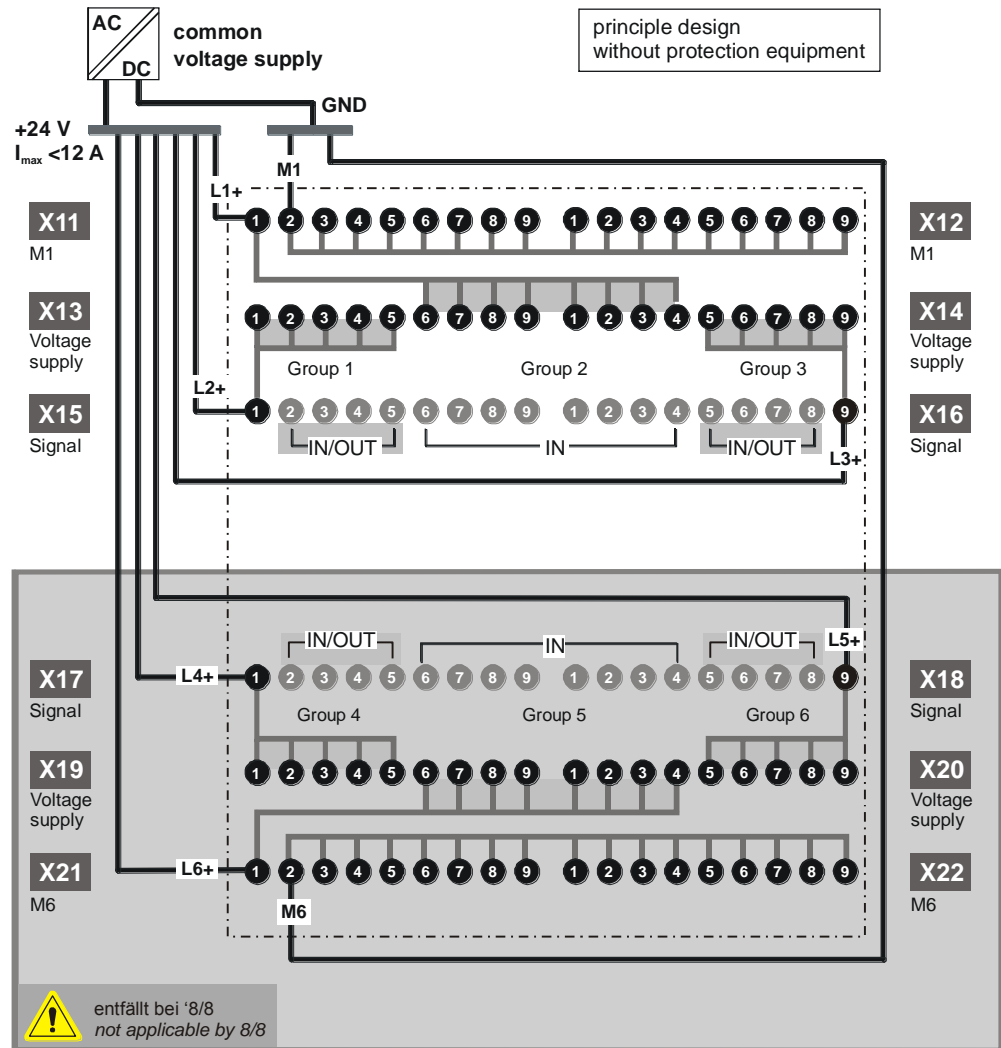
entfällt bei '8/8 not applicable by 8/8

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3.1.2. Without Grouping

Wird auf die Gruppenbildung bei der Spannungsversorgung verzichtet, sind vom Anwender die im folgenden Bild dargestellten Verbindungen herzustellen.

Without grouping of the voltage supply, the user has to build the following connection.

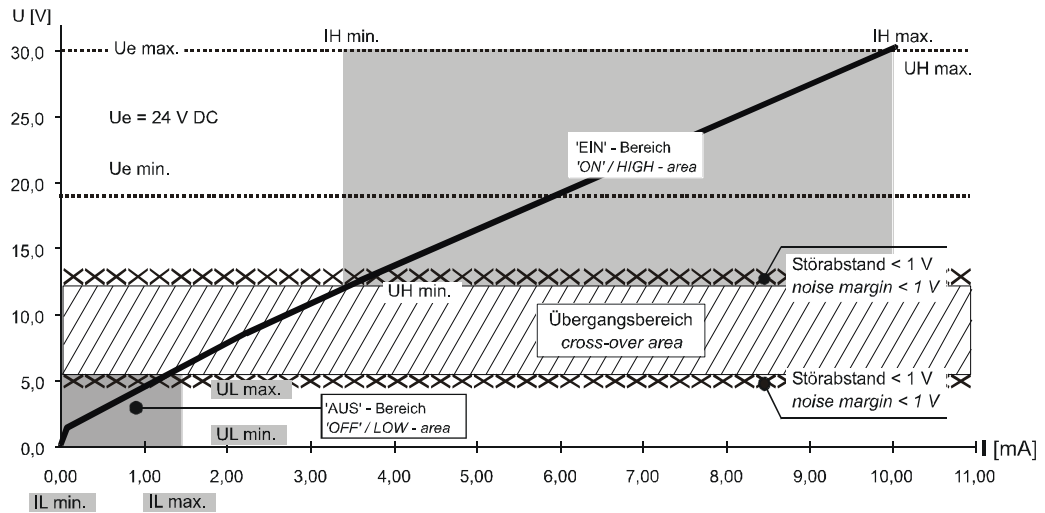


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3.2.2. Digital Inputs Data

Module data	16/16	8/8
Number of inputs	16 (max. 32)	8 (max. 16)
Line lengths: <div style="display: flex; justify-content: space-between; padding: 0 20px;"> <div style="width: 40%;">in switchgear cabinet</div> <div style="width: 55%;">Allow for voltage drop when choosing conductor cross-section, otherwise no restrictions in practice.</div> </div> <div style="display: flex; justify-content: space-between; padding: 0 20px;"> <div style="width: 40%;">dedicated I.v. wiring</div> <div style="width: 55%;">Observe all relevant local regulations and the requirements of EN 61131-3. Please consult manufacturer regarding lightning hazard.</div> </div>		
Rated load voltage L+ Reverse voltage protection	24 VDC (SELV) yes	
Electrical isolation	yes (optical isolator) in groups	
Status display	yes, yellow LED for each input	
Alarms	definable according to software	
Input delay	parameterisable by software	
Input capacitance	< 10 nF	

Digital-input operating areas



Eingangsspannung (DC) der externen Stromversorgung
 Input voltage (DC) of extern power supply

Ue	24 V	Bemessungsspannung / rated voltage
Ue max.	30 V	oberer Grenzwert / upper limit
Ue min.	19,2 V	unterer Grenzwert / lower limit

Grenzwerte für '1' Signal für die 'EIN'-Bedingung
 Limit for '1' signal for the 'ON'-condition

UH max.	30,0 V	obere Spannungsgrenze / upper voltage limit
IH max.	10,0 mA	obere Stromgrenze / upper current limit
UH min.	13,5 V	untere Spannungsgrenze / lower voltage limit
IH min.	3,5 mA	untere Stromgrenze / lower current limit

Grenzwerte für '0' Signal für die 'AUS'-Bedingung
 Limit for '0' signal of the 'OUT'-condition

UL max.	5,5 V	obere Spannungsgrenze / upper voltage limit
IL max.	1,5 mA	obere Stromgrenze / upper current limit
UL min.	0 V	untere Spannungsgrenze / lower voltage limit
IL min.	0 mA	untere Stromgrenze / lower current limit

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3.3. Digital Outputs, high side switching



The module can be destroyed by overvoltages > 32 V and / or feedback.
Risk of **fire!**

Each digital output is also usable as an input. See description under 'Digital Inputs' if using as input.

Outputs

The outputs are of high side switching 24 volt type (two-conductor). Maximum output current per output is 500 mA. The outputs have a common earth (GND) when operating in groups. Power is supplied separately from the supply for the modular electronic circuit (see 'Connection Assignment').

The outputs switch automatically to '0' (LOW) if there is no available data link to the CPU or if the module's internal supply is insufficient.

Protected output

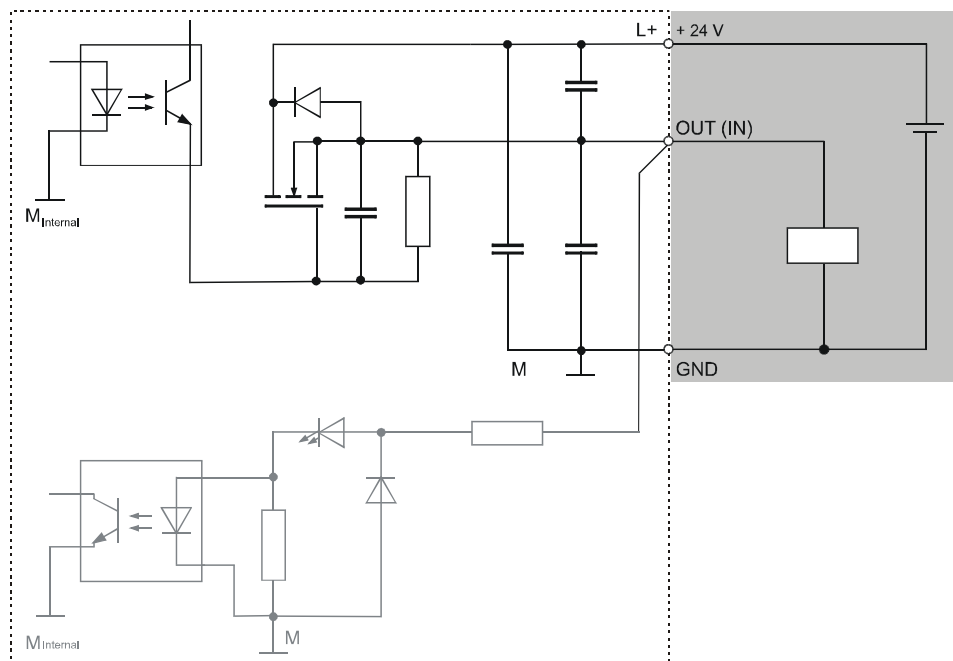
All outputs are protected by an incorporated current-limiting circuit and a thermal overload protection circuit. If overloaded, the affected output switches off. The output can be re-activated by program on elimination of the overload and thermal cooling. A high-speed de-excitation feature having a terminal voltage of 50 V, related to L+, protects all outputs against induced voltage peaks under inductive loads.

The overload protection of non-involved outputs may also respond prematurely if feedback or high-speed de-excitation give rise to thermal loads.

Operating status

The status of each output is indicated by a yellow operating status LED on the front panel of the module. The LEDs are spatially assigned to the supply terminals. A LED lights when its associated output is activated, logical '1' (HIGH).

3.3.1. Block diagram of output high side switching



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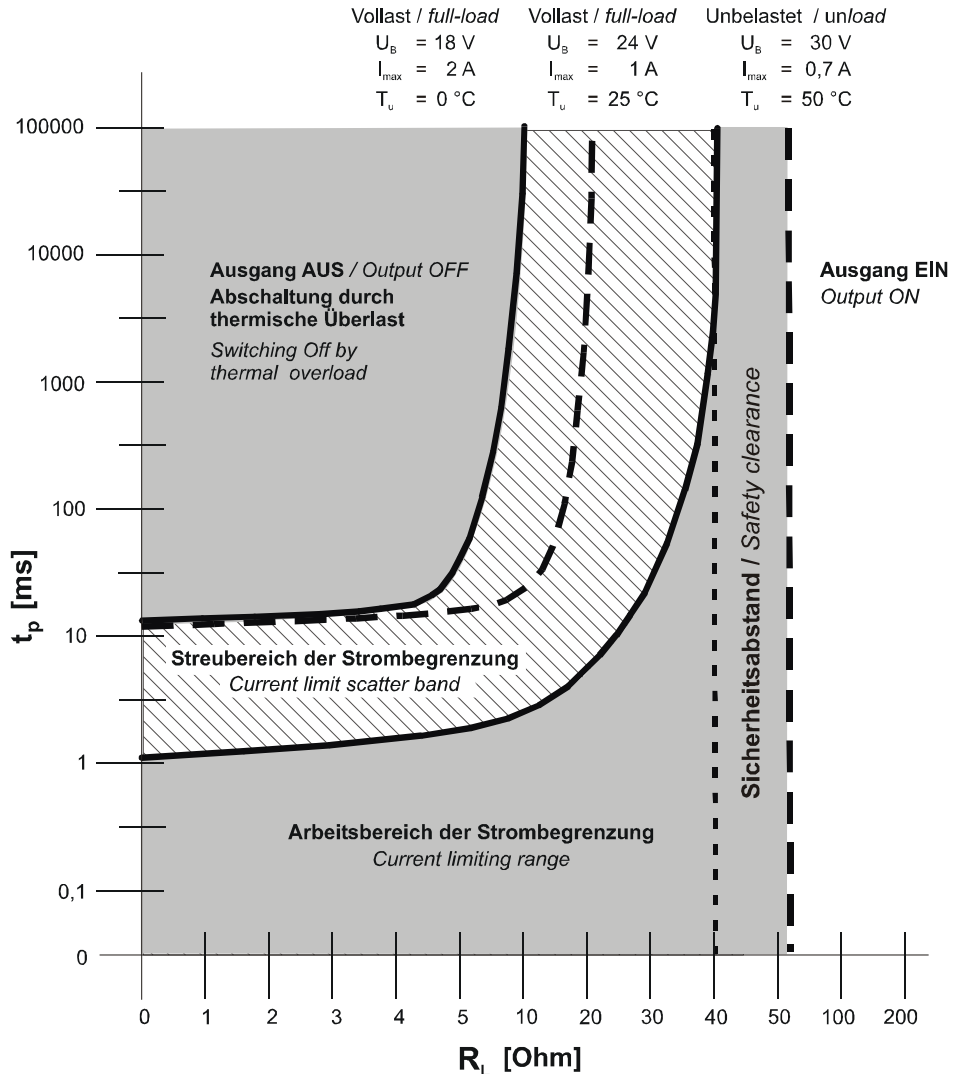
3.3.2. Digital Outputs Data

Module data	16/16	8/8
Number of outputs	16 semiconductor outputs in 4 groups	8 semiconductor outputs in 2 groups
Type of outputs	semiconductor, non-holding	
Suppressor circuit for inductive loads	high-speed de-excitation 50 V terminal voltage (typical) to + 24 V	
Power loss due to de-excitation	max. 0.5 watts per output max. 4 watts per module	
Status display	yes, yellow LED for each output	
Diagnostic function	yes, switching state can be read back at pin	
Load connection		
Total loading (100%)	8 A (16 x 0,5 A)	4 A (8 x 0,5 A)
Overload protection	yes, in event of thermal overload Responding of thermal overload protection may influence adjoining outputs	
Short-circuit protection ¹⁾ response threshold	yes, electronic current-limiting feature, min. 0.5 A, typically 0.9 A	
1) Current is limited electronically. Responding of the short-circuit protection feature produces thermal overload and trips the thermal overload protection circuit.		
Output delay for '0' to '1' for '1' to '0'	max. 0,5 ms max. 0,5 ms	
Output capacitance	< 20 nF	
Rated voltage Voltage drop (at rated current)	DC +24 V < 0,5 V	
Rated current for '1' signal Leakage current for '0' signal	0,5 A max. 0,1 mA	
Total current of all outputs	max. 8 A (16 x 0,5)	max. 4 A (8 x 0,5)
Total current per group (horizontal mounting on vertical mounting plate)	max. 2 A (4 x 0,5)	
Lamp load (DC +24 V)	max. 6 watts	
Connection of two outputs in parallel to provide logic operation to increase performance	allowed not allowed	
Insulation resistance		
Rated voltage	0 V <U _e <50 V	
Test voltage up to 2,000 m altitude	500 VDC	

Overload Reaction of Digital Outputs

Überlast-Verhalten der digitalen Ausgänge

Overload-reaction of digital output



Innerhalb des Streubereichs der Strombegrenzung ist das Verhalten der Strombegrenzung undefiniert.
 Within the current-limit scatter band the reaction of current limiting is undefined.

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It is not possible to know for certain within the current limit scatter band whether the response will be to disconnect or to return to the working range. As a result, this state should be avoided! The output is ready for operation by elimination of the overload and thermal cooling.

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4. Annex

4.1. Environmental Protection

4.1.1. Emission

When used correctly, our modules do not produce any harmful emissions.

4.1.2. Disposal

At the end of their service life, modules may be returned to the manufacturer against payment of an all-inclusive charge to cover costs. The manufacturer will then arrange for the modules to be recycled.

4.2. Maintenance/Upkeep



Do not insert, apply, detach or touch connections while in operation – risk of destruction or malfunction.

Disconnect all incoming power supplies before working on our modules; this also applies to connected peripheral equipment such as externally powered sensors, programming devices, etc. All ventilation openings must always be kept free of any obstruction.

The modules are maintenance-free when used correctly.
Clean only with a dry, non-fluffing cloth.
Do not use detergents.

4.3. Repairs/Service



Repair work may only be carried out by the manufacturer or its authorised service engineers.

4.3.1. Warranty

Sold under statutory warranty conditions. Warranty lapses in the event of unauthorised attempts to repair the equipment and/or product, or in the event of any other form of intervention.

4.4. Nameplate

Erklärungen zu den Typenschildern (Beispiel) nameplate descriptions (example)

Barcode
Identifizierungs-Nr.
identification-no.

Modul-Typ
module type

Identifizierungs-Nr.
identification-no.

Modell / Bestell-Nr.
model / order-number

Version

Versorgungsspannung
supply voltage

Datum / Date

CE Kennzeichnung
CE mark

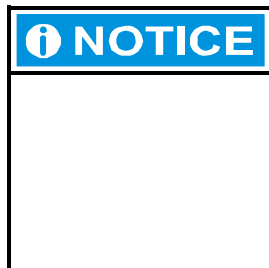
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- ① **Barcode**
same as identification number.
- ② **Module type**
plain-text name of module.
- ③ **Identification no.**
module's identification number.
- ④ **Model/order no.**
You only need to give this number when ordering a module. The module will be supplied in its current hardware and software version.
- ⑤ **Version**
defines the design-level of the module as supplied ex-works.
- ⑥ **Supply voltage**
- ⑦ **Date**
internal code.
- ⑧ **CE mark**



The 'Version' (supply version) panel specifies the design-level of the module as supplied ex-works.

When replacing a module, users, with the CNW (CANtrol Node Wizard) tool, can read off the current software version of the newly supplied module, and then reload their 'own' software version for a particular project if necessary. With the latter in mind, before the download you should always keep a record of the existing software levels in your project documentation (software version, node IDs, baud rate, etc.).

4.5. Addresses and Bibliography

4.5.1. Addresses

CiA 'CAN in Automation', international manufacturers and users organisation for CAN users in the field of automation:

CiA - CAN in Automation e.V.
Am Weichselgarten 26
D-91058 Erlangen /Germany
e-mail: headquarters@can-cia.de
<http://www.can-cia.de>

DIN-EN Standards Beuth Verlag GmbH or VDE-Verlag GmbH
10772 Berlin 10625 Berlin

IEC Standards VDE Verlag GmbH or Internet search
10625 Berlin <http://www.iec.ch/>

4.5.2. Standards/Bibliography

IEC61131-1/EN61131-1 Programmable controllers Part 1: General information
IEC61131-2/EN61131-2 Programmable controllers Part 2: Equipment requirements and tests
IEC61131-3/EN61131-3 Programmable controllers Part 3: Programming languages
IEC61131-4/EN61131B1 Programmable logic controllers
 Supplementary Sheet 1: User guidelines

IEC61000-6-4 / EN61000-6-4 German EMC Act: Emitted interference
IEC61000-6-2 / EN61000-6-2 German EMC Act: Noise immunity
ISO/DIS 11898 Draft International Standard: Road vehicles - Interchange of digital information - Controller Area Network (CAN) for high-speed communication
EN 954-1 Safety of machinery: Safety-related parts of control systems (Part 1)
Bibliography A variety of specialist publications on the CANbus is available from specialist bookshops, or can be obtained through the CiA users' organisation.



Our Technical Support team will be glad to provide other literature references on request.