DIOLINE20 CANopen

Bus Coupler

User Manual

Version 1.11

08/2025

Technik mit System

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1 Safety Information

Importance of the User Manual

The user manual is part of the DIOLINE20 module product, and must always be kept handy. That applies up until the module is disposed of. If the module is sold or lent, the user manual must be provided along with the module.

Copyright

This user manual is intended for the operator and its personnel. Its contents may not be fully passed on in part, reproduced or otherwise communicated, unless expressly authorized.

Violations of that provision can result in legal consequences.

Liability exclusion

We at Lütze have reviewed the contents of this publication to ensure that they agree with the hardware and software. However, differences can not be totally excluded, so that we can not guarantee their full agreement. The information contained in this publication is reviewed regularly, and any necessary corrections will be included in subsequent versions. Suggestions for improvement are welcomed.

Friedrich Lütze GmbH & Co. KG excludes any liability that stems from non-existent or insufficient knowledge of the user manual. For the operator, it is therefore advisable to have the instruction of staff in writing.

Use as Intended

The intended use includes adherence to the user manual.

The DIOLINE20 modules may only be used for the situations envisioned in the documents, and only in conjunction with the third-party devices and third-party components that we have recommended and/or approved.

The proper and safe operation of the product assumes and requires proper transport, proper storage, installation, assembly, operation, and maintenance.

Qualification of the personnel

Only qualified personnel should perform the following work on DIOLINE20 modules:

Installation

Putting into operation

Operation

Maintenance

Within the context of the safety information, persons who are qualified are those that have the authorization to put into operation devices, systems, and power supply circuits, in accordance with the safety technology, to ground it, and to mark it.

Operating personnel must be correspondingly instructed and trained.

Maintenance of the DIOLINE20 modules

DIOLINE20 module themselves are maintenance-free. Therefore, when they are in operation, no inspection or maintenance intervals are required.

Decommissioning and disposal of DIOLINE20 module

The company that is operating the modules must follow the relevant environmental laws and regulations, when disposing of the DIOLINE20 module, at the location where they are being used.

Symbols in the manual

The operating manual contains notes and information that you must follow for your personal safety, and to avoid damage to property. The notes are identified by a warning triangle, and graded according to risk level.

Imminent danger

to the life and health of persons. Failure to observe poses a risk of death or serious injuries (crippling injury, etc.).

Impending danger

to the life and health of persons. If it is not followed, can result in death or serious injury.

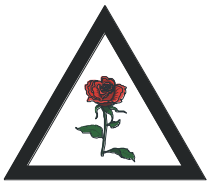
Possibly dangerous situation

If not followed, slight injuries may result. This symbol is also used as a warning, indicating potential property damage.

Instructions for proper use

Describes a potentially harmful situation.

Failure to comply may damage the product, or something in its environment.



Environmental Protection

Ignoring this information can result in damage to the environment.

Additional safety information

The DIOLINE20 modules correspond to the level of modern technology (state of the art) and also fulfill the valid safety requirements of the applicable, harmonized European norms (EN).

For the user, the following apply:

Relevant accident prevention regulations

EC/EU directives and other country-specific rules

Generally accepted safety rules in the industry, etc.

General ESD requirements

Vorsicht

When electrical welding work is done on the frame, on which the electrical components are mounted, all connections from and to those modules must be disconnected. Only in this way, the modules can be protected from destruction by electrical power

Disturbances or disruptions of any kind or other damage must be immediately reported to the proper person(s).

Protective and safety equipment may not be circumvented or bypassed. Disassembled safety devices are to be remounted before being used again and must be subjected to a function test.

The modules must be protected against misuse and accidental use.

Original installed signs, labels, stickers, etc. are always to be observed and maintained in a legible condition.

To supply the DIOLINE20 module, DC 24 V power is used. The operating voltage of 24 V DC falls under the category of SELV (safety extra low voltage) and is thus not subject to the EC/EU Low Voltage Directive. Using other power supplies is not allowed.

Supply occurs at the X3 CAN head. The logic supply for the outgoing modules is fed through the L-bus flat band ribbon, from interface to interface.

2 DIOLINE20 Product Overview

The CANopen DIOLINE20 modules are designed for use on vehicles that travel by rail.

One module cluster contains the standard controller core as the head, and a maximum of 10 additional expansion modules of the DIOLINE20 product family.

The enhancements are connected by a flat cable line, from interface to interface. A loose plug-in connector is included with the CAN head. It is designed to protect the contacts of the enhancement plug-in location in the last module of the cluster.

The DIOLINE20 product family consists of a multiplicity of combined interface types.

There are both digital and analog input and output modules.
The description of the interfaces is included with the modules.

The CAN-head as a connecting element, between the CAN bus and the interface modules.

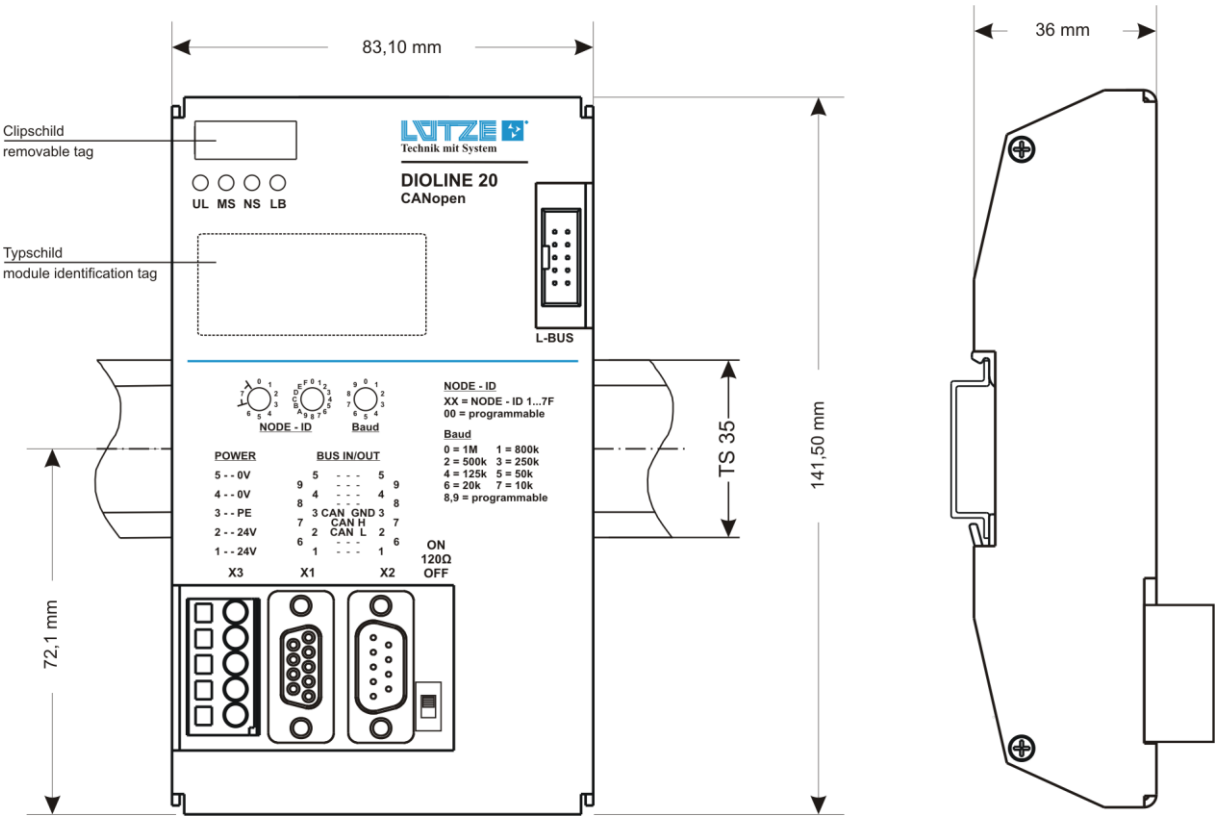


Figure 1: DIOLINE20 CAN head housing

3 The Controller Core

The technology

The controller core is based on a micro-controller with an integrated field bus connection.

This basis component is used to control the digital and analog input/output modules.

The system can be used in terminal boxes and control cabinets, to set up DIN rails.

Connection setups:

- Network supply using a 24 V - connection (X3).
- CAN bus using a SUB-D terminal block (X1 and X2)
- Connection of the additional modules, by means of a flat cable (L-bus).
- Switchable CAN load resistance (120Ω)

Application options

The controller core is a bus coupling module that is used to connect the CAN field bus. The CANopen protocol is used.

3.1 DIOLINE20 controller core specifications

Field bus interface:

- Bus system:
  CANopen DS 301 and DS 401
- Module type:
  Slave I/O module
- Data width in the process image:
  dependent on the type of the I/O interface
- Addressing:
  Node ID 1 .. 127 via rotary switch
- Transmission rate:
  10/20/50/125/250/500/800/1000 kbit/s
- Transmission medium:
  twisted two-wire line
- Bus connection incoming: X1 spring, SUB-D, 9-pin
  M3 optional UNC
  additional: X2 pin connector, SUB-D, 9-pin
  M3 optional UNC

L-bus interface:

- There can be a max.of 10 I/O modules connected with the L-bus interface.

Environmental test:

- EMC disturbance message / immunity:
  DIN EN 50121-3-2
- Isolation coordination:
  DIN EN 50124-1
- Vibration / shock immunity:
  DIN EN 61373
- Cold / heat / climate
  DIN EN 50155

Supply part:

- Supply voltage:
  DC 24 V (area DC 16.8 to 30.0 V)
- Ripple:
  max. ±10 %
- Power consumption at DC 24 V:
  nom. 50 mA plus power consumption of the individual I/O interface;
  if error (for internal short circuit or surge at L-bus plug)
  protected by 1.6A fuse
  ($10*I_N$ for 100ms or $5*I_N$ fr 1s)
- Connection through 5-pin X3 spring terminal block
- Reverse polarity protection: yes

Potential isolation:

- Isolation voltages:
  CAN bus and electronic
  AC 500 V

Diagnosis:

- 4 LEDs for the following status displays:
  Logic supply UL, module status MS, network status NS,
  L-bus status LB

Other:

- Module size:
  141.5 x 83.1 x 36 mm
- Weight (without plug connector):
  260 g
- Housing: Aluminum
- Protection type: IP 20
- DIN rail assembly
- Installation position:
  standing fitting panel;
  after consultations, other installation positions allowed
- Operating temp:
  -40 .. +70 °C
  (+85 °C for 10 min), corresponds with EN 50155 class Tx
- Storage temp:
  -40 .. +85 °C
- Relative humidity:
  100 %, short-term dewing possible
- Optional conversion kit of the threads at the sub-D-plug M3 in UNC4/40 (article Nr. 746840)

3.2 DIOLINE20 Controller Core Block Diagram

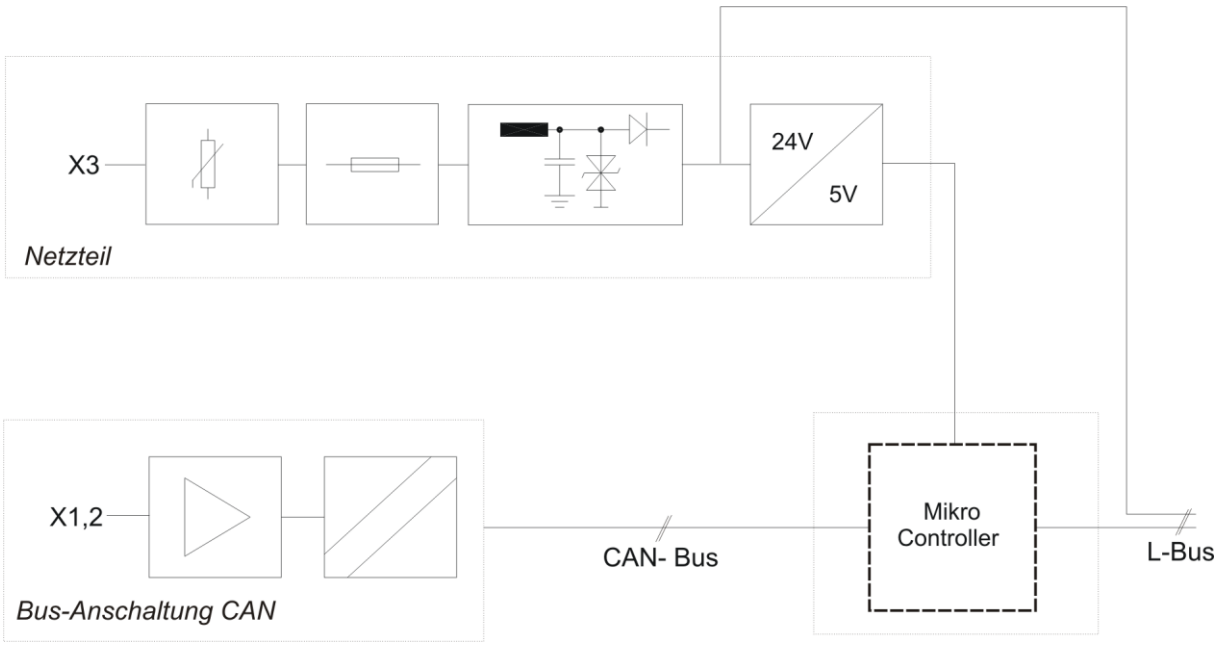
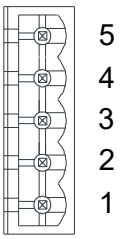


Figure 2: Controller core block diagram

3.3 Power supply

A direct current voltage of DC 24V is used, which corresponds to the rail specification, EN 50155.



The X3 terminal block for the power supply is designed as a pluggable 5-pin cage clamp terminal.

Figure 3: Power supply terminal block

Pin-Nr.	Signal	Description
1	24V	24 V - supply
2	24V	24 V - supply
3	PE	Grounding connection
4	0V	0 V - supply
5	0V	0 V - supply

Figure 4: Terminal block pin assignment - power supply

Warnung

The device may not be used without the attached protective conductor, because if the device were to become defective, it could act as a voltage conductor!

3.4 CAN bus interface description

In the standard delivery, the modules are connected to the CAN bus using 2 SUB-D connectors (M3 thread; with a simple conversion option to UNC4/40). A differentiation is made between the incoming "BUS IN" bus signal, and the outgoing "BUS OUT" bus signal.

The CAN bus connections are located on the front side: X1 and X2.

In addition, a bus terminal with 120Ω can be activated via a slide switch.

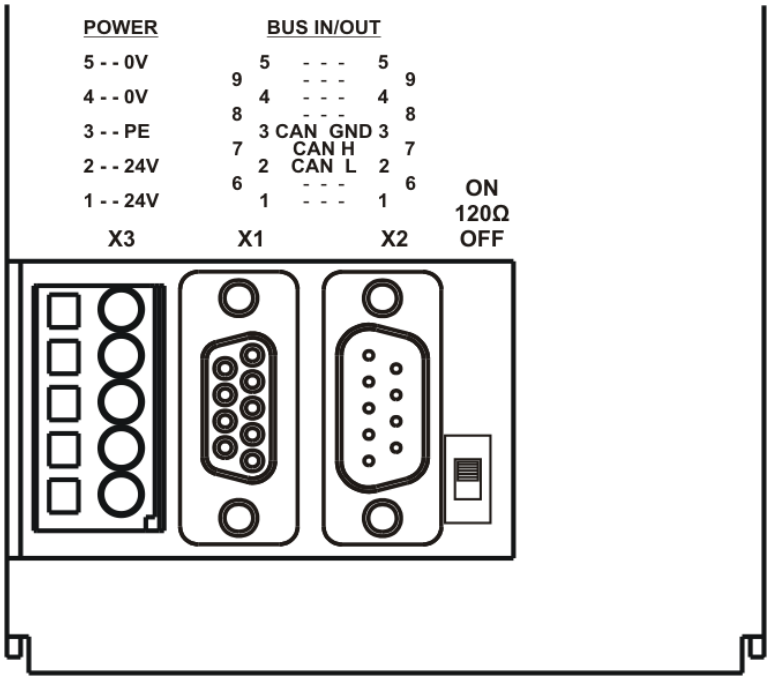
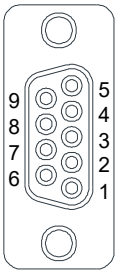


Figure 5: Connections for the CAN bus

3.4.1 CAN in connection



The X1 "CAN in" plug-in connector is a 9-pin SUB-D box.

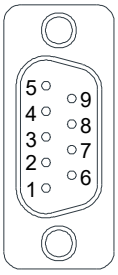
Figure 6: X1 plug-in box for CAN in

Pin-Nr.	Signal	Description
1	NC	Not used
2	CAN low [1)]	From previous model or host
3	CAN GND [1)]	From previous model or host
4	NC	Not used
5	NC	Not used
6	NC	Not used
7	CAN high [1)]	From previous model or host
8	NC	Not used
9	NC	Not used
Connector housing	PE	Ground connection

Figure 7: CAN in connector pin assignment

[1)] All Signals are connected 1:1 with the X2 "CAN out" plug connector.

3.4.2 CAN out connection



The X2 "CAN out" plug-in switch is a 9-pin SUB-D socket board.

Figure 8: X2 plug-in connector for CAN out

Pin-Nr.	Signal	Description
1	NC	Not used
2	CAN low [1) 2)]	For the next module
3	CAN GND [1)]	For the next module
4	NC	Not used
5	NC	Not used
6	NC	Not used
7	CAN high [1) 2)]	For the next module
8	NC	Not used
9	NC	Not used
Plug-in housing	PE	Grounding connection

Figure 9: CAN out plug connector pin assignment

Description of the designations:

1) these signals are connected 1:1 with the X1 "CAN in" plug connector.

2) The first and the last module in the chain must be closed with a resistance of 120Ω (between CAN high and CAN low). That integrated switch can be used to do that, by flipping it up into the "ON" position. In the lower "OFF" position, the 120Ω-resistance is not operable.

3.5 Settings and Displays

3.5.1 Settings of the module address (Node ID)

The settings of the module address are set using the SW1 and SW2 rotary switches, as hexidecimal values. The SW1 rotary switch corresponds to the higher position of 00H to 70H, the SW2 switch of the lower value position, of 00H to 0FH.

The following addresses are allowed: 1..127 (decimal), corresponds to hexidecimal: 01H .. 7FH.

Node ID 01 is set at the factory.

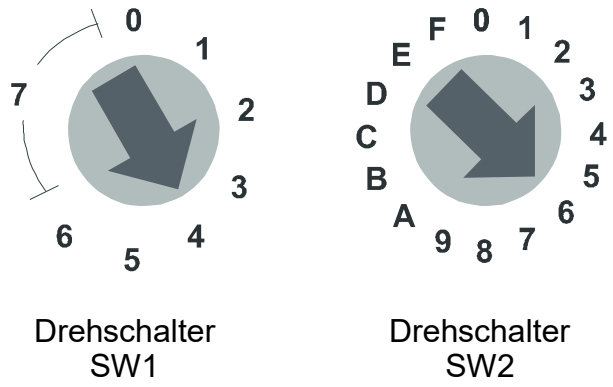


Figure 10: SW1 and SW2 rotary switches for the module address

Module address (hexi-decimal)		**Module address (decimal)**
Position of the SW1 rotary switch	Position of the SW2 rotary switch	
0	0	SDO 2000
0	1	1
0	2	2
.	.	.
.	.	.
.	.	.
7	E	126
7	F	127

Note:

When the 00H setting on the rotary switch is set, the EEPROM (SDO 2000) saved setting and/or the default address, 7FH (hex) = 127 (dec.) become active.

3.5.2 Setting the CAN baudrate

The SW3 rotary switch is used to set the CAN baudrate.

It is set at the factory to 125kbit/s.

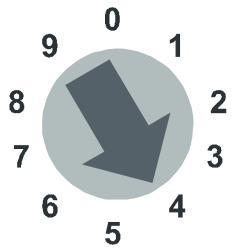


Figure 11: SW3 rotary switch for the CAN baudrate

The following assignment applies:

Position of SW3 rotary switch	CAN baudrate
0	1 Mbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s
4	125 kbit/s
5	50 kbit/s
6	20 kbit/s
7	10 kbit/s
8	EEPROM SDO 2001
9	EEPROM SDO 2001

Note:

In the 8 and 9 position at the SW3 rotary switch, the baud rate that is saved at EEPROM (SDO2001) is activated.

3.5.3 Diagnostics and LED indicator of the module

The DIOLINE20 module has the following LEDs for displaying the current module status:

Figure 12: LED indicators

LED	Color	Meaning
UL	green	Logic supply
MS	green / red	Module status
NS	green / red	Network status
LB	green / red	L-bus status

The following LED indicators represent the following status states:

LED	Color	Status
UL	green	HW Reset no
MS	red	Error recognition process
	blinking green	Stopped mode is running
	green	Internal process is running
NS	red	Bus error, Bus off, Consumer heartbeat error, Guarding life time error
	blinking red	Bus passive /warning level
	blinking green	Pre-operational mode, stopped mode
	green	Operational mode
LB	green	L-Bus active
	red	L-Bus error

4 Change history

Version	Change	
1.00	First version	
1.10	April 2008	
	Chapter 2	Note on maximum 8 I/O-Modules at L-Bus added
	Chapter 3.1	Note on maximum 8 I/O-Modules at L-Bus added.
	Chapter 1	Safety note changed
	Chapter 4	Appendix replaced by change history
1.11	August 2025	
		Title actualized; Fax removed; TOC and index of graphics actualized
	Chapter 2	Note on maximum 10 I/O-Modules at L-Bus added
	Chapter 3.1	Note on maximum 10 I/O-Modules at L-Bus added