Operating Instructions

DIOLINE 20
Analog I/O Modules

Version 3.70

22.1.15

LUTZE TRANSPORTATION

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LÜTZE TRANSPORTATION

Content

1 Introduction

This manual is part of the Analog I/O Modules. It contains important information about the handling and safety. To avoid hazardous situations read the manual before installing the product and using it.

Store the manual at a handy place. If selling, renting or in case of a divestiture pass the manual to the authorize person.

2 General Information

2.1 Symbol Description

The manual contains several safety messages. Each safety message contains a defined signal word and a color. The color and the word are referring to an alert level. There are 4 levels. The safety messages point out hazardous situations and give information to avoid those.

DANGER	**Indicates a hazardous situation which, if not avoided will result in death or serious injury.**
WARNING	**Indicates a hazardous situation which, if not avoided could result in death or serious injury.**
CAUTION	**Indicates a hazardous situation which, if not avoided could result in minor or moderate injury.**
NOTICE	**Is used to address practices not related to personal injury**

2.2 Copyright

This manual is intended for the operator and his staff. It is forbidden to give the content to a third party, to duplicate, exploit or impart it. The Lütze Transportation GmbH has to allow it explicit in writing.

General data, text, images and drawings are copyrighted and are liable to the industrial property right. Contravention can be prosecuting criminally. The named brands and product names in this document are trademarks or registered trademarks by titleholder.

2.3 Disclaim of Liability

The manual was written under consideration of the applied standards, regulations and the current state of technology.
The content is verified of accuracy. Discrepancies are not excluded. For those discrepancies we disclaim liability. Applicable changes and additional information will be in the next version of the manual.

The Lütze Transportation GmbH does not assume liability for any damages and accidents of following reasons:

- Nonobservance of the manual
- Untrained and unqualified employees
- Non conventional use
- Non approved reconstructions and functional modifications of the product
- Using non original or non admitted parts or equipment

2.4 Related Documents

The digital I/O modules are always operated with different PLCs and buscoupler.

NOTICE	**Read the manual of the PLC or buscoupler before using the I/O modules.**

3 Safety

3.1 Content of the Manual

Read and follow the manual before using the product the first time.
This applies to every person which is getting in touch with the product. Trained employees and experts especially qualified persons which had worked with similar products before have to read and understand the manual.

3.2 Intended Use

The DIOLINE20 I/O modules are designed for the exclusive use in railway vehicles, as:

- In- and output for signals which are controlled by a busnode or a PLC.

Only use the I/O modules for the listed cases and only with external devices recommended and allowed by the Lütze Transportation GmbH.

The intended use involves also the use according to the operation instructions.

3.3 Recepients

The operating manual addresses planers, project manager and programmers. It also addresses the operating employees which are responsible for the initial operation, the operating and for the maintenance of the products and systems. Regarding the employees different qualification levels are differentiated.

3.4 Operating Employees

⚠ WARNING	**Risk of injury by deploying insufficient qualified operating employees.** Inappropriate appoint of not qualified or insufficient personal can cause property damages and personal injuries. Tasks which apply special procedures should be done by trained and qualified employees or experts, especially electricians.

Trained Employees
The employee was trained by the employer on the task and possible hazardous situations. The employee does not have any technical knowledge.

Experts
The employee has a technical education, knowledge and/or experience in the required field. The employee is capable to do specific operations on and with the product.

Electrically qualified persons
The employee has a technical education in the required field. The employee is capable to do special operations on and with the product.

The different sections of the manual referingt to the qualification level of the operating employees.

3.5 Responsibility of the Operator

The operator is obligate by the law of occupational safety, if the product is used in a commercial field.

- The operator is responsible to train the employees and to inform himself about the industrial safety regulation.
- The operator is responsible that safety, environment protection regulations and rules for accident prevention are observed.
- The operator has to run a risk assessment at the working environment/place of installation to expose hazards and to alert those.
- The manual has to be stored near the product.
- The manual has to be obeyed.
- The product can just be run in a faultless technical condition.

3.6 Protective Clothing and Equipment

NOTICE	▪ **If working with or on the I/O Modules wear special ESD clothing.** Because static electrification can destroy parts of the buscoupler which can cause a malfunction of the whole product. ▪ **Follow the instructions and regulations of the employer.**

3.7 Reconstruction and Modifications of the Product

⚠ WARNING	**Reconstructions and modifications of the product can cause property damages or personal injuries.** Do not reconstruct or modify the product if the manufacturer does not allow it explicit in writing.

3.8 Safety Appliance

⚠ CAUTION	**Do not bypass protection equipment and safety arrangements.** The product can be damaged by overvoltage and electric shocks are possible.

NOTICE	**The I/O Modules do not garuantee the safety of the whole process and/or the whole system.**

3.9 Special Safety Messages

CAUTION	**Use a nominal operating voltage of 24 Volts.** The lower (16.8 Volts) and upper (30 Volts) threshold voltage is given in the technical data. A higher voltage can cause electric shocks and damage the product.

NOTICE	▪ **Dismount all electronic modules and their connections of the frame if intended to do some welding.** The product can be damaged by compensating current. ▪ **An EMC performance according to the standards is only possible if the EMC shield clip set is mounted.**

4 Product Overview

4.1 Product Description

The DIOLINE20 I/O Modules are connected to a buscoupler or PLC via the L-Bus (Lütze Bus). Following options of the I/O Modules are available:

Type
8 digital Inputs
8 digital Outputs
16 digital Inputs
16 digital Outputs
8 digital Inputs, 8 digital Outputs
4 analog Inputs
4 analog Outputs
4 analog Inputs multiplexed
4analog Outputs multiplexed
6 analog Inputs
6 analog Outputs
2 analog Inputs, 2 analog Outputs
16 digital Inputs, 8 digital Outputs
4 analog Inputs, 4 analog Outputs
4 analog Inputs, 2- analog Outputs
Spacer (alle data bits are reset)

4.2 System Overview

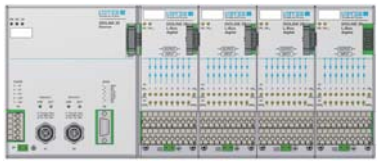
The I/O modules can be integrated in the product line of the DIOLINE20 automating system as follows.

The DIOLINE product line contains modular components. A unit consists of a controller with an integrated CPU and an extension module. It is possible to connect max. 10 local I/O extension modules on the controller. The extension modules are connected over the L-Bus. The graphic shows the DIOLINE product after their intelligence. The first module is the most intelligent one. The last one is a module with the fewest intelligence.

DIORAIL PC 2
Vehicle Control Unit

DIOLINE PLC
Compact Control Unit

DIOLINE20
Buscoupler Ethernet/ IP Adapter
Modular I/O Busnode



DIOLINE20
Buscoupler MVB Slave
Modular I/O Busnode

DIOLINE20
Buscoupler CANopen Slave
Modular I/O Busnode

DIOSWITCH
Unmanaged Ethernet Switch

4.3 Field of Application

The DIOLINE20 I/O Modules can be connected to buscoupler or PLCs.

5 Transport and Storing

NOTICE

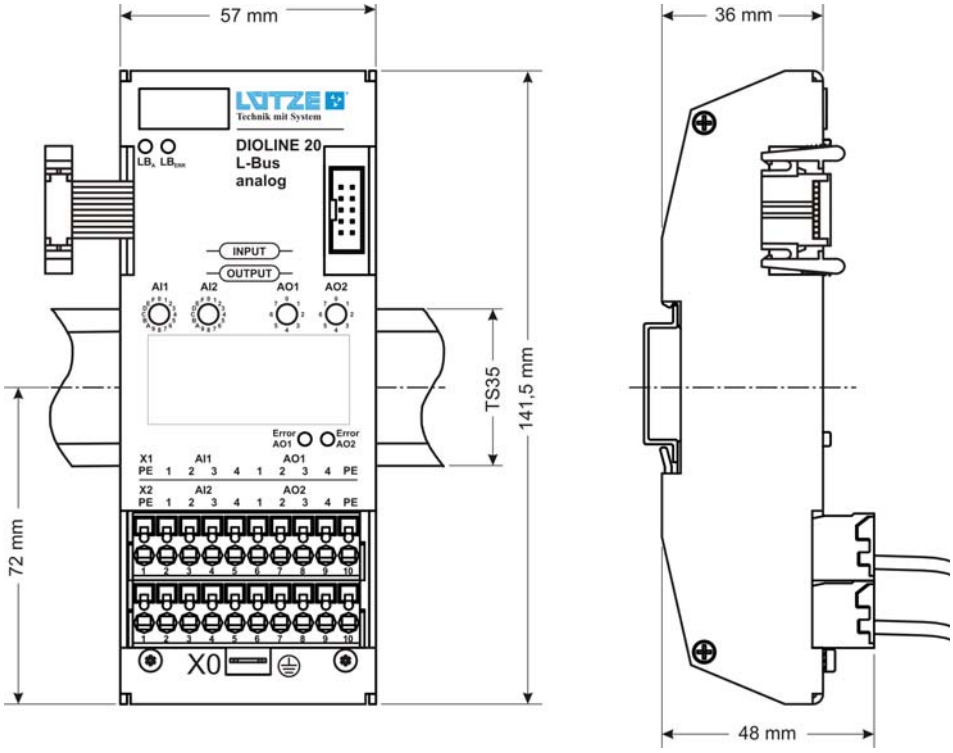
- **Protect the product against humidity. Store the product in a dry room between -40 and 85°C.**
- **Make sure that the I/O Modules are safely packaged for transporting, to absorbe possible crushes.**
- **Dust can destroy electronic components.** The circuit boards of the I/O Modules are coated. But try to store and transport it in a dust free environment to avoid damages of the modules.

6 Scope of Delivery

- DIOLINE20 I/O Module
- Plug-in Terminals
- Instruction Leaflet

7 General Technical Data

NOTICE **For detailed description of the standards, please see the technical data sheets.**



Mechanics	
Dimensions (WxHxD))	57.0x141.5x48.0 mm
Weight	ca. 200 g without cage clamps
Housing	aluminum
Mounting	top hat rail

Electronic Module Supply	
Voltage Supply	DC 16.8-30 V
Ripple	max. 10 %
Nominal Voltage	nom. 10 mA

Enviromental Condition	
Operating Temperature	-40°C bis +70°C (+85°C for 10 min) according to EN 50155 class TX
Storage Temperature range min./ max.	-40°C bis +85°C

Standards

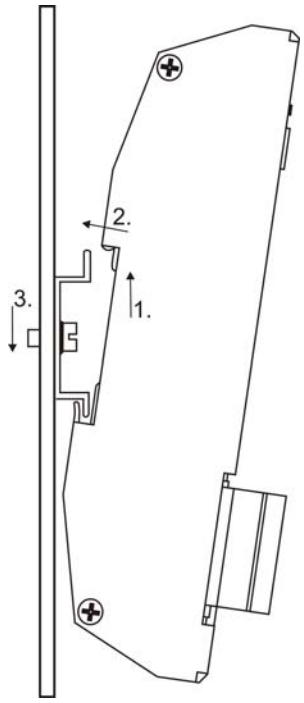
EN 50155	Electronic equipment on railway vehicles
EN 50121	Electromagnetic compability
EN 50124	Insulation coordination
EN 61373	Vibration and shocks

8 Mounting

⚠ CAUTION	**Risk of injury by electric current.** People can be injured by electric current and the product can be damaged. Deenergize the system before mounting.

NOTICE	**Mount the product with a distance of 5 mm minimum to other products to provide good air conditions.**

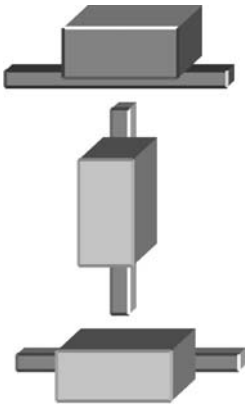
1. Hook the module into the lower part of the top-hat rail.
2. Push the module a little bit up.
3. Push the module back that it catches the top-hat rail.



8.1 Mounting Options

The I/O Modules can be mounted on a top-hat rail. Following mounting options are possible:

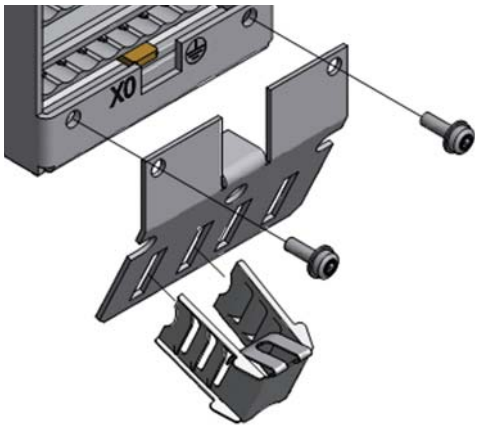
- horizontal
- vertical
- across



8.2 EMC Shield Clip Set

To get an EMC performance according to the standardsit is mandatory to mount an EMC shield clip set to the analog module.
The shield clip set is not scope of the delivery.
To mount the shield clip set proceed as follows:

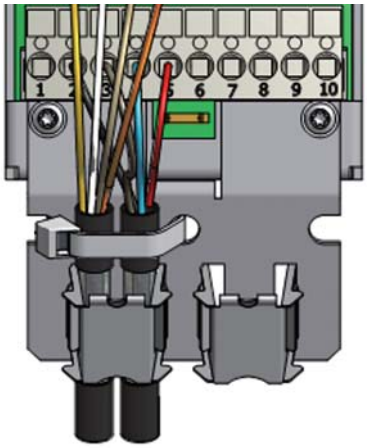
1. Losen the screws on the analog module.
2. Mount the shield sheet and the shield clip as shown in the drawing.



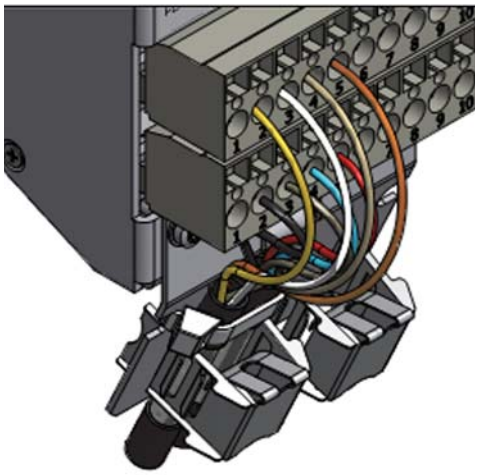
3. Connect the module.
4. Remove the jacket of the cable, till you can see the shielding.
5. Fix the cable with the shield clip. The shield of the cable must have contact to the shield clip.

The shield clip can be adjust in 3 levels.

6. For strain relieve fix the cable with a wire strap to the module as shown in the picture.



7. Insulate the cable.



9 Initial Operation – Hardware

NOTICE

The initial operation has to be done by electricians.

To connect the modules correctly read the chapter of the required module. In the chapters you will also find information about the pin assignments.

9.1 Power Supply

The power supply has to be connected over the cage clamps of the modules. Read the required chapter. To ground the module connect the mounting tab X0.

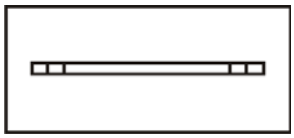


Fig. 1: Mounting Tab X0

9.2 L-Bus – Interface

The L-Bus interface is for coupling the local DIOLINE20 I/O Modules. The L-Bus, Lütze-Bus is a special fieldbus invented by company Lütze.

WARNING

Switch off the power when connecting or disconnecting the I/O Modules. If not observe, the whole system can be damaged. Hot Plugging is not supported by the system.

NOTICE

- **Connect max 10 I/O Modules over the L-Bus interface.** Mind the current consumption of the single modules. In the appendix *Seite 73* the according values are listed. A total current of max 1 A is possible on the L-Bus.
- **A change of the pin assignment is not possible, because of the predetermined connectors.**

1. Switch off the power.

Pin	Signal	Description
1	24 V	Supply Voltage
2	24 V	Supply Voltage
3	GND	0 V Potential
4	/L_BUS_ RESET	Module Reset
5	BUS_END	Identifier Bus End
6	OUT_OK	Data Confirmation
7	SDIN	Receiving Serial Data
8	SCK	Clock
9	SDOUT	Sending Serial Data
10	GND	0 V Potential

2. Connect the DIOLINE20 I/O modules via the L-Bus Interface.

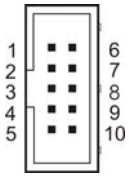


Abb. 2: L-Bus Master

3. Switch on the power.

Abb. 3: MVB Buscoupler with I/O Modules

4. The „LB“ LED is green.
   The devices are ready for operation.

10 Analog Inputs

10.1 Characteristics Voltage Inputs

- Insulation Channel
  Potential insulation between the inputs and the system bus
  (not between the single inputs)
- Input Varistor
  For overload protection

10.2 Characteristics Current Inputs

- Insulation Channel
  Potential Insulation between the inputs and the system bus
  (not between the single inputs)
- Input Varistor
  For overload protection
- Overcurrent Protection
  By PTC resistance

10.3 Characteristics Temperature Inputs

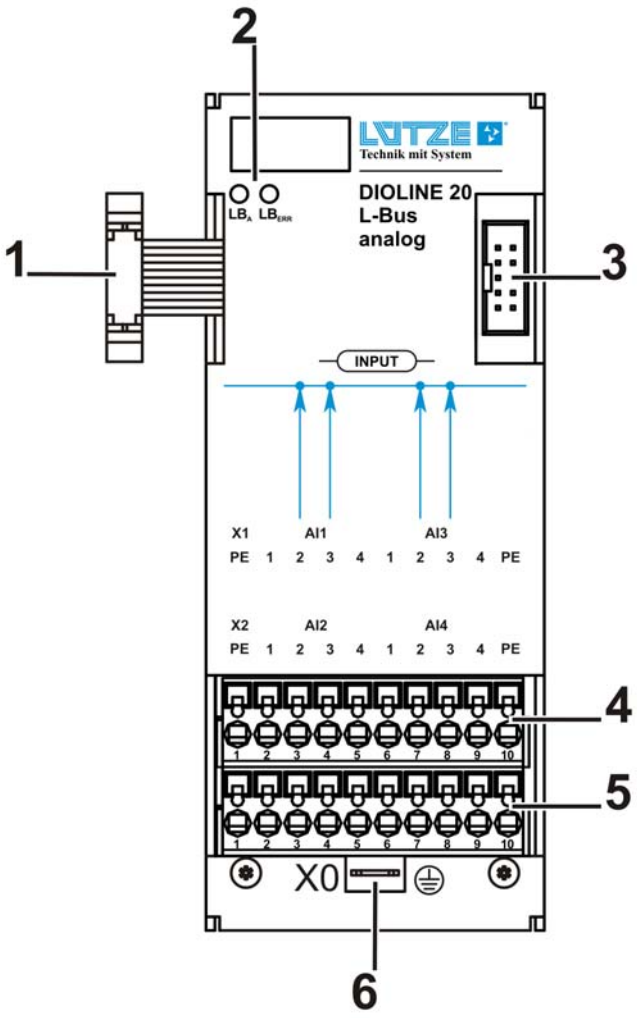
NOTICE

- **The interface is always prefixed.** It is not possible to choose an interface. The selection of the analog inputs has to be done by choosing the corresponding item-number.
- **Only voltage and current inputs can be combined within an interface.** PT 100 and PT 1000 cannot be combined.

- Insulation Channel
  Potential insulation between the inputs and the system bus
  (not between the single inputs)
- Input Varistor
  For overload protection

10.4 Analog Inputs

10.4.1 Product Assembly



1	L-Bus Interface – incoming
2	LED-Diagnosis Display – L-Bus
3	L-Bus Interface – outgoing
4	Connector analoge Inputs – X1
5	Connector analoge Inputs – X2
6	Neutral Conductor – Mounting Tab

10.4.2 LED Display

10.4.2.1 LEDs – L-Bus

LED	Color	Status
LB_A	green	active
LB_{ERR}	red	Error

10.4.3 Technical Data

Inputs General	
Number	4
Data Width in the Process Image	4x16 Bit
Current Consumption at DC 24 V	nom. 50 mA
Possible Inputs	Voltage: DC 0...10 V Voltage: DC -10...+10V Current: DC 0...20 mA Current: DC 0...24 mA Current: DC 4...20 mA Temperature: PT 100 Temperature: PT 1000
Potential Insulation	AC 500 V between L-Bus and analog inputs
Module Status Flag	The module status flag is set to “1“. (“1“ = Module Error) ▪ EEprom checksum error ▪ Hardware error in the AD converter circuit
Recommended Error Response	Error handling by the manufacturer, because it is an internal error and can lead to invalid analog values.

10.4.3.1 Analog Voltage Inputs

Voltage Input DC 0...10 V	
Input Signal	Voltage DC 0...10V
Input Resistance	200 kΩ
Data Width in the Process Image	4x16 Bit
Resolution	12 Bit, 1 LSB= DC 2.442 mV
Measured Value Exposion	16 Bit unsigned intel format 0 V – 0000 hex 5 V – 0800 hex 10 V – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	Option: 10 Hz Option: 20 Hz
Max Input Voltage	± 35 V DC

Voltage Input
DC -10 ...+10 V x

Input Signal	Voltage DC -10...+10 V
Input Resistance	200 kΩ
Data Width in the Process Image	4x16 Bit
Resolution	12 Bit, 1 LSB= DC 4.884 mV
Measured Value Exposion	16 Bit signed Intel-Format -10 V – F800 hex 0 V – 0000 hex 10 V – 07FF hex
Accuracy	± 0,5%
Sampling Rate	Option: 10 Hz Option: 20 Hz
Max Input Voltage	± 35 V DC

10.4.3.2 Analoge Current Inputs

Current Inputs DC 0..20/24 mA	
Input Signal	Current 0..20/24 mA DC
Input Resistance	35...45 Ω
Data Width in the Process Image	4x16 Bit
Resolution	12 Bit, 1 LSB= 4,884 µA at 20 mA 1 LSB= 5,860 µA at 24 mA
Measured Value Exposion	0...20 mA 16 bit unsigned intel format 0 mA – 0000 hex 10 mA – 0800 hex 20 mA – 0FFF hex 0...24 mA 16 bit unsigned intel format 0 mA – 0000 hex 12 mA – 0800 hex 24 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	Option: 10 Hz Option: 20 Hz
Max Input Voltage	DC ± 35 V
Safety Function	inverse-polarity protection, PTC overcurrent protection

Current Input DC 4...20 mA	
Input Signal	Current 4...20 mA
Input Resistance	35...45 Ω
Data Width in the Process Image	4x16 Bit
Resolution	12 Bit, 1 LSB= DC 3.907 µA
Measured Value Exposion	0...20 mA 16 bit unsigned intel format 4 mA – 0000 hex 12 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	Option: 10 Hz Option: 20 Hz
Max Input Voltage	DC ± 35 V
Safety Function	inverse-polarity protection, PTC overcurrent protection

10.4.3.3 Temperature Inputs

Temperature Input PT 100

Input Signal	Temperature -60...300 °C
Measurement Current	1 mA
Data Width in the Process Image	4x16 Bit analog Input
Resolution	16 Bit, 1 LSB=24.4 mK
Measured Value Exposion	16 bit signed intel format -100°C – F000 hex – error - 50°C – F800 hex 0°C – 0000 hex 100°C – 1000 hex 350°C – 3800 hex – error
Accuracy	-100 ... 0°C: ± 1.8 K 0 ... 100°C: ± 0.9 K 100 ... 350°C: ± 1.8 K
Sampling Rate	10 Hz
Max Input Voltage	DC ± 35 V
Connection	2-,3- or 4 wire technology

Temperature Input PT 1000

Input Signal	Temperature -60...300 °C
Measurement Current	250 µA
Data Width in the Process Image	4x16 Bit analog Input
Resolution	16 Bit, 1 LSB=24.4 mK
Measured Value Exposion	16 bit unsigned Intel Format -100°C – F000 hex – error - 50°C – F800 hex 0°C – 0000 hex 100°C – 1000 hex 350°C – 3800 hex – error
Accuracy	-100 ... 0°C: ± 1.8 K 0 ... 100°C: ± 0.9 K 100 ... 350°C: ± 1.8 K
Sampling Rate	10 Hz
Max Input Voltage	DC ± 35 V
Connection	2-,3- or 4 wire technology

10.4.4 Connecting the Analog Voltage and Current Inputs

NOTICE

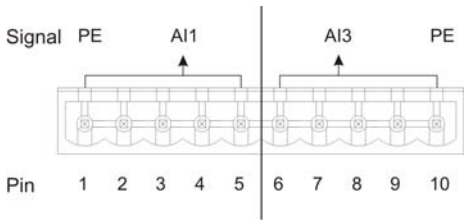
The connecting of the ground at voltage inputs -10...+10 V can cause interruption and incorrect measurements. Do not wire pin 5 and 9 of the analaog -10...+10 V voltage modules.

Connect the analog inputs via the terminal X1 and X2. Proceed as follows::

1. Switch off the voltage of the system.

2. Connect the inputs regarding the pin assignment.

Analog Inputs (Voltage and Current)



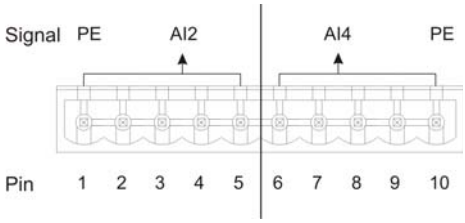
Terminal X1

Pin	Signal	Description
1	PE	AI1 Protective Earth
2	NC	AI1 Not Connected
3	IN+	AI1 Positive Signal Inputs
4	IN-	AI1 Negative Signal Inputs
5	GND	AI1 internal connected with GND
6	NC	AI3 Not Connected
7	IN+	AI3 Positive Signal Input
8	IN-	AI3 Negative Signal Input
9	GND	AI3 internal connected with GND
10	PE	AI 3 Protective Earth

Coding

Module	Multi Pin Connector	Cage Clamp
all	Pin 2 and 4	Pin 3

Terminal X2



Pin	Signal	Description
1	PE	AI2 Protective Earth
2	NC	AI2 Not Connected
3	IN+	AI2 Positive Signal Input
4	IN-	AI2 Negative Signal Input
5	GND	AI2 internal connected with GND
6	NC	AI4 Not Connected
7	IN+	AI4 Positive Signal Input
8	IN-	AI4 Negative Signal Input
9	GND	AI4 internal connected with GND
10	PE	AI4 Protective Earth

Coding

Module	Multi Pin Connector	Cage Clamp
alle	Pin 3 and 4	Pin 2

10.4.4.1 Connecting the Analog Temperature Inputs

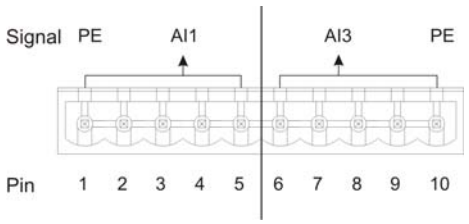
Connect the analog temperature inputs via the terminal X1 and X2. Proceed as follows::

1. Switch off the voltage of the system.

2. Connect the inputs regarding the pin assignment.

Analog Inputs (Temperature)

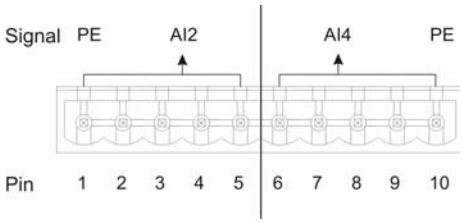
Terminal X1



Pin	Signal	Description
1	PE	AI1 Protective Earth
2	US	AI1 Current Source
3	IN+	AI1 Positive Signal Inputs
4	IN-	AI1 Negative Signal Inputs
5	GND	AI1 0 V-Potential
6	US	AI3 Current Source
7	IN+	AI3 Positive Signal Input
8	IN-	AI3 Negative Signal Input
9	GND	AI3 0 V-Potential
10	PE	AI 3 Protective Earth

Terminal X2

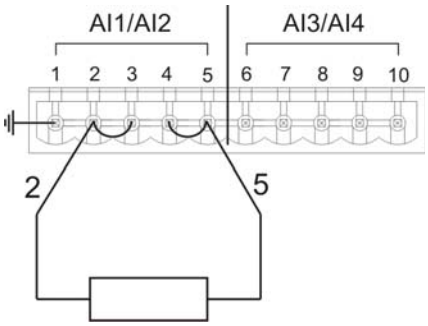
Pin	Signal	Description
1	PE	AI2 Protective Earth
2	US	AI2 Current Source
3	IN+	AI2 Positive Signal Input
4	IN-	AI2 Negative Signal Input
5	GND	AI2 0V-Potential
6	US	AI4 Current Source
7	IN+	AI4 Positive Signal Input
8	IN-	AI4 Negative Signal Input
9	GND	AI4 0V-Potential
10	PE	AI4 Protective Earth



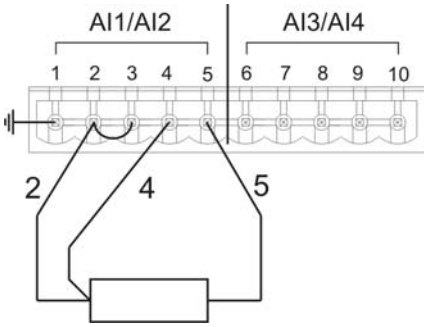
10.4.4.2 Connecting the Temperature Sensors

The temperature sensors can be connected via a 2-, 3- or 4-wire technology. The connection is realized by a jumper in the connector.

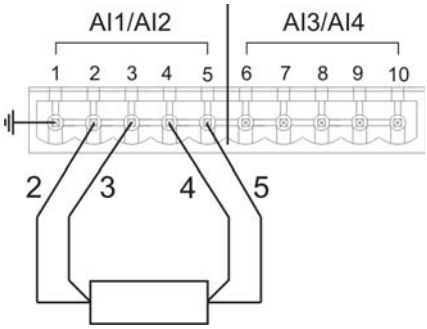
Connection 2-wire technology



Connection 3-wire technology

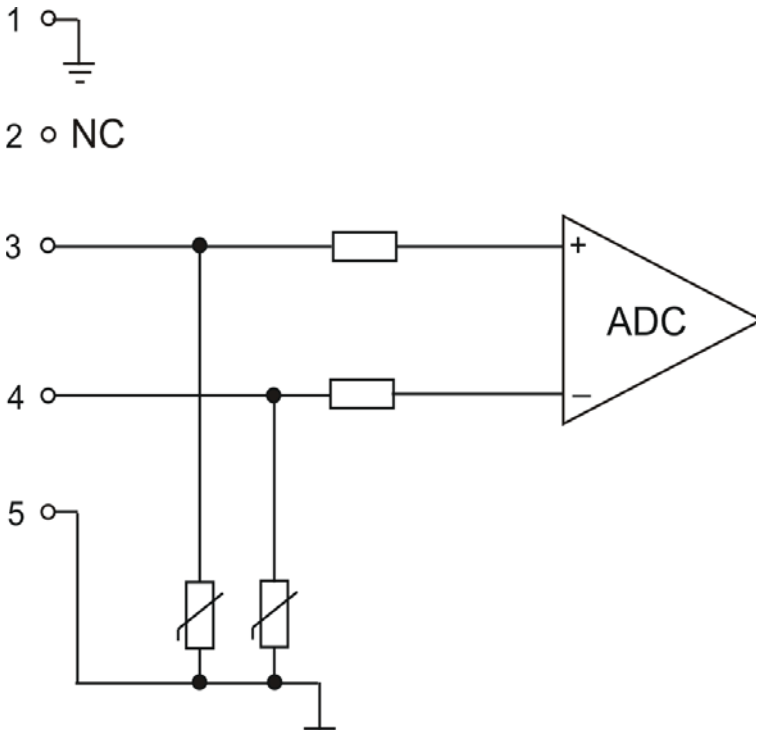


Connection 4-wire technology

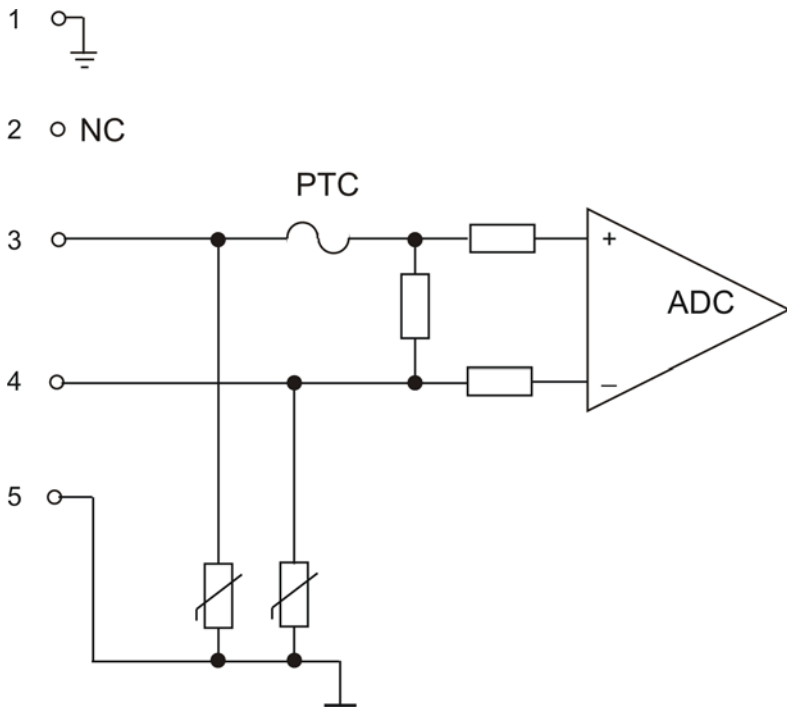


10.4.5 Operation

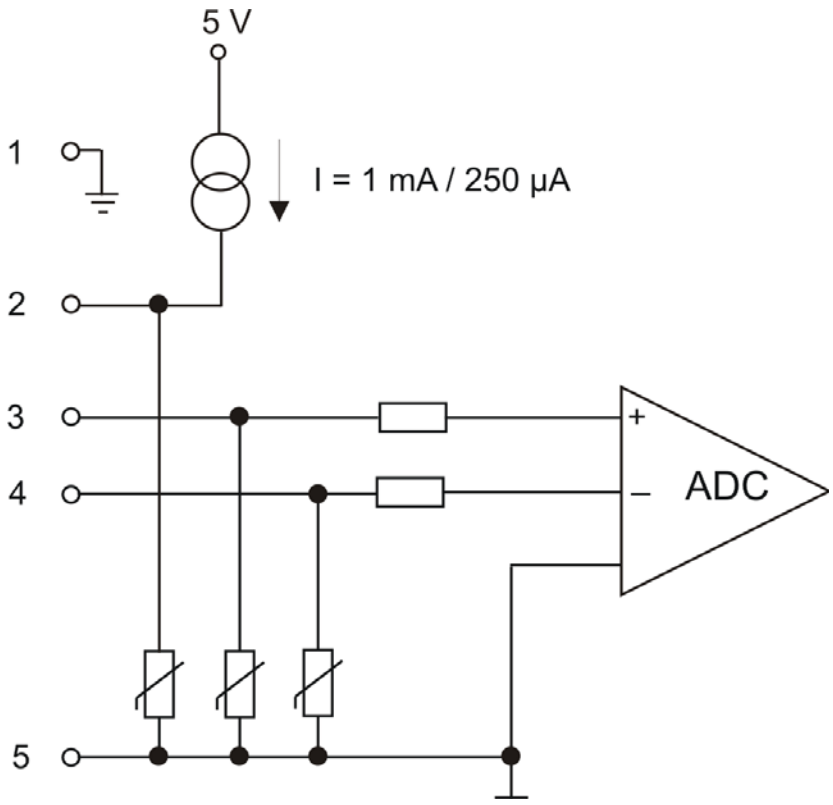
10.4.5.1 Block Diagram Analog Voltage Inputs



10.4.5.2 Block Diagram Analog Current Inputs



10.4.5.3 Block Diagram Analog Temperature Inputs



11 Analog Outputs

NOTICE

- **The interface is always prefixed.** It is not possible to choose an interface. The selection of the analog outputs has to be done by choosing the corresponding item-number.
- **Only voltage and current inputs can be combined within an interface.**

11.1 Characteristics Voltage Outputs

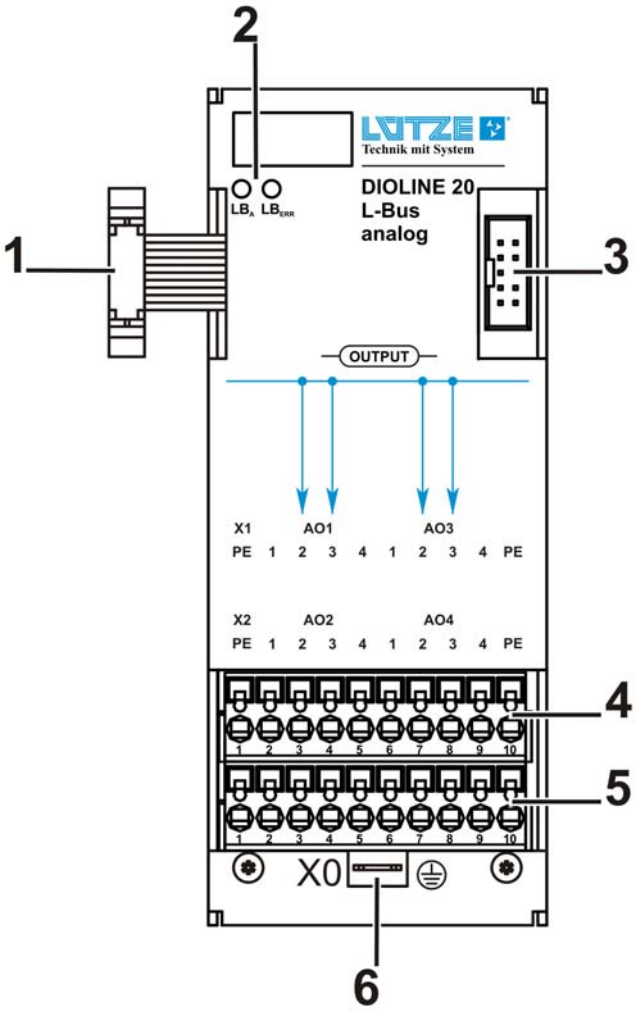
- Insulation Channel
  Potential insulation between the outputs and the system bus (not between the single outputs)
- Electronical Current Limiting
  Protects the module of an output short circuit
- Transient Voltage Supressor Diode
  Protection for impulse voltage with a pulse power up to 400 W.

11.2 Characteristics Current Outputs

- Insulation Channel
  Potential insulation between the outputs and the system bus (not between the single outputs)
- Transient Voltage Supressor Diode
  Protection for impulse voltage with a pulse power up to 400 W.

11.3 Analog Outputs

11.3.1 Product Assembly



1	L-Bus Interface – incoming
2	LED-Diagnosis Display – L-Bus
3	L-Bus Interface – outgoing
4	Connector Analog Outputs – X1
5	Connector Analog Outputs – X2
6	Neutral Conductor – Mounting Tab

11.3.2 LED Display

11.3.2.1 LEDs – L-Bus

LED	Color	Status
LB_A	green	active
LB_{ERR}	red	Error

11.3.3 Technical Data

Outputs General	
Number	4
Data Width in the Process Image	4x16 Bit
Possible Outputs	Voltage: DC 0...10 V Voltage: DC -10...+10 V Current: DC 0...20 mA Current: DC 4...20 mA
Potential Insulation	AC 500 V between L-Bus and analog outputs
Module Status Flag	The module status flag is set to “1“. (“1“ = Module Error) ▪ EEprom checksum error
Recommended Error Reaction	Error handling by the manufacturer, because it is an internal error and can lead to invalid analog values.

11.3.3.1 Analog Voltage Outputs

Voltage Output DC 0...10 V	
Output Signal	Voltage DC 0...10 V
Max Output Current	10 mA
Data Width in the Process Imaged	4x16 Bit analog output
Resolution	12 Bit, 1 LSB= DC 2.442 mV
Measured Value Exposion	16 Bit unsigned intel format 0 V – 0000 hex 5 V – 0800 hex 10 V – 0FFF hex
Accuracy	± 0.5%
Frequenzy of Updating	100 Hz
Safety Function	short-circuit proofed

Voltage Output
DC -10 ...+10 V

Output Signal	Voltage DC -10...+10V
Max Output Current	2 mA
Data Width in the Process Image	4x16 Bit analog output
Resolution	12 Bit, 1 LSB= DC 4.884 mV
Measured Value Exposion	16 Bit signed Intel-Format -10 V – F800 hex 0 V – 0000 hex 10 V – 07FF hex
Accuracy	± 0.5%
Frequency of Updating	100 Hz
Safety Function	short-circuit proofed

11.3.3.2 Analog Current Output

Current Output DC 0..20 mA

Output Signal	Current DC 0..20 mA
Max Resistance	500 Ω
Data Width in the Process Image	4x16 Bit analog output
Resolution	12 Bit, 1 LSB= DC 4.884 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 10 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Frequency of Updating	100 Hz

Current Output DC 4...20 mA

Output Signal	Current DC 4...20 mA
Maxi Resistance	500 Ω
Data Width in the Process Image	4x16 Bit analog output
Resolution	12 Bit, 1 LSB= DC 3.907 µA
Measured Value Exposion	16 bit unsigned intel format 4 mA – 0000 hex 12 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Frequency of Updating	100 Hz

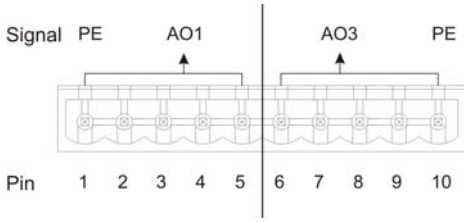
11.3.4 Connecting the analog Outputs

Connect the analog outputs via the terminal X1 and X2. Proceed as follows:

1. Switch off the voltage of the system.
2. Connect the outputs regarding the pin assignment.

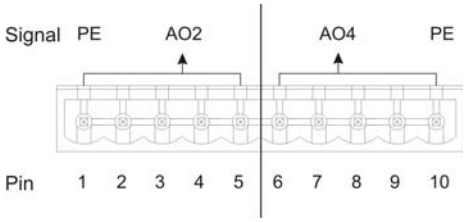
Analog Outputs (Voltage and Current)

Terminal X1



Pin	Signal	Description
1	PE	AO1 Protective Earth
2	OUT+	AO1 Positive Signal Output
3	OUT+	AO1 Positive Signal Output
4	OUT-	AO1 Negative Signal Output
5	OUT-	AO1 Negative Signal Output
6	OUT+	AO3 Positive Signal Output
7	OUT+	AO3 Positive Signal Output
8	OUT-	AO3 Negative Signal Output
9	OUT-	AO3 Negative Signal Output
10	PE	AO3 Protective Earth

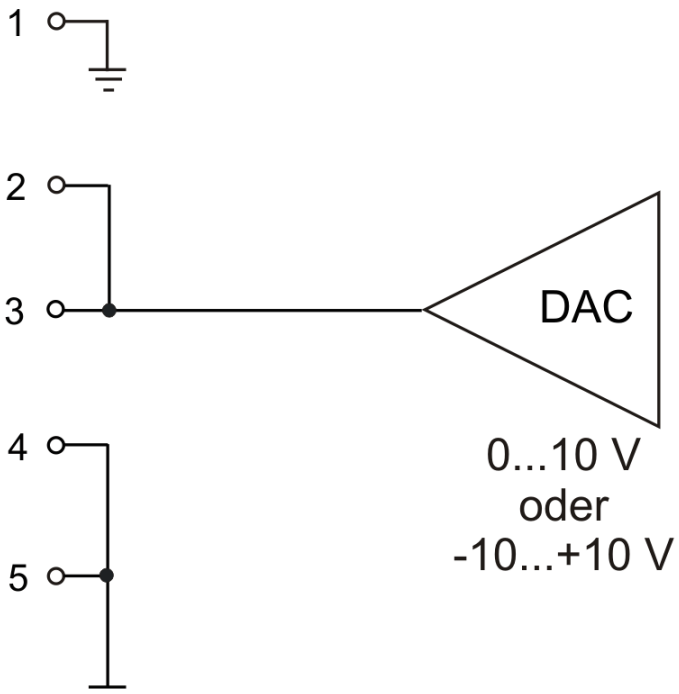
Terminal X2



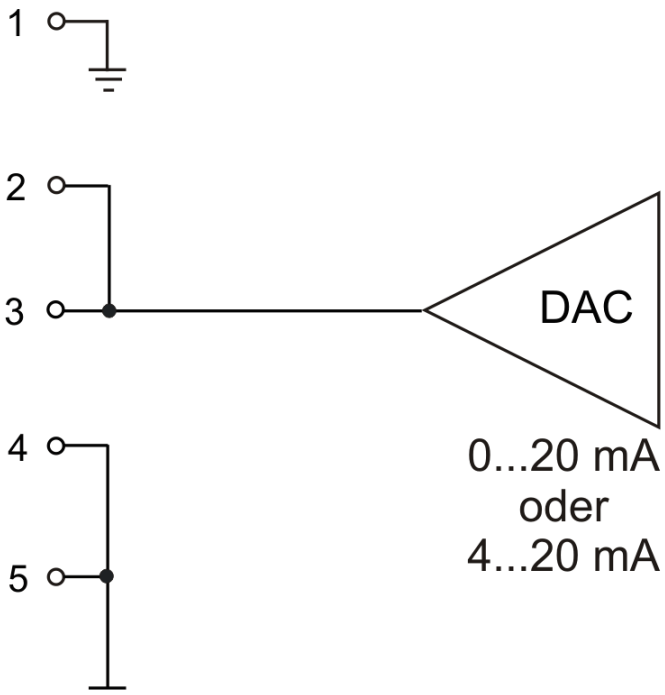
Pin	Signal	Description
1	PE	AO2 Protective Earth
2	OUT+	AO2 Positive Signal Output
3	OUT+	AO2 Positive Signal Output
4	OUT-	AO2 Negative Signal Output
5	OUT-	AO2 Negative Signal Output
6	OUT+	AO4 Positive Signal Output
7	OUT+	AO4 Positive Signal Output
8	OUT-	AO4 Negative Signal Output
9	OUT-	AO4 Negative Signal Output
10	PE	AO4 Protective Earth

11.3.5 Operation

11.3.5.1 Block Diagram Analog Voltage Outputs



11.3.5.2 Block Diagram Analog Current Outputs



12 Analog Combinations

12.1 Characteristics

The analog combinations can be configured by the rotary type switches. The basic module has two inputs and two outputs with one potential. Following input and output options are possible:

Inputs

NOTICE	**In case of temperature inputs and an open and/or short circuit sensor all inputs are affected.**

- Voltage Inputs
  DC 0...10 V or DC -10 ... +10 V
  selectable voltage or current source (10 V/ 20 mA)
- Current Inputs
  DC 0...20 mA, DC 4...20 mA, DC 0...24 mA or 0...40 mA
  selectable voltage or current source (10 V/ 20 mA)
- Temperature Input
  PT 100 or PT 1000 with 2-, 3- or 4-wire technology

Outputs

- Voltage Outputs
  -5...+5 V DC, 0...10 V DC or -10 ... +10 V DC
- Current Output
  0...20 mA DC, 4...20 mA DC or 0 ... 24 mA DC

It is also possible to choose an additional voltage supply source or a current source.

Voltage Supply Source

- Output Voltage
  DC 10 V
- Output Current
  max. 20 mA (sum of both outputs)

Current Source

- Output Current
  DC 20 mA
- Output Voltage
  max. 10 V
- Ohm resistive Load
  max. 500 Ohm

12.2 Characteristics

Inputs

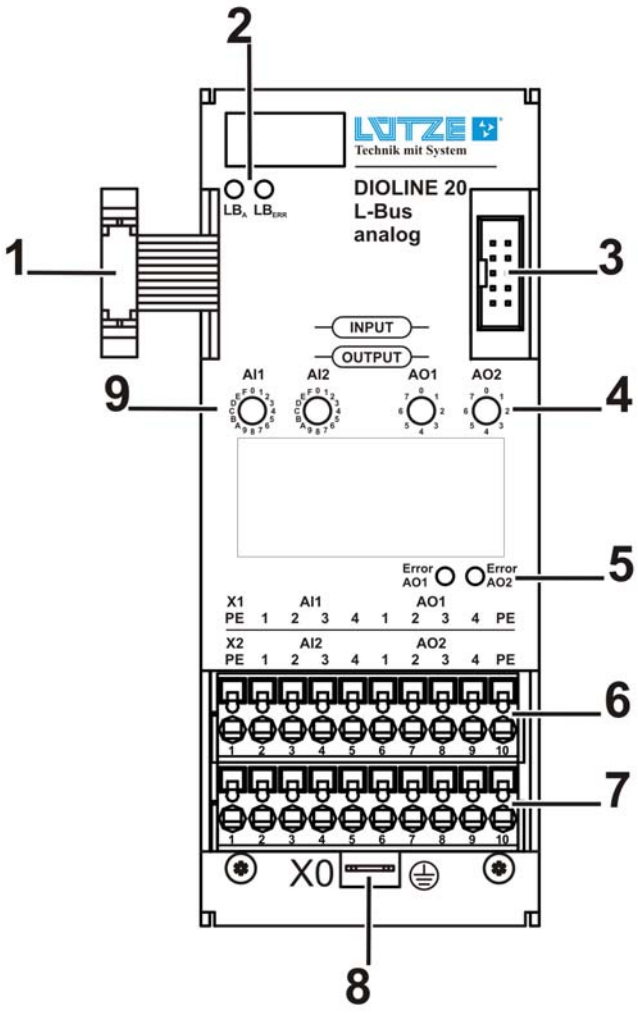
NOTICE	**In case of a sensor error at the configured temperature input, all input signals of both channels are isolated from the connecting clamps.** Channels which are not in use has to be configured with rotary switch posistion 0.

- Insulation Channel
  Potential insulation between the inputs and the system bus (not between the single inputs)
- Addiotional Insulation Channel
  Potential insulation between the inputs and outputs
- Input Diode
  For overload protection and surge protection
- Overcurrent Protection
  By PTC resistance

Outputs

- Insulation Channel
  Potential insulation between the outputs and the system bus (not between the single outputs)
- Addiotional Insulation Channel
  Potential insulation between the inputs and outputs
- Bipolar Suppressordiode
  Protection of voltage surge with a pulse power up to 400 W.
- Electronic Current Limiting
  At an output short circuit it avoids the damage of the module.

12.3 Product Assembly



1	L-Bus Interface – incoming
2	LED-Diagnosis Display – L-Bus
3	L-Bus Interface – outgoing
4	Rotary Switch Type for Analog Outputs
5	LED-Diagnosis Display – Analog Outputs
6	Connection analog Outputs/Inputs – X1
7	Connection analog Outputs/Inputs – X2
8	Neutral Conductor – Mounting Tab
9	Rotary Switch Type for Analog Inputs

12.3.1 LED Display

12.3.1.1 LEDs – L-Bus

LED	Color	Status
LB_A	green	active
LB_{ERR}	red	Error

12.3.1.2 LEDs – Analoge Outputs

LED	Color	Status	Description
ErrorAO1	red	Error	Following errors could appear: ▪ Overtemperature of the output stage Load Failure: ▪ Voltage range: voltage outside of +/- 15 V ▪ Current range: open or short circuit load
ErrorAO2	red	Error	Following errors could appear: ▪ Overtemperature of the output stages Load Failure: ▪ Voltage Range: Voltage outside of +/- 15 V ▪ Current Range: open or short circuit load

12.3.2 Technical Data

General	
Number	Inputs: 2 Outputs: 2
Data Width in the Process Image	2x16 Bit
Potential Insulation	AC 500 V between the L-Bus, analog inputs and analog outputs
Current Consumption	nom. 200 mA at DC 24 V (current-/ voltage supply at full load), max. 300 mA at DC 16.8 V
Module Status Flag	The module status flag remains to “0“. (“0“ = no hardware error)

12.3.2.1 Analog Voltage Inputs

Voltage Input DC 0...10 V	
Input Signal	Voltage DC 0...10 V
Input Resistance	200 kΩ
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 2.442 mV
Measured Value Exposion	16 Bit unsigned intel format 0 V – 0000 hex 5 V – 0800 hex 10 V – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Max Input Voltage	DC ±30 V

Voltage Input
DC -10 ...+10 V

Input Signal	Voltage DC -10...+10 V
Input Resistance	200 kΩ
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 4.884 mV
Measured Value Exposion	16 Bit signed intel format -10 V – F800 hex 0 V – 0000 hex 10 V – 07FF hex
Accuracy	± 0.5%
Sampling Rate	100 Hz
Max Input Voltage	DC ±30 V

12.3.2.2 Analog Current Inputs

Current Input DC 0..20 mA	
Input Signal	Current DC 0..20 mA
Input Resistance	35...45 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit,1 LSB=DC 4.884 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 10 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Max. Input Voltage	DC ± 35 V
Safety Function	inverse-polarity protection, PTC overcurrent protection

Current Input DC 4...20 mA	
Input Signal	Current DC 4...20 mA
Input Resistance	35...45 Ω
Datad Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 3.907 µA
Measured Value Exposion	16 bit unsigned intel format 4 mA – 0000 hex 12 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Max Input Voltage	DC ± 35 V
Protection Function	inverse-polarity protection, PTC overcurrent protection

Current Input DC 0...24 mA

Input Signal	Current DC 0...24 mA
Input Resistance	35...45 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB=DC 5.86 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 12 mA – 0800 hex 24 mA – 0FFF hex
Safety Function	inverse-polarity protection, PTC overcurrent protection

Current Input DC 0...40 mA

Input Signal	Current DC 0...40 mA
Input Resistance	35...45 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB = DC 9.768 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 20 mA – 0800 hex 40 mA – 0FFF hex
Safety Function	inverse-polarity protection, PTC overcurrent protection

12.3.2.3 Analoge Temperature Inputs

Temperature Input PT 100

Input Signal	Temperature -100...+350 °C
Measuring Current	1 mA
Data Width in the Process Image	16 Bit
Resolution	16 Bit, 1 LSB = 24.4 mK
Measured Value Exposion	16 bit signed intel format -100 °C – F000 hex – error -50 °C – F800 hex 0 °C – 0000 hex 100 °C – 1000 hex 350 °C – 3800 hex – error
Accuracy	-100 ... 0 °C: ± 1.7 K 0 ... 100 °C: ± 0.5 K 100 ... 350 °C: ± 1.7 K
Sampling Rate	200 Hz
Max Input Voltage	DC ±30 V
Connection	2-,3- or 4- wire technology

Temperature Input PT 1000

Input Signal	Temperature -100..+350 °C
Measuring Current	250 µA
Data Width in the Process Image	16 Bit
Resolution	16 Bit, 1 LSB = 24.4 mK
Measured Value Exposion	16 bit signed intel format -100 °C – F000 hex – error -50 °C – F800 hex 0 °C – 0000 hex 100 °C – 1000 hex 350 °C – 3800 hex – error
Accuracy	-100 ... 0 °C: ± 1.7 K 0 ... 100 °C: ± 0.5 K 100 ... 350 °C: ± 1.7 K
Sampling Rate	200 Hz
Max Input Voltage	DC ±30 V
Connection	2-,3- oder 4-wire technology

12.3.2.4 Voltage Outputs

Voltage Output DC -5 ... +5V	
Output Signal	Voltage DC -5...+5 V
Max Output Current	20 mA
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB=DC 2.442 mV
Measured Value Exposion	16 Bit signed Intel-Format -5 V – 0000 hex 0 V – 0800 hex 5 V – 07FF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Safety Function	short-circuit prooved, overvoltage protected up to DC ±30 V

Voltage Input -10 ...+10 V DC	
Output Signal	Voltage DC -10...+10 V
Max Output Current	2 mA
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 4.884 mV
Measured Value Exposion	16 Bit signed intel format -10 V – F800 hex 0 V – 0000 hex 10 V – 07FF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Safety Function	short-circuit prooved, overvoltage protected up to DC ±30 V

Voltage Input DC 0 ...10 V

Output Signal	Voltage DC 0...10 V
Max Output Current	20 mA
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 2.442 mV
Measured Value Exposion	16 Bit signed intel format 0 V – 0000 hex 5 V – 0800 hex 10 V – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz
Safety Function	short-circuit prooved, overvoltage protected up to DC ±30 V

12.3.2.5 Current Output

Current Output DC 0..20 mA

Output Signal	Current DC 0..20 mA
Max Resistance	500 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 4.884 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 10 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz

Current Output DC 0..24 mA

Output Signal	Current DC 0..24 mA
Max Resistance	500 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 5.86 µA
Measured Value Exposion	16 bit unsigned intel format 0 mA – 0000 hex 12 mA – 0800 hex 24 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz

Current Output DC 4..20 mA

Output Signal	Current DC 0..20 mA
Max Resistance	500 Ω
Data Width in the Process Image	16 Bit
Resolution	12 Bit, 1 LSB= DC 3.907 µA
Measured Value Exposion	16 bit unsigned intel format 4 mA – 0000 hex 12 mA – 0800 hex 20 mA – 0FFF hex
Accuracy	± 0.5%
Sampling Rate	200 Hz

12.3.3 Configuration of the analog Inputs and Outputs

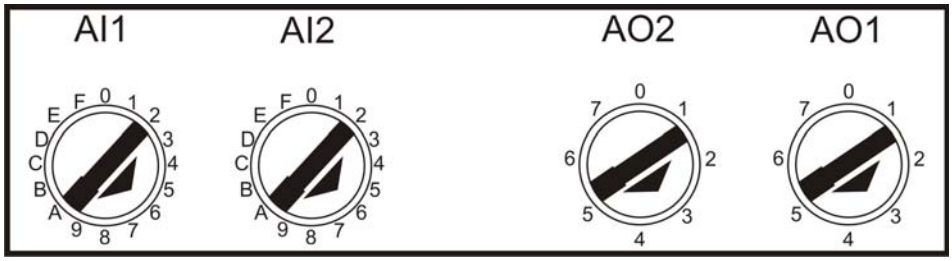
The input ranges can be configured by setting the rotary-type switches A1 and A2.

The output ranges can be configured by setting the rotary-type switches AO1 and AO2.

The table below shows which settings have to made for the single in - and output ranges.

NOTICE

Switch off the product before setting the ranges. Otherwise it can cause errors in the communication.
Channels which are not in use has to be configured with rotary switch posistion 0.



Switch Setting	Input Ranges AI1 and AI2	Output Ranges AO1 and AO2
0	-10...+10 V/10 V – Source	-5...+5 V
1	-10...+10 V/20 mA – Source	-10...+10 V
2	0...10 V/10 V – Source	0...10 V
3	0...10 V/20 mA – Source	0...20 mA
4	0...20 mA/10 V – Source	4...20 mA
5	0...20 mA /20 mA – Source	0...24 mA
6	4...20 mA /10 V – Source	No Function
7	4...20 mA/20 mA – Source	No Function
8	0...24 mA/10 V – Source	
9	0...24 mA/20 mA – Source	
A	0...40 mA/10 V – Source	
B	PT100 (1 mA – Measuring Current)	
C	PT100 (1 mA/3-conductor)	
D	PT1000 (250 µA – Measuring Current)	
E	PT1000 (250 µA/3-Conductor)	
F	no function	

12.3.4 Connecting the Analog Inputs

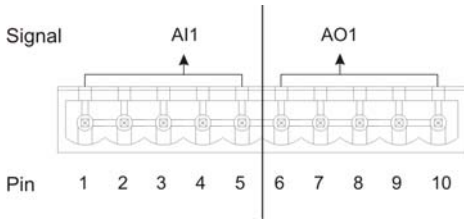
Connect the analog inputs via the terminal X1 and X2. Proceed as follows:

1. Switch off the voltage of the system.
2. Connect the inputs regarding the pin assignment.

Analog Voltage Inputs

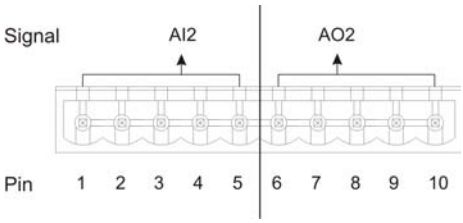
The inputs are arranged on the two cage clamps.
The input AI 1 is on cage clamp X1 (Pin1-5).
The input AI 2 is on cage clamp X2 (Pin1-5).
The inputs are identical:

Terminal X1



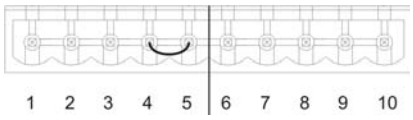
Pin	Signal	Description
1	PE	AI1 Protective Earth
2	SRC	AI1 Power Supply/ Current Source
3	IN+	AI1 Positive Signal Input
4	IN-	AI1 Negative Signal Input
5	GND	AI1 internal connected with GND

Terminal X2



Pin	Signal	Description
1	PE	AI2 Protective Earth
2	SRC	AI2 Power Supply/ Current Source
3	IN+	AI2 Positive Signal Input
4	IN-	AI2 Negative Signal Input
5	GND	AI2 internal connected with GND

Voltage Measuring



To measure the voltage do following step:

1. Connect a bridge on the particular cage clamp between Pin 4 IN- and Pin 5 GND.

Analog Current Inputs

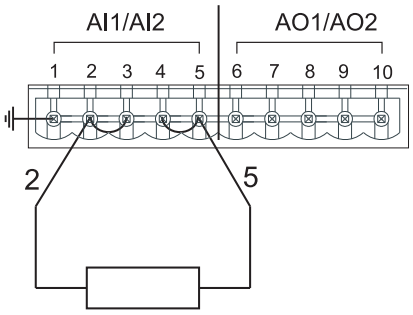
The pin assignment of the current inputs is conform to the pin assignment of the voltage inputs. Please read *page 61.*

Analog Temperature Inputs

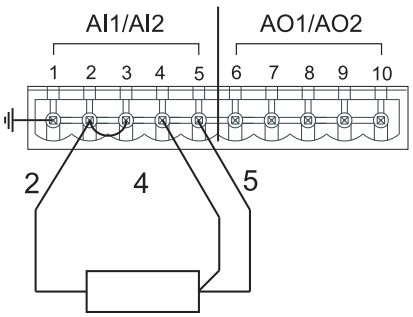
The pin assignment of the temperature inputs in conform to the pin assignment of the voltage inputs. Please read *page 61*.

The temperature sensors can be connected according to the 2-,3- or 4-wire technology.
Connect the inputs via a bridge as shown in the pictures.

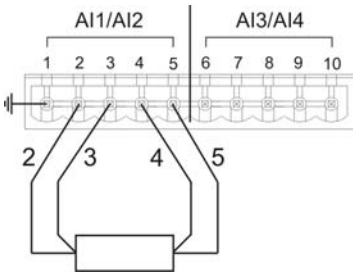
- Connection 2 wire technology



- Connection 3 wire technology



- Connection 4 wire technology



12.3.5 Connecting the analog Outputs

Connect the analog outputs via the terminal X1 and X2. Proceed as follows:

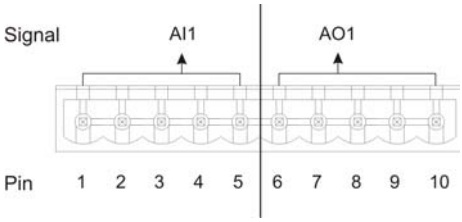
1. Switch off the voltage of the system.
2. Connect the outputs regarding the pinassignment.

Analog Voltage Outputs

The outputs are arranged on the two cage clamps.
The output AO 1 is on cage clamp X1 (Pin 6-10).
The output AO 2 is on cage clamp X2 (Pin 6-10).
The outputs are identical:

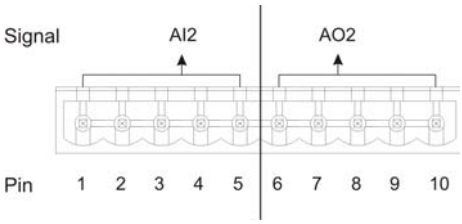
Terminal X1

Pin	Signal	Description
6	OUT+	AO1 Positive Signal Output
7	OUT+	AO1 Positive Signal Output
8	OUT-	AO1 Negative Signal Output
9	OUT-	AO1 Negative Signal Output
10	PE	AO1 Protective Earth



Terminal X2

Pin	Signal	Description
6	OUT+	AO2 Positive Signal Output
7	OUT+	AO2 Positive Signal Output
8	OUT-	AO2 Negative Signal Output
9	OUT-	AO2 Negative Signal Output
10	PE	AO2 Protective Earth

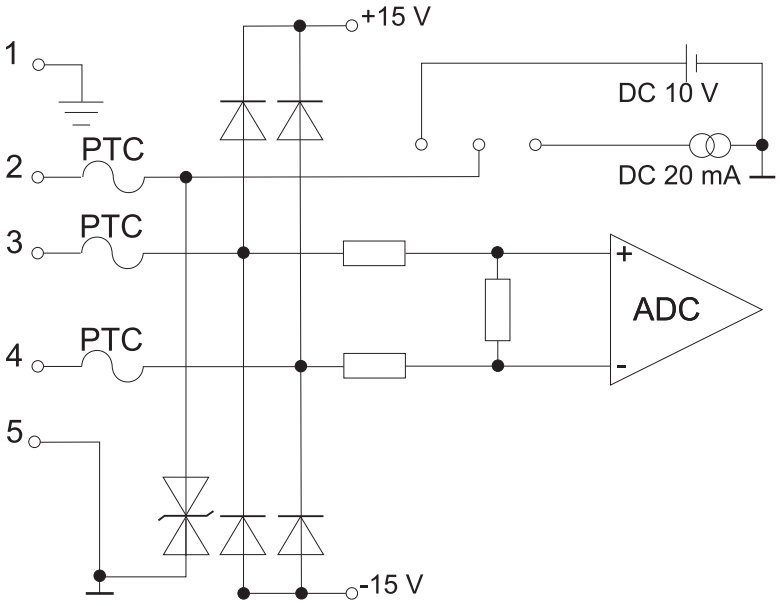


Analog Current Output

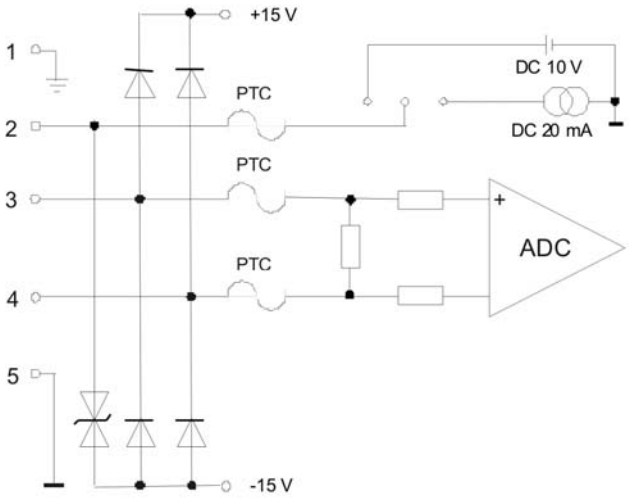
The pin assignment of the current inputs is conform to the pin assignment of the voltage inputs. Please read *page 64.*

12.3.6 Operation

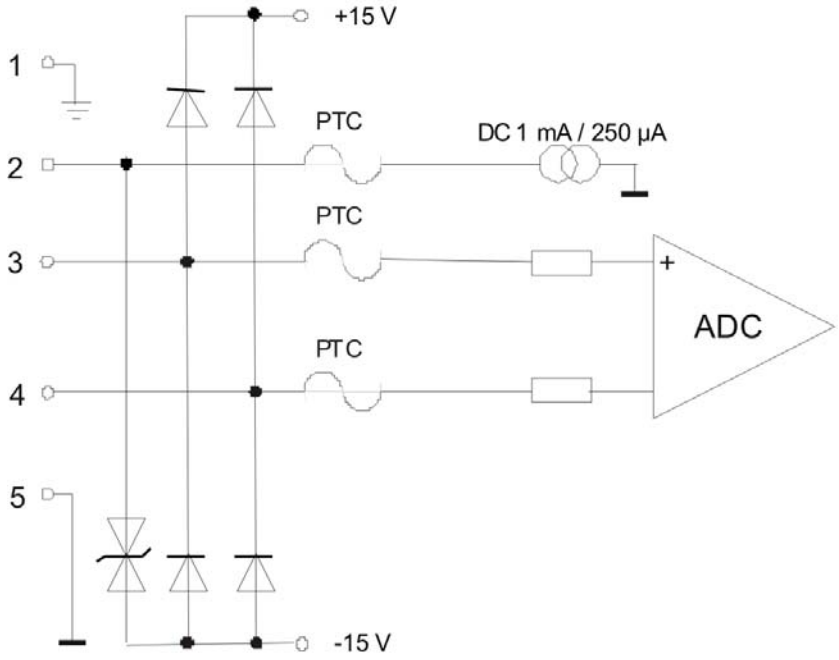
12.3.6.1 Block Diagram Analog Volatge Inputs



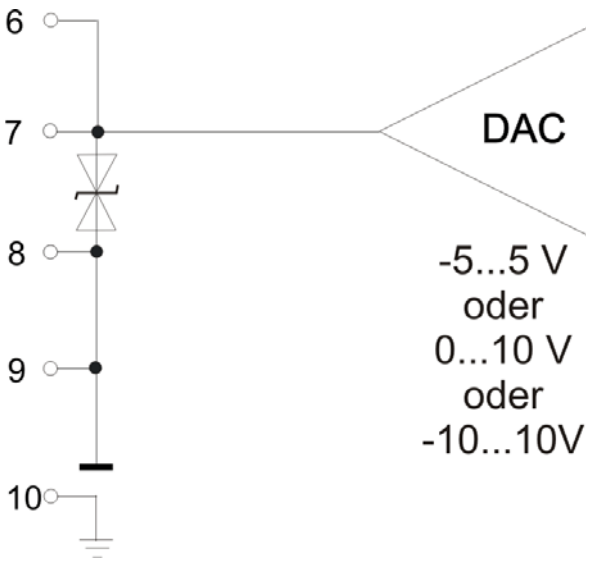
12.3.6.2 Block Diagram Analog Current Inputs



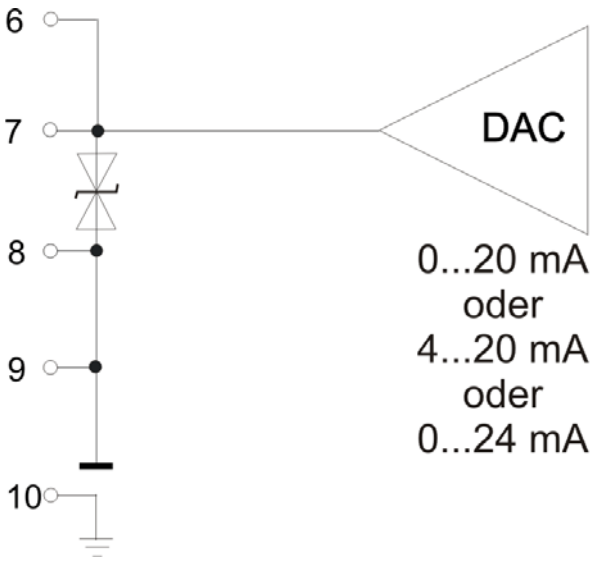
12.3.6.3 Block Diagram Temperature Inputs



12.3.6.4 Block Diagram Voltage Outputs

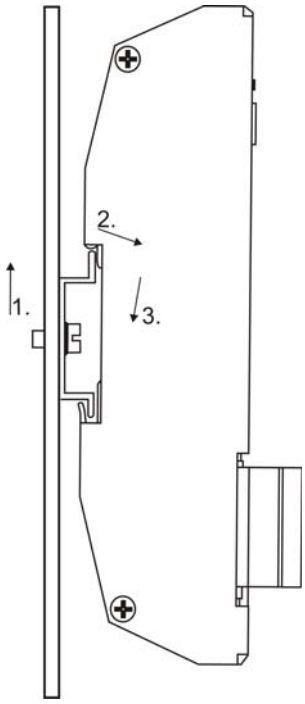


12.3.6.5 Block Diagram Current Outputs



13 Demounting

1. Push the module up.
2. Pull the module from the top-hat rail.
3. Push the module down and take the module off the rail.



14 Final Shutdown and Disposal

Mind the valid environmental standard of your country for the final shutdown and disposal.

For the final shutdown the device has to be disassembled. Electric Parts must be disposed after the national electronic scrap regulation. You take the responsibility for the shipped article. You have to dispose the article after the terms of use and legal liability on your own costs and exempt the Lütze Transportation GmbH from the responsibilities of §10 passage 2 ElektroG (Take-back obligation of the manufacturer) and any third party in this content.

If you have handled the device to a commercial third party without any contractual acceptance of the disposal, you have to take back the device after the final shutdown on your own cost and the legal liability.

The entitlement of indemnity from the Lütze Transportation GmbH by the customer does not prescribe before two years after the final shut down of the device. The two year deadline of the suspension of statue forlimitations can start with a written message about the terms from you to the Lütze Transportation GmbH.

15 Service

If you have any further questions regarding the product or our repairing service please contact us:

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71384 Weinstadt
Tel.: +49 (0) 7151 6053-545
Fax: +49 (0) 7171 6053-6545
Sales.Transportation@luetze.de

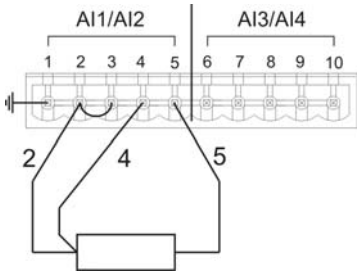
16 Appendix

16.1 Overview – DIOLINE 20 Identifier

Type	I/O-Range	Length (Bytes)		ID (hex)
		I	O	
4 Analog Inputs	4AI	8	0	70
4 Analog Outputs	4AO	0	8	71
4 Analog Inputs multiplexed	4AIM	4	0	72
4 Analog Outputs multiplexed	4AOM	0	3	73
6 Analog Inputs	6AI	12	0	74
6 Analog Outputs	6AO	0	12	75
2 Analog Inputs, 2 Analog Outputs	2AI/2AO	4	4	76
4 Analog Inputs, 4 Analog Outputs	4AI/4AO	8	8	77
4 Analog Inputs, 2 Analog Outputs	4AI/2AO	8	4	78

16.2 Error Status – Analoge Temperatur I/O Module

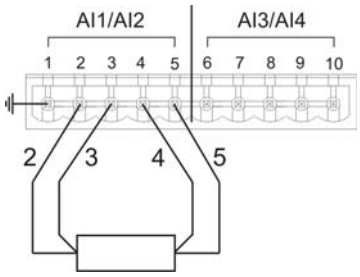
16.2.1 Module connected via 3-wire-technology



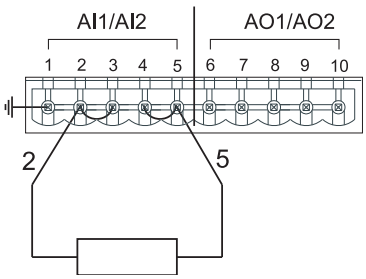
Value	Error
0xF000h or 0x3800h	▪ Short circuit PT100 Sensor ▪ Loss of measuringpoint ADC1 (break of connection at pin 3)
0x3800h	▪ Loss of supply voltage (break of connection at pin 2) ▪ Break of connection at pin 2 or 3 ▪ Break of connection at PT100 Sensor ▪ Loss of input ADC (break of connection at pin 4)

16.2.2 Module connected via 2- or 4-wire-technology

2-wire-technology



4-wire-technology



Value	Error
0xF000h or 0x3800h	▪ No sensor connected during powering on. ▪ Loss of input ADC1 (Ubreak of connection at pin 3) ▪ Short circuit PT100 Sensor ▪ Loss of input ADC 2 (break of connection at pin 4)
0x3800h	▪ Loss of supply voltage (break of connection at pin 2) ▪ Break of connection at PT100 Sensor ▪ Loss of ground (break of connection at pin 5)

17 History of Revision

Version	Change
3.70	Supplement ▪ Error Status of Analog Temperature I/O Module ▪ References regarding the Analog Temperature I/O Module ▪ References regarding the Analog I/O Module -10...+10 V Modification of the document layout