

SIEMENS

SICAM A8000 Series

SICAM I/O Modules

Preface

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Open Source Software

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Standard I/O Modules

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**Note**

Please observe Notes and Warnings for your own safety in the Preface.

Disclaimer of Liability

Although we have carefully checked the contents of this publication for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded.

The information provided in this manual is checked at regular intervals and any corrections that might become necessary are included in the next releases. Any suggestions for improvement are welcome.

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Preface

This document is applicable to the following product(s):

- CP-8000
- CP-8021
- CP-8022
- CP-8050

Purpose of this manual

This manual describes the characteristics and functions of all SICAM input/output modules. It contains:

- Functional Overviews
- Technical Specifications
- Interface Descriptions
- External Circuit Elements

Target Group

The document you are reading right now is addressed to sales engineers and users who are in charge of the following engineering tasks:

- Evaluation of the module specifications
- Evaluation of quotation criteria, such as technical specifications
- Conceptual activities, as for example design and configuration
- Electrical installation
- Technical system maintenance and service, module handling

Recommendations for Third-Party Products

Siemens does neither receive liability nor warranty for recommendations which are given or implied by this manual. For the correct and intended use of the respective product the associated technical descriptions must be paid attention to in any case.

References to Third-Party Web Sites

Siemens is not responsible for the contents of third-party websites mentioned in this document, as well as the correctness of the publications and links. For all product information the respective manufacturer is responsible.

Placement in the Information Landscape

Document	Item number
Common Functions Peripheral Elements according to IEC 60870-5-101/104	DC0-011-2
SICAM A8000 Series – CP-8000, CP-8021, CP-8022 Manual	DC8-023-2

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Notes on Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question because special operating conditions might require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.



Danger

means that death, serious bodily injury or considerable property damage **will** occur, if the appropriate precautionary measures are not carried out.



Warning

means that death, serious bodily injury or considerable property damage **can** occur, if the appropriate precautionary measures are not carried out.

Caution

means that minor bodily injury or property damage could occur, if the appropriate precautionary measures are not carried out.



Note

is important information about the product, the handling of the product or the respective part of the documentation, to which special attention is to be given.

Qualified Electrical Engineering Personnel

Qualified electrical engineering personnel may commission and operate the device described in this document. Qualified electrical engineering personnel in the sense of this document are people who can demonstrate up to date technical qualifications as electrical technicians including safety and first aid training. These person may commission, isolate, ground and label devices, systems and circuits according to the standards of safety engineering.

Use as Prescribed

The device may only be used for such applications as set out in the catalogs and the technical description, and only in combination with third-party equipment recommended and approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation and mounting in a control cabinet, as well as appropriate use and maintenance.

During operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections, ground the equipment at the grounding terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- The device does not represent a safety-oriented application.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- LED display does not ensure that the connectors are free of voltage.
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual must not be exceeded; that also applies to testing and commissioning.



Danger

Consider obligatory the safety rules for the accomplishment of works at electrical plants:

1. Switch off electricity all-pole and on all sides!
 2. Ensure that electricity cannot be switched on again!
 3. Double check that no electrical current is flowing!
 4. Discharge, ground, short circuit!
 5. Cover or otherwise isolate components that are still electrically active!
-

Statement of Conformity



The product described conforms to the regulations of the following European Directives:

- 2014/30/EU
Directive of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility; Official Journal of the EU L96, 29/03/2014, p. 79–106
- 2014/35/EU
Directive of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits; Official Journal of the EU L96, 29/03/2014, p. 357–374
- 2011/65/EU
Directive of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment; Official Journal of the EU L174, 01/07/2011, p. 88-110





The conformity of the product with the above mentioned regulations is proven through the observance of the following harmonized standards:

- EN 60870-2-1:1996 for 2014/35/EU
- EN 61010-1:2010 for 2014/35/EU
- EN 50581:2012 for 2011/65/EU

This declaration certifies the conformity with the specified directives, but is not an assurance of characteristics in the sense of the product liability law.

The product is intended exclusively for use in an industrial environment.

Symbols used on the I/O Modules

Symbol	Description	Symbol	Description
	Warning, risk of electric shock		Protection class II / protective insulation
	Caution, risk of danger. The documentation must be observed.		CE conformity

Symbols used in Connection Diagrams

Symbol	Description	Symbol	Description
	Functional earth (FE)		Protective earth (PE)

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1 Introduction

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1.1 Overview

1.1.1 Application

The SICAM I/O modules are used for external expansion of the SICAM A8000 Series with additional in- and outputs. The modules can only be used in combination to SICAM CMIC and the coupling module for SICAM I/O modules.

The SICAM A8000 Series is suitable for electrical distribution substations, gas distribution substations, hydropower plants, pipelines and railway power supplies.

The SICAM I/O modules are used in the peripheral element of the SICAM A8000 Series from the SICAM RTUs system family.

Peripheral Element	Designation
CP-8000/USIO81	Universal Signal Input / Output

1.1.2 I/O Modules

I/O Module	Designation	MLFB
DI-8110	Binary Input 2x8, 24 VDC	6MF28110AA00
DI-8111	Binary Input 2x8, 48/60 VDC	6MF28111AA00
DI-8112	Binary Input 2x8, 110 VDC	6MF28112AA00
DI-8113	Binary Input 2x8, 220 VDC	6MF28113AA00
DO-8212	Binary Output Relays 8x 24...220 VDC/230 VAC	6MF28212AA00
AI-8310	Analog Input 2x2 Pt100/Pt1000	6MF28310AA00
AI-8320	Analog Input 4x ± 20 mA/ ± 10 V	6MF28320AA00
AI-8510	Analog Input 3x V, 3x C (LoPo)	6MF28510AA00
AI-8511	Analog Input 3x V (LoPo), 3x C (LoPo)	6MF28511AA00
AO-8380	Analog Output 4x ± 20 mA/ ± 10 V	6MF28380AA00

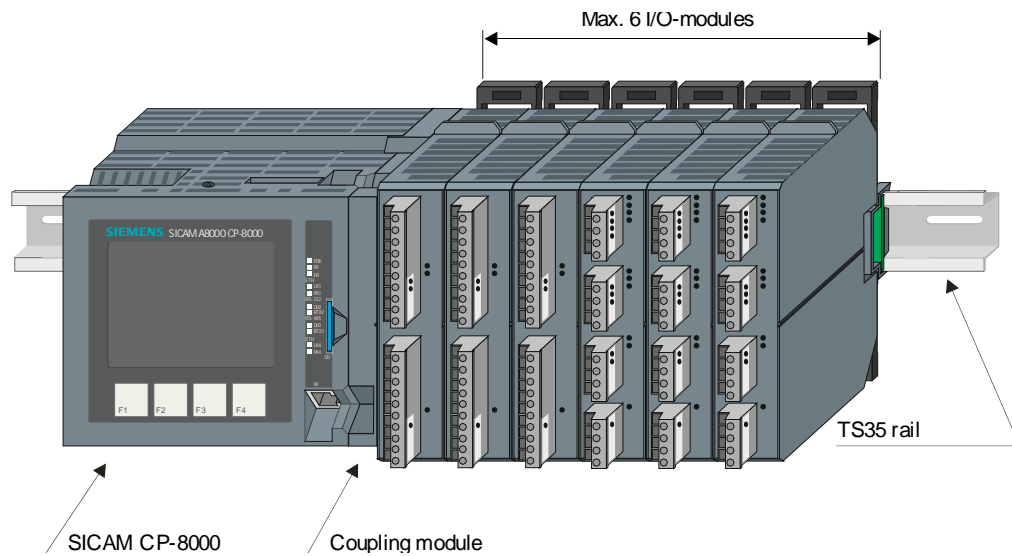
1.1.2.1 Accessories

I/O Module	Designation	MLFB
CM-8811	Coupling module SICAM I/O Modules (only for SICAM CP-8000)	6MF28811AA00
CM-8812	Bus connector SICAM I/O 10 pcs. (spare part)	C53207-A5812-D481
CM-8820	Current transformer adaptor module 3x C (1 A/5 A)	6MF28820AA00

1.2 Mechanical Design

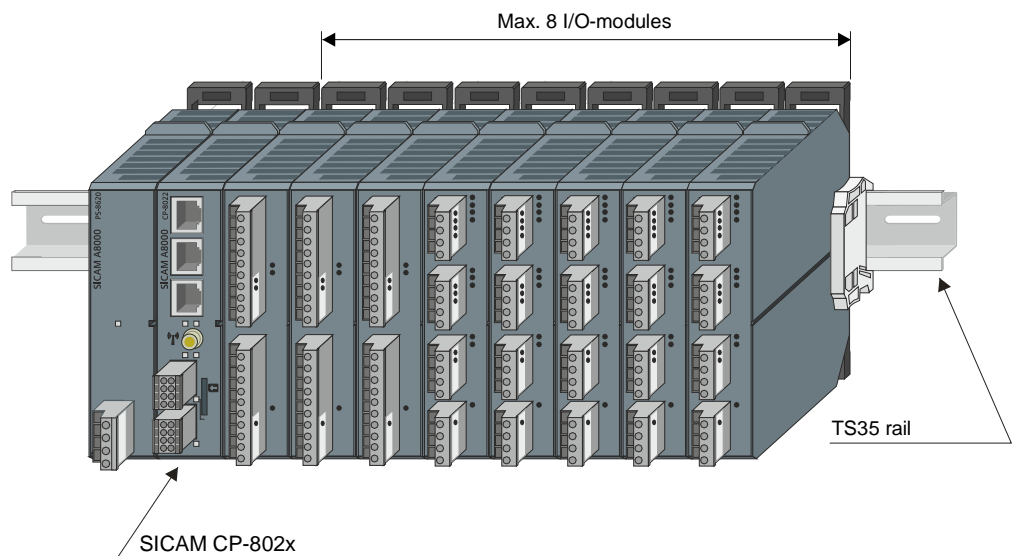
1.2.1 System SICAM CMIC CP-8000

A SICAM CP-8000 system can be expanded by means of the coupling module CM-8811 with up to 6 external I/O modules. The modules are mounted on a TS35 rail (DIN rail).

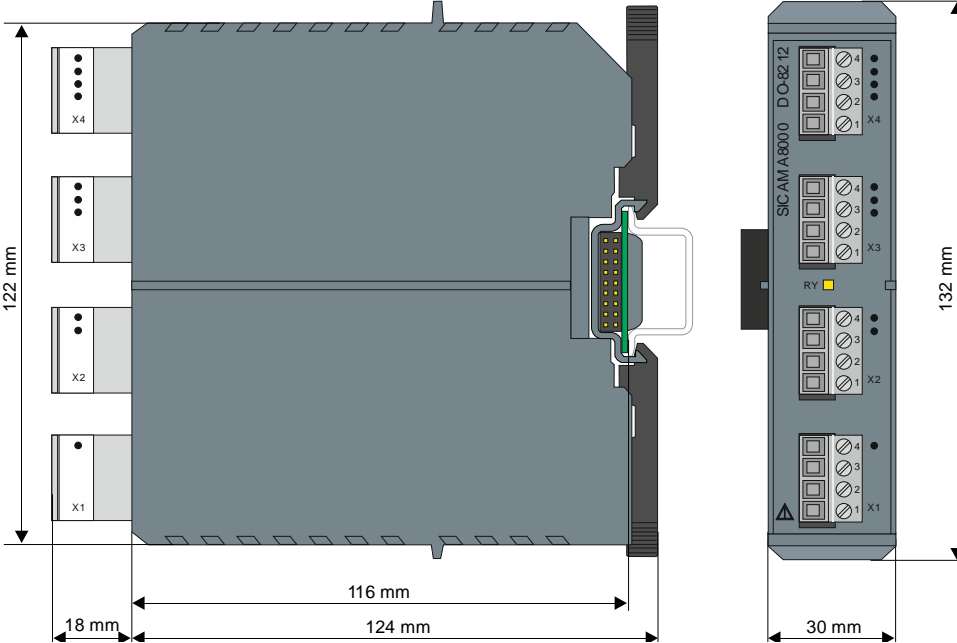


1.2.2 System SICAM CMIC CP-802x

A SICAM CP-802x system can be expanded with up to 8 I/O modules. The modules are mounted on a TS35 rail (DIN rail).



1.2.3 I/O Modules Dimensions



1.3 Commissioning

1.3.1 Mounting

Precondition for the mounting of the SICAM I/O module is, that the SICAM A8000 System, which should be expanded, is already mounted on the DIN rail.

Then you can mount the bus connector, which is delivered with the SICAM I/O module, on the DIN rail and press it into the connector of the master module (in case of SICAM CP-8000 in the connector of the coupling module). Afterwards you can plug the SICAM I/O module on the bus connector.

The removal and plugging of SICAM I/O Modules is permitted also in operation (energized). The behavior is dependent of the respective system type and of the firmware of the peripheral element.



Note

For details about the mounting refer to the manual *SICAM A8000 Series CP-8000, CP-8021, CP-8022*.

1.3.2 Electrical Connection

- Check the adherence of the specified limit values.
- Connect the process-devices to the screw terminals.
Cabinet-internal wiring is preferably carried out with plastic-insulated cables according to DIN VDE 298 T4 2/89. Types: H05V-K/H05V2-K (0.5...1 mm²) or H07V-K/H07V2-K (1.5...2.5 mm²). Use only copper wires.

Due to the power dissipation in the device there is a higher temperature on the terminals than the device ambient temperature. This increase is maximum 15 °C with full load. For this reason the isolation of the wires must withstand a higher temperature than the device environment temperature.

Example:

Max. environment temperature	Max. temperature on the terminal	appropriate wire type
55 °C	70 °C	H05V-K, H07V-K
70 °C	85 °C	H05V2-K, H07V2-K



Note

The SICAM I/O modules are switched ON and OFF with the SICAM A8000 master module.

1.3.3 Labeling

The following places on the SICAM I/O modules are reserved for labels:

- Area on the center left hand side of the housing label
Label with 2D code for scanning and readable serial number (upon delivery already stuck)
- Bevel at the housing front, bottom
Operational equipment indicator (free definable)

2 Standard I/O Modules

Contents

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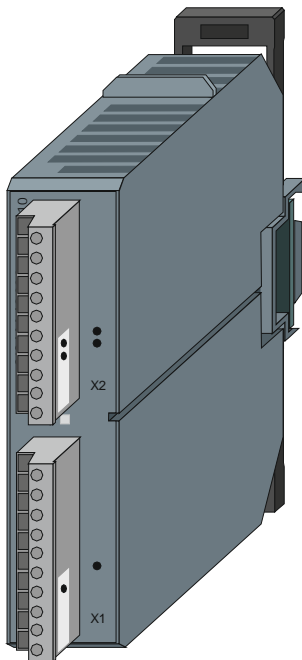
2.1 DI-8110

2.1.1 Features

Binary input module

- Mounting on DIN rail
- 16 inputs (2 groups of 8 each)
- Galvanical insulation by optocouplers
- Each group has a common return
- Signal voltage DC 24 V
- Removable screw terminals
- Indication of function via LED
- Acquisition with a resolution of 1 ms

2.1.2 View



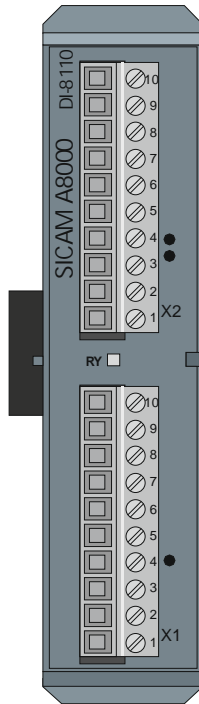
2.1.3 Technical Specifications

Binary Inputs					
16 binary inputs	<ul style="list-style-type: none"> · 2 groups, 8 inputs each · Galvanical insulation · Each group has a common return of selectable polarity 				
Filter time	3 ms ^{*)}				
Nominal voltage	DC 24 V				
Operating points	<table border="0"> <tr> <td>£ 12 V</td> <td>logical "0"</td> </tr> <tr> <td>³ 18 V</td> <td>logical "1"</td> </tr> </table>	£ 12 V	logical "0"	³ 18 V	logical "1"
£ 12 V	logical "0"				
³ 18 V	logical "1"				
Input circuits	DC 18...31.2 V The circuits are operated by means of an external voltage				
Rated current	0.9...4.8 mA at 18...31.2 V				
Power Supply					
Operating voltage	DC 4.75...5.5 V 130 mW The voltage is picked off at the system bus				
Mechanics and Connectors					
Terminals	Removable screw terminals (grid size 5.08)				
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)				
Weight	Approx. 249 g (inkl. bus module 12 g)				

^{*)} if the sensor voltage of a group of binary inputs is monitored for failures (parameter `SVM_monitoring`), there is a dedicated binary input for each group (IN D07 and IN D17), this input has a filter time of 2 ms

2.1.4 Pin Assignment and Display

The process signals must be connected to four 10-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
10	COM00
9	COM00
8	IN D07
7	IN D06
6	IN D05
5	IN D04
4	IN D03
3	IN D02
2	IN D01
1	IN D00

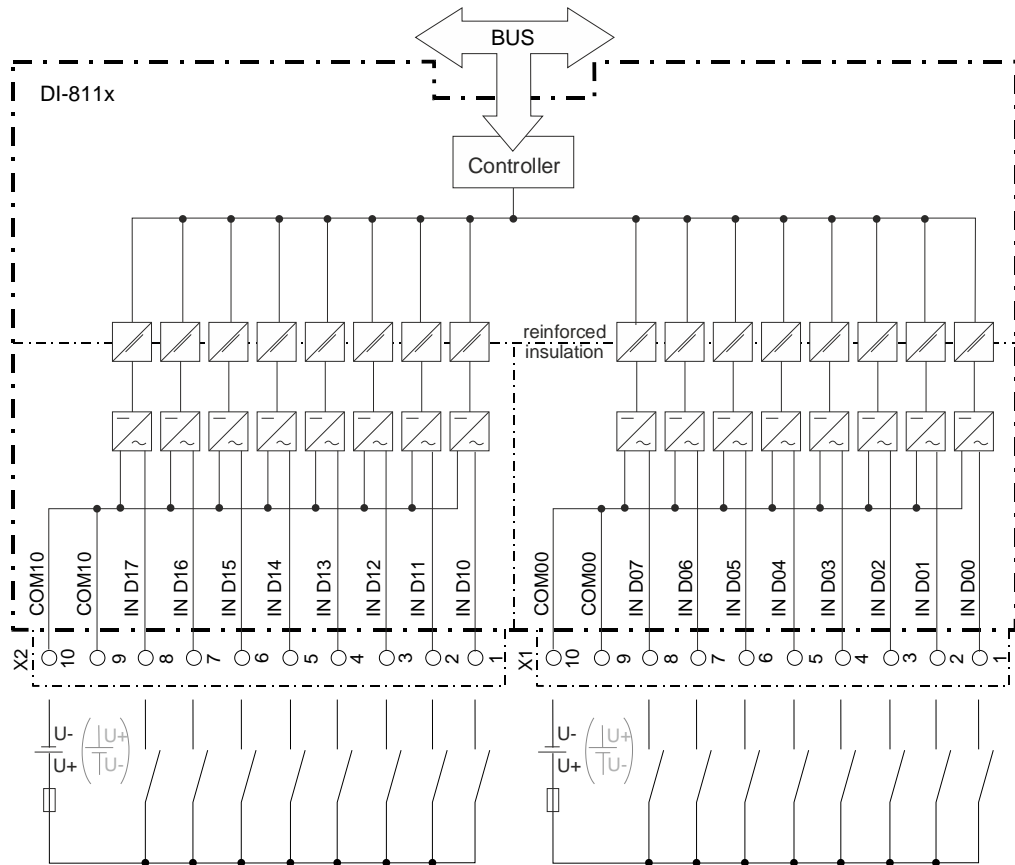
X2	
Pin	Signal
10	COM10
9	COM10
8	IN D17
7	IN D16
6	IN D15
5	IN D14
4	IN D13
3	IN D12
2	IN D11
1	IN D10

IN D00...IN D07
 IN D10...IN D17
 COM00
 COM10
 RY

binary inputs group 0, inputs 0...7
 binary inputs group 1, inputs 10...17
 common supply of group 0
 common supply of group 1
 readiness

2.1.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



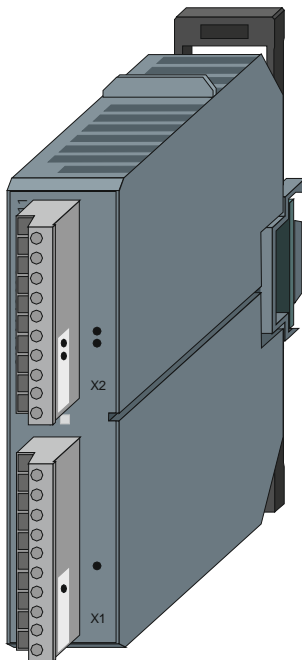
2.2 DI-8111

2.2.1 Features

Binary input module

- Mounting on DIN rail
- 16 inputs (2 groups of 8 each)
- Galvanical insulation by optocouplers
- Each group has a common return
- Signal voltage DC 48/60 V
- Removable screw terminals
- Indication of function via LED
- Acquisition with a resolution of 1 ms

2.2.2 View



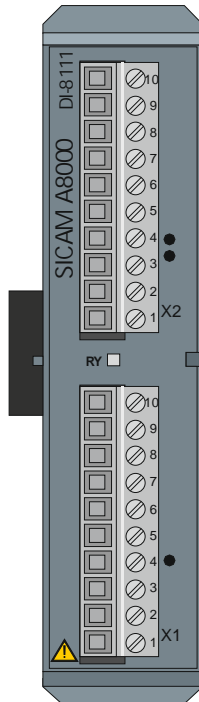
2.2.3 Technical Specifications

Binary Inputs	
16 binary inputs	<ul style="list-style-type: none"> · 2 groups, 8 inputs each · Galvanical insulation · Each group has a common return of selectable polarity
Filter time	3 ms ^{*)}
Nominal voltages	DC 48/60 V
Operating points	£ 24 V logical "0" ³ 36 V logical "1"
Input circuits	DC 36...78 V The circuits are operated by means of an external voltage
Rated current	0.5...2.5 mA at 36...78 V
Power Supply	
Operating voltage	DC 4.75...5.5 V 130 mW The voltage is picked off at the system bus
Mechanics and Connectors	
Terminals	Removable screw terminals (grid size 5.08)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 249 g (inkl. bus module 12 g)

^{*)} if the sensor voltage of a group of binary inputs is monitored for failures (parameter `SVM_monitoring`), there is a dedicated binary input for each group (IN D07 and IN D17), this input has a filter time of 2 ms

2.2.4 Pin Assignment and Display

The process signals must be connected to 2 pieces 10-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
10	COM00
9	COM00
8	IN D07
7	IN D06
6	IN D05
5	IN D04
4	IN D03
3	IN D02
2	IN D01
1	IN D00

X2	
Pin	Signal
10	COM10
9	COM10
8	IN D17
7	IN D16
6	IN D15
5	IN D14
4	IN D13
3	IN D12
2	IN D11
1	IN D10

IN D00...IN D07

IN D10...IN D17

COM00

COM10

RY

binary inputs group 0, inputs 0...7

binary inputs group 1, inputs 10...17

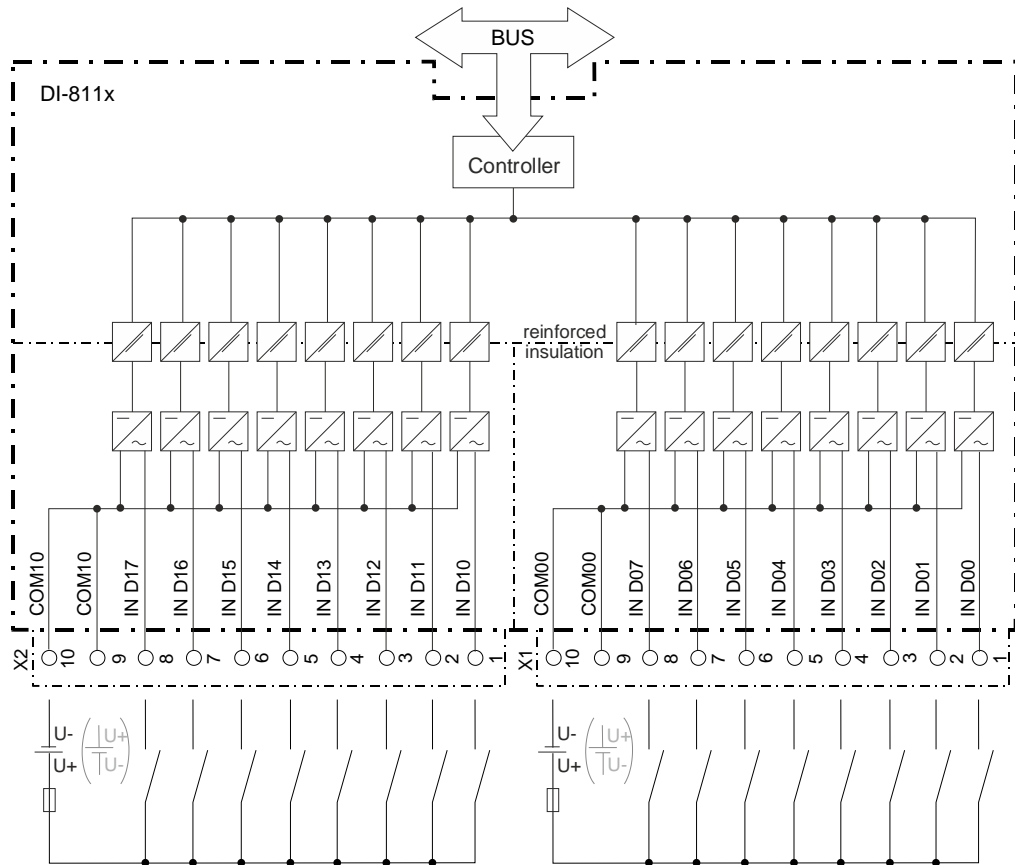
common supply of group 0

common supply of group 1

readiness

2.2.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



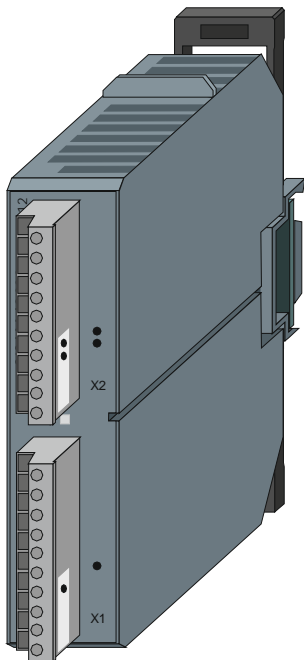
2.3 DI-8112

2.3.1 Features

Binary input module

- Mounting on DIN rail
- 16 inputs (2 groups of 8 each)
- Galvanical insulation by optocouplers
- Each group has a common return
- Signal voltage DC 110 V
- Removable screw terminals
- Indication of function via LED
- Acquisition with a resolution of 1 ms

2.3.2 View



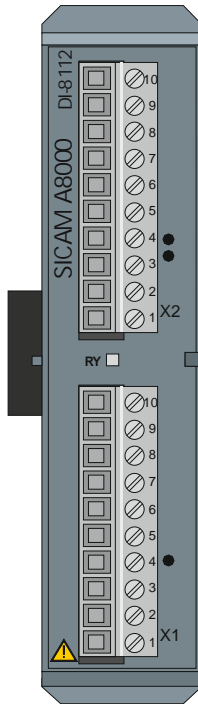
2.3.3 Technical Specifications

Binary Inputs					
16 binary inputs	<ul style="list-style-type: none"> · 2 groups, 8 inputs each · Galvanical insulation · Each group has a common return of selectable polarity 				
Filter time	3 ms ^{*)}				
Nominal voltage	DC 110 V				
Operating points	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">£ 55 V</td> <td style="width: 50%;">logical "0"</td> </tr> <tr> <td>³ 82.5 V</td> <td>logical "1"</td> </tr> </table>	£ 55 V	logical "0"	³ 82.5 V	logical "1"
£ 55 V	logical "0"				
³ 82.5 V	logical "1"				
Input circuits	DC 82.5...143 V The circuits are operated by means of an external voltage				
Rated current	0.4...1.4 mA at 82.5...143 V				
Power Supply					
Operating voltage	DC 4.75...5.5 V 130 mW The voltage is picked off at the system bus				
Mechanics and Connectors					
Terminals	Removable screw terminals (grid size 5.08)				
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)				
Weight	Approx. 249 g (inkl. bus module 12 g)				

^{*)} if the sensor voltage of a group of binary inputs is monitored for failures (parameter `SVM_monitoring`), there is a dedicated binary input for each group (IN D07 and IN D17), this input has a filter time of 2 ms

2.3.4 Pin Assignment and Display

The process signals must be connected to 2 pieces 10-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
10	COM00
9	COM00
8	IN D07
7	IN D06
6	IN D05
5	IN D04
4	IN D03
3	IN D02
2	IN D01
1	IN D00

X2	
Pin	Signal
10	COM10
9	COM10
8	IN D17
7	IN D16
6	IN D15
5	IN D14
4	IN D13
3	IN D12
2	IN D11
1	IN D10

IN D00...IN D07

IN D10...IN D17

COM00

COM10

RY

binary inputs group 0, inputs 0...7

binary inputs group 1, inputs 10...17

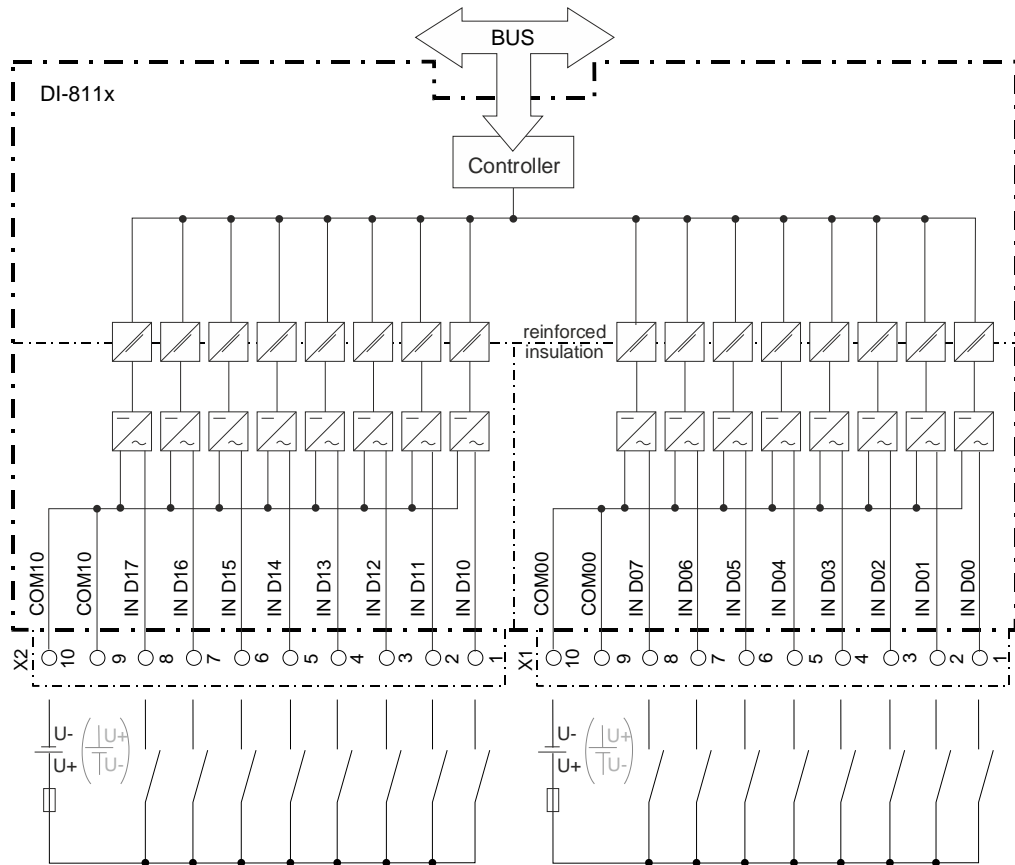
common supply of group 0

common supply of group 1

readiness

2.3.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



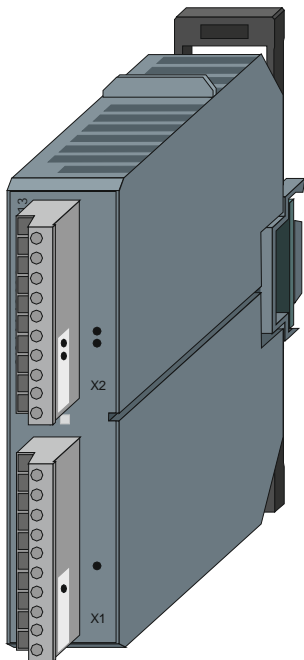
2.4 DI-8113

2.4.1 Features

Binary input module

- Mounting on DIN rail
- 16 inputs (2 groups of 8 each)
- Galvanical insulation by optocouplers
- Each group has a common return
- Signal voltage DC 220 V
- Removable screw terminals
- Indication of function via LED
- Acquisition with a resolution of 1 ms

2.4.2 View



2.4.3 Technical Specifications

Binary Inputs	
16 binary inputs	<ul style="list-style-type: none"> · 2 groups, 8 inputs each · Galvanical insulation · Each group has a common return of selectable polarity
Filter time	3 ms ^{*)}
Nominal voltage	DC 220 V
Operating points	£ 110 V logically "0" ³ 165 V logically "1"
Input circuits	DC 165...253 V The circuits are operated by means of an external voltage
Rated current	0.3...0.7 mA at 165...253 V
Power Supply	
Operating voltage	DC 4.75...5.5 V 130 mW The voltage is picked off at the system bus
Mechanics and Connectors	
Terminals	Removable screw terminals (grid size 5.08)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 249 g (inkl. bus module 12 g)

^{*)} if the sensor voltage of a group of binary inputs is monitored for failures (Parameter `SVM_monitoring`), there is a dedicated binary input for each group (IN D07 and IN D17), this input has a filter time of 2 ms

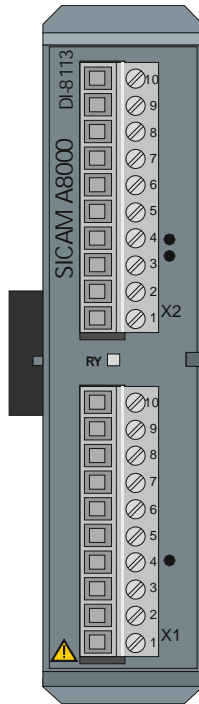


Note

There will be derating above an input voltage of 238 V and above an ambient temperature of +65°C. Then only maximum 14 inputs may be operated simultaneously.

2.4.4 Pin Assignment and Display

The process signals must be connected to 2 pieces 10-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
10	COM00
9	COM00
8	IN D07
7	IN D06
6	IN D05
5	IN D04
4	IN D03
3	IN D02
2	IN D01
1	IN D00

X2	
Pin	Signal
10	COM10
9	COM10
8	IN D17
7	IN D16
6	IN D15
5	IN D14
4	IN D13
3	IN D12
2	IN D11
1	IN D10

IN D00...IN D07

IN D10...IN D17

COM00

COM10

RY

binary inputs group 0, inputs 0...7

binary inputs group 1, inputs 10...17

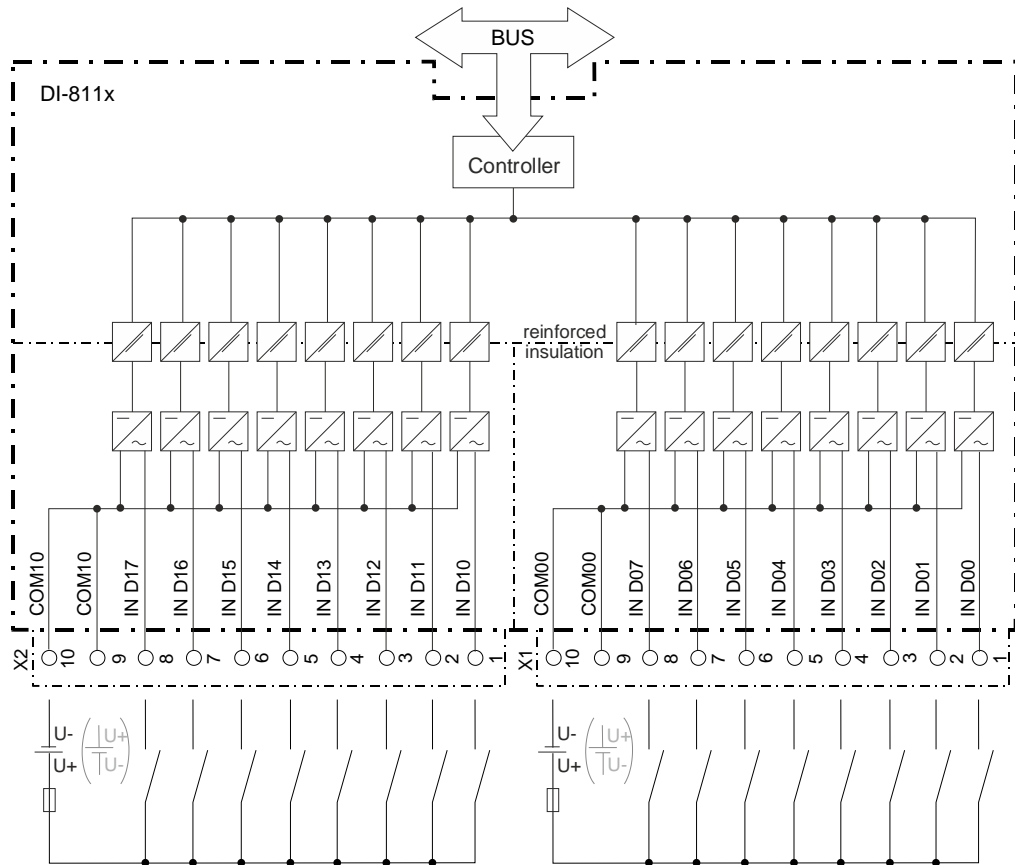
common supply of group 0

common supply of group 1

readiness

2.4.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



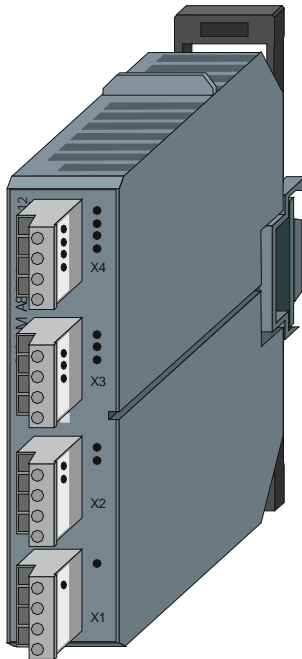
2.5 DO-8212

2.5.1 Features

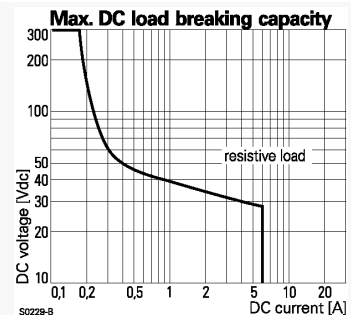
Binary output module

- Mounting on DIN rail
- 8 relay outputs (4 groups, 2 each)
- Galvanical insulation
- Switching voltage DC 24...220 V / AC 230 V
- The outputs can switch DC and also AC voltages
- Removable screw terminals
- Indication of function via LED

2.5.2 View



2.5.3 Technical Specifications

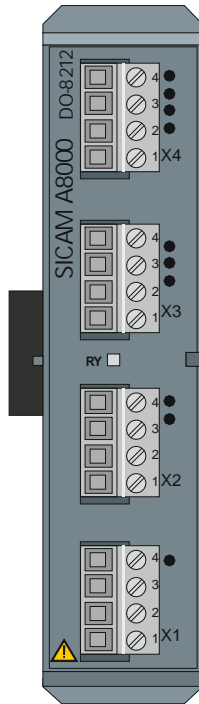
Binary outputs	
8 binary outputs (relay)	<ul style="list-style-type: none"> 4 groups, 2 outputs each, potential-free Galvanical insulation
Nominal voltages	<ul style="list-style-type: none"> DC 24/48/60/110/220 V AC 110/230 V
Maximum continuous current	Standard circuitry <ul style="list-style-type: none"> 8 outputs max. 2 A each (5 A/1 min) Circuitry with derating resp. for switching capacity 6 A ^{*)} <ul style="list-style-type: none"> 4 outputs max. 3 A each, 4 outputs max. 1 A each Circuitry with derating at 5 A <ul style="list-style-type: none"> 1 output max. 5 A, 7 outputs max. 1 A each 2 outputs max. 5 A each, 6 outputs max. 0 A each (relay must not be activated)
Switching capacity	DC voltage <ul style="list-style-type: none"> Min. 50 mW at DC 5 V Max. acc. to diagram 
	AC voltage <ul style="list-style-type: none"> Max. 1250 VA 5 A / AC 250 V, resistive load Max. 500 VA 2 A / AC 250 V, $\cos \phi = 0.4$
Switching cycles	3×10^4
Output circuits	Max. DC 250 V / AC 253 V The circuits are operated by means of an external voltage
Power Supply	
Operating voltage	DC 4.75...5.5 V 800 mW The voltage is picked off at the system bus
Mechanics and Connectors	
Terminals	Removable screw terminals (grid size 5.08)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 287 g (incl. bus module 12 g)

^{*)} with parallel connection

- For power augmentation 2 relays may be connected parallel, this must happen within one group (applies only for $I < 6 \text{ A} \rightarrow 2 \times 3 \text{ A}$)
- Groups with parallel connection must not be next to another
- Next to a group with parallel connection outputs may be loaded only with $\leq 2 \text{ A}$
- Outputs that are loaded with $> 3 \text{ A}$ must not be next to another; exception: with power augmentation the outputs of one group must be used
- Groups that are loaded with $> 2 \text{ A}$ shall not be next to another; example: **3 A-3 A-1 A-1 A-3 A-3 A-1 A-1 A** instead of **3 A-3 A-3 A-3 A-1 A-1 A-1 A-1 A**

2.5.4 Pin Assignment and Display

The process signals must be connected to 4 pieces 4-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
4	COM D01
3	COM D00
2	OUT D01
1	OUT D00

X2	
Pin	Signal
4	COM D03
3	COM D02
2	OUT D03
1	OUT D02

X3	
Pin	Signal
4	COM D05
3	COM D04
2	OUT D05
1	OUT D04

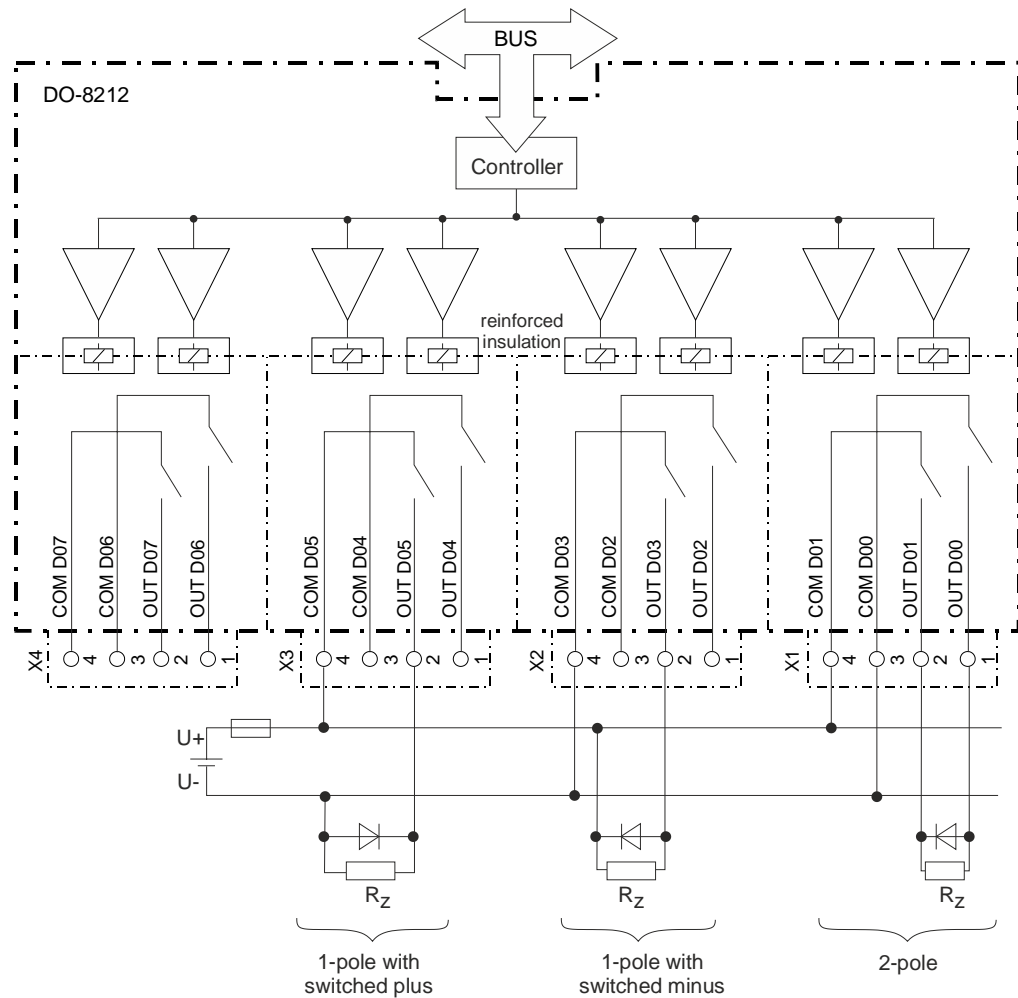
X4	
Pin	Signal
4	COM D07
3	COM D06
2	OUT D07
1	OUT D06

OUT D00...OUT D07 binary outputs 0...7
 COM D00...COM D07 common/outputs 0...7
 RY readiness

2.5.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.

1-pole and 2-pole circuitry

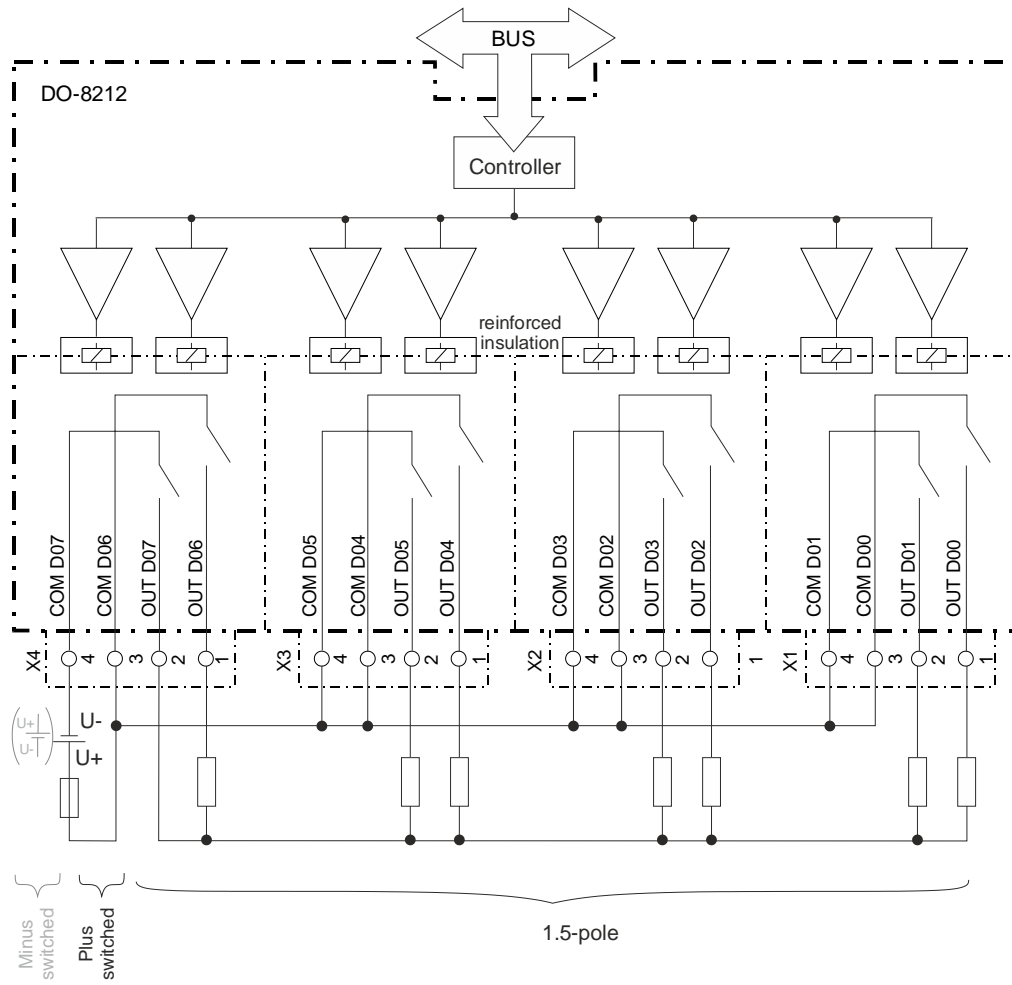


Note

Within a group of signal outputs exists only functional insulation. Therefore, the use of different current circuits is not permitted.

The insulation between the groups is provided as reinforced insulation.

1.5-pole circuitry



2.6 AI-8310

2.6.1 Features

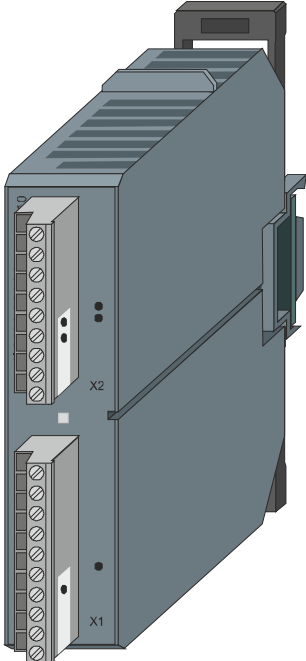
Analog input module

- Mounting on DIN rail
- 4 inputs (2 groups of 2 each)
- Galvanic insulation by optocouplers
- Acquisition of temperatures via Pt100/Pt1000/Ni100 resistance measurement in 2-wire-, 3-wire- and 4-wire-technique
- Noise rejection
- Removable screw terminals
- Function indication via LED

2.6.2 Functions

- Temperatures
 - Connecting resistance thermometers: 2-, 3- or 4-wire technique
 - Settable measuring ranges
 - Temperature values
 - Input range
 - Pt100: -50...+350°C / -58...+662°F / (»80.31...229.67 Ω)
 - Pt100: -100...+700°C / -148...+1292°F / (»60.25...345.13 Ω)
 - Ni100: -60...+250°C / -76...+482°F / (»69.5...289.2 Ω)
 - Pt1000: -100...+700°C / -148...+1292°F / (»602.5...3451.3 Ω)
 - Resolution
 - Pt100: -50...+350°C 0.15°C / 0.28°F / (10 mΩ)
 - Pt100: -100...+700°C 0.15°C / 0.28°F / (10 mΩ)
 - Ni100: -60...+250°C 0.15°C / 0.28°F / (10 mΩ)
 - Pt1000: -100...+700°C 0,15°C / 0,28°F / (100 mΩ)
 - Update grid
 - 16⅔ Hz < 1.2 s
 - 50 Hz < 1.0 s
 - 60 Hz < 0.9 s
 - Resistance values
 - Input range
 - 40...400 Ω, Resolution: 10 mΩ
 - 400...4000 Ω, Resolution: 100 mΩ
 - Update grid
 - 16⅔ Hz < 1.2 s
 - 50 Hz < 1.0 s
 - 60 Hz < 0.9 s
 - Revision
 - Noise rejection
 - Calibration for 2-wire technique
 - Smoothing
 - Adaption
 - Temperature value (°C, °F), conversion using implemented curves
 - Resistance value (Ω)
 - Change monitoring
 - Spontaneous transmission upon change

2.6.3 View

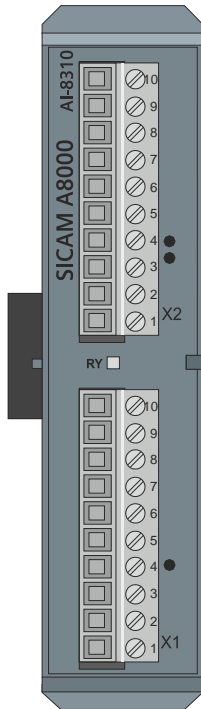


2.6.4 Technical Specifications

Analog Inputs							
4 analog inputs	<ul style="list-style-type: none"> · 2 groups, 2 inputs each · galvanically insulated · Voltage between 2 inputs of a group max. DC 600 mV 						
Measuring ranges (resistance measurement)	<ul style="list-style-type: none"> · 40 to 400 Ω (Pt100, Ni100) · 400 to 4000 Ω (Pt1000) 						
Resolution	<ul style="list-style-type: none"> · 10 mW (Pt100, Ni100) · 100 mW (Pt1000) 						
Noise rejection	16 $\frac{2}{3}$ Hz, 50 Hz, 60 Hz						
Conversion time	<table border="0"> <tr> <td>Noise rejection for 50 Hz</td> <td>200 ms</td> </tr> <tr> <td>Noise rejection for 60 Hz</td> <td>200 ms</td> </tr> <tr> <td>Noise rejection for 16$\frac{2}{3}$ Hz</td> <td>500 ms</td> </tr> </table>	Noise rejection for 50 Hz	200 ms	Noise rejection for 60 Hz	200 ms	Noise rejection for 16 $\frac{2}{3}$ Hz	500 ms
Noise rejection for 50 Hz	200 ms						
Noise rejection for 60 Hz	200 ms						
Noise rejection for 16 $\frac{2}{3}$ Hz	500 ms						
Accuracy	<table border="0"> <tr> <td>0.19 %</td> <td>0 to +50 °C</td> </tr> <tr> <td>0.4 %</td> <td>-40 to +70 °C</td> </tr> </table>	0.19 %	0 to +50 °C	0.4 %	-40 to +70 °C		
0.19 %	0 to +50 °C						
0.4 %	-40 to +70 °C						
Reference current	250 μ A						
Connecting line impedance	Sum of go-and-return line max. 300 Ω						
Common mode rejection ratio	16 $\frac{2}{3}$ Hz, 50 Hz, 60 Hz to 20 kHz > 100 dB 10 Hz to 1 MHz > 70 dB						
Normal mode rejection ratio	16 $\frac{2}{3}$ Hz > 106 dB 50 Hz > 98 dB 60 Hz > 91 dB						
Input circuits	The circuits are operated by means of an internal voltage (constant-current source)						
Power Supply							
Operating voltage	DC 4.75 to 5.5 V max. 500 mW The voltage is taken from the bus						
Mechanics and Connectors							
Terminals	Removable screw terminals (grid size 5.08)						
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)						
Weight	Approx. 241 g (inkl. bus module 12 g)						

2.6.5 Pin Assignment and Display

The process signals must be connected to 2 pieces 10-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



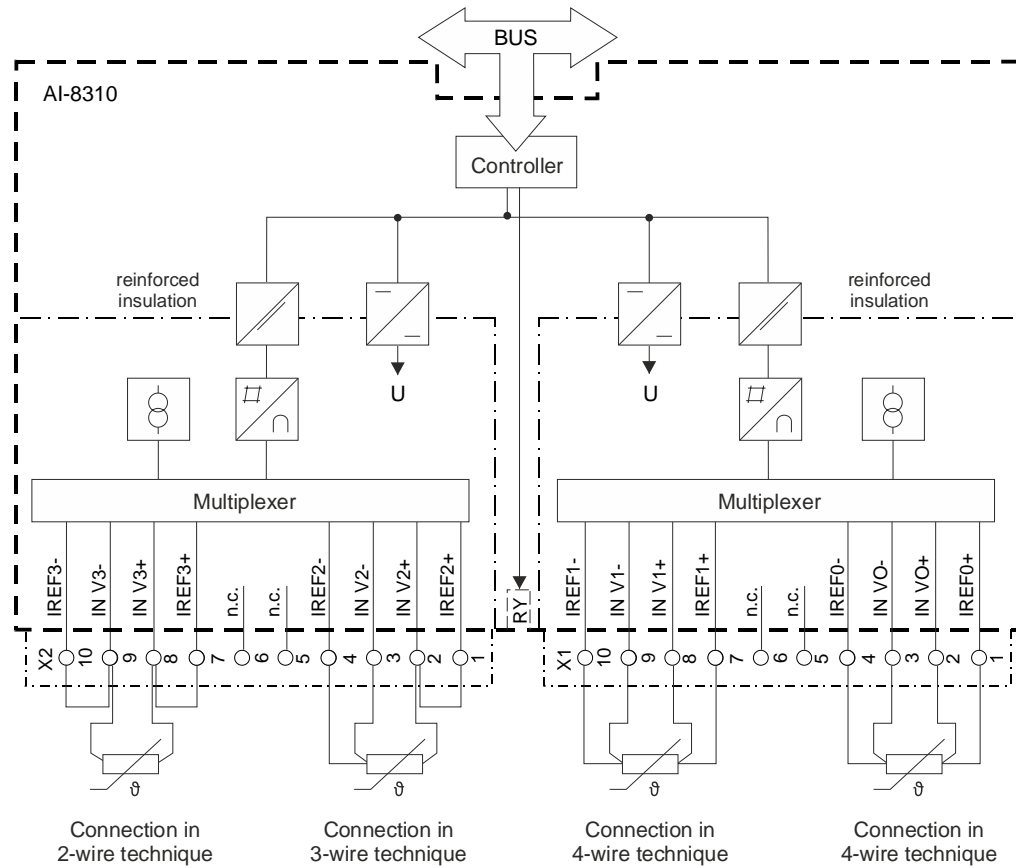
X1	
Pin	Signal
10	IREF1-
9	IN V1-
8	IN V1+
7	IREF1+
6	n.c.
5	n.c.
4	IREF0-
3	IN V0-
2	IN V0+
1	IREF0+

X2	
Pin	Signal
10	IREF3-
9	IN V3-
8	IN V3+
7	IREF3+
6	n.c.
5	n.c.
4	IREF2-
3	IN V2-
2	IN V2+
1	IREF2+

IREF0...IREF3	analog current outputs
IN V0...IN V03	analog voltage inputs
n.u.	not connected
RY	readiness

2.6.6 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



Note

The connectors X1 and X2 may be detached or attached in de-energized state only!

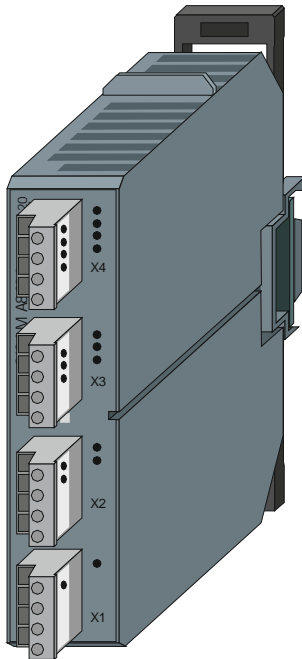
2.7 AI-8320

2.7.1 Features

Analog input module

- Mounting on DIN rail
- 4 inputs (4 groups of 1 each)
- Galvanic insulation by transformer
- Acquisition of currents ± 20 mA
- Acquisition of voltages ± 10 V
- Removable screw terminals
- Function indication via LED

2.7.2 View

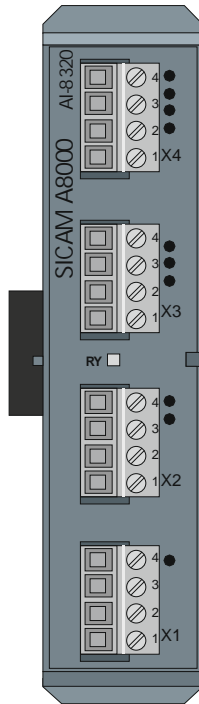


2.7.3 Technical Specifications

Analog Inputs		
4 analog inputs	<ul style="list-style-type: none"> · 4 groups, 1 input each · Groups are galvanically insulated from one another 	
Measuring ranges	Current measurement	-20...0...+20 mA
	Voltage measurement	-10...0...+10 V
	Overrange	current ~20% voltage ~30%
Resolution	0.004%	at ±20 mA
	0.004%	at ±10 V
Accuracy	0.15%	at 25°C
Accuracy current inputs	0.2%	at 0...50°C
	0.3%	at -20...70°C
	0.4%	at -40...70°C
Accuracy voltage inputs	0.4%	at 0...50°C
	0.5%	at -20...70°C
	0.6%	at -40...70°C
Input impedance	52 Ω	at ±20 mA
	10.5 kΩ	at ±10 V
Common mode rejection ratio current inputs	min. 90 dB	(1 Hz...1 MHz)
Common mode rejection ratio voltage inputs	min. 50 dB	(1 Hz...5 kHz)
	min. 70 dB	(5 kHz...1 MHz)
Normal mode rejection ratio	0 dB	(10 Hz...500 Hz)
	+30 dB/decade	(500 Hz...1 kHz)
	+50 dB/decade	(1 kHz...10 kHz)
	min. 70 dB	(10 kHz...1 MHz)
Noise rejection	50 dB	(50 Hz, 60 Hz, 16⅔ Hz)
Power Supply		
Operating voltage	DC 4.75...5.5 V	max. 180 mW
	The voltage is picked off at the system bus	
Mechanics and Connectors		
Terminals	Removable screw terminals (grid size 5.08)	
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)	
Weight	Approx. 241 g (inkl. bus module 12 g)	

2.7.4 Pin Assignment and Display

The process signals must be connected to 4 pieces 4-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
4	IN V0 U-
3	IN V0 I-
2	IN V0 I+
1	IN V0 U+

X2	
Pin	Signal
4	IN V1 U-
3	IN V1 I-
2	IN V1 I+
1	IN V1 U+

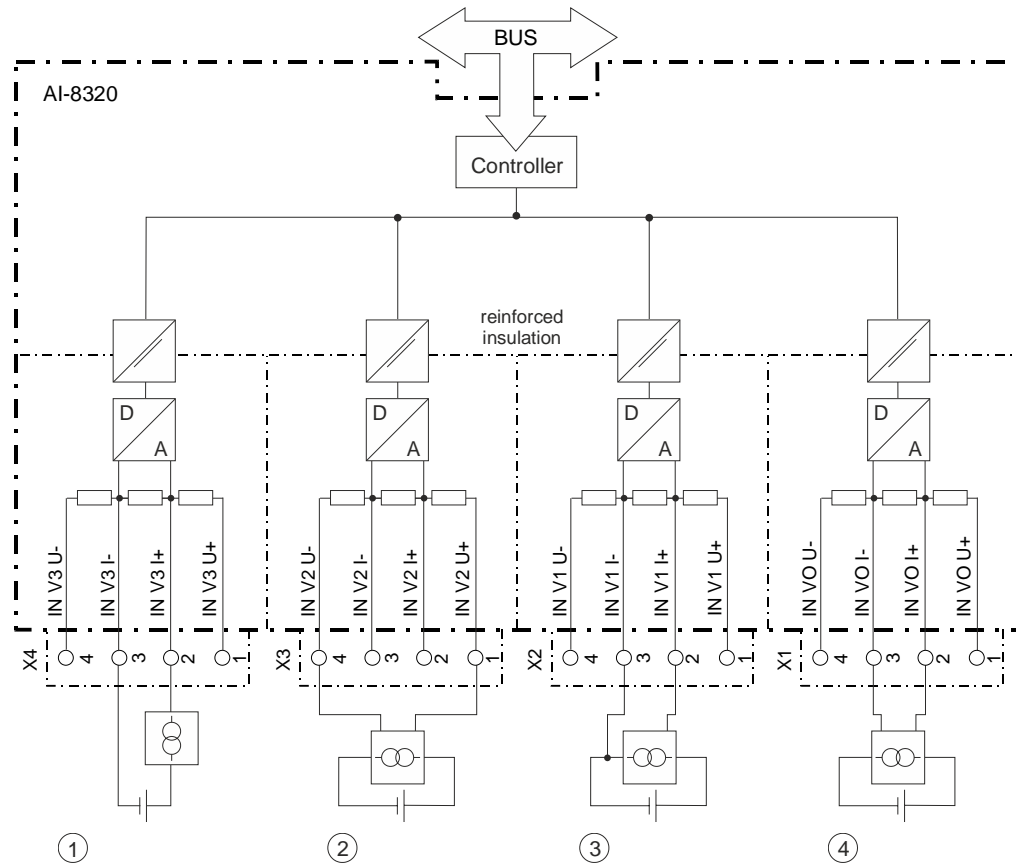
X3	
Pin	Signal
4	IN V2 U-
3	IN V2 I-
2	IN V2 I+
1	IN V2 U+

X4	
Pin	Signal
4	IN V3 U-
3	IN V3 I-
2	IN V3 I+
1	IN V3 U+

IN V0 U+/-...IN V3 U+/- analog voltage inputs 0...3
 IN V0 I+/-...IN V3 I+/- analog current inputs 0...3
 RY readiness

2.7.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.



- 1 Connection of a 2-wire measuring transformer with current output
- 2 Connection of a 4-wire measuring transformer with voltage output
- 3 Connection of a 3-wire measuring transformer with current output
- 4 Connection of a 4-wire measuring transformer with current output

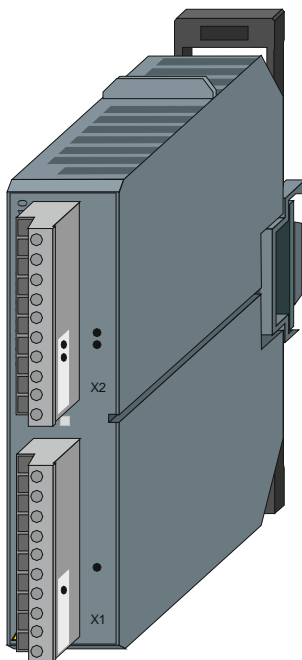
2.8 AI-8510

2.8.1 Features

Analog input module

- Mounting on DIN rail
- 3 low-power (LoPo) current measuring inputs **in conjunction with adaptor module [CM-8820](#)**
- 3 voltage measuring inputs (settable 100 V/ $\sqrt{3}$, 230 V or 400 V/ $\sqrt{3}$)
- Frequency acquisition (nominal frequency 45 to 65 Hz)
- Calculation of the r.m.s. values
 - Currents
 - Phase and phase-to-phase voltages
- Calculation of
 - Frequency
 - Active, reactive and apparent power
 - Zero voltage, ground current
 - Power factor
 - Phase angle
 - Fault current direction, Power direction
- Acquisition and processing according to IEC 60870-5-101/104
- Removable screw terminals
- Function indication via LED

2.8.2 View



2.8.3 Technical Specifications

Inputs for measuring currents (only via adaptor module CM-8820)	
Nominal voltage at I_N	AC 225 mV following IEC 60044-8
Max. input voltage	AC 2.25 V
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)
Resolution	16 bits
Scanning	1 value/ms
Inputs for measuring voltages	
Nominal voltage U_N	AC 100 V/Ö3, AC 230 V, AC 400 V/Ö3 acc. to IEC 60044-7 (parameter-settable)
Max. measuring voltage	150% U_N
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)
Resolution	16 bits
Scanning	1 value/ms
Internal consumption	< 0.3 VA at $V_N = 230$ V < 0.02 VA at $V_N = 110$ V/Ö3
Power supply	
Operating voltage	DC 4.75...5.5 V max. 800 mW (typ. 625 mW) The voltage is picked off at the system bus
Mechanics and connectors	
Peripheral connector	Removable screw terminals up to 2.5 mm ² (grid size 5.08) · 3 LoPo measuring currents, 10-pin (X1) · 3 measuring voltages, 9-pin (X2)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 252 g (incl. bus module 12 g)

2.8.3.1 Accuracy of the Measured Values

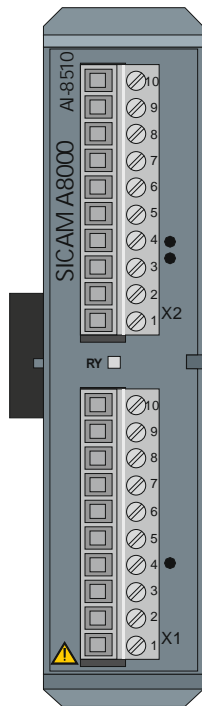
Measured variable	Dependency of accuracy class acc. to IEC 61557-12:2007-08 (K55)
Voltage U	1% (100/√3 up to 3%)
Phase current I	1% at nominal frequency
Power P	3%
Reactive power Q	3%
Apparent power S	3%
Power factor	3%
Frequency f (49...51/59...61 Hz)	1%

2.8.3.2 Accuracy of the Measured Ground Current with Isolated/Resonant Ground Connection

Measured variable	Dependency of accuracy class acc. to IEC 61557-12:2007-08 (K55)	
Ground current I_N setting	0.4...1.9 A	2.0...2000 A
Measuring range	0.2...2.89 A @ 50 Hz 0.2...2.99 A @ 60 Hz	2.9...600 A @ 50 Hz 3.0...600 A @ 60 Hz
Accuracy	±0.19 A for current range 0.2...2.9 A	±0.19 A for current range 2.8...11.99 A ±1% for current range 12...600 A

2.8.4 Pin Assignment and Display

The process signals must be connected to 2-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.

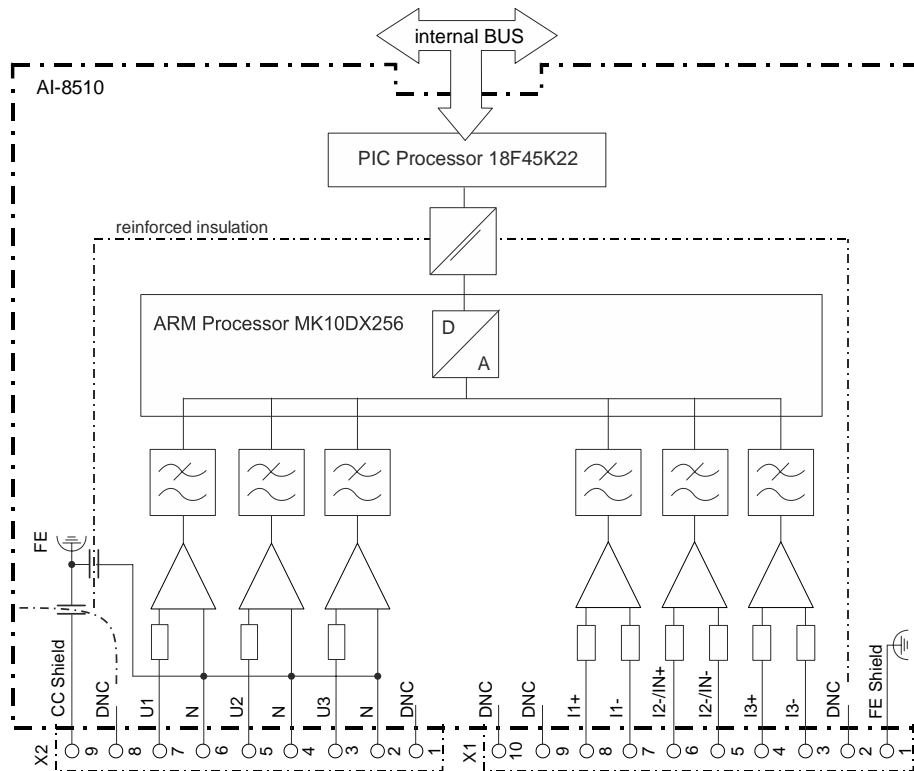


X1	
Pin	Signal
10	d.n.c.
9	d.n.c.
8	I1+
7	I1-
6	I2+/IN+
5	I2-/IN-
4	I3+
3	I3-
2	d.n.c.
1	FE shield

X2	
Pin	Signal
9	CC shield
8	d.n.c.
7	U1
6	N
5	U2
4	N
3	U3
2	N
1	d.n.c.

RY	readiness
I1+/-...I3+/-	measuring current inputs
IN+/-	(sensitive) ground current
U1/N...U3/N	measuring voltage inputs
FE	functional earth
CC	capacitive coupled to protective earth
d.n.c.	do not connect

2.8.5 Block Diagram



Note

For the measurement of currents, the current transformer module CM-8820 is to be connected ahead of AI-8510. The specification for the connection cable can be found in section [2.10.7, Requirements for Connection Cable CM-8820 → AI-8510](#).



Danger

The connectors X1 and X2 may be detached or attached in de-energized state only!

The connector X1 must always be plugged during operation (even if no current measurement is used)!



Warning

The inputs of connector X1 must not be connected directly with a mains supply circuit!

The inputs of connector X2 may be connected directly with system current circuits up to AC 240/415 V. Higher voltages must be adapted via interconnected voltage transformers!

2.8.6 External Circuitry

The following circuitry variants are examples and not related exclusively to the shown values.



Danger

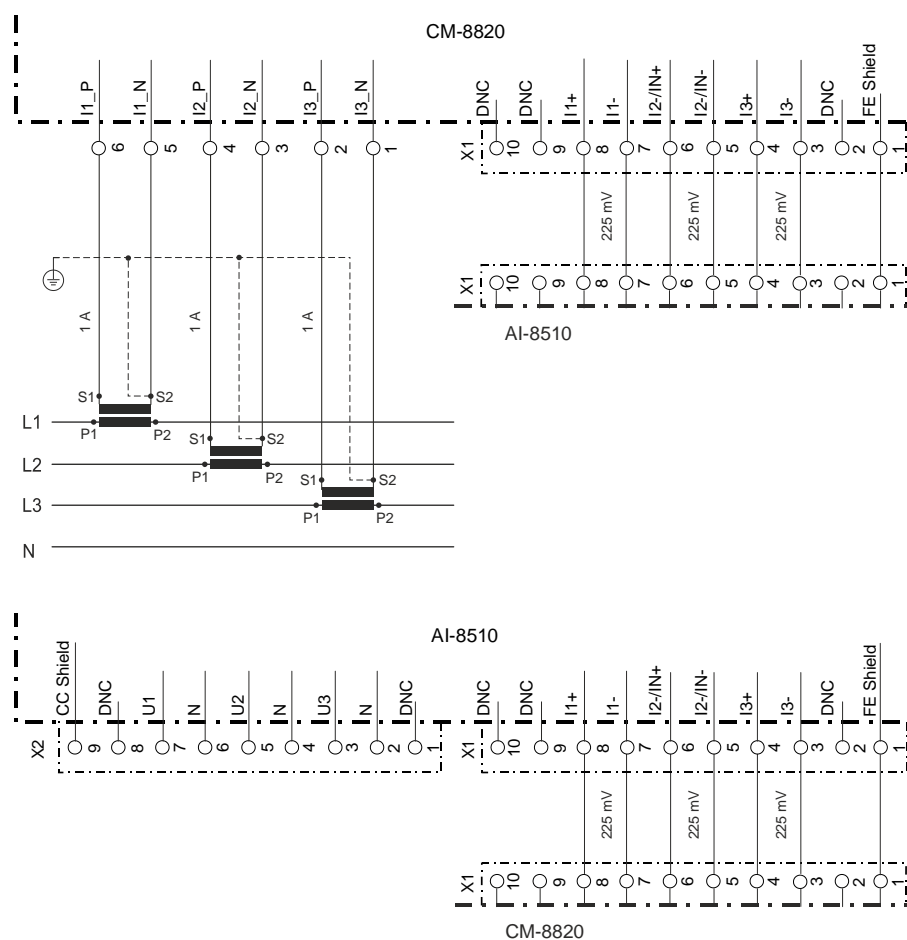
Works on the circuitry may be performed in de-energized state only!

During electrical installation, all the rules and regulations of power systems must be considered.

2.8.6.1 Short-Circuit Indicator

The current inputs I1, I2/IN, I3 are connected via the adaptor module CM-8820 with the measuring transformers of the corresponding phase currents.

In this configuration, the module functions as short-circuit indicator. Fault information on the direction is not provided.



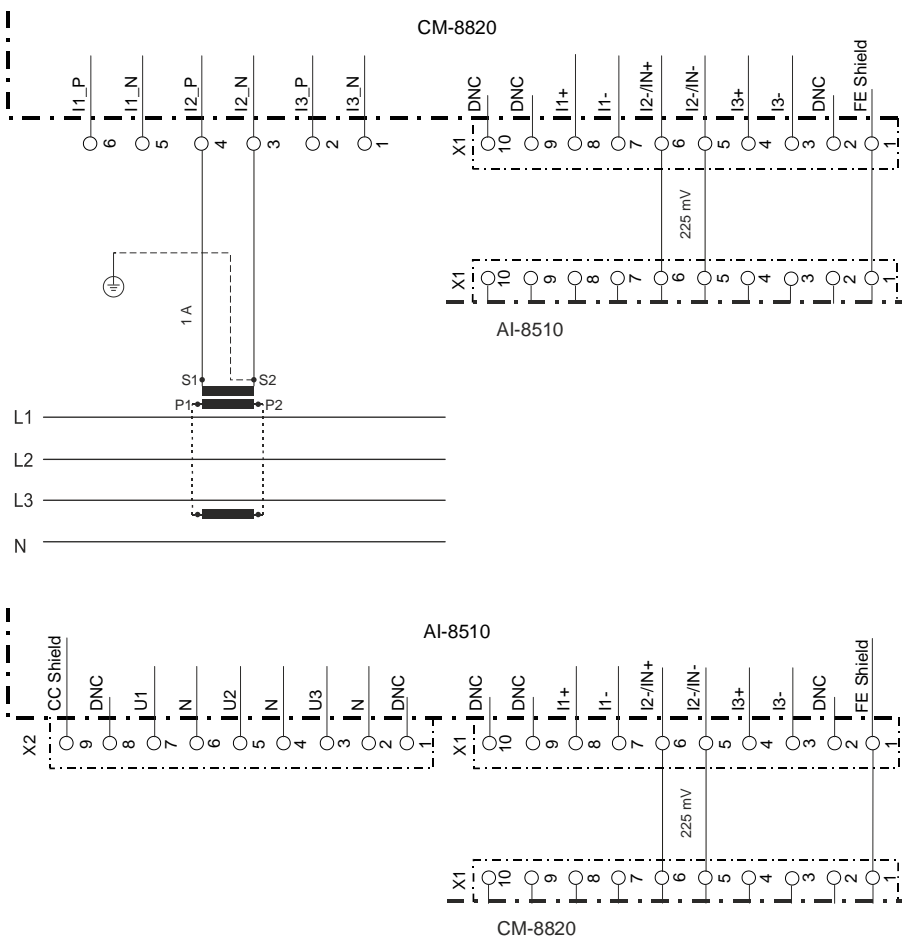
Note

With this connection scheme, the accuracy of ground current measurements for isolated/resonant ground connections cannot be assured.

2.8.6.2 Ground Fault Indicator

The current input I2/IN is connected via the adaptor module CM-8820 with the sum current measuring transformer.

In this configuration, the module functions as non-directional ground fault indicator.



2.8.6.3 Fault Detector

The current inputs I1, I2/IN, I3 are connected via the adaptor module CM-8820 with the corresponding measuring transformers. Additionally, the voltage inputs U1, U2, U3 are connected

- through voltage transformers of $100 \text{ V}/\sqrt{3}$ with the middle-voltage network
- through voltage transformers of $400 \text{ V}/\sqrt{3}$ with the low-voltage network
- directly with 230 V with the low-voltage network

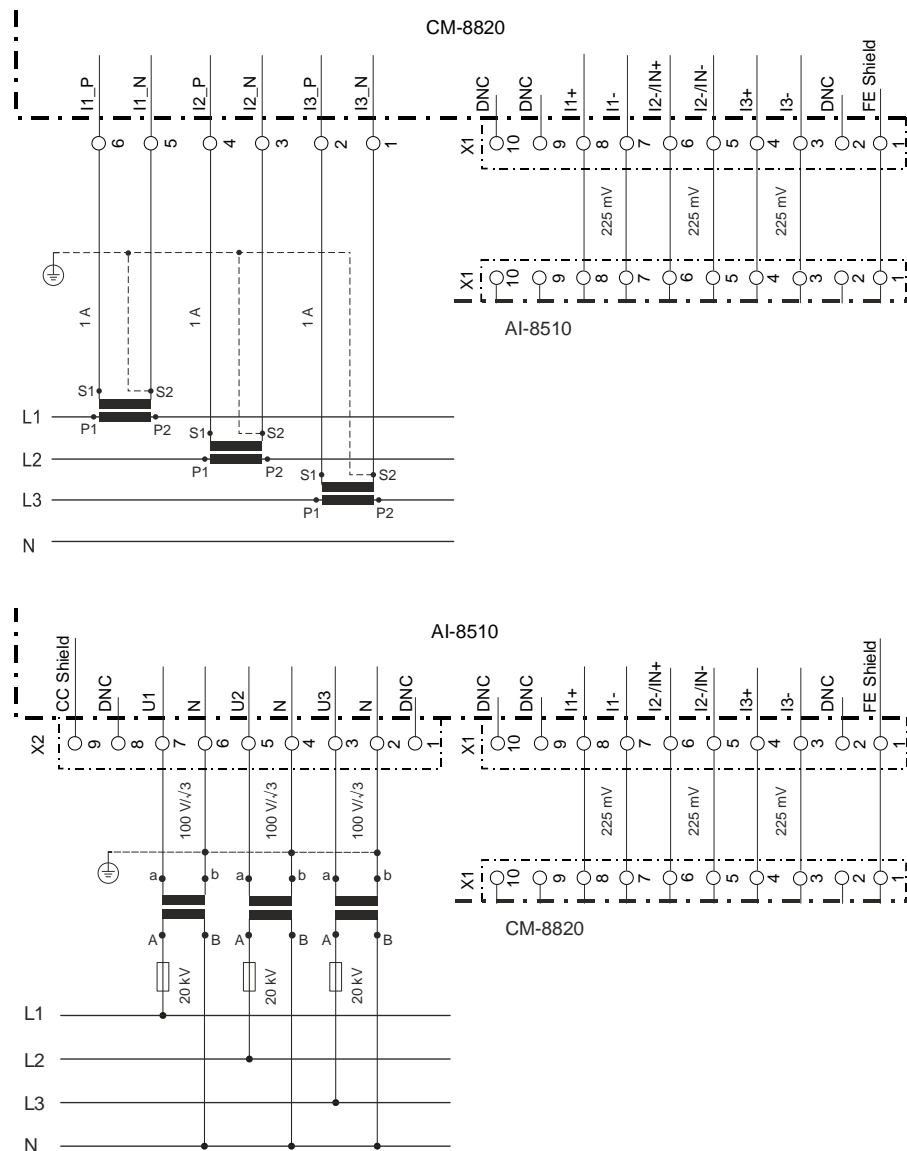
In this configuration, fault information with directional indication is output. Thereby, also all the measured and calculated measurands are provided.

2.8.6.3.1 3-Phase Voltage, 3-Phase Current

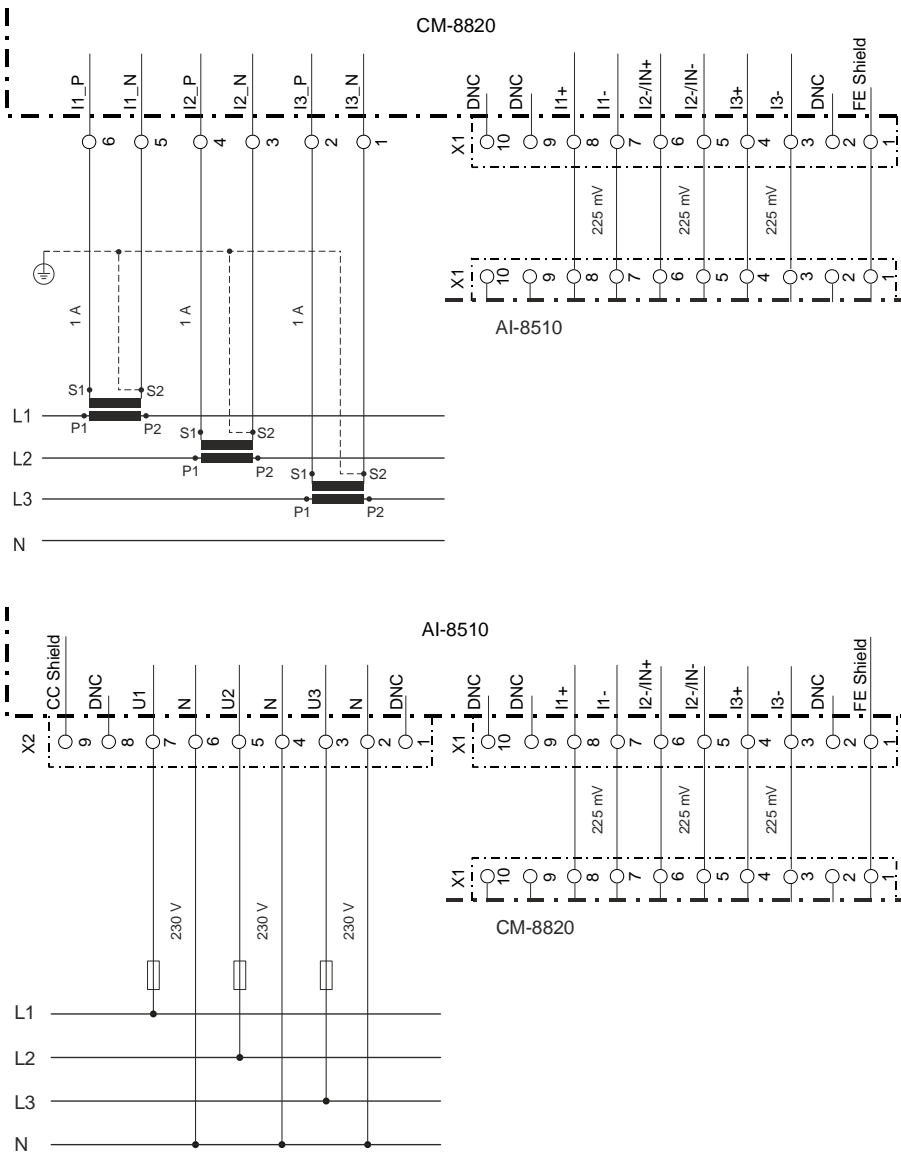
Through the current inputs I1, I2/IN, I3 the corresponding phase currents are measured. The value IN is calculated.

This configuration is used for solidly grounded networks. In this configuration, the module works also as a power meter.

Example: Middle-voltage network



Example: Low-voltage network



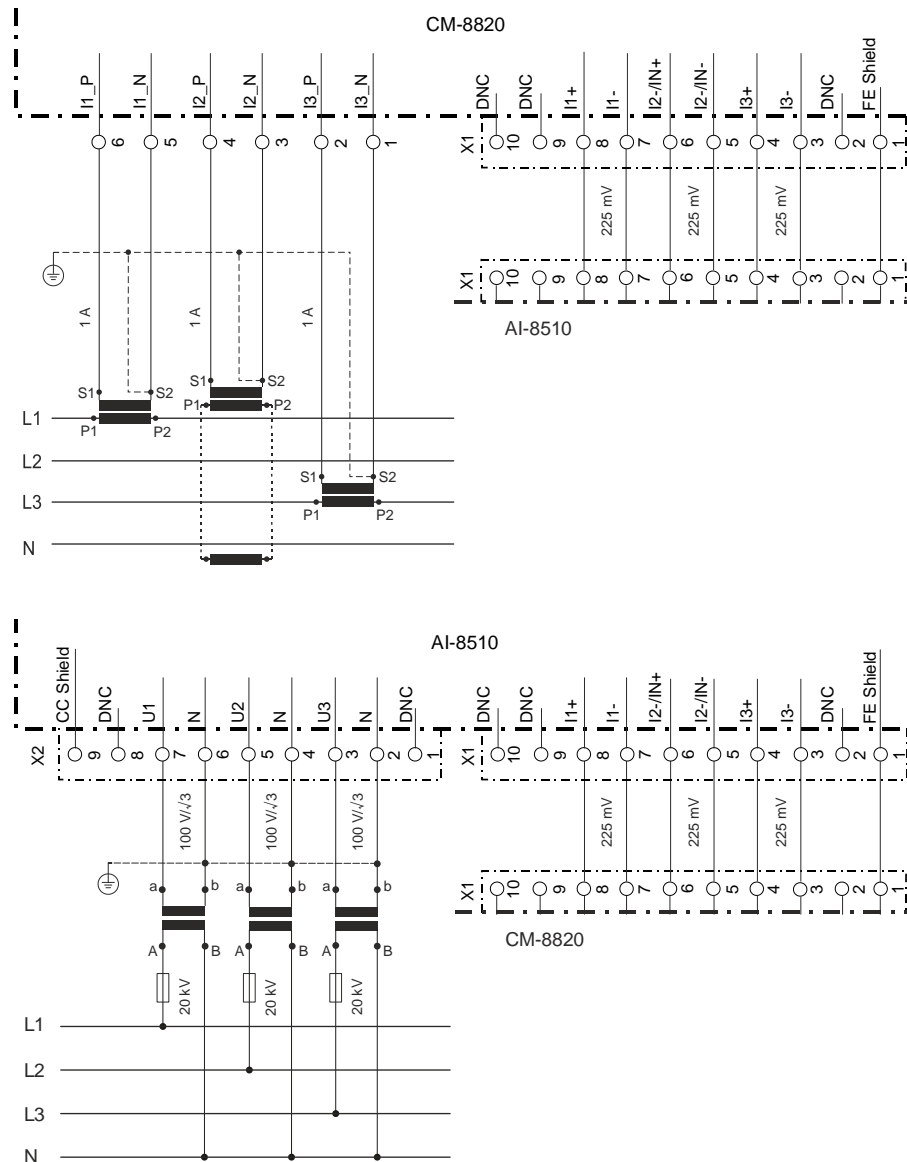
Miniature circuit breakers are mandatory (2 A recommended).

2.8.6.3.2 3-Phase Voltage, 2-Phase Current + Sensitive Ground Current

Through the current inputs I1, I3 the corresponding phase currents are measured, I2/IIN is connected with the sensitive ground current transformer. The value I2 is calculated.

This configuration is used for isolated and resonant grounded networks.

Example: Middle-voltage network



2.8.6.4 Medium Voltage/Low Voltage Measurement

The voltages in the medium-voltage network are determined by measuring the voltages from the low-voltage network (secondary side of the transformer).

The voltage inputs U1, U2, U3 are directly connected with 230 V in the low-voltage network. The current inputs I1, I2/IN, I3 are connected through the adaptor module CM-8820 with the corresponding measuring sensors in the medium-voltage network.

In this configuration, the module determines the direction of phase fault and ground fault.

These connection diagrams are used for solidly grounded networks.



Note

The module supports Dy-11 transformer type only. For this type, the secondary side of the transformer lags the primary side by a phase angle of 330°.

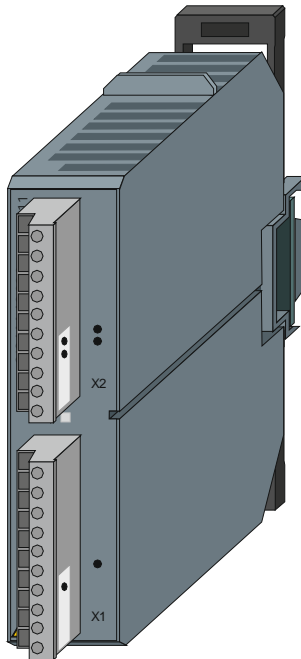
2.9 AI-8511

2.9.1 Features

Analog input module

- Mounting on DIN rail
- 3 low-power (LoPo) current measuring inputs (225 mV)
- 3 low-power (LoPo) voltage measuring inputs ($3.25 \text{ V}/\sqrt{3}$)
- Frequency acquisition (nominal frequency 45 to 65 Hz)
- Calculation of the r.m.s. values
 - Currents
 - Phase and phase-to-phase voltages
- Calculation of
 - Frequency
 - Active, reactive and apparent power
 - Zero voltage, ground current
 - Power factor
 - Phase angle
 - Fault current direction, Power direction
- Acquisition and processing according to IEC 60870-5-101/104
- Removable screw terminals
- Function indication via LED

2.9.2 View



2.9.3 Technical Specifications

Inputs for measuring currents	
Nominal voltage at I_N	AC 225 mV acc. to IEC 60044-8
Max. input voltage	AC 2.25 V
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)
Resolution	16 bits
Scanning	1 value/ms
Internal resistance	22 k Ω
Inputs for measuring voltages	
Nominal voltage at U_N	AC 3.25 V/Ö3 acc. to IEC 60044-7
Max. measuring voltage	150% U_N
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)
Resolution	16 bits
Scanning	1 value/ms
Internal resistance	200 k Ω
Power supply	
Operating voltage	DC 4.75...5.5 V max. 800 mW (typ. 625 mW) The voltage is picked off at the system bus
Mechanics and connectors	
Peripheral connector	Removable screw terminals up to 2.5 mm ² (grid size 5.08) · 3 LoPo measuring currents , 10-pin (X1) · 3 LoPo measuring voltages , 9-pin (X2)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 252 g (incl. bus module 12 g)

2.9.3.1 Accuracy of the Measured Values

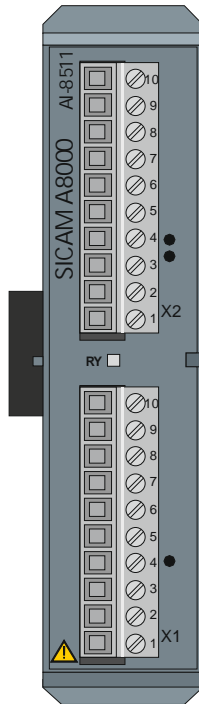
Measured variable	Dependency of accuracy class acc. to IEC 61557-12:2007-08 (K55)
Voltage U	1%
Phase current I	1% at nominal frequency
Power P	3%
Reactive power Q	3%
Apparent power S	3%
Power factor	3%
Frequency f (49...51/59...61 Hz)	1%

2.9.3.2 Accuracy of the Measured Ground Current with Isolated/Resonant Ground Connection

Measured variable	Dependency of accuracy class acc. to IEC 61557-12:2007-08 (K55)	
Ground current I_N setting	0.4...1.9 A	2.0...2000 A
Measuring range	0.2...2.43 A @ 50/60 Hz	2.44...600 A @ 50/60 Hz
Accuracy	±0.1 A for current range 0.2...2.43 A	±0.18 A for current range 2.44...11.99 A ±1% for current range 12...600 A

2.9.4 Pin Assignment and Display

The process signals must be connected to 2 screw terminals. The pin assignment of the peripheral connectors is described in the following table.

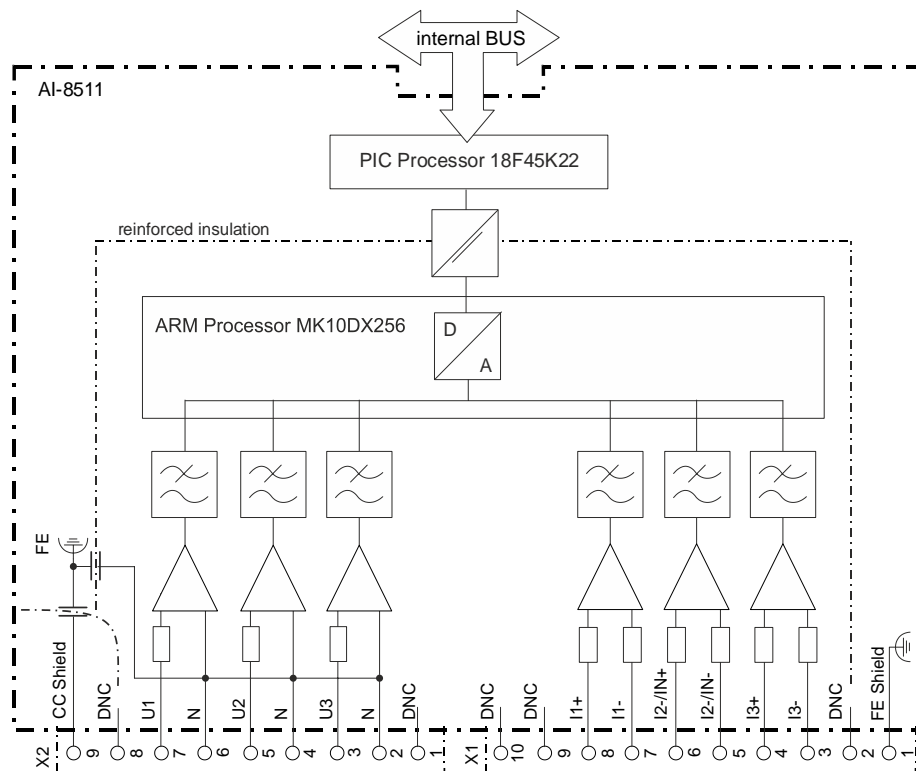


X1	
Pin	Signal
10	d.n.c.
9	d.n.c.
8	I1+
7	I1-
6	I2+/IN+
5	I2-/IN-
4	I3+
3	I3-
2	d.n.c.
1	FE shield

X2	
Pin	Signal
9	CC shield
8	d.n.c.
7	U1
6	N
5	U2
4	N
3	U3
2	N
1	d.n.c.

RY	readiness
I1+/-...I3+/-	measuring current inputs
IN+/- (sensitive)	ground current
U1/N...U3/N	measuring voltage inputs
FE	functional earth
CC	capacitive coupled to protective earth
d.n.c.	do not connect

2.9.5 Block Diagram



Warning

The connectors X1 and X2 may be detached or attached in de-energized state only!

AI-8511 must not be connected directly with a mains supply circuit!

2.9.6 External Circuitry

The following circuitry variants are examples and not related exclusively to the shown values.



Danger

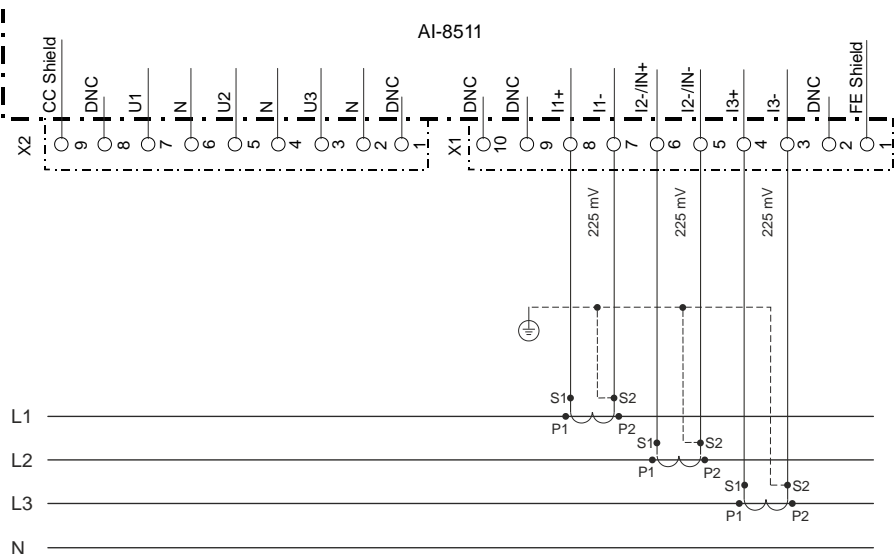
Works on the circuitry may be performed in de-energized state only!

During electrical installation, all the rules and regulations of power systems must be considered.

2.9.6.1 Short-Circuit Indicator

The current inputs I1, I2/IN, I3 are connected with the LoPo measuring sensors of the corresponding phase currents.

In this configuration, the module functions as short-circuit indicator. Fault information on the direction is not provided.



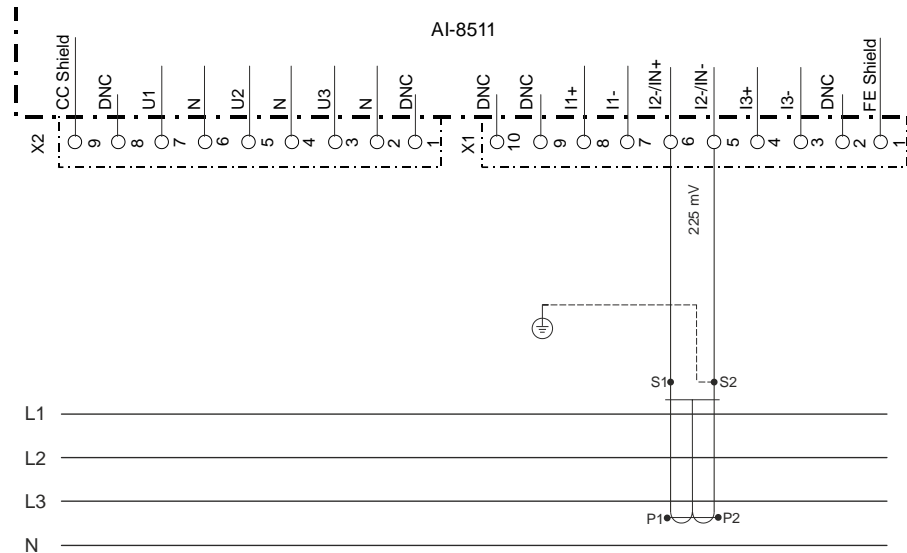
Note

With this connection scheme, the accuracy of ground current measurements for isolated/resonant ground connections cannot be assured.

2.9.6.2 Ground Fault Indicator

The current input I2/IN is connected with the LoPo sum current measuring sensor.

In this configuration, the module functions as non-directional ground fault indicator.



2.9.6.3 Fault Detector

The current inputs I1, I2/IN, I3 are connected through the adaptor module CM-8820 with the corresponding LoPo measuring sensors. Additionally, the voltage inputs U1, U2, U3 are connected

- through LoPo voltage transformers of $3.25 \text{ V}/\sqrt{3}$ with the medium-voltage network

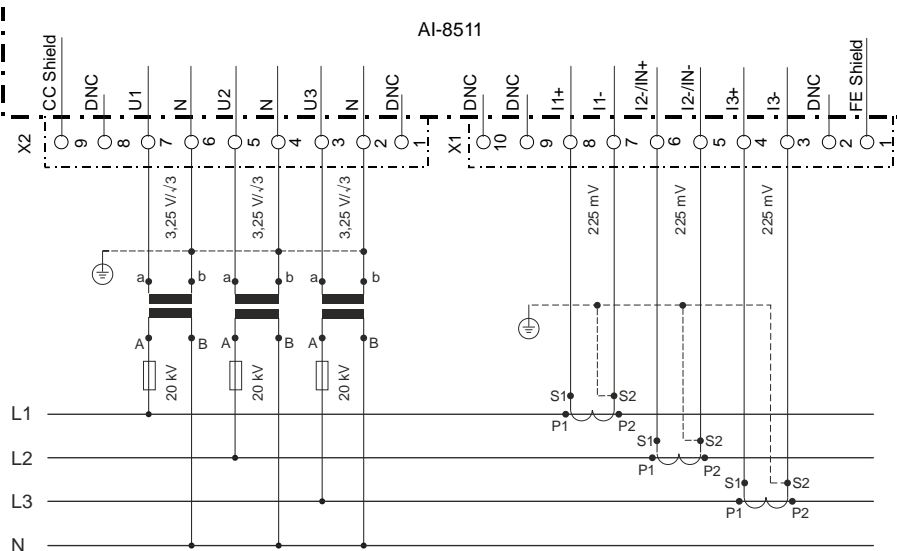
In this configuration, fault information with directional indication is output. Thereby, also all the measured and calculated measurands are provided.

2.9.6.3.1 3-Phase Voltage, 3-Phase Current

Through the current inputs I1, I2/IN, I3 the corresponding phase currents are measured. The value IN is calculated.

This configuration is used for solidly grounded networks. In this configuration, the module works also as a power meter.

Example: Middle-voltage network

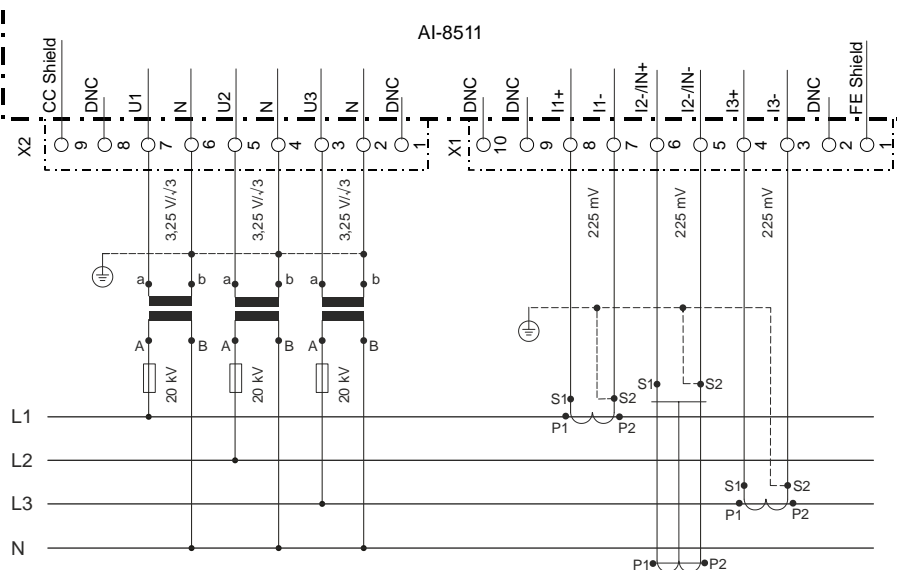


2.9.6.3.2 3-Phase Voltage, 2-Phase Current + Sensitive Ground Current

Through the current inputs I1, I3 the corresponding phase currents are measured, I2/IN is connected with the sensitive ground current transformer. The value I2 is calculated.

This configuration is used for isolated and resonant grounded networks.

Example: Middle-voltage network

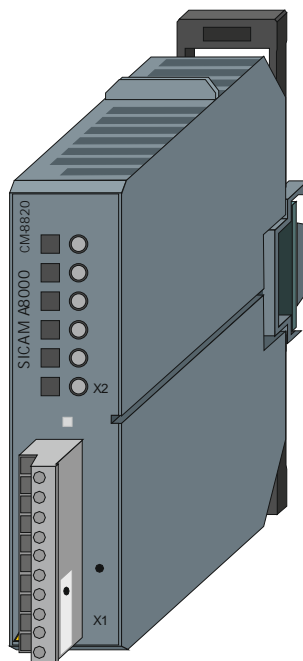


2.10 CM-8820

2.10.1 Features

- Mounting on DIN rail, at the last (right-most) slot of the I/O module line
- Current transformer adaptor for AI-8510
- 3 current transformer inputs
 - Connection of current transformers with secondary currents of 1 A or 5 A
 - It is only possible to measure alternating currents
- LoPo voltage output 225 mV
 - Connection with AI-8510
 - Removable screw terminal for LoPo output

2.10.2 View



2.10.3 Technical Specifications

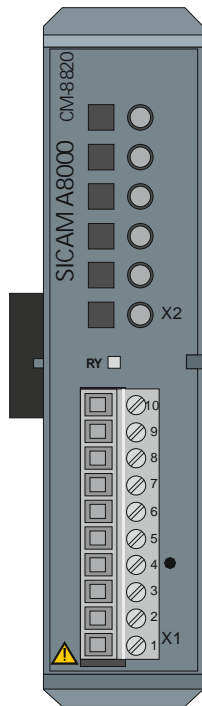
Inputs for measuring currents		
Nominal current	1 A/5 A (parameter-settable)	
Max. measurement current	200% I_N	
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)	
Internal consumption	< 0.1 W	at $I_N = 1$ A
	< 0.3 W	at $I_N = 5$ A
Thermal withstand capability	10 A	continuous
	100 A	1 s
Outputs for measuring currents		
Nominal voltage	225 mV	at $I_N = 1$ A following IEC 60044-8
	1.125 V	at $I_N = 5$ A
Max. voltage	2.25 V	at $I_N = 10$ A
Nominal frequency	50 Hz, 60 Hz (range 45...65 Hz)	
Mechanics and connectors		
Peripheral connector	<ul style="list-style-type: none"> Removable screw terminal up to 2.5 mm² (grid size 5.08) 3 LoPo measuring current outputs, 10-pin (X1) Screw terminals up to 2.5 mm² 3 measuring current inputs, 6-pin 	
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)	
Weight	Approx. 303 g	

2.10.3.1 Accuracy of the Measured Values

Measured variable	Dependency of accuracy class acc. to IEC 61557-12:2007-08 (K55)		
Nominal current (input)	1 A	2% @ 50 Hz	max. angle deviation 3°
		2% @ 60 Hz	max. angle deviation 3°
	5 A	2% @ 50 Hz	max. angle deviation 3°
		3% @ 60 Hz	max. angle deviation 3°
Nominal voltage (output)	3%		
Nominal frequency (49...51/59...61 Hz)	50 Hz	2% @ 0,2...10 A	max. angle deviation 3°
	60 Hz	3% @ 0,2...10 A	max. angle deviation 3°

2.10.4 Pin Assignment and Display

The process signals must be connected to 2 screw terminals. The pin assignment of the peripheral connectors is described in the following table.



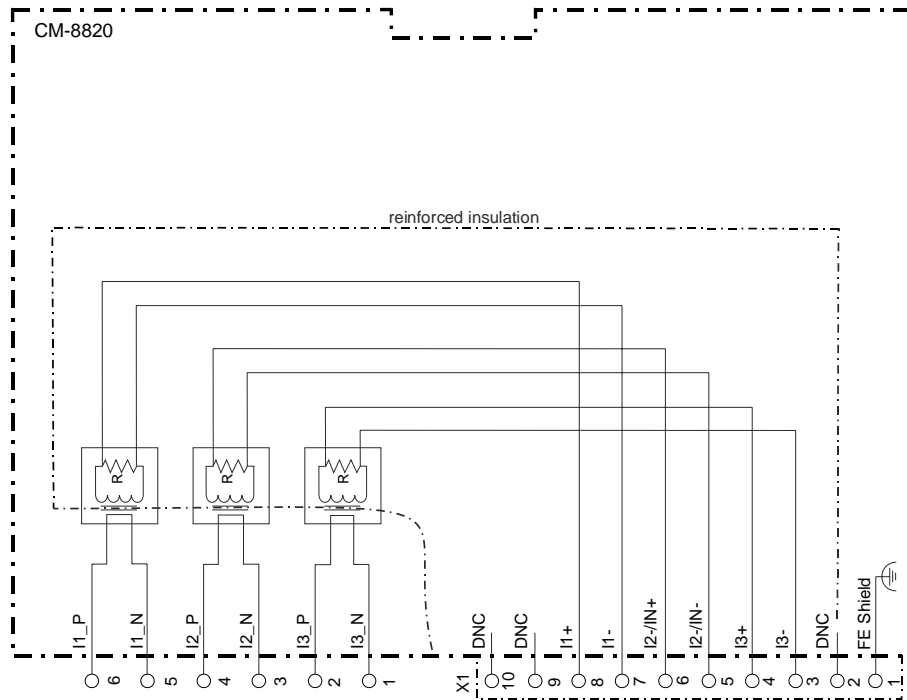
X1	
Pin	Signal
10	d.n.c.
9	d.n.c.
8	I1+
7	I1-
6	I2+/IN+
5	I2-/IN-
4	I3+
3	I3-
2	d.n.c.
1	FE shield

CT terminals	
Pin	Signal
6	I1_P
5	I1_N
4	I2_P
3	I2_N
2	I3_P
1	I3_N

I1+/-...I3+/-
 IN+/-
 I1_P/N...I3_P/N
 FE
 d.n.c.

measuring current outputs
 (sensitive) ground current
 current transformer inputs
 functional earth
 do not connect

2.10.5 Block Diagram



Warning

The connector X1 and the CT terminals may be detached or attached in de-energized state only!
 CM-8820 must not be connected directly with a mains supply circuit!



Note

Within the signal inputs exists only functional insulation. Therefore, the use of different current circuits is not permitted.

2.10.6 External Circuitry

The following circuitry variants are examples and not related exclusively to the shown values.



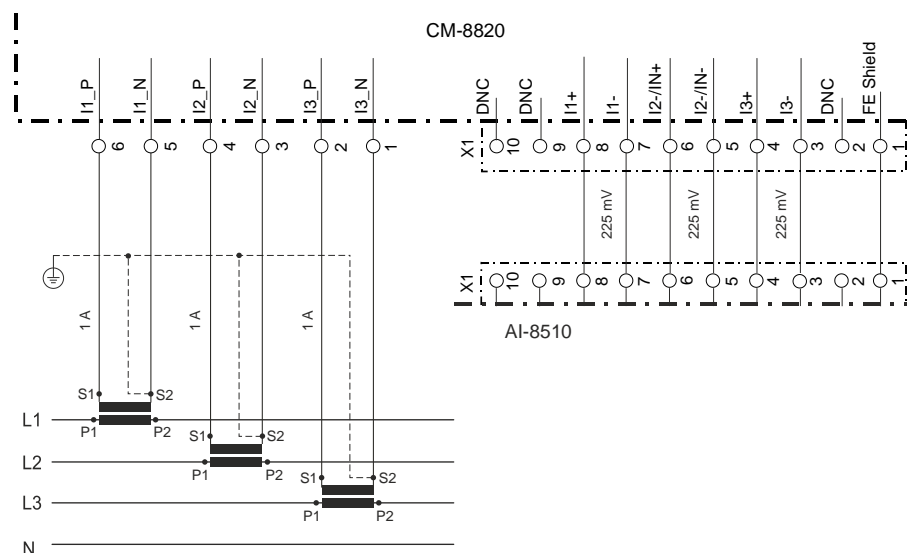
Danger

Works on the circuitry may be performed in de-energized state only!

During electrical installation, all the rules and regulations of power systems must be considered.

2.10.6.1.1 3-Phase Current

Through the current inputs I1_P/I1_N, I2_P/I2_N, I3_P/I3_N the corresponding phase currents are measured.



For further examples refer to [2.8.6, External Circuitry](#) (AI-8510).



Danger

Open transformer circuits will result in electric shock and arc flashover.

Will cause death, serious injury or considerable property damage.

Only measure current with external current transformers. Do not use fuses for circuit protection. Do not open the secondary circuit under load. Short circuit the secondary current terminals of the current transformer before removing this device. The safety information for the current transformers used must be followed.

**Note**

Please take account of the direction of current flow when connecting the current measuring inputs. With inverse connection, the measured values are inverted and receive a negative sign.

**Vorsicht**

Direct currents cannot be measured with CM-0822.

2.10.7 Requirements for Connection Cable CM-8820 → AI-8510

Cable type	
Structure	plastic-insulated copper conductors with shield ^{*)}
Lead number	7
Min. conductor cross section	0.2 mm ² (inflexible) 0.25 mm ² (flexible with wire end sleeve)
Max. conductor cross section	2.5 mm ² (inflexible) 1.5 mm ² (flexible with wire end sleeve)
Max. cable length	0.5 m
Nominal voltage U ₀ /U	300/500 V
Temperature range	-40...80°C

^{*)} up to 10 cm (for side-by-side plugged AI-8510 and CM-8820) single wires without shield are possible

**Note**

For each installed AI-8510 a CM-8820 must be connected ahead, if the current measurement is used. Thereby CM-8820 modules may only be installed at the end of a module line (right-most), else the internal I/O bus is interrupted.

CM-8820 modules may also be installed at a separate DIN rail.

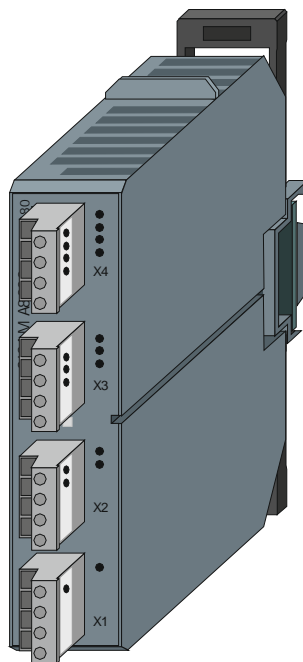
2.11 AO-8380

2.11.1 Features

Analog output module

- 4 outputs
- Galvanically insulated by optocouplers
- Output of currents ± 20 mA, ± 10 mA
- Output of voltages ± 10 V
- Removable screw terminals
- Function indication via LED

2.11.2 View

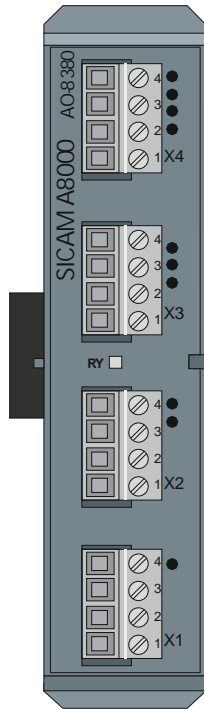


2.11.3 Technical Specifications

Analog Outputs	
4 analog outputs	· All outputs galvanically insulated
Current output	· Max. ± 20 mA on max. 500 W load · Max. ± 10 mA on max. 1 kW load
Voltage output	Max. ± 10 V on min. 1 kW load
Resolution	0.025% at ± 20 mA, ± 10 mA, ± 10 V
Accuracy	0.3% at 25°C 0.4% at 0...50°C 0.7% at -20...70°C 0.8% at -40...70°C
Output circuits	The circuits are operated by means of an internal voltage
Power Supply	
Operating voltage	DC 4.75...5.5 V max. 2200 mW The voltage is picked off at the system bus
Mechanics and Connectors	
Terminals	Removable screw terminals (grid size 5.08)
Dimensions	124 x 30 x 132 mm (L x W x H, dimensions w/o DIN rail)
Weight	Approx. 300 g (including bus module 12 g)

2.11.4 Pin Assignment and Display

The process signals must be connected to 4 pieces 4-pin screw terminals. The pin assignment of the peripheral connectors is described in the following table.



X1	
Pin	Signal
4	not used
3	OUT V0-
2	OUT V0+
1	not used

X2	
Pin	Signal
4	not used
3	OUT V1-
2	OUT V1+
1	not used

X3	
Pin	Signal
4	not used
3	OUT V2-
2	OUT V2+
1	not used

X4	
Pin	Signal
4	not used
3	OUT V3-
2	OUT V3+
1	not used

OUT V0+/- ... OUT V3+/-

analog outputs 0 ... 3

2.11.5 Block Diagram and External Circuitry

The following circuitry variants are examples, and do not relate exclusively to the depicted inputs/outputs.

