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AEA 300
Analog Input and Output Modules

700-331-0V010 / 700-331-4MA20

700-331-PT100 / 700-331-1KF01

700-332-5HB01 / 700-332-5HD01

Manual

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Note:

We have checked the content of this manual for conformity with the hardware and software described. Nevertheless, because deviations cannot be ruled out, we cannot accept any liability for complete conformity. The data in this manual have been checked regularly and any necessary corrections will be included in subsequent editions. We always welcome suggestions for improvement.

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Contents

1	**Safety Information**	**9**
1.1	General	9
1.2	Restriction of access	10
1.3	Information for the user	10
1.4	Use as intended	10
1.5	Avoiding use not as intended!	10
1.6	Installation and mounting	10
2	**Installation and Mounting**	**12**
2.1	Foreword	12
2.2	Restriction of access	12
2.3	Planning mounting	12
2.4	Minimum clearance	13
2.5	Mounting of the module on the DIN rail	13
3	**Wiring**	**15**
3.1	Protection from external electrical interference	15
3.2	Current consumption and power loss	15
3.3	Outdoor cable laying	15
3.4	Wiring the AEA 300 front connector	16
3.4.1	Wire 40-way connector with screw-type terminal	16
3.4.2	Wire 20-way connector with screw-type terminal	17
3.4.3	Wire 40-way connector with spring contacts	19
3.4.4	Wire 20-way connector with spring contacts	20
3.4.5	Wire 40-way connector with **EasyConnect**® clamp connection technique	21
4	**System Overview**	**22**
4.1	Application and function description	22
4.1.1	Analog input module 0 to 10 V	22
4.1.2	Analog input module 20 mA	24
4.1.3	Analog input module PT100	26
4.1.4	Analog input module AI 8 x 13 Bit	28
4.1.5	Analog output module AO 2 x 12 Bit	33
4.1.6	Analog output module AO 4 x 12 Bit	35
5	**Basics of Analog Value Representation**	**37**
5.1	General	37
5.1.1	Analog value representation with 16-bit resolution	37

5.1.2	Measured value resolution	37
5.1.3	Binary representation of the input ranges	38
5.1.4	Analog value representation of the voltage meas. ranges	39
5.1.5	Analog value representation in current measuring ranges	41
5.1.6	Analog value representation for resistance meas. range	42
5.1.7	Analog value representation for resistance thermometer Pt 100 Standard	42
5.1.8	Analog value representation for Pt 100 Climate resistance thermometers	43
5.1.9	Analog value representation for Ni 100 Standard resistance thermometers	43
5.1.10	Analog value representation for Ni 100 Climate resistance thermometers	44
5.1.11	Binary representation of output ranges	45
5.1.12	Analog value representation of the voltage output ranges	46
5.1.13	Analog value representation of the current output ranges	47
6	**Operational Performance of the Analog Modules**	**48**
6.1	Power supply and operating state of the CPU	48
6.1.1	Response to failure of power supply L+	48
6.2	Messages depending on the value range	49
7	**Definition of the Operational Limit and Basic Error Limit**	**50**
7.1	Operational limit	50
7.2	Basic error limit	50
7.3	Calculation example for the input error of an analog input module	50
8	**Conversion, Cycle, Settling, and Response Times of the Analog Modules**	**51**
8.1	Conversion time of the analog input channels	51
8.1.1	Integrating conversion method	51
8.1.2	Instantaneous value conversion	51
8.2	Cycle time of analog input channels	51
8.3	Conversion and cycle time for analog input channels in channel groups	51
8.4	Cycle time of the analog output channels	52
9	**Parameterizing Modules**	**53**

9.1	Static parameters	53
9.2	Dynamic parameters	53
9.3	Parameters of the analog input modules	53
9.4	Parameters of the analog output modules	55
10	**Connecting Transducers to Analog Inputs**	**56**
10.1	Abbreviations used	56
10.2	Signal cables	56
10.3	Isolated analog input modules	57
10.4	Non-isolated analog input modules	57
10.5	Limited potential difference U_{CM}	57
10.5.1	Connection of isolated sensors	57
10.5.2	Non-isolated sensors	58
10.6	Connection of voltage sensors	60
10.7	Connection of current sensors	60
10.7.1	Power supply of sensors	60
10.8	Connecting resistance thermometers and resistors	61
10.8.1	4-wire connection of a resistance thermometer	61
10.8.2	3-wire connection of a resistance thermometer	62
10.8.3	2-wire connection of a resistance thermometer	62
11	**Connection of loads and actuators to analog outputs**	**63**
11.1	Abbreviations used	63
11.1.1	2-wire connection of loads/actuators at voltage output	63
11.1.2	4-wire connection of loads/actuators at the voltage output	64
11.1.3	Connection of loads/actuators at the current output	64
12	**Diagnostics of the Analog Modules**	**65**
12.1	Diagnostic messages	65
12.2	Actions after diagnostic messages in STEP 7®	65
12.3	Reading out the diagnostic messages	65
12.4	Diagnostic message in the measured value of analog input modules	65
12.5	Diagnostic messages on the group fault LED	66
12.6	Diagnostic messages of the analog input modules	66
12.7	Diagnostic messages of the analog output modules	66
12.8	Causes of error and remedies for the analog input modules	67

12.9 Causes of error and remedies for the analog output modules 67
12.10 Alarms of the analog modules 68
12.10.1 Enabling alarms 68
12.10.2 Diagnostic alarm 68
12.10.3 Process alarm with trigger "upper or lower limit violated" 68
12.10.4 Structure of start information variable 0B40 69

13 Technical Data 70

13.1 Analog input module 0 to 10 V 70
13.2 Analog input module 4 to 20 mA 72
13.3 Analog input module PT100 74
13.4 Analog input module AI 8 x 13 Bit 76
13.5 Analog output module 2 outputs 79
13.6 Analog output module 4 outputs 81

14 Starting Up Analog Input Modules 83

14.1 Analog input module 0 to 10 V 83
14.2 Analog input module 20 mA 85
14.3 Analog input module PT100 87
14.4 8 x 13 Bit Analog input module 89
14.5 2 x 12 bits output module 91
14.6 4 x 12 bits output module 93

15 Ordering data 95

List of tables 96

1 Safety Information

Please observe the safety information given for your own and other people's safety. The safety information indicates possible hazards and provides information about how you can avoid hazardous situations.

The following symbols are used in this manual.



Caution, indicates hazards and sources of error



gives information



hazard, general or specific



*danger of **electric shock***

1.1 General

The AEA 300 Analog Input and Output Modules are only used as part of a complete system.



The operator of a machine system is responsible for observing all safety and accident prevention regulations applicable to the application in question.



During configuration, safety and accident prevention rules specific to the application must be observed.



Emergency OFF facilities according to EN 60204 / IEC 204 must remain active in all modes of the machine system. The system must not perform an undefined restart.



Faults occurring in the machine system that can cause damage to property or injury to persons must be prevented by additional external equipment. Such equipment must also ensure entry into a safe state in the event of a fault. Such equipment includes electromechanical safety buttons, mechanical interlocks, etc. (see EN 954-1, risk estimation).



Never execute or initiate safety-related functions using the operator terminal.

1.2 Restriction of access



Only authorized persons must have access to the modules!

The modules are open equipment and must only be installed in electrical equipment rooms, cabinets, or housings. Access to the electrical equipment rooms, barriers, or housings must only be possible using a tool or key and only permitted to personnel having received instruction or authorization. See also Chapter 2.

1.3 Information for the user



During configuration it is imperative to observe the safety and accident prevention rules applicable in the particular application.

This manual is addressed to anyone wishing to configure, use, or install the AEA 300 modules.

It is intended to show the user how to operate the AEA 300 and explain the signalling functions. It provides the installing technician with all the necessary data.

The AEA 300 module is exclusively for use with an S7-300 programmable controller from Siemens or with an PAS 153 PROFIBUS Slave Interface from Systeme Helmholz GmbH.

AEA 300 modules are only used as part of a complete system. For that reason, the configuring engineer, user, and installing technician must observe the standards, safety, and accident prevention rules applicable in the particular application. The operator of the automation system is responsible for observing these rules.

1.4 Use as intended

AEA 300 modules must only be used as a communication and signalling system as described in the manual.

1.5 Avoiding use not as intended!



Uncontrolled restarts must be prevented in the software.

Safety-related functions must not be controlled using the AEA 300 module alone. Uncontrolled restarts must be prevented in the software. The modules must only be operated in the correct slots with a 5 V data bus.

1.6 Installation and mounting



Before you start installation work, all system components must be disconnected from their power source.

The module must be installed and mounted according to VDE 0100 / IEC 364. Because they are IP20 (Open Type) modules, they must be installed in a switching cabinet.

Surrounding air temperature: 0 °C to 60 °C.

!

Note these instructions:

Use 60/75 °C copper wire only

Use Class 1 wire only or equivalent

Suitable for pollution degree 2 environment only

Connected to 5 V bus only

See manual for all output ratings

2 Installation and Mounting

2.1 Foreword

This section describes planning the mechanical structure, preparing the components for installation, and installation itself.

2.2 Restriction of access

Only authorized persons must have access to the modules!

The AEA 300 module must be installed according to VDE 0100 IEC 364. The modules are open equipment and must only be installed in electrical equipment rooms, cabinets, or housings. Access to the electrical equipment rooms, barriers, or housings must only be possible using a tool or key and only permitted to personnel having received instruction or authorization.

2.3 Planning mounting

The modules can be mounted either vertically or horizontally.

Permissible surrounding air temperature:

for vertical mounting: from 0 to 40 °C

for horizontal mounting: from 0 to 60 °C

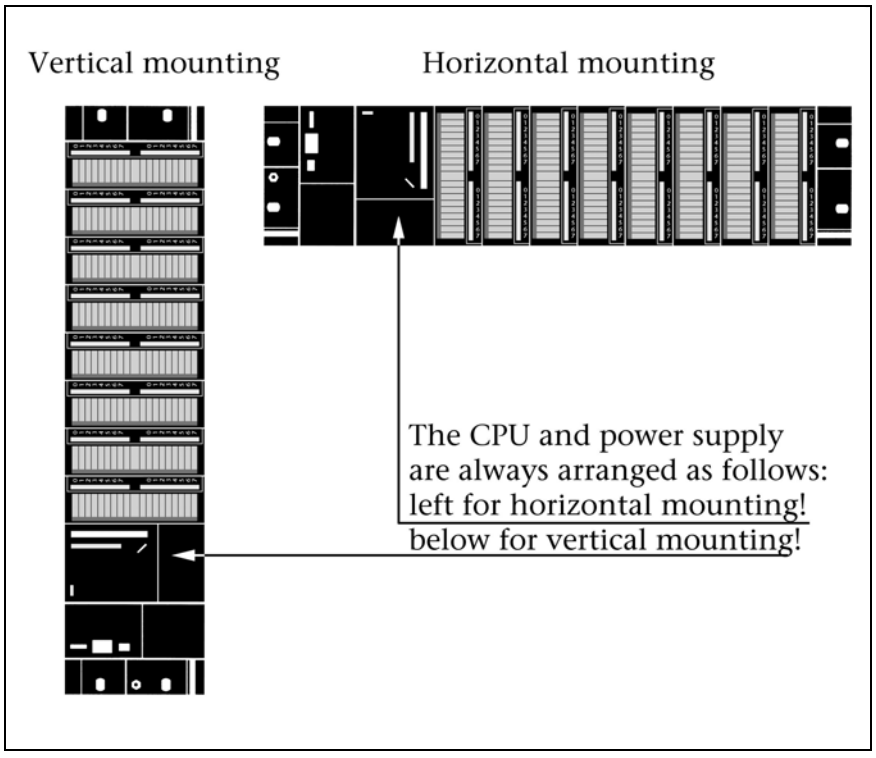


Fig. 2-1:
Vertical and horizontal mounting

2.4 Minimum clearance

Non-observance of the minimum distances can destroy the module at high surrounding air temperature!

Minimum clearances must be observed because

it ensures cooling of the AEA 300 modules

it provides space to insert and remove modules

it provides space to route cables

it increases the mounting height of the module rack to 185 mm, although the minimum spacing of 40 mm must still be observed

The following diagram Fig. 2-2 shows the minimum spacing between the module racks and between these and any adjacent cabinet walls, equipment, cable ducts, etc. for S7-300s mounted in several module racks.

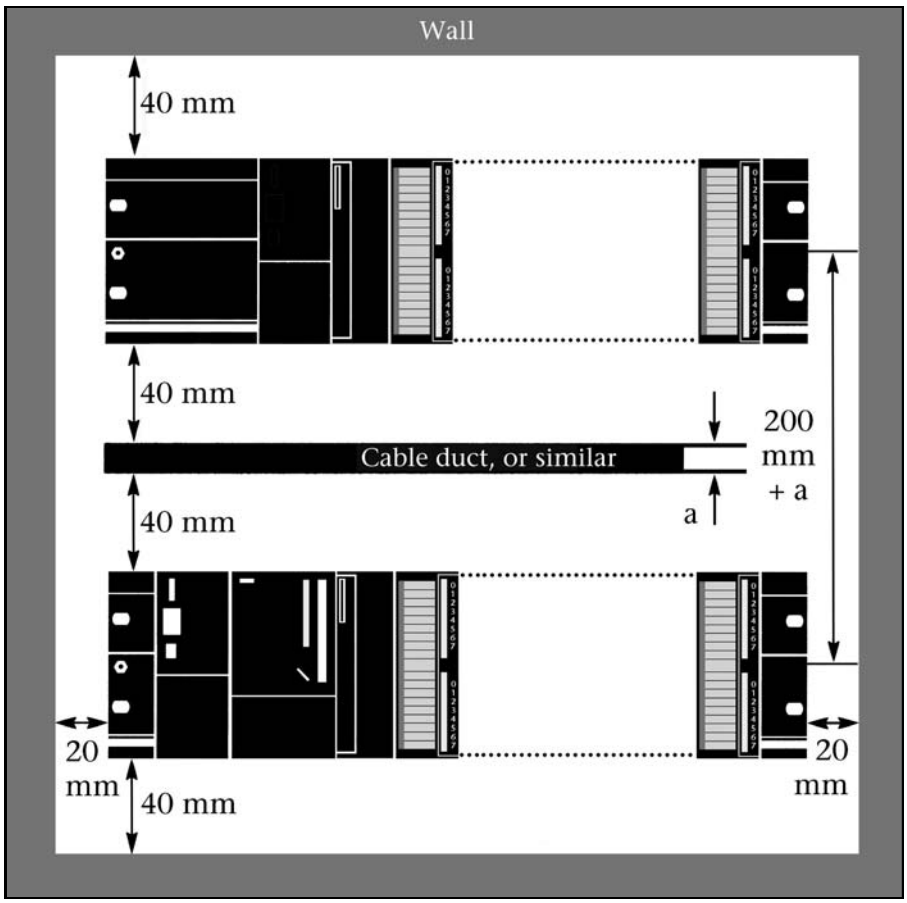


Fig. 2-2: Minimum clearances for installation

2.5 Mounting of the module on the DIN rail

Sectional rail 700-390-1xxxx length see chapter 15 Ordering data

A bus connector is included with each signal module but not with the CPU. When connecting the bus connector, always start with the CPU.

Take the bus connector off the last module and insert it into the CPU. Do not plug a bus connector into the last module of the tier.

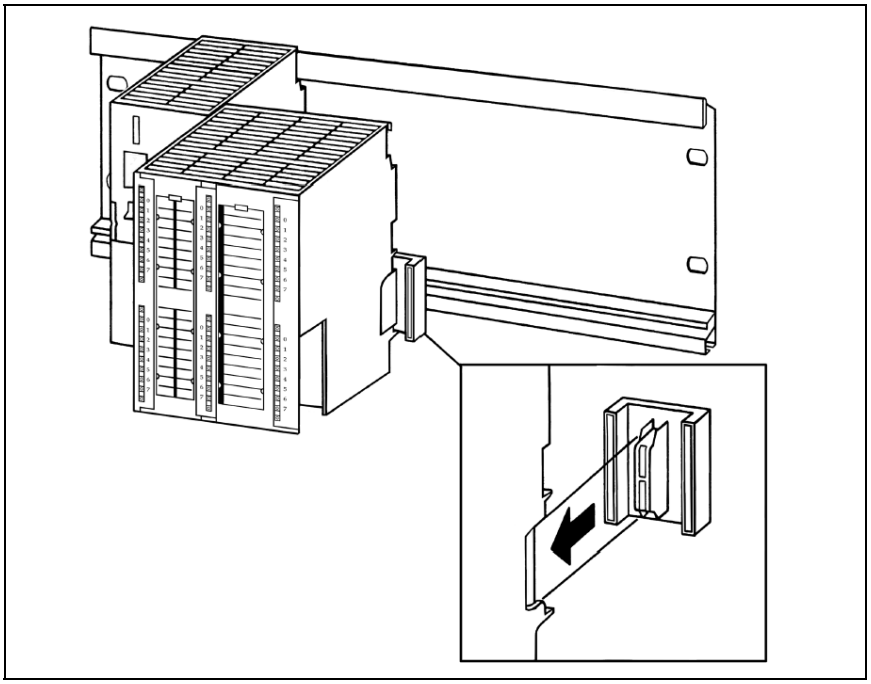


Fig. 2-3:
Plugging the bus connector

Hook on the modules (1), slide them up to the left module, and click them downward (3).

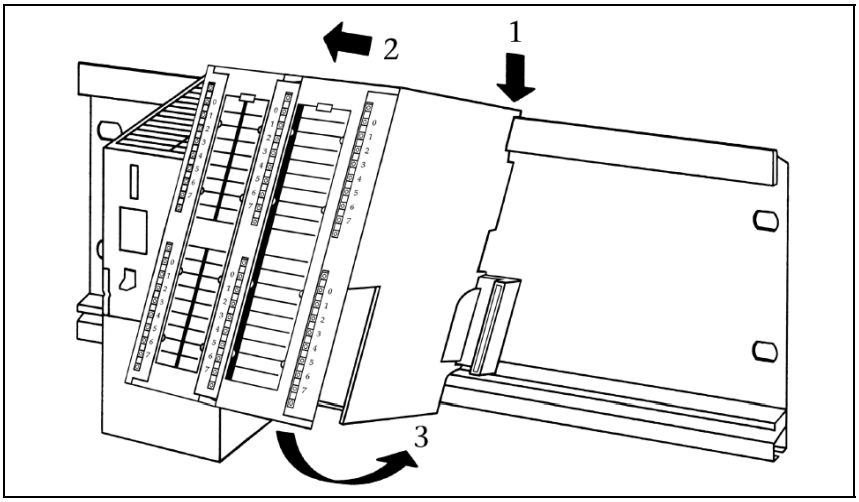


Fig. 2-4:
Inserting the modules

Screw on the modules with a torque of 0.8 to 1.1 Nm.

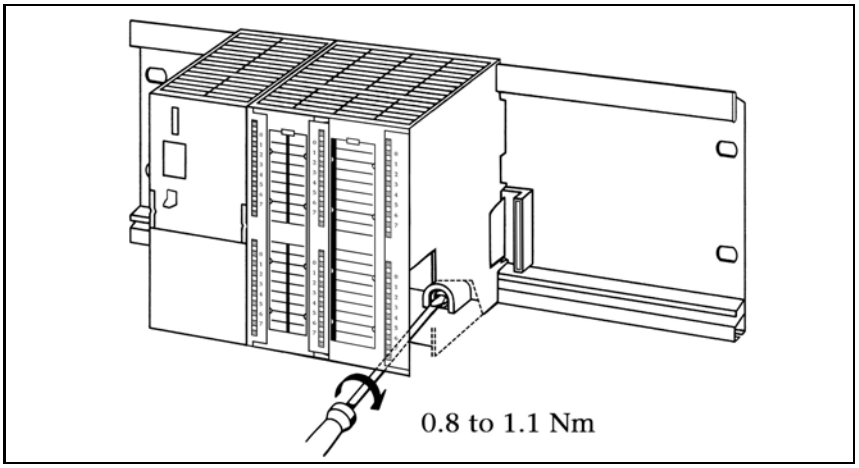


Fig. 2-5:
Screwing on the modules

3 Wiring

3.1 Protection from external electrical interference

Make sure that all systems and plants in which the AEA 300 modules are installed are connected to the protective ground conductor to divert electromagnetic interference.

Make sure that all supply, signal, and bus cables are correctly installed and routed.

For all signal and bus cables, make sure that conductor or wire break does not lead to undefined states in the system or plant.

3.2 Current consumption and power loss

When choosing cabinet dimensions, remember that the temperature in the cabinet must not exceed 60°C if the external temperatures is high.

AEA 300 modules draw the current required to power them from the backplane bus and from an external power supply.

The current consumption of all signal modules from the backplane bus must not exceed the current that the CPU can supply to the backplane bus.

The power loss of all modules used in a cabinet must not exceed the maximum power that can be dissipated from the cabinet.

Information on current consumption and power loss of a module is given in the Technical Data of each module.

3.3 Outdoor cable laying

Lightning protection must always be based on an individual assessment of the overall plant.

The same guidelines apply as for indoor cable laying.

The cables must be laid on metal cable trays.

Joints between cable trays must be conductively connected.

Cable trays must be grounded.

Adequate equipotential bonding between connected devices must also be ensured.

Interior and exterior lightning protection must be ensured and such grounding measures must be taken as are suitable for the application in question.

3.4 Wiring the AEA 300 front connector

40-way front connector with screw-type terminal:
Order No 700-392-1AM01

20-way front connector with screw-type terminal:
Order No 700-392-1AJ10

40-way front connector with spring-type terminal:
Order No 700-392-1BM01

20-way front connector with spring-type terminal:
Order No 700-392-1BJ01

40-way front connector with **EasyConnect**®:
Order No 700-392-1AM10



Fig. 3-1: Helmholz 20- and 40-way front connector

3.4.1 Wire 40-way connector with screw-type terminal

Technical specifications

Order number	700-392-1AM01
Number of terminals	**40**
Terminal type	screw-type terminal
Connectable cables	flexible, fixed
Cross-section with/without end ferrules	0,125 – 1,5 mm²
Strip-back length	6 - 8 mm
end ferrules	with or without
Required torque, clamp	0,5 Nm
Required torque, screw	0,7 Nm
Weight	120 g

With the cables brought out from the module at the bottom, start with terminal 40 or 20 and then proceed wiring alternately, in the sequence of order terminal 39, 19, 38, 18 etc.

With the cables brought out from the module at the top, start with terminal 1 or 21 and then proceed wiring alternately in the sequence of order terminal 2, 22, 3, 23, etc. up to terminals 20 and 40.

Close unused terminals.

Lay the supplied strain relief around the cable loom and around the front connector.

Screw the strain relief for the cable loom tight, press the lock of the strain relief to the left inside so that the cable space can be utilised more efficiently.

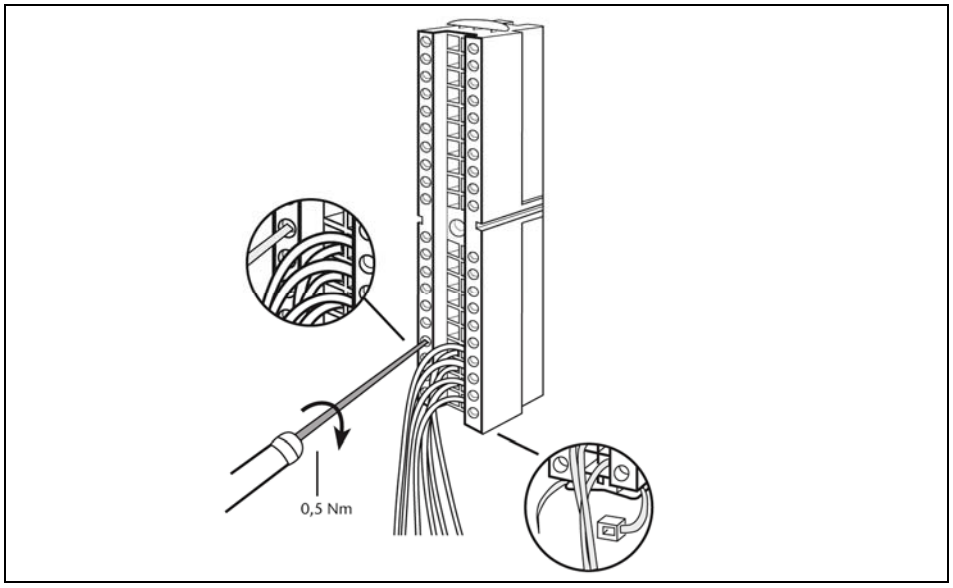


Fig. 3-2:
Wiring the 40-way front connector

3.4.2 Wire 20-way connector with screw-type terminal

Technical specifications

Order number	700-392-1AJ10
Number of terminals	**20**
Terminal type	screw-type terminal
Connectable cables	flexible, fixed
Cross-section with/without end ferrules	0,25 – 1,5 mm²
Strip-back length	6 mm
end ferrules	with or without
Required torque, clamp	0,5 Nm
Weight	60 g

Open the AEA 300 modules (1).

Snap the front connector into the signal module (2)

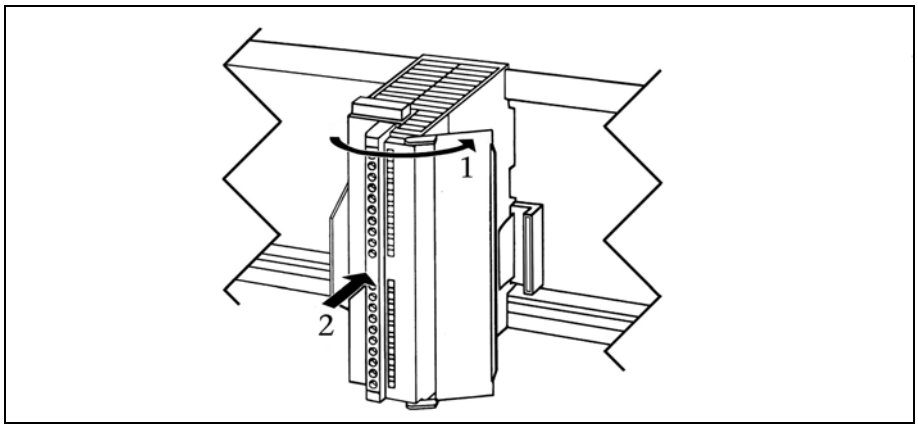


Fig. 3-3:
Bringing the front connector into the wiring position

Strip the isolation from the cables.

When using connector sleeves, crimp the sleeves with the cables.

CAUTION: When the power supply module and, in some cases, additionally, the load power supplies are turned on, make absolutely sure that nobody is able to come into contact with alive lines or cables.

Insert the supplied strain relief for the loom of cables into the front connector (0).

With the cables brought out from the module at the bottom, start with terminal 20 and then proceed wiring in the sequence of order terminal 20, 19, etc. (1) up to terminal 1 (2). Wiring front connectors

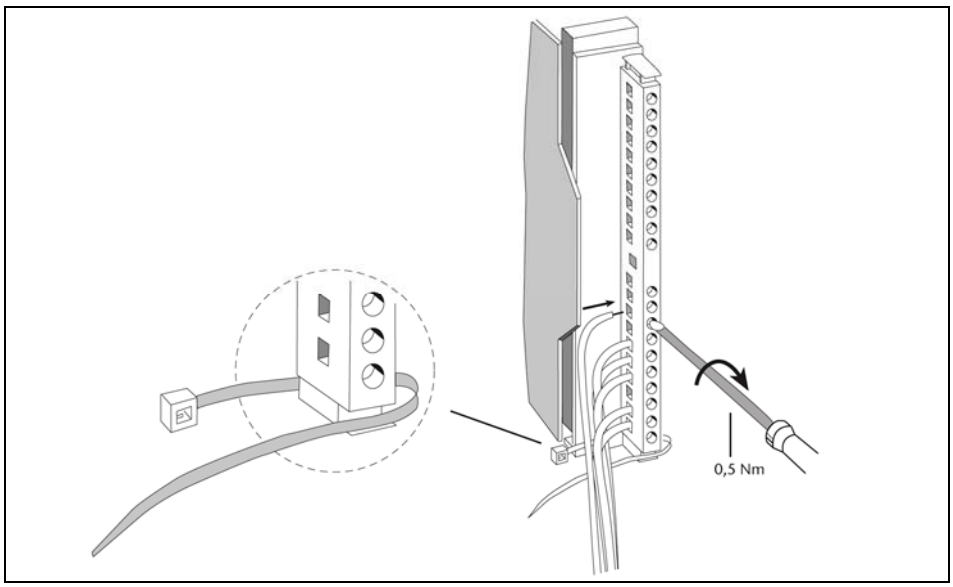


Fig. 3-4:
Wiring the 20-way front connector

With the cables brought out from the module at the top, start with terminal 1 and then proceed wiring in the sequence of order terminal 1, 2, etc. up to terminal 20.

In the case of screw-type terminals (3), screw tight also the connection screws of those screw-type terminals which are not wired.

Tighten the strain relief for the loom of cables (4).

Press the lock of the strain relief to the left inside so that the cable space can be utilised more efficiently.

3.4.3 Wire 40-way connector with spring contacts

Technical specifications

Order number	700-392-1BM01
Number of terminals	**40**
Terminal type	spring contacts
Connectable cables	flexible, fixed
Cross-section with/without end ferrules	0,34 – 1,5 mm²
Strip-back length	8 mm
Weight	Approx. 70 g

The unlock mechanism of the front connector with spring contacts could be damaged easily by edgewise movements of the screwdriver or by using the wrong screwdriver.
Use always the right tool to open the unlock mechanism!

Easy wiring of front connector with spring contacts: put a screwdriver (for slotted grub screws 0,6 x 3,5) vertically into the chamber with the unlock mechanism until mechanical stop, plug the wire into the spring contact and remove the screwdriver.

Cable routing is similar to the 40 way front connector with screw contacts.

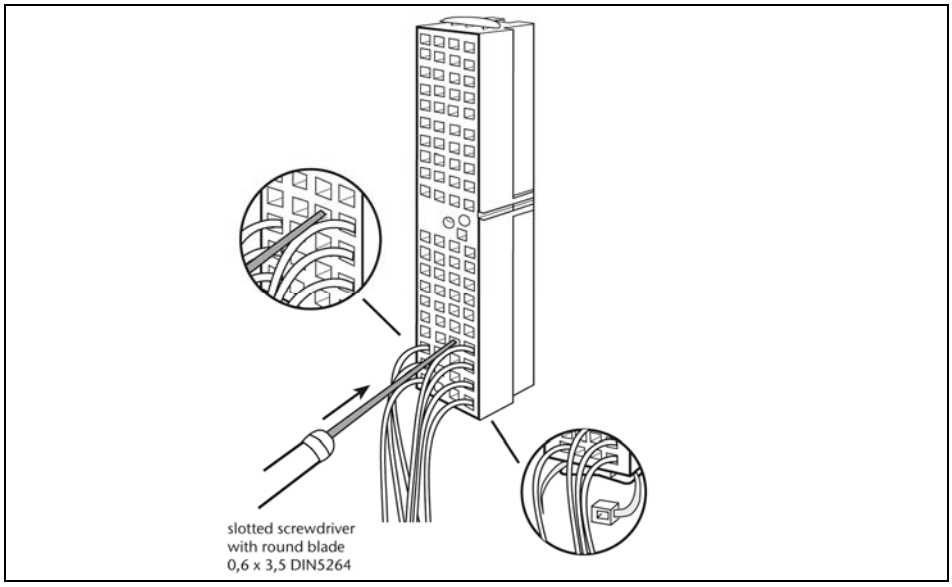


Fig. 3-5:
Wiring the 40-way front connector

3.4.4 Wire 20-way connector with spring contacts

Technical specifications

Order number	700-392-1BJ01
Number of terminals	**20**
Terminal type	spring contacts
Connectable cables	flexible, fixed
Cross-section with/without end ferrules	0,34 – 1,5 mm²
Strip-back length	8 mm
Weight	Approx. 50 g

The unlock mechanism of the front connector with spring contacts could be damaged easily by edgewise movements of the screwdriver or by using the wrong screwdriver.
Use always the right tool to open the unlock mechanism!

Easy wiring of front connector with spring contacts: put a screwdriver (for slotted grub screws 0,6 x 3,5) vertically into the chamber with the green unlock mechanism until mechanical stop, plug the wire into the spring contact and remove the screwdriver.

Cable routing is similar to the 20 way front connector with screw contacts.

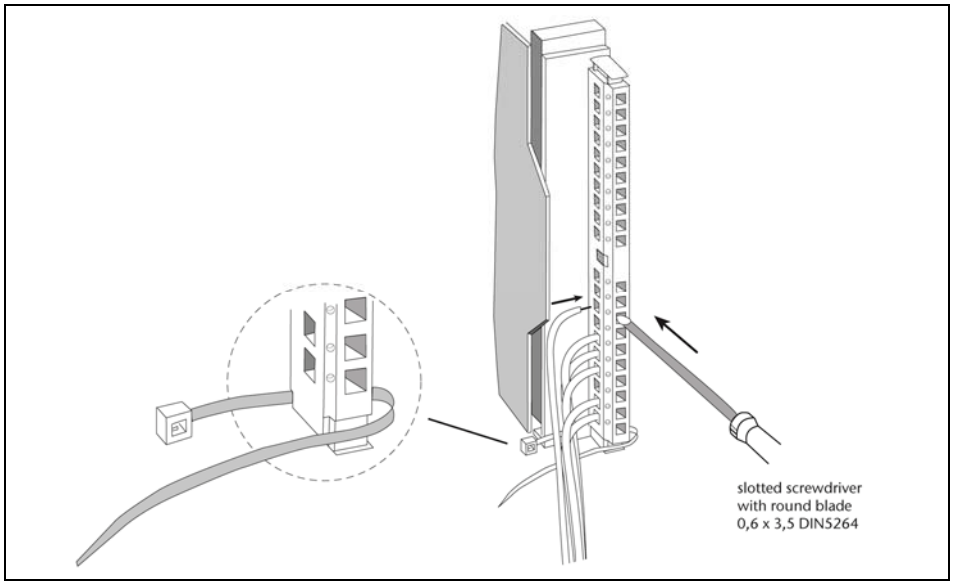


Fig 3-6:
Wiring the 20-way front connector

3.4.5 Wire 40-way connector with **EasyConnect**® clamp connection technique

Technical specifications

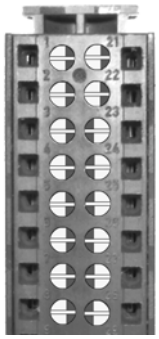
Order number	700-392-1AM10
Number of terminals	**40**
Terminal type	Spring
Connectable cables	Flexible cables
Cross-section without end ferrules	0.34 – 1 mm²
Strip-back length	8 – 10 mm
Wire end ferrules	Not required
Open terminal	180° turn counter clockwise
Close terminal	180° turn clockwise
Required torque, clamp	0.15 Nm
Required torque, screw	0.7 Nm
Weight	70 g

Tighten terminals with fingers only, do not use a power screwdriver!

The terminals are supplied closed.

The eccentric screws are marked with a beveled side. If the beveled – darker side – is turned toward the terminal, the terminal opens.

Counter clockwise - Open terminal
Clockwise - Close terminal



The figure shows Terminals 21 and 22 open.

To avoid material fatigue, always close unused terminals!

The eccentric screw is only used to open the terminal, it has no fixing function. Although the screw will still turn a few degrees on a closed terminal, this will not make the connection any more secure!

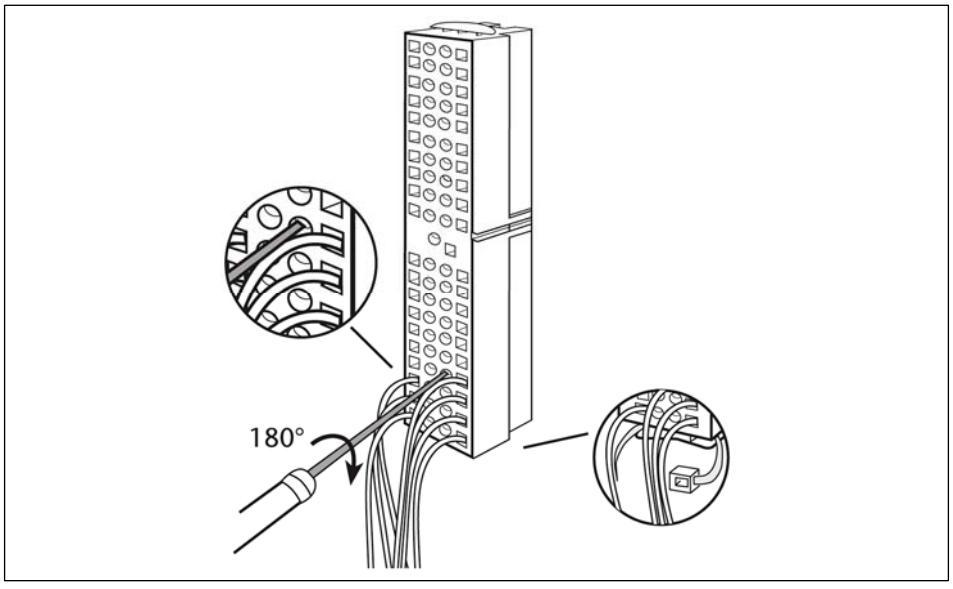


Fig 3-7:
Wiring the 40-way front connector

4 System Overview

4.1 Application and function description

Various analog modules are available for connecting sensors and transducers for measuring voltages, currents, and thermal resistances. The output module with a voltage or current output is used for connecting analog actuators.

4.1.1 Analog input module 0 to 10 V

Order No.	700-331-0V010
Design	8 inputs for connection of voltage sensors
Voltage meas. ranges	±80 mV / 10 MΩ ±250 mV / 10 MΩ ±500 mV / 10 MΩ ±1 V / 10 MΩ ±2.5 V / 100 kΩ ±5 V / 100 kΩ 1 ... 5 V / 100 kΩ ±10 V / 100 kΩ
Input voltage	max. 20 V permissible
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time
Operational limit	max. ±0.6 %
Basic error limit	max. ±0.5 % at 25 °C
Interf. voltage suppression	for interf. frequencies 400 / 60 / 50 / 10 Hz
Cable length	shielded max. 200 m, for measuring range ±80 mV max. 50 m
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector
Current consumption	typ. 120 mA at 5 V (backplane bus) max. 200 mA at 24 V
Power loss	typ. 1.8 W
Isolation	isolated from backplane bus isolated from power supply
Diagnostics	red LED for group fault display
Alarm	limit value and diagnostic alarm parameterizable for channels 0 and 2
Fault signal	value 7FFFH irrespective of parameterization
Connection	16-bit DEA 300 front connector (20-way)

Dimensions	40 x 125 x 120 mm³	
Surrounding air temperature	operation	0 °C ... +60 °C
	storage	-25 °C ... +75 °C
Weight	approx.	220 g

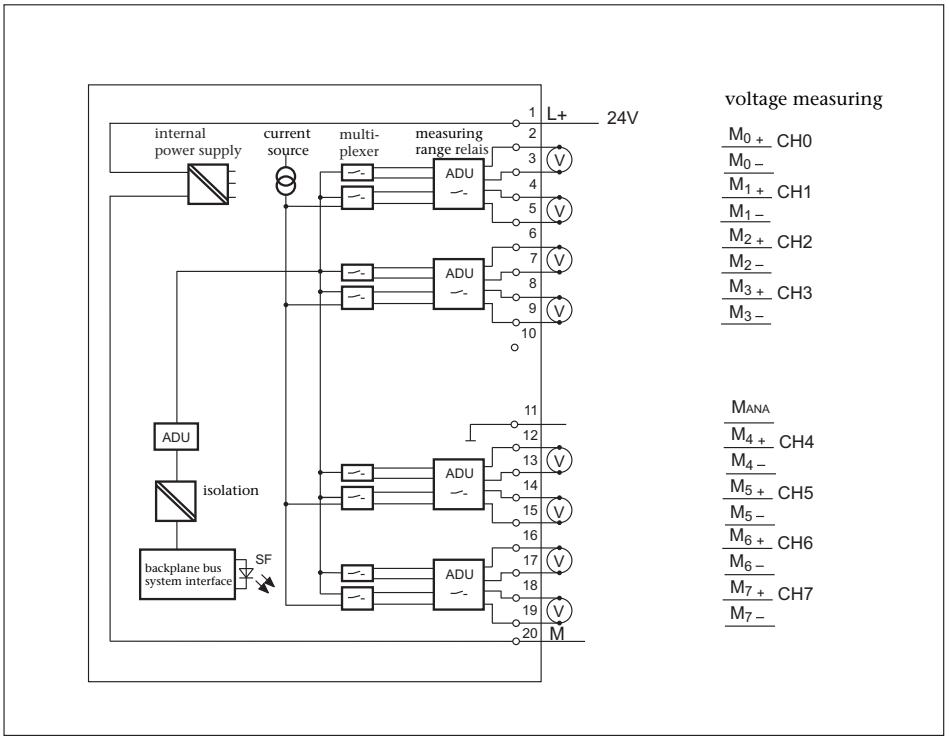


Fig. 4-1:
Block diagram module 700-331-0V010

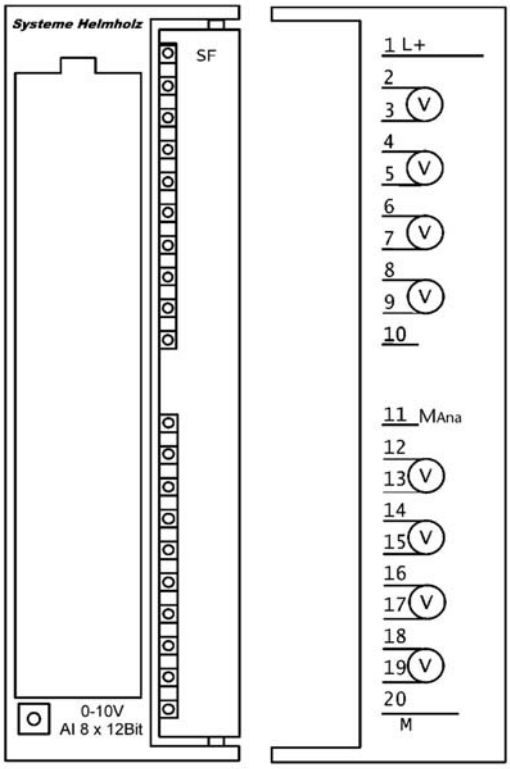


Fig. 4-2:
Front view and terminal assigment module 700-331-0V010

4.1.2 Analog input module 20 mA

Order No.	700-331-4MA20
Design	8 inputs for connecting current sensors and current sinks
Current meas. ranges	4-wire transmitter: ±3.2 mA / 25 Ω ±10 mA / 25 Ω 0 ... 20 mA / 25 Ω 4 ... 20 mA / 25 Ω ±20 mA / 25 Ω 2-wire transmitter: 4 ... +20 mA / 25 Ω
Input current	max. 40 mA permissible
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time
Operational limit	max. ±0.6 %
Basic error limit	max. ±0.5 % at 25 °C
Interf. voltage suppression	for interf. frequencies 400 / 60 / 50 / 10 Hz
Cable length	shielded max. 200 m
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector Reverse polarity protection
Current consumption	typ. 120 mA at 5 V (backplane bus) max. 200 mA at 24 V
Power loss	typ. 1.8 W (without current for 2-wire-transmitters)
Isolation	isolated from backplane bus isolated from power supply
Diagnostics	red LED for group fault display
Alarm	limit value and diagnostic alarm parameterizable for channels 0 and 2
Fault signal	value 7FFFH irrespective of parameterization
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm^3
Surrounding air temperature	operation 0 °C ... +60 °C storage -25 °C ... +75 °C
Weight	approx. 220 g

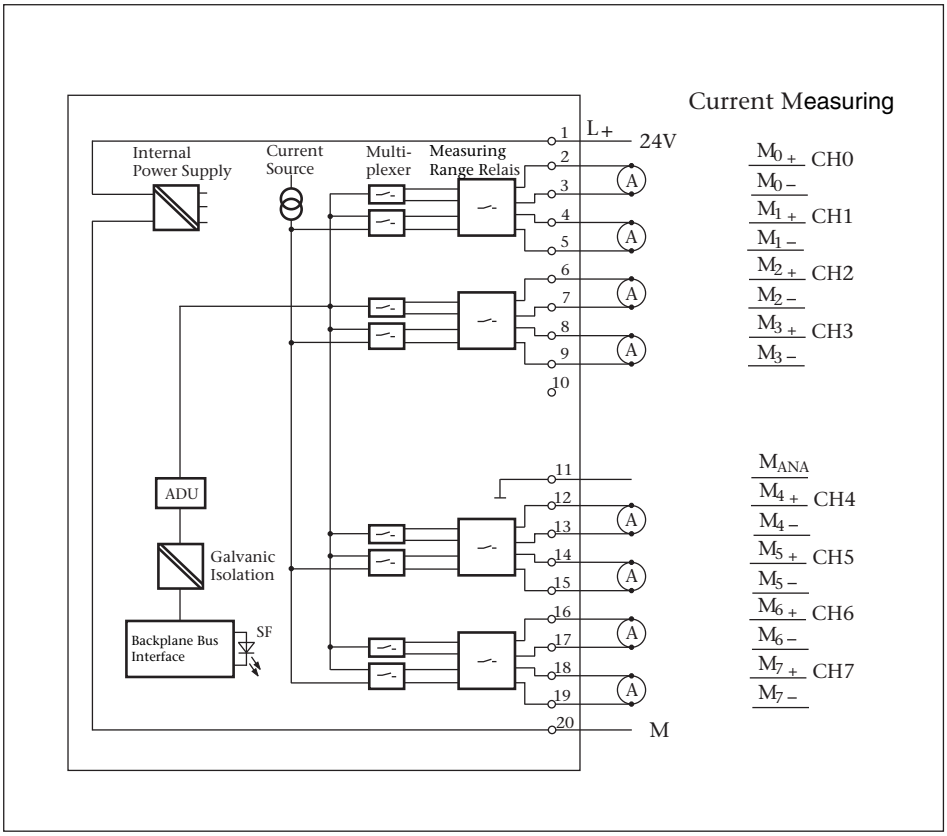


Fig. 4-3:
Block diagram module 700-331-4MA20

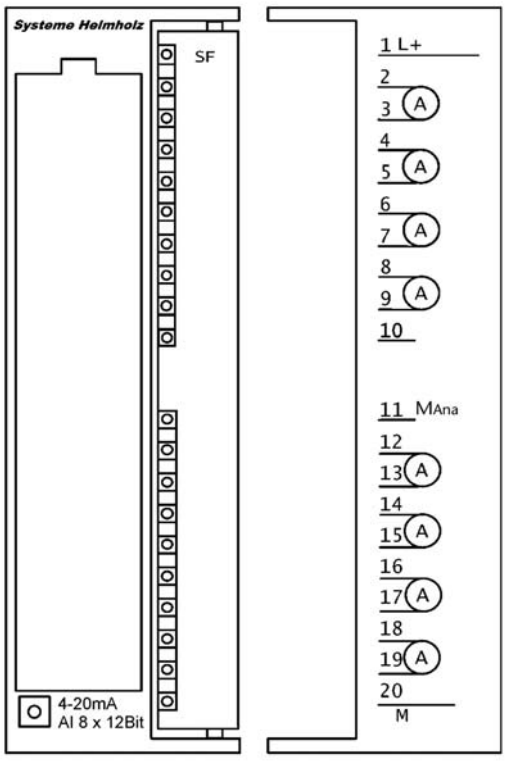


Fig. 4-4:
Front view and terminal assignment module 700-331-4MA20

4.1.3 Analog input module PT100

Order No.	700-331-PT100	
Design	4 inputs, 4-wire connection	
Resistance thermometer	Pt100 Standard / Climate Ni100 Standard / Climate	
Resistance measuring range	150 Ω, 300 Ω, 600 Ω	
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time	
Reverse polarity prot.	yes	
Operational limit	max. ±0.6 %	
Basic error limit	max. ±0.5 % t 25 °C	
Interf. voltage suppression	for interf. frequencies 400 / 60 / 50 / 10 Hz	
Cable length	shielded max. 200 m	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector Reverse polarity protection	
Current consumption	typ. 120 mA at 5 V (backplane bus) max. 200 mA at 24 V	
Power loss	typ. 1.8 W	
Isolation	isolated from backplane bus isolated from power supply	
Diagnostics	red LED for group fault display	
Alarm	limit value and diagnostic alarm parameterizable for channels 0 and 2	
Fault signal	value 7FFFH irrespective of parameterization	
Connection	16-bit DEA 300 front connector (20-way)	
Dimensions	40 x 125 x 120 mm^3	
Surrounding air temperature	operation storage	0 °C ... +60 °C -25 °C ... +75 °C
Weight	approx.	220 g

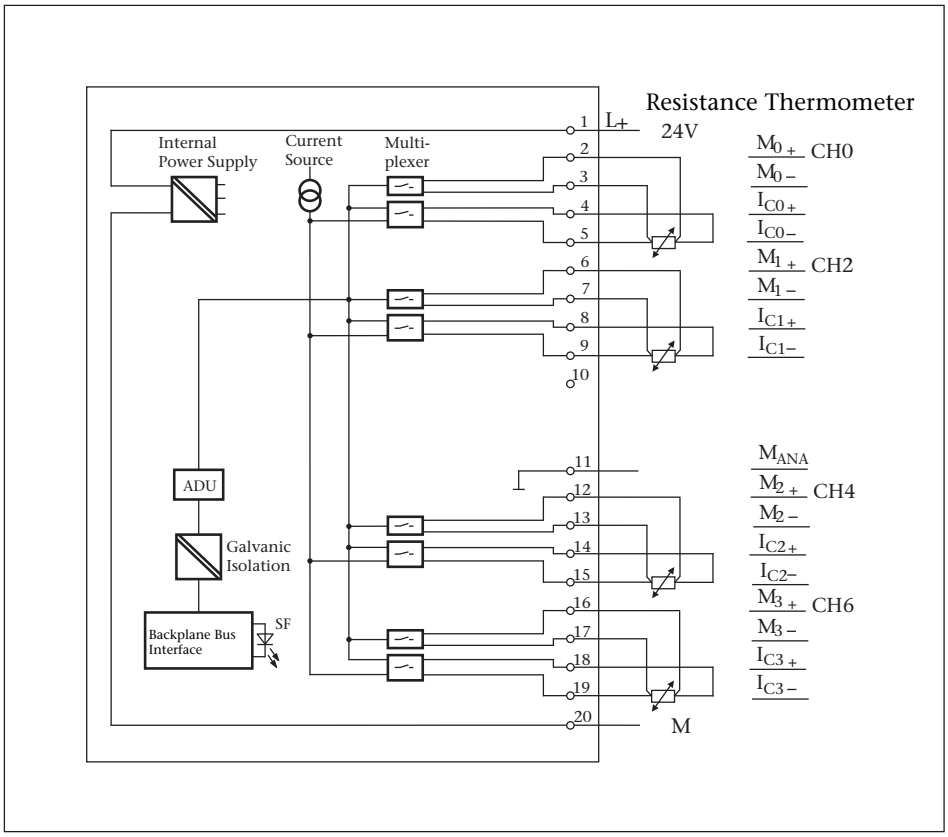


Fig. 4-5:
Block diagram module 700-331-PT100

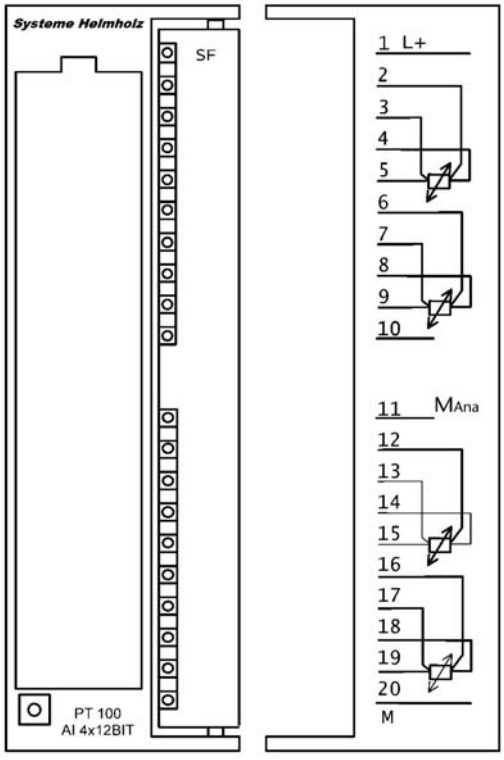


Fig. 4-6:
Front view and terminal assignment module 700-331-PT100

4.1.4 Analog input module AI 8 x 13 Bit

Order No. 700-331-1KF01

The SM 331; AI 8 * 13 Bit has the following qualities:

8 inputs in 8 channel groups

Resolution 12 bits + sign adjustable per channel group

Measuring method adjustable per channel group:
– Voltage
– Current
– Resistance
– Temperature

Any measuring range selection per channel.

isolated from backplane bus

Fig. 4-7 shows the block diagram of the AEA AI 8 x 13 Bit, the technical data see Section 13.4 Analog input module AI 8 x 13 Bit.

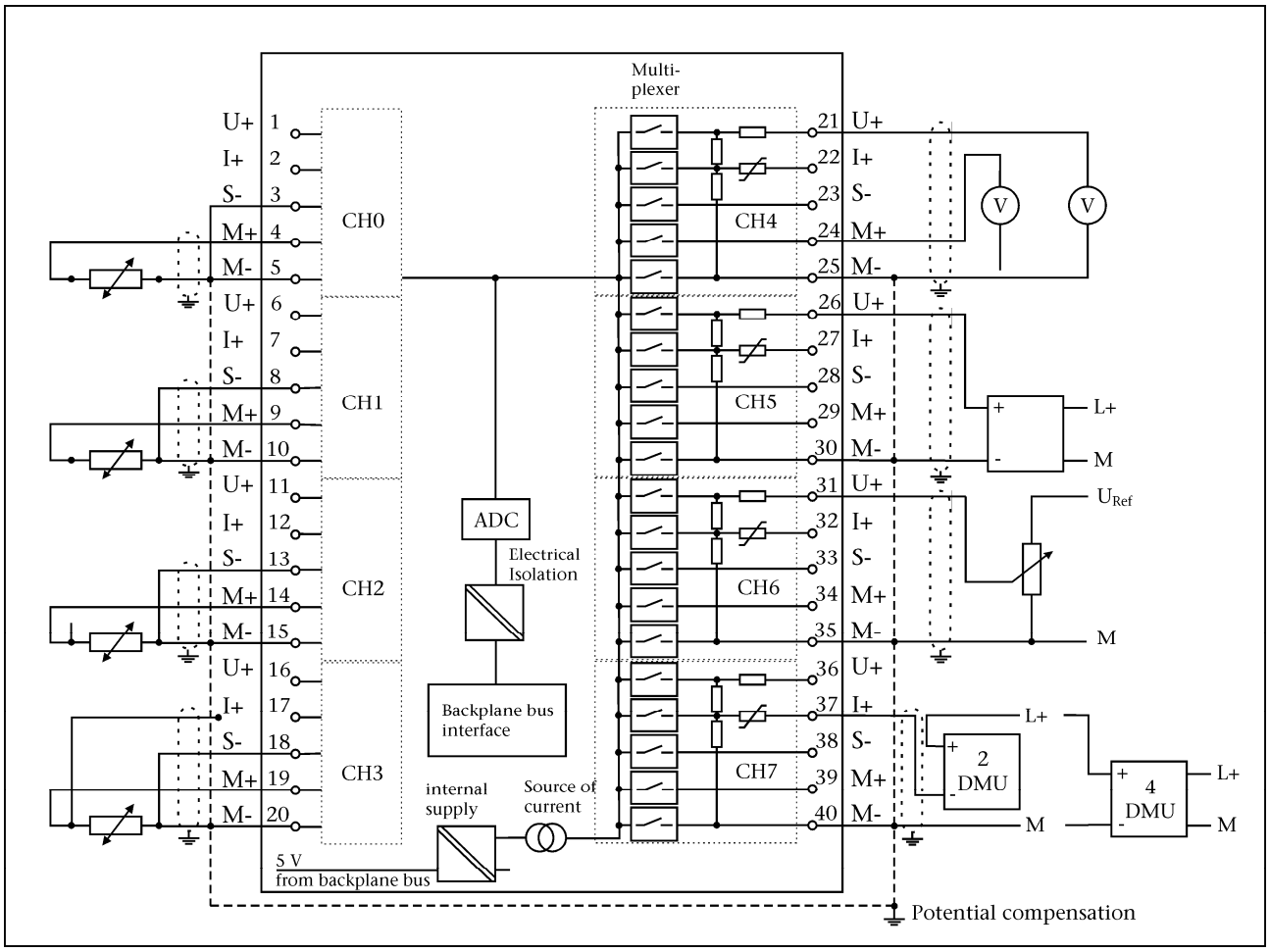


Fig. 4-7:
Block diagram module
700-331-1KF01

Design	8 inputs in 8 channel groups
Measuring method	Voltage Current Resistance Temperature
Voltage meas. ranges	±50 mV / 100 kΩ ±500 mV / 100 kΩ ±1 V / 100 kΩ ±5 V / 100 kΩ ±10 V / 100 kΩ 1 ... 5 V / 100 kΩ 0 ... 10 V / 100 kΩ
Current meas. ranges	±20 mA / 50 Ω 0 … 20 mA / 50 Ω 4 … 20 mA / 50 Ω
Resistance measuring range	0 … 6 kΩ / 100 MΩ 0 … 600 Ω / 100 MΩ
Resistance thermometers	Standard and Climate Pt 100, Ni 100, Ni 1000, LG-Ni 1000/100 MΩ Characteristic linearization programmable Technical unit of temperature measurements: Degrees Centigrade, degrees Fahrenheit, Kelvin
Measuring range selection	any, per channel group
Input voltage	max. 30 V at voltage input U+ max. 12 V continuous / 30 V for a duration of max. 1 s at voltage inputs M+, M-, S-
Input current	max. 40 mA current input I+
Resolutions	adjustable per channel group 12 bits + sign
Operational limit	max. ±0,6 %, max. 1,2 K
Basic error limit	max. ±0,4 % at 25 °C, max. 1 K
Interf. voltage suppression	for interf. frequencies 60 / 50 Hz
Cable length	shielded max. 200 m, at measuring range ±50 mV max. 50 m
Nominal voltage	DC 5 V via backplane bus
Current consumption	typ. 160 mA at 5 V (backplane bus)
Power loss	typ. 0,8 W
Isolation	isolated from backplane bus
Connection	32 Bit-DEA300 front connector (40-way)
Dimensions	40 x 125 x 117 mm^3

Surrounding air temperature	operation	0 °C ... +60 °C
	storage	-25 °C ... +75 °C
Weight	approx. 260 g	

Input wiring

CH0 2-wire connection, without line resistance compensation. M- and S- are short cut.

CH1 3-wire connection

CH2 4-wire connection, the fourth line must not be wired (line remains unused).

CH3 4-wire connection, the fourth line is routed to the terminal strip in the control cubicle but is not wired.

CH4 Voltage measurement at U+: ±5 V, ±10 V, 1 ... 5 V, 0 ... 10 V Voltage measurement at M+: ±50 mV, ±500 mV, ±1 V

CH5 Transducer with voltage output 0 ... 10 V, 1 … 5 V, ±5 V, ±10 V

CH6 Voltage measurement
Please note input resistance, see Section 13.4.

CH7 2-wire transducer 4 ... 20 mA or
4-wire transducer 0/4 ... 20 mA or ±20 mA

The represented terminal assignments are exemplary und not bound to the channel group. Every channel can be used arbitrarily.

Non-connected channels

Reducing the cycle time of the module enables you to parameterize the unused channel groups as "deactivated" under Measurement - Measuring Type.

The terminal connections M- of the not connected channels should be connected with each other.

Measuring of resistors and resistance thermometers

It is not required to interconnect the M- terminals when measuring resistances and resistance thermometers. A connection between the M- terminals can however increase the interference resistance.

voltage and current transducers

When connecting voltage and current transducers, make sure the maximum permitted common-mode voltage (U_{CM}) is not exceeded between the inputs. To prevent measuring errors, interconnect the various M- terminals.

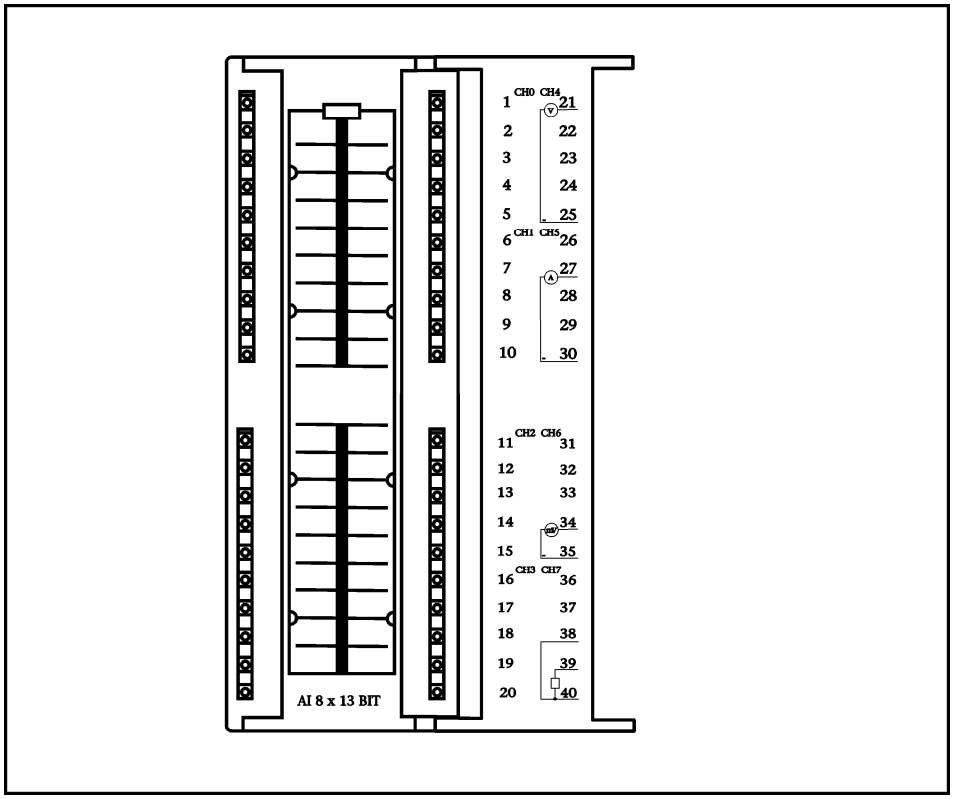


Fig. 4-8:
Front view and terminal assigment module 700-331-1KF01

4.1.5 Analog output module AO 2 x 12 Bit

Order No.	700-332-5HB01	
Design	2 outputs in 2 groups	
Channels	Selectable channel-by-channel as - voltage output - current output	
Output ranges	1 … 5 V, 0 … 10 V, ±10 V 0 … 20 mA, 4 … 20 mA, ±20 mA	
Resolution	12 Bit	
Operational limit	voltage output ±0,5 % current output ±0,6 %	
Basic error limit	voltage output ±0,4 % at +25 °C current output ±0,5 % at +25 °C	
Cable length	shielded max. 200 m	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector with Reverse polarity protection	
Current consumption (without load)	typ. 100 mA at 5 V (backplane bus) max. 240 mA at 24 V	
Power loss	typ. 3 W	
Isolation	isolated from backplane bus isolated from power supply	
Diagnostics	Red LED for group fault display	
Alarm	diagnostic alarm parameterizable diagnostic function parameterizable diagnostic information readable	
Substitute values	Output parameterizable	
Connection	16 Bit-DEA 300 front connector (20-way)	
Dimensions	40 x 125 x 120 mm^3	
Surrounding air temperature	operation storage	0 °C ... +60 °C -25 °C ... +75 °C
Weight	approx.	220 g

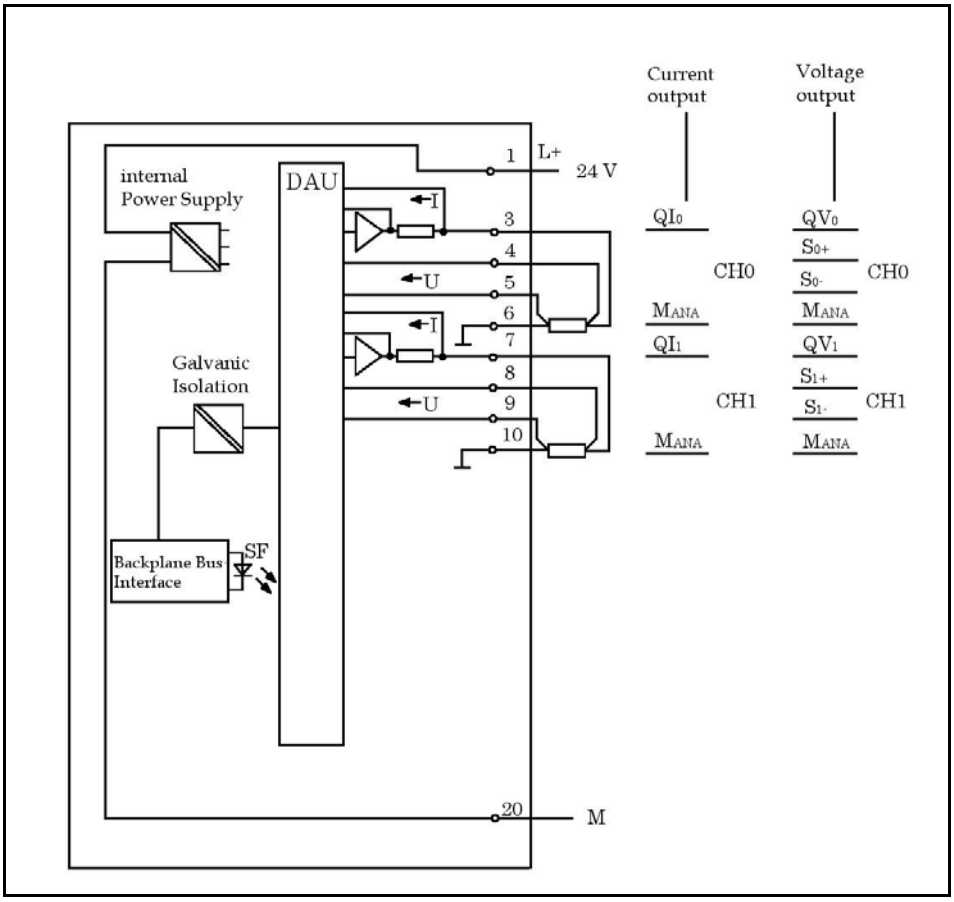


Fig. 4-9:
Block diagram module 700-332-5HB01

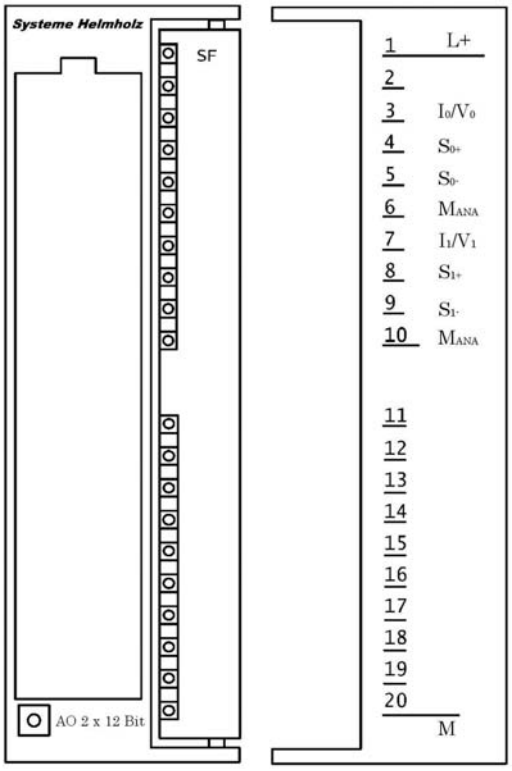


Fig. 4-10:
Front view and terminal assignment module 700-332-5HB01

4.1.6 Analog output module AO 4 x 12 Bit

Order No.	700-332-5HD01
Design	4 outputs in 4 groups
Channels	Selectable channel-by-channel as - voltage output - current output
Output ranges	1 … 5 V, 0 … 10 V, ±10 V 0 … 20 mA, 4 … 20 mA, ±20 mA
Resolution	12 Bit
Operational limit	voltage output ±0,5 % current output ±0,6 %
Basic error limit	voltage output ±0,4 % at +25 °C current output ±0,5 % at +25 °C
Cable length	shielded max. 200 m
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector with Reverse polarity protection
Current consumption (without load)	typ. 100 mA at 5 V (backplane bus) max. 240 mA at 24 V
Power loss	typ. 3 W
Isolation	isolated from backplane bus isolated from power supply
Diagnostics	Red LED for group fault display
Alarm	diagnostic alarm parameterizable diagnostic function parameterizable diagnostic information readable
Substitute values	Output parameterizable
Connection	16 Bit-DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm^3
Surrounding air temperature	operation 0 °C ... +60 °C storage -25 °C ... +75 °C
Weight	approx. 220 g

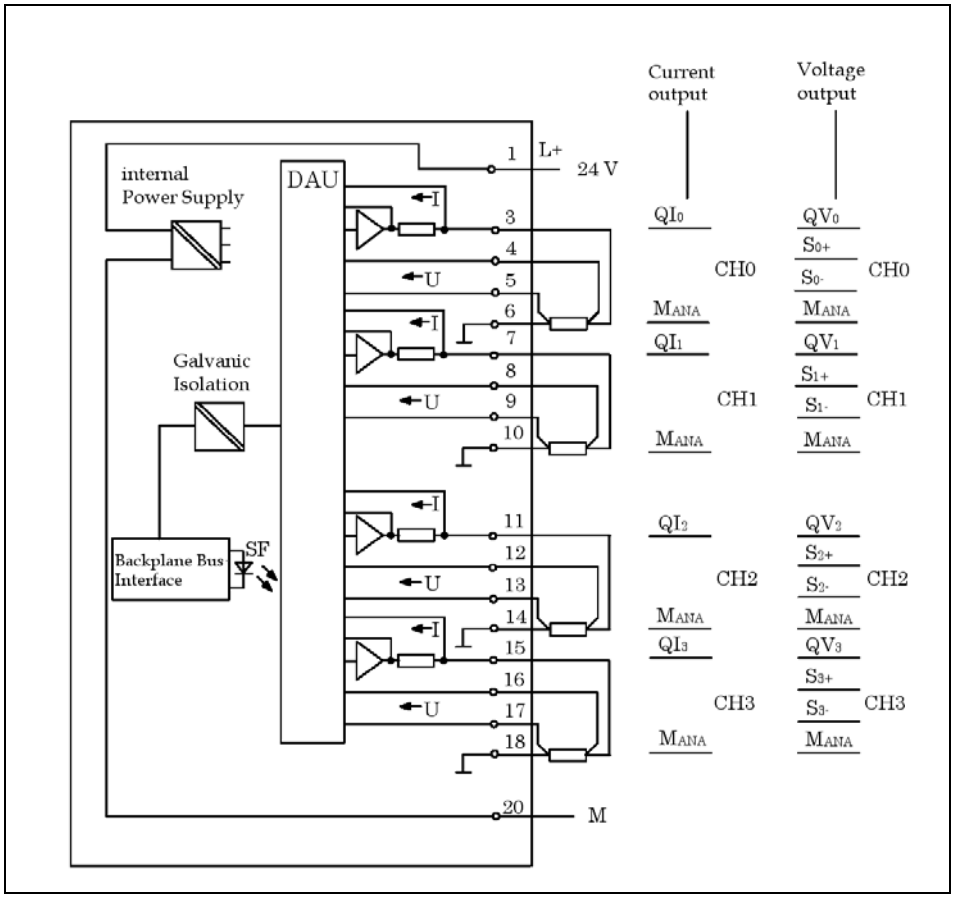


Fig. 4-11:
Block diagram module 700-332-5HD01

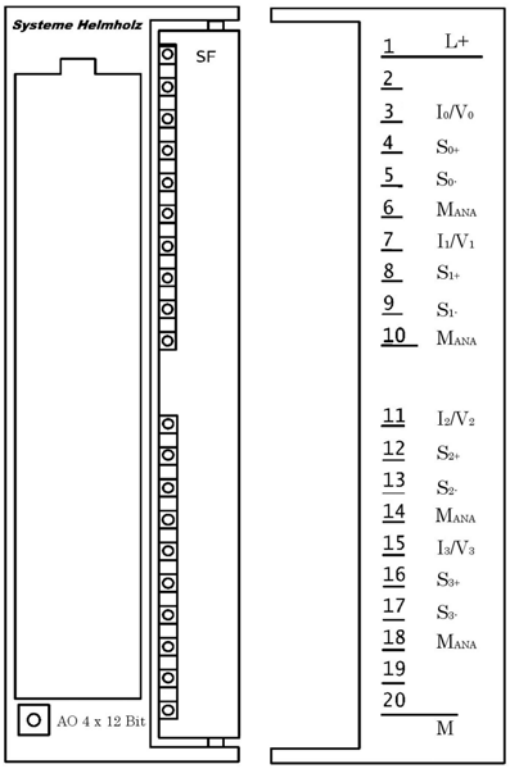


Fig. 4-12:
Front view and terminal assignment module 700-332-5HD01

5 Basics of Analog Value Representation

5.1 General

The CPU can only process analog values as binary values. The analog input modules convert analog input values into binary numbers with 16-bit resolution.

5.1.1 Analog value representation with 16-bit resolution

The analog values are represented as a two's complement fixed-point number. The sign of the analog value is always in bit 15, i.e. when 15 = 1 the value is negative.

	Sign	High byte							Low byte							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit significance	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

5.1.2 Measured value resolution

Depending on analog input module parameterization, the resolution of analog values can be <15 bits. For resolutions lower than 15 bits, bits "x" are set to "0" starting with the least significant bit.

Resolution in bits (+sign)	Units		Analog value	
	Decimal	Hexadecimal	High byte	Low byte
8	128	80H	sign 0 0 0 0 0 0 0	1 x x x x x x x
9	64	40H	sign 0 0 0 0 0 0 0	0 1 x x x x x x
10	32	20H	sign 0 0 0 0 0 0 0	0 0 1 x x x x x
11	16	10H	sign 0 0 0 0 0 0 0	0 0 0 1 x x x x
12	8	8H	sign 0 0 0 0 0 0 0	0 0 0 0 1 x x x
13	4	4H	sign 0 0 0 0 0 0 0	0 0 0 0 0 1 x x
14	2	2H	sign 0 0 0 0 0 0 0	0 0 0 0 0 0 1 x
15	1	1H	sign 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1

Table 5-1: Measured value resolution

5.1.3 Binary representation of the input ranges

Dec. value	Meas. value	Data word																Range
	in %	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32767	≥118.515	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	>100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nom. range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	≤-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Underrange
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
-32768	≤-117.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

Table 5-2: Bipolar input ranges

Dec. value	Meas. val.	Data word																Range
	in %	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
32767	≥118.515	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	>100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nom. range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Underrange
-4864	-17.593	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	
-32768	≤-17.596	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

Table 5-3: Unipolar input ranges

5.1.4 Analog value representation of the voltage meas. ranges

System			Voltage measuring range				Range
	dec.	hex.	±10V	±5V	±2.5V	±1 V	
118.515 %	32767	7FFF	11.851 V	5.926 V	2.963 V	1.185 V	Overflow
117.593 %	32512	7F00					
117.589 %	32511	7EFF	11.759 V	5.879 V	2.940 V	1.176 V	Overrange
	27649	6C01					
100.000 %	27648	6C00	10.000 V	5.000 V	2.500 V	1.000 V	Nom. range
75.000 %	20736	5100	7.500 V	3.75 V	1.875 V	0.750 V	
0.003617 %	1	1	361.7 µV	180.8 µV	90.4 µV	36.17 µV	
0 %	0	0	0 V	0 V	0 V	0 V	
-0.003617 %	-1	FFFF	-361.7 µV	-180.8 µV	-90.4 µV	-36.17 µV	
-75.00 %	-20736	AF00	-7.500 V	-3.750 V	-1.875 V	-0.750 V	
-100.000 %	-27648	9400	-10.000 V	-5.000 V	-2.500 V	-1.000 V	
	-27649	93FF					Underrange
-117.593 %	-32512	8100	-11.759 V	-5.879 V	-2.940 V	-1.176 V	
-117.596 %	-32513	80FF					Underflow
-118.519 %	-32768	8000	-11.851 V	-5.926 V	-2.963 V	-1.185 V	

Table 5-4: Analog value representation of the voltage measuring ranges ±10 V to ±1 V

System			Voltage measuring range			Range
	dec.	hex.	± 500 mV	± 250 mV	± 80 mV	
118.515 %	32767	7FFF	592.6 mV	296.3 mV	94.8 mV	Overflow
117.593 %	32512	7F00				
117.589 %	32511	7EFF	587.9 mV	294.0 mV	94.1 mV	Overrange
	27649	6C01				
100.000 %	27648	6C00	500 mV	250 mV	80 mV	Nom. range
75.00 %	20736	5100	375 mV	187.5 mV	60 mV	
0.003617 %	1	1	18.08 µV	9.04 µV	2.89 µV	
0 %	0	0	0 mV	0 mV	0 mV	
-0.003617 %	-1	FFFF	-18.08 µV	-9.04 µV	-2.89 µV	
-75.00 %	-20736	AF00	-375 mV	-187.5 mV	-60 mV	
-100.000 %	-27648	9400	-500 mV	-250 mV	-80 mV	
	-27649	93FF				Underrange
-117.593 %	-32512	8100	-587.9 mV	-294.0 mV	-94.1 mV	
-117.596 %	-32513	80FF				Underflow
-118.519 %	-32768	8000	-592.6 mV	-296.3 mV	-94.8 mV	

Table 5-5: Analog value representation in the voltage measuring ranges ±500 mV to ±80 mV

System			Voltage measuring range		Range
	dec.	hex.	1 to 5 V	0 to 10 V	
118.515 %	32767	7FFF	5.741 V	11.852 V	Overflow
117.593 %	32512	7F00			
117.589 %	32511	7EFF	5.704 V	11.759 V	Overrange
	27649	6C01			
100.000 %	27648	6C00	5 V	10 V	
75 %	20736	5100	3.00 V	7.5 V	
0.003617 %	1	1	1 V + 144.7 µV	0 V + 361.7 µV	Nom. range
0 %	0	0	1 V	0 V	
-0.003617 %	-1	FFFF	1 V - 144.7 µV	negative values not possible	Underrange
-17.593 %	-4864	ED00	0.296 V		
	-4865	ECFF			Underflow
≤ -17.596 %	-32768	8000			

Table 5-6: Analog value representation in the voltage measuring range 1 to 5 V and 0 to 10 V

5.1.5 Analog value representation in current measuring ranges

System			Current measuring range			Range
	dec.	hex.	±20 mA	±10 mA	±3.2 mA	
118.515 %	32767	7FFF	23.70 mA	11.85 mA	3.79 mA	Overflow
117.593 %	32512	7F00				
117.589 %	32511	7EFF	23.52 mA	11.76 mA	3.76 mA	Overrange
	27649	6C01				
100.000 %	27648	6C00	20 mA	10 mA	3.2 mA	
75 %	20736	5100	15 mA	7.5 mA	2.4 mA	
0.003617 %	1	1	723.4 nA	361.7 nA	115.7 nA	
0 %	0	0	0 mA	0 mA	0 mA	Nom. range
-0.003617 %	-1	FFFF	-723.4 nA	-361.7 nA	-115.7 nA	
-75 %	-20736	AF00	-15 mA	-7.5 mA	-2.4 mA	
-100.000 %	-27648	9400	-20 mA	-10 mA	-3.2 mA	
	-27649	93FF				Underrange
-117.593 %	-32512	8100	-23.52 mA	-11.76 mA	-3.76 mA	
-117.596%	-32513	80FF				Underflow
118.519 %	-32768	8000	-23.70 mA	-11.85 mA	-3.79 mA	

Table 5-7: Analog value representation in the current measuring ranges ±20 mA to ±3.2 mA

System			Current measuring range		Range
	dec.	hex.	0 to 20 mA	4 to 20 mA	
118.515 %	32767	7FFF	23.70 mA	22.96 mA	Overflow
117.593 %	32512	7F00			
117.589 %	32511	7EFF	23.52 mA	22.81 mA	Overrange
	27649	6C01			
100.000 %	27648	6C00	20 mA	20 mA	Nom. range
75 %	20736	5100	15 mA	16 mA	
0.003617 %	1	1	723.4 nA	4 mA + 578.7 nA	
0 %	0	0	0 mA	4 mA	
-0.003617 %	-1	FFFF	-723.4 nA	4 mA - 578.7 nA	Underrange
-17.593 %	-4864	ED00	-3.52 mA	1.185 mA	
	-4865	ECFF			Underflow
≤ -17.596 %	-32768	8000			

Table 5-8: Analog value representation in the current measuring ranges 0 to 20 mA and 4 to 20 mA

5.1.6 Analog value representation for resistance meas. range

System			Resistance measuring range			Range
	dec.	hex.	150 Ω	300 Ω	600 Ω	
118.515 %	32767	7FFF	177.77 Ω	355.54 Ω	711.09 Ω	Overflow
117.593 %	32512	7F00				
117.589 %	32511	7EFF	176.38 Ω	352.77 Ω	705.53 Ω	Overrange
	27649	6C01				
100.000 %	27648	6C00	150 Ω	300 Ω	600 Ω	Nom. range
75 %	20736	5100	112.5 Ω	225 Ω	450 Ω	
0.003617 %	1	1	5.43 mΩ	10.85 mΩ	21.70 mΩ	
0 %	0	0	0 Ω	0 Ω	0 Ω	
			(negative values not physically possible)			Underrange

Table 5-9: Analog value representation for resistance sensors from 150 Ω to 600 Ω

5.1.7 Analog value representation for resistance thermometer Pt 100 Standard

Pt 100 Standard in °C 1 digit = 0.1 °C	Units		Range
	decimal	hexa-decimal	
>1000.0	32767	7FFFH	Overflow
1000.0	10000	2710H	Overrange
850.1	8501	2135H	
850.0	8500	2134H	Nom. range
-200.0	-2000	F830H	
-200.1	-2001	F82FH	Underrange
-243.0	-2430	F682H	
< -243.0	-32768	8000H	Underflow

Table 5-10: Analog value representation for Pt 100 Standard resistance thermometers

5.1.8 Analog value representation for Pt 100 Climate resistance thermometers

Pt 100 Climate in °C 1 digit = 0.01 °C	Units		Range
	decimal	hexa-decimal	
>155.00	32767	7FFFH	Overflow
155.00	15500	3C8CH	Overrange
130.01	13001	32C9H	
130.00	13000	32C8H	Nom. range
-120.00	-12000	D120H	
-120.01	-12001	D11FH	Underrange
-145.00	-14500	C75CH	
< -145.00	-32768	8000H	Underflow

Table 5-11: Analog value representation for resistance thermometers Pt 100 Climate

5.1.9 Analog value representation for Ni 100 Standard resistance thermometers

Ni 100 Standard in °C 1 digit = 0.1 °C	Units		Range
	decimal	hexa-decimal	
>295.0	32767	7FFFH	Overflow
295.0	2950	B86H	Overrange
250.1	2501	9C5H	
250.0	2500	9C4H	Nom. range
-60.0	-600	FDA8H	
-60.1	-601	FDA7H	Underrange
-105.0	-1050	FBE6H	
105.0	-32768	8000H	Underflow

Table 5-12: Analog value representation for Ni 100 Standard resistance thermometers

5.1.10 Analog value representation for Ni 100 Climate resistance thermometers

Ni 100 Climate in °C 1 digit = 0.01 °C	Units		Range
	decimal	hexa-decimal	
>295.00	32767	7FFFH	Overflow
295.00	29500	733CH	Overrange
250.01	25001	61A9H	
250.00	25000	61A8H	Nom. range
-60.00	-6000	E890H	
-60.01	-6001	E88FH	Underrange
-105.00	-10500	D6FCH	
< -105.00	-32768	8000H	Underflow

Table 5-13: Analog value representation for Ni 100 Climate resistance thermometers

5.1.11 Binary representation of output ranges

Decimal unit	Output	Data word																Range
	[%]	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
≥32512	0	0	1	1	1	1	1	1	1	x	x	x	x	x	x	x	x	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	>100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nom. range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	-0.003617	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
-27648	-100.000	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	
-27649	≤-100.004	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	Underrange
-32512	-117.593	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
≤32513	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Underflow

Table 5-14: Bipolar input ranges

Decimal unit	Output	Data word																Range
	[%]	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
≥32512	0	0	1	1	1	1	1	1	1	x	x	x	x	x	x	x	x	Overflow
32511	117.589	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	Overrange
27649	>100.004	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
27648	100.000	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	Nom. range
1	0.003617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
0	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
-1	0.000	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Limited to nominal lower range limit 0 V or 0 mA
-32512		1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
≤32513	0	1	0	0	0	0	0	0	0	x	x	x	x	x	x	x	x	Underflow

Table 5-15: Unipolar input ranges

5.1.12 Analog value representation of the voltage output ranges

System			Voltage output range	
	dez.	hex.	±10 V	
118.515 %	32767	7FFF	0 V	Overflow de-energized
117.593 %	32512	7F00	0 V	
117.589 %	32511	7EFF	11.759 V	Overrange
	27649	6C01		
100.000 %	27648	6C00	10.000 V	Nom. range
75.000 %	20736	5100	7.500 V	
0.003617 %	1	1	361.7 µV	
0 %	0	0	0 V	
-0.003617 %	-1	FFFF	-361.7 µV	
-75.00 %	-20736	AF00	-7.500 V	
-100.000 %	-27648	9400	-10.000 V	
	-27649	93FF		Underrange
-117.593 %	-32512	8100	-11.759 V	
-117.596 %	-32513	80FF	0 V	Underflow de-energized
-118.519 %	-32768	8000	0 V	

Table 5-16: Analog value representation in the output range ±10 V

System			Voltage output range		
	dez.	hex.	0 … 10 V	1 … 5 V	
118.515 %	32767	7FFF	0 V	0 V	Overflow de-energized
117.593 %	32512	7F00	0 V		
117.589 %	32511	7EFF	11.76 V	5.70 V	Overrange
	27649	6C01			
100.000 %	27648	6C00	10.000 V	5.00 V	Nom. range
75.000 %	20736	5100	7.500 V	4 V	
0.003617 %	1	1	361.7 µV	1 V + 144.7mV	
0 %	0	0	0 V	1 V	
-0.003617 %	-1	FFFF			Underrange
-25.00 %	-6912	E500		0 V	
	-6913	E4FF			Not possible, Output value set to 0 V
-117.593 %	-32512	8100			
-117.596 %	-32513	80FF			Underflow de-energized
-118.519 %	-32768	8000	0 V	0 V	

Table 5-17: Analog value representation in the output range 0 …10 V / 1 … 5 V

5.1.13 Analog value representation of the current output ranges

System			Current output range	
	dez.	hex.	±20 mA	
118.515 %	32767	7FFF	0.00 mA	Overflow de-energized
117.593 %	32512	7F00	0.00 mA	
117.589 %	32511	7EFF	23.52 mA	Overrange
	27649	6C01		
100.000 %	27648	6C00	20.00 mA	Nom. range
75.000 %	20736	5100	15.00 mA	
0.003617 %	1	1	723.4 nA	
0 %	0	0	0 mA	
-0.003617 %	-1	FFFF	-723.4 nA	
-75.00 %	-20736	AF00	-15.00 mA	
-100.000 %	-27648	9400	-20.00 mA	
	-27649	93FF		Underrange
-117.593 %	-32512	8100	-23.52 mA	
-117.596 %	-32513	80FF	0.00 mA	Underflow de-energized
-118.519 %	-32768	8000	0.00 mA	

Table 5-18: Analog value representation in the output range ±20 mA

System			Current output range		
	dez.	hex.	0…20 mA	4…20 mA	
118.515 %	32767	7FFF	0.00 mA	0.00 mA	Overflow de-energized
117.593 %	32512	7F00	0.00 mA		
117.589 %	32511	7EFF	23.52 mA	22.81 mA	Overrange
	27649	6C01			
100.000 %	27648	6C00	20.00 mA	20.00 mA	Nom. range
75.000 %	20736	5100	15.00 mA	16.00 mA	
0.003617 %	1	1	723.4 nA	4 mA + 578.7 nA	
0 %	0	0	0 mA	4 mA	
-0.003617 %	-1	FFFF			Underrange
-25.00 %	-6912	E500		0 mA	
	-6913	E4FF			Not possible, output value is set to 0 mA
-117.593 %	-32512	8100			
-117.596 %	-32513	80FF			Underflow de-energized
-118.519 %	-32768	8000	0.00 mA	0.00 mA	

Table 5-19: Analog value representation in the output range 0…20 mA / 4…20 mA

6 Operational Performance of the Analog Modules

6.1 Power supply and operating state of the CPU

The measured values of the analog input modules depend on the power supply L+ and the operating state of the CPU, see Table 6-1.

Operating state of CPU		Power supply L+ on analog module	Input value of the analog input module
POWER ON	RUN	L+ applied	Measured value 7FFFH until 1st conversion after power-on or after parameterization of the module completed
		L+ missing	Overflow value
POWER ON	STOP	L+ applied	Measured value 7FFFH until 1st conversion after power-on or after parameterization of the module completed
		L+ missing	Overflow value
POWER OFF	-	L+ applied	-
		L+ missing	-

Table 6-1: Measured values and operating state of the CPU

6.1.1 Response to failure of power supply L+

If the power supply of the analog modules fails, the fault will be displayed by the group fault LED on the module. This information is provided as an entry in the diagnostic buffer.

If the alarm has been enabled in the parameterization, the diagnostic alarm will be triggered, see Section 12.

6.2 Messages depending on the value range

If parameterized accordingly, the faults detected could trigger a diagnostic entry and diagnostic alarm. For a fault description, see Section 12.

The response of the analog input module depends on the input range in which the input values are, see Table.

Meas. value is in	Input value	Group fault LED	Diagnostics	Alarm
Nom. range	meas. value	-	-	-
Overrange / underrange	meas. value	-	-	-
Overflow	7FFFH	lit [1)]	entry made [1)]	diagnostic alarm [1)]
Underflow	8000H	lit [1)]	entry made [1)]	diagnostic alarm [1)]
Outside parameterized limit value	meas. value	-	-	process alarm [1)]

[1)] depending on parameterization

Table 6-2: Messages of the individual input ranges

7 Definition of the Operational Limit and Basic Error Limit

The percentage values for the operational limit and basic error limit in the technical data of the module always refer to the maximum input value in the nominal range of the module.

7.1 Operational limit

The operational limit is the measurement error of the analog input module over the entire permissible temperature range with reference to the nominal range of the module.

7.2 Basic error limit

The basic error limit is the operational limit at 25 °C with reference to the nominal range of the module.

7.3 Calculation example for the input error of an analog input module

An analog input module 700-331-0V010 is used with input range "0 to 10 V". The module must be operated with an surrounding air temperature of 30 °C. The input error must therefore be calculated on the basis of the operational limit.

The technical data are:

operational limit ±0.6 %

The input error over the entire nominal range of the module is:

±0.6 % ∗ 10 V = ±0.06 V

The table shows the actual measured values for some input voltages. Remember, the smaller the input value, the greater the measurement error.

Input error	±0.06 V	±0.06 V	±0.06 V	±0.06 V	±0.06 V
Input value	1 V	2.5 V	5 V	8 V	10 V
Meas. value	0.94 ... 1.06 V	2.44 ... 2.56 V	4.94 ... 5.06 V	7.94 ... 8.06 V	9.94 ... 10.06 V
Relative error	6 %	2.4 %	1.2 %	0.75 %	±0.6 %

Table 7-1: Relative error with reference to the operational limit

8 Conversion, Cycle, Settling, and Response Times of the Analog Modules

8.1 Conversion time of the analog input channels

The conversion time is composed of the basic conversion time of the module and additional processing times for open-circuit monitoring.

The conversion time is determined by the conversion method of the analog input channel.

8.1.1 Integrating conversion method

With the integrating conversion method, the integration time is included directly in the conversion time. The integration time depends on the interference frequency suppression and determines the possible resolution, see Technical Data. The relevant settings are made in STEP 7®.

8.1.2 Instantaneous value conversion

The conversion time is determined by the basic conversion time and additional processing times of the analog modules, see Technical Data of the module in question.

8.2 Cycle time of analog input channels

Analog-to-digital conversion and transfer of the digitized measured value to memory or to the backplane bus is performed sequentially, i.e. the analog input channels are converted one after the other. The cycle time of the channels is the time until an analog input value is converted again. The cycle time results from the sum of the conversion times of all activated analog input channels of the analog input module.

8.3 Conversion and cycle time for analog input channels in channel groups

If analog input channels in the channel groups are grouped together, the conversion time must considered separately for each channel group.

Channel	Conversion time	Open-circuit monitoring	Channel group
CH0	50.0 ms	0.5 ms	101.0 ms
CH1	50.0 ms	0.5 ms	
CH2	16.6 ms	deactivated	33.2 ms
CH3	16.6 ms	deactivated	
CH4	deactivated	-	0 ms
CH5	deactivated	-	0 ms
CH6	deactivated	-	0 ms
CH7	deactivated	-	0 ms

conversion time of the module: 134.2 ms

8.4 Cycle time of the analog output channels

You should deactivate unused analog channels to reduce the cycle time in STEP 7.

Conversion of the analog output channels is sequential, the analog output channels are converted one after the other.

The cycle time, i.e. the time before an analog output value is converted again, results from the sum of the conversion times of all activated analog output channels of the analog output module.

9 Parameterizing Modules

9.1 Static parameters

The properties of an analog input module, see Section 13 "Technical Data", are parameterized in the hardware configurer, e.g. STEP 7®. Parameterization must be performed in the STOP state of the CPU.

After you have defined all module parameters, you must transfer the parameters from the programming unit to the CPU. On STOP -> RUN, the CPU transfers the parameters to the modules. The settings are stored permanently.

9.2 Dynamic parameters

The dynamic parameters can also be changed in a running user program using the system function (SFC 55). But remember that after a RUN -> STOP, STOP -> RUN change of the CPU, the parameters set with STEP 7® will apply again.

9.3 Parameters of the analog input modules

If no parameterization has been made with STEP 7®, the defaults will apply.

The analog input modules use parameters and value ranges that are specific to functionality. For the parameterization that is possible for each analog module, see Section 13 Technical Data.

The following table contains an overview of the parameters of the analog input modules.

Parameter	Value range	Default	Type of parameter	Scope of action
Enable • diagnostic alarm • process alarm on limit violation	 yes / no yes / no	 no no	dynamic	module
Trigger for process alarm • module 0 to 10 V upper limit value lower limit value • module 0 to 20 mA upper limit value lower limit value • module Pt100 upper limit value lower limit value	restriction due to measuring range possible 32511 -32512 32511 -32512 32511 0	 - - - - - -	dynamic	channel or channel group
Diagnostics • group diagnostics • with open-circuit monitoring	 yes / no yes / no	 no no	static	channel or channel group
Measurement • Measuring type	deactivated U voltage 4DMU current (4-wire transmitter) 2DMU current (2-wire transmitter) RT-4L resistance (4-wire connection) RT resistance (thermal, linearized)	U		
• Measuring range	for settable measuring ranges of the input channels see Section 13 Technical Data	±10 V		
• Interference frequency suppression	400 / 60 / 50 Hz; 400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz	dynamic	channel or channel group

[1)] 1 digit = 0.1 °C; 1 digit = 0.1 °F

Table 9-1: Parameters of the analog input modules

If no parameterization was performed with STEP 7®, the default settings apply.

9.4 Parameters of the analog output modules

The analog output modules each use specific parameters and value ranges depending on functionality. For the parameterization that is possible for each analog module, see Chapter 13 Technical Data.

The following table contains an overview of the parameters of the analog output modules.

Parameter	Value range	Default	Type of parameter	Scope of action
Enable • diagnostic alarm	yes / no	no	dynamic	module
Diagnostics • group diagnostics	yes / no	no	static	channel
Output • Output mode • Output range	deactivated Voltage Current For the settable output ranges of the output channels, see the relevant module description	U ±10 V	dynamic	channel
Behavior to CPU-STOP	OCV Outputs have no current or voltage KLV Keep last value SV Substitute a value	OCV	dynamic	channel

Table 9-2: Parameters of the analog output modules

10 Connecting Transducers to Analog Inputs

10.1 Abbreviations used

M +	Measurement line (positive)
M -	Measurement line (negative)
M_{ANA}	Reference potential of the analog measurement circuit
M	Ground connection (GND)
L +	Power supply connection 24 V DC
U_{CM}	Potential difference between inputs and reference potential of the measurement circuit M_{AMA}
U_{ISO}	Potential difference between M_{ANA} and M connection of CPU

10.2 Signal cables

Shielded twisted-pair cables should be used for analog signals. The shield of the analog cables should be grounded at both ends.

If potential differences exist between the cable ends, an equalization current may flow through the shield and interfere with the analog signals. In that case the shield should only be grounded at one end or an additional equipotential cable be connected.

Signal cables must not run parallel with power cables.

Route signal and data cables and power cables in separate ducts or bundles. Signal and data cables must be routed as close as possible to grounding surfaces, e.g. supports, metal rails, mounting plates, or cabinet sheet metal.

Motor cables, incoming power cables and information electronics signal cables must be routed at least 0.2 m apart inside the cabinet. If cables cross, they may be closer. Outside the cabinet, motor cables, in particular, must be routed in separate bundles at least 0.3 m from other cables.

This reduces interference due to coupling.

If a join is required, it must be implemented such that less than 2 cm of cable are unshielded. The shields of both cable ends must be connected via a shield bus, not via a terminal, see Fig. 10-1. The cable shield must not be connected with analog ground M_{ANA}.

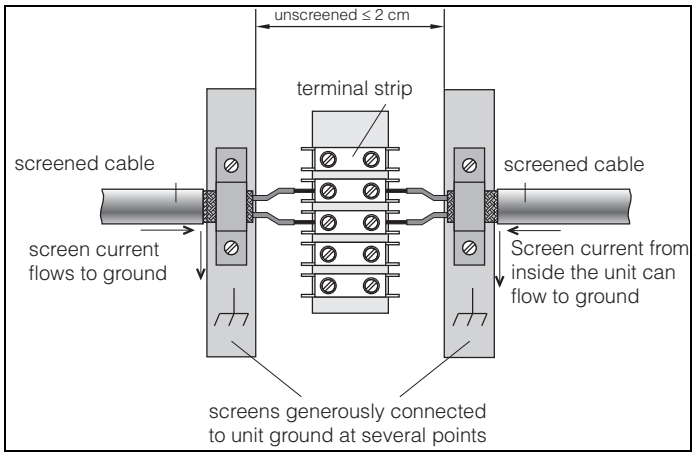


Fig. 10-1: Implementing a terminal connection

10.3 Isolated analog input modules

On isolated analog input modules there is no galvanic connection between the reference point of the measurement circuit M_{ANA} and the M (GND) terminal of the CPU.

Isolated analog input modules are used if a potential difference U_{iso} can arise between the reference point of the measuring circuit M_{ANA} and the M (GND) connection of the CPU. An equipotential lead between terminal M_{ANA} and the M (GND) terminal of the CPU ensures that U_{iso} does not exceed the permissible value.

10.4 Non-isolated analog input modules

On non-isolated analog input modules, a connection must be made between the reference point of the measurement circuit M_{ANA} and the M (GND) terminal of the CPU or PAS 153 / IM 153. That is done by connecting terminal M_{ANA} with the M (GND) terminal of the CPU or PAS 153 / IM 153. A potential difference between M_{ANA} and the M (GND) terminal of the CPU or PAS 153 / IM 153 can corrupt the analog signal.

10.5 Limited potential difference U_{CM}

Between the measurement lines M- of the input channels and the reference point of the measurement circuit M_{ANA} only a limited potential difference must occur U_{CM} (common-mode voltage). Protective circuits may be necessary to avoid exceeding the permissible value for U_{CM}.

10.5.1 Connection of isolated sensors

The isolated sensors are not connected to local ground potential (building ground). Floating operation is possible.

With isolated sensors, potential differences can occur between sensors. These potential differences can be arise because of faults or the physical distribution of the sensors.

To avoid exceeding the permissible value for U_{CM} in environments with heavy EMC interference, connecting M- with M_{ANA} is recommended.

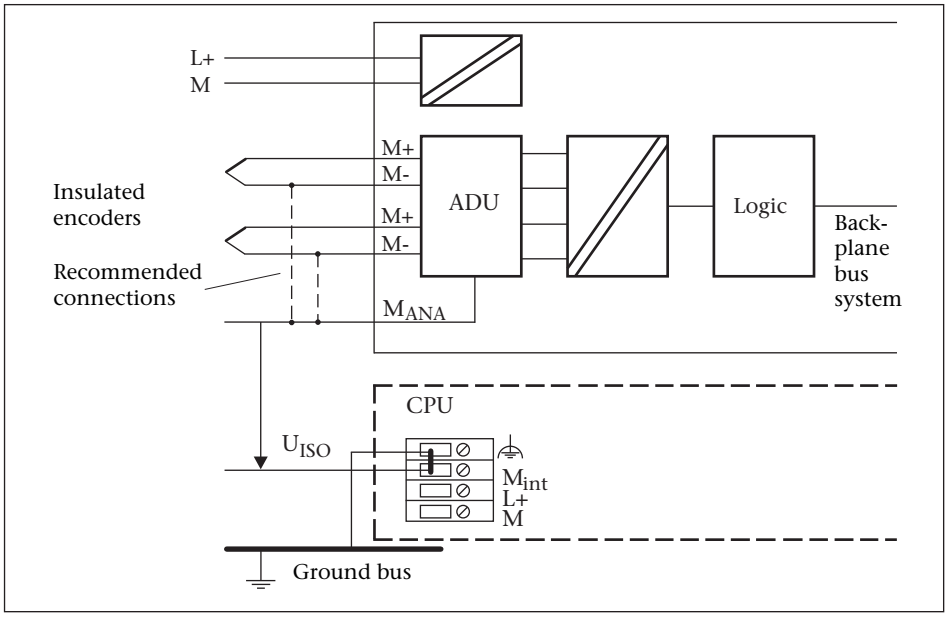


Fig. 10-2: Connection of isolated transducers to an isolated AI

When connecting 2-wire transmitter for current measurement and connecting resistance sensors, no connection from M- to M_{ANA} must exist. The same applies to inputs that are parameterized for such a connection but not used.

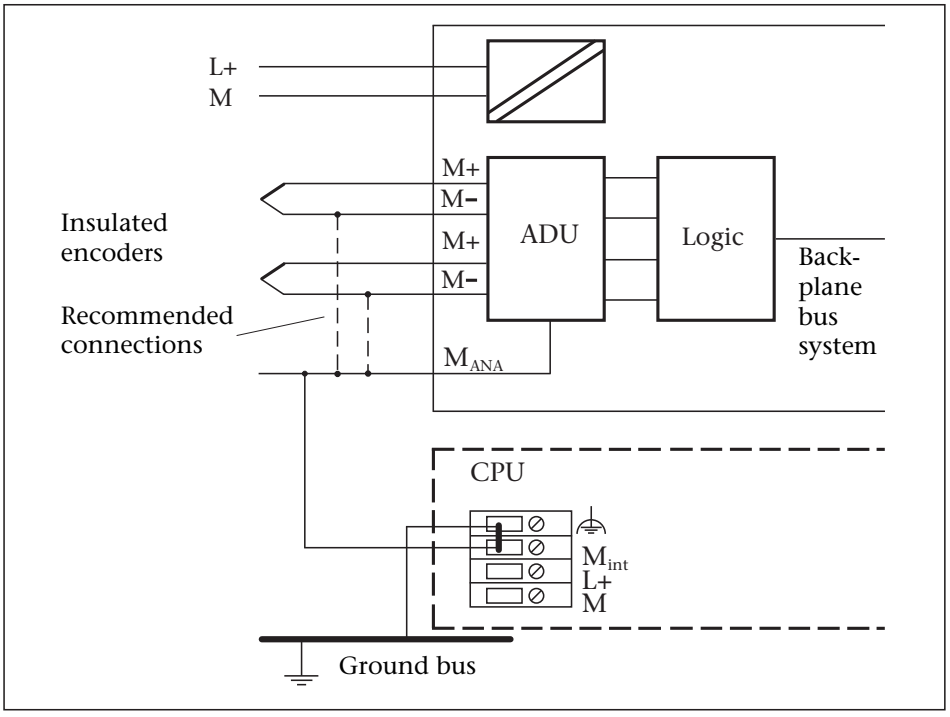


Fig. 10-3: Connection of isolated transducers to a non-isolated AI

10.5.2 Non-isolated sensors

The non-isolated sensors are connected with the local ground potential (building ground). To use non-isolated sensors, M_{ANA} must be connected with building ground.

Local conditions or interference can cause static or dynamic potential differences U_{CM} to arise between the distributed measurement points. If the permissible value for U_{CM} is exceeded, equipotential conductors must interconnect the measurement points.

When connecting non-isolated sensors to isolated modules, the CPU can be operated floating or grounded.

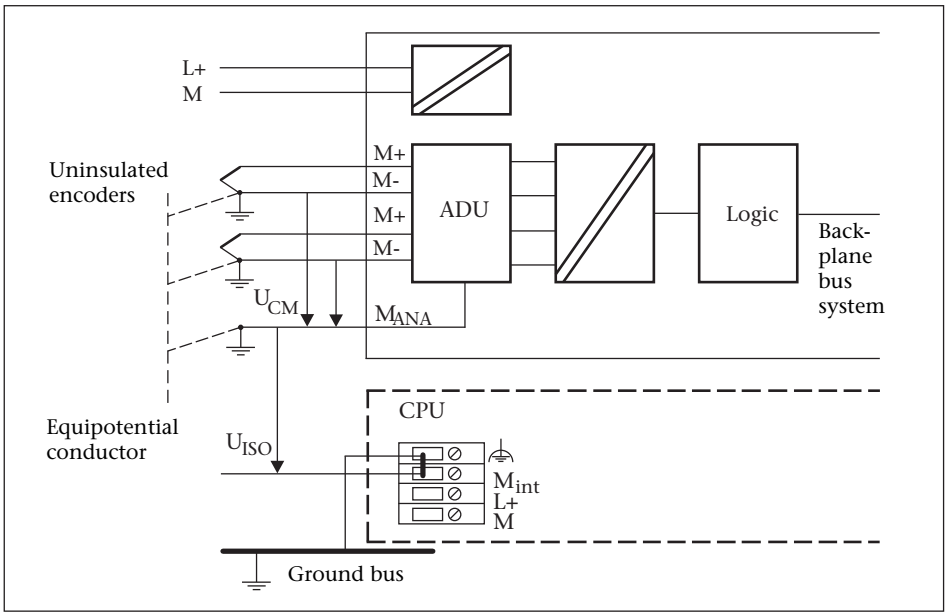


Fig. 10-4:
Connection of non-isolated transducers to an isolated AI

Non-isolated 2-wire transducers and non-isolated resistance sensors must not be used on non-isolated AIs!

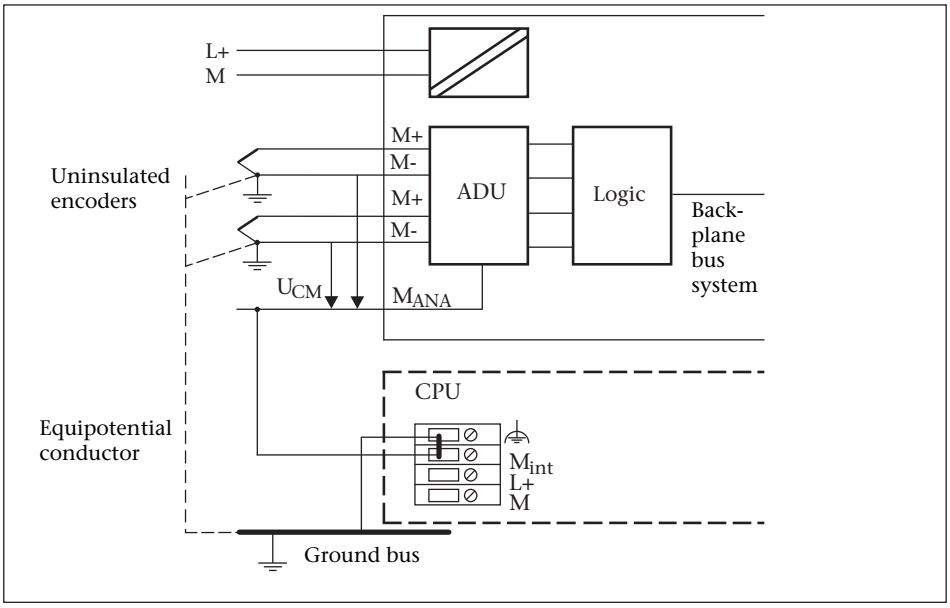


Fig. 10-5:
Connection of non-isolated transducers to a non-isolated AI

In Fig. 10-6, the connecting leads resulting from the potential connection of the analog input module and the sensor are not drawn.

10.6 Connection of voltage sensors

The generally applicable information at the beginning of the chapter on connecting sensors must be implemented.

For abbreviations used, see Section 10.1.

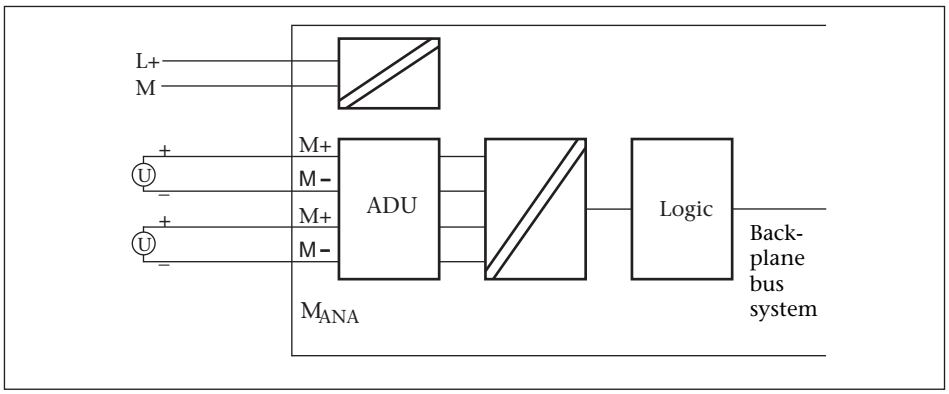


Fig. 10-6: Connection of non-isolated voltage sensors to a non-isolated AI

10.7 Connection of current sensors

The generally applicable information at the beginning of the chapter on connecting sensors must be implemented.

For abbreviations used, see Section 10.1.

In Fig. 10-7, the connecting leads resulting from the potential connection of the analog input module and the sensor are not drawn.

10.7.1 Power supply of sensors

The power supply is brought to the 2-wire sensor via the terminals of the analog input module with short-circuit protection. The 2-wire sensor converts the measured quantity into a current. The 2-wire transducers must be isolated sensors.

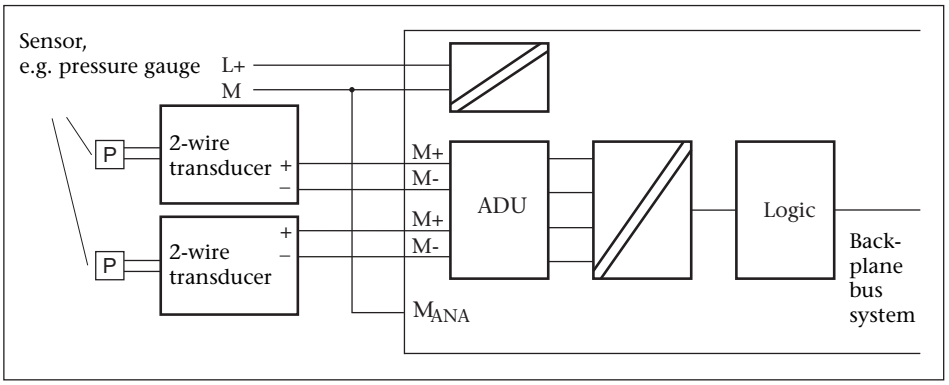


Fig. 10-7: Connection of 2-wire transmitter to isolated AI

If the module is powered with supply voltage L+, the 2-wire transducer must be parameterized as a 4-wire transducer in STEP 7®.

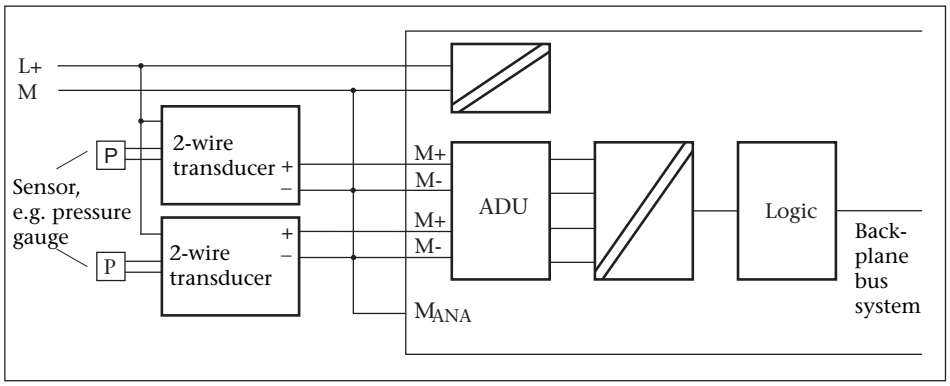


Fig. 10-8: Connection of 2-wire transmitter to isolated AI powered from L+

In Fig. 10-8 and Fig. 10-9, the connecting leads resulting from the potential connection of the analog input module and the sensor are not drawn.

4-wire transducers have a separate power supply.

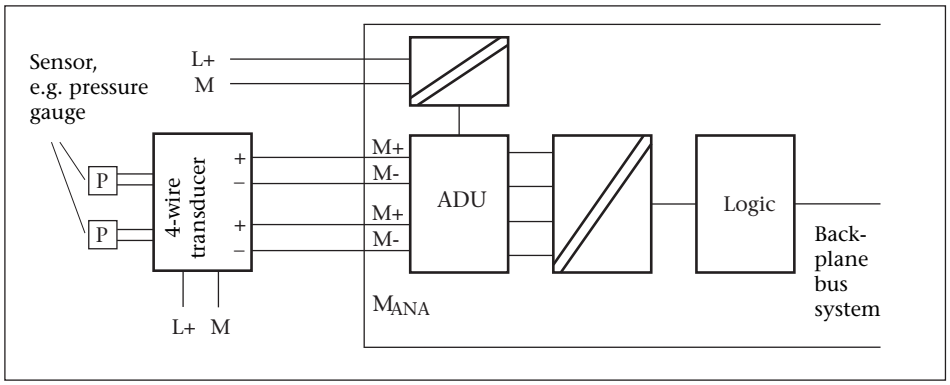


Fig. 10-9: Connection of 4-wire transmitter to isolated AI

10.8 Connecting resistance thermometers and resistors

The resistance thermometer / resistances are wired in a 4-wire, 3-wire, or 2-wire connection.

A 4-wire or 3-wire connection supplies constant current to the module via terminals I_{C+} and I_{C-} so that the voltage drop on the measurement cables can be compensated. It is important to connect the connected constant current lines directly to the resistance thermometer / resistance.

Measurements with 4-wire or 3-wire connection provide a more precise measurement result than measurements with a 2-wire connection.

10.8.1 4-wire connection of a resistance thermometer

The voltage arising at the resistance thermometer is measured via terminals M+ and M-. When connecting, pay attention to the polarity of the connected line I_{C+} and M+, and I_{C-} and M- on the resistance thermometer.

Lines I_{C+} and M+ and lines I_{C-} and M- must be connected directly to the resistance thermometer.

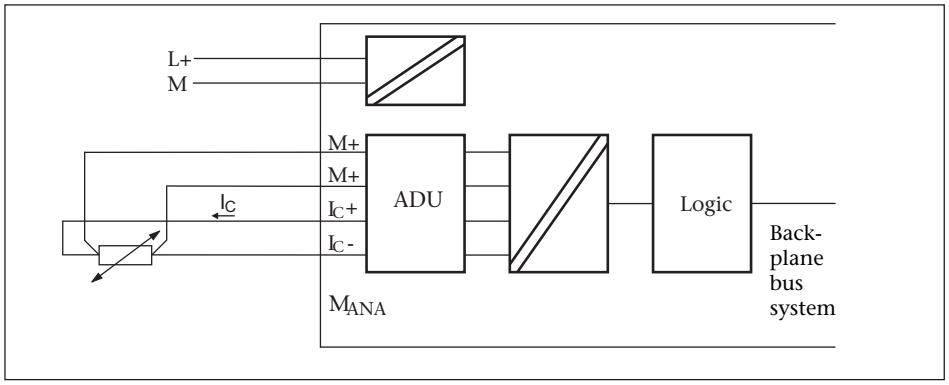


Fig. 10-10:
4-wire connection of resistance thermometers to isolated AI

10.8.2 3-wire connection of a resistance thermometer

In a 3-wire connection to modules with 4 terminals, M- and I_{C-} must be jumpered.

Lines I_{C+} ,I_{C-} and M+ must be connected directly to the resistance thermometer.

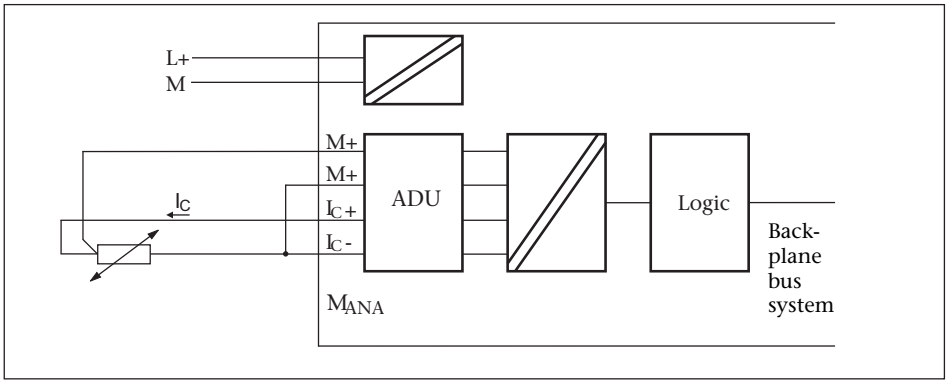


Fig. 10-11:
3-wire connection of resistance thermometers to isolated AI

10.8.3 2-wire connection of a resistance thermometer

In a 2-wire connection to modules with 4 terminals M+ and I_{C+}, and M- and I_{C-} must be jumpered.

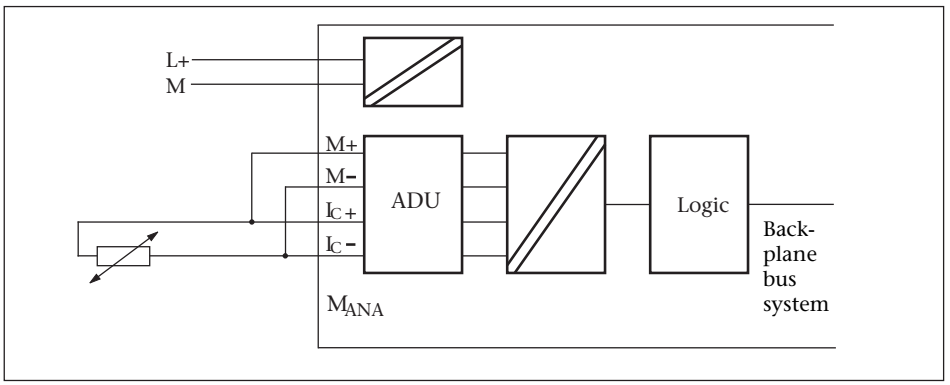


Fig. 10-12:
2-wire connection of resistance thermometers to isolated AI

11 Connection of loads and actuators to analog outputs

11.1 Abbreviations used

M_{ANA}	Reference potential of the analog measuring circuit
M	Ground terminal
L +	24 V DC power supply terminal
U_{ISO}	Potential difference between M_{ANA} and ground terminal of the CPU
R_L	Load resistance
Q_V	Analog output voltage
Q_I	Analog output current
S+	Sensor line positive

11.1.1 2-wire connection of loads/actuators at voltage output

With the 2-wire connection, the S+ and S- terminals remain open, the load is connected to Q_V and the ground reference point M_{ANA} is connected.

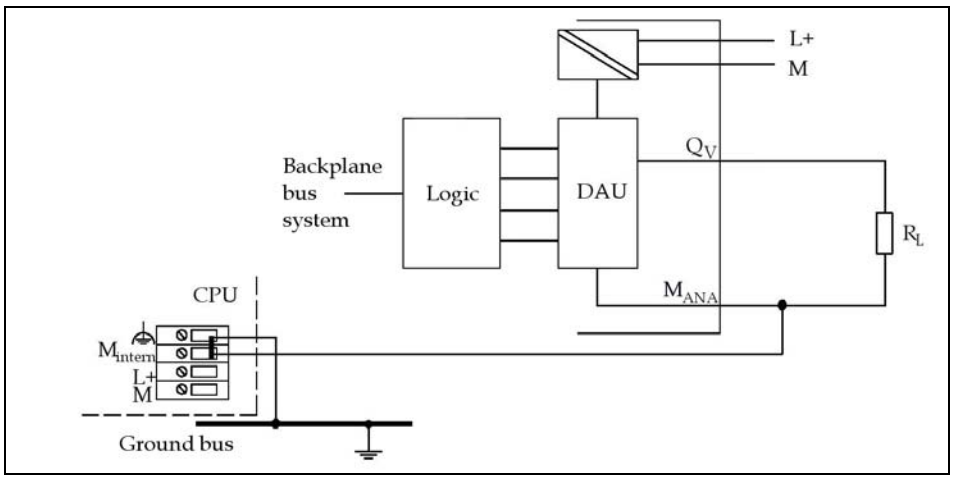


Fig. 11-1: 2-wire connection of loads at the voltage output non-floating

11.1.2 4-wire connection of loads/actuators at the voltage output

In the 4-wire connection, the voltage is measured directly at the load via sensor leads. This compensates for voltage drops over the connection lines. A high degree of precision and constancy of the voltage at the load is achieved.

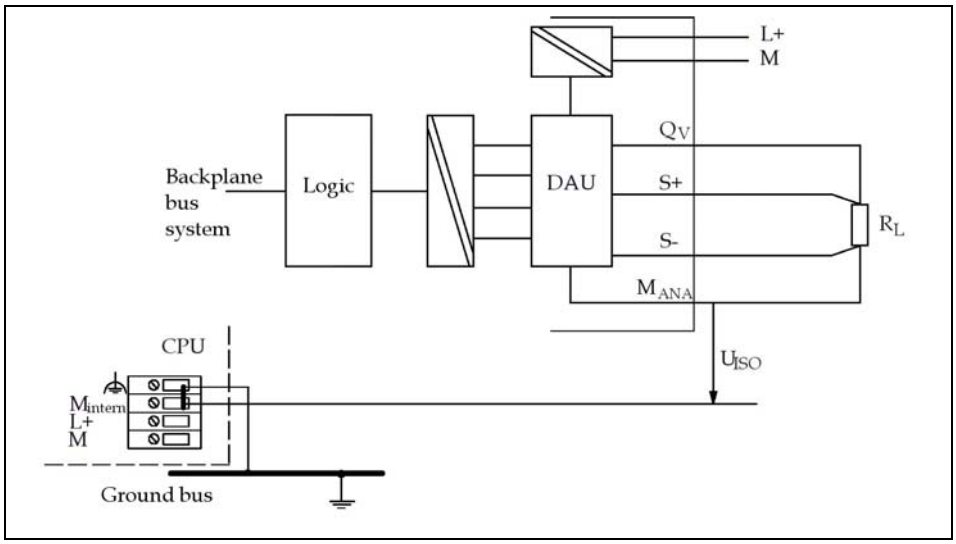


Fig. 11-2: 4-wire connection of loads at the voltage output, floating

11.1.3 Connection of loads/actuators at the current output

The load is connected to QI and the ground reference point M_{ANA}, terminals S+ and S- are left open.

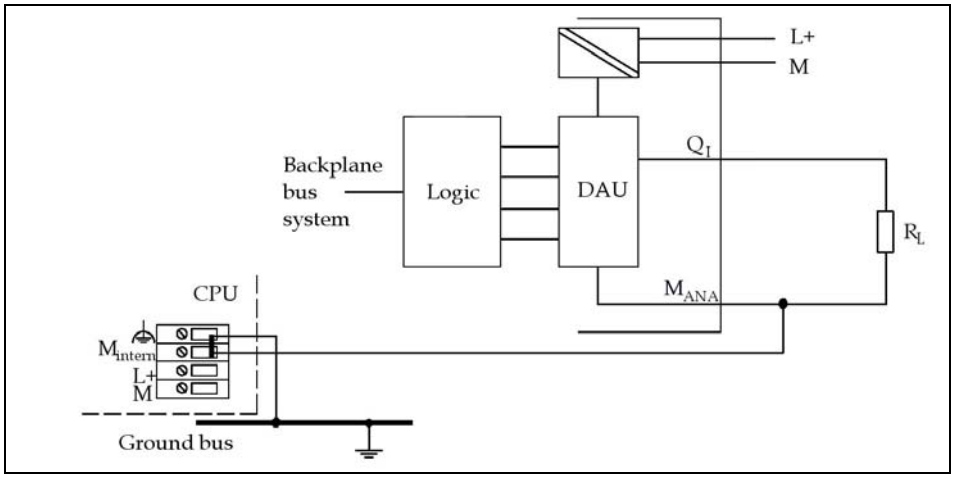


Fig. 11-3: Connection of loads at the current output, non-floating

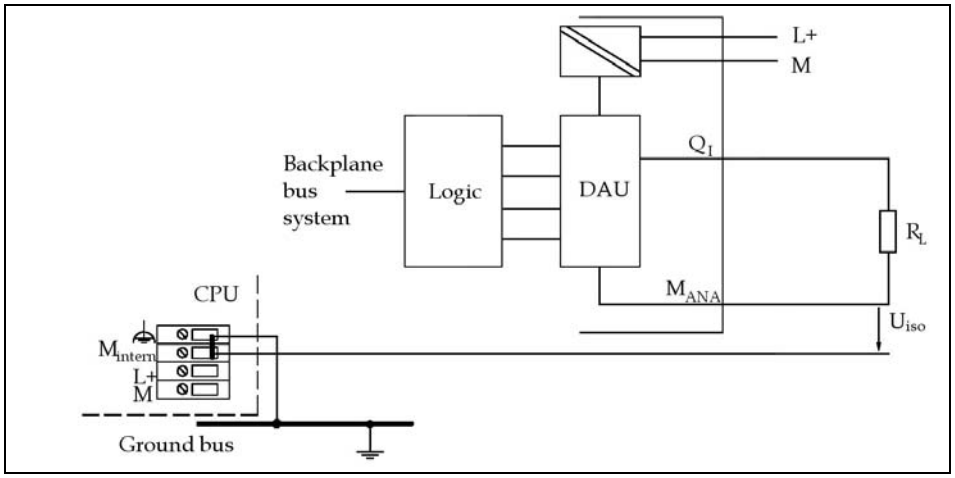


Fig. 11-4: Connection of loads at the current output, floating

12 Diagnostics of the Analog Modules

12.1 Diagnostic messages

Two types of diagnostic message are available:

Parameterizable diagnostic messages
These diagnostic messages must be enabled by parameterization. Parameterization is performed in STEP 7® in the parameter block "Diagnostics".

Non-parameterizable diagnostic messages
These diagnostic messages are always provided by the input module irrespective of parameterization.

12.2 Actions after diagnostic messages in STEP 7®

Diagnostic messages always trigger the following actions in STEP 7®:

The diagnostic message is entered in the diagnostics of the analog module and passed on to the CPU.

The fault LED on the analog module lights up.

If the "Enable diagnostic alarm" is parameterized with STEP 7®, a diagnostic alarm will be triggered and OB 82 called up.

12.3 Reading out the diagnostic messages

The detailed diagnostic messages can be read out using SFCs in the user program (see "Diagnostic data of the signal modules").

The cause of error can be displayed in STEP 7® in the module diagnostics (see Online Help STEP 7®).

12.4 Diagnostic message in the measured value of analog input modules

Each analog input module provides the measured value 7FFFH on detecting an error irrespective of parameterization. This measured value means either overflow, fault, or channel deactivated.

12.5 Diagnostic messages on the group fault LED

Each analog module displays errors with the group fault LED (GRP LED). The group fault LED lights up when a diagnostic message is triggered by the analog module. It will switch off when all errors have been rectified.

12.6 Diagnostic messages of the analog input modules

To have errors indicated by the parameterizable diagnostic messages, the diagnostic messages of the analog input module must be enabled by parameterization in STEP 7.

Diagnostic message	LED	Scope of diagnostics	Parameter-izable
External power supply missing	GRP	module	no
Config./parameterization error	GRP	channel	yes
Common-mode error	GRP	channel	yes
Wire-break	GRP	channel	yes
Underflow	GRP	channel	yes
Overflow	GRP	channel	yes

Table 12-1: Diagnostic messages of the analog input modules

12.7 Diagnostic messages of the analog output modules

To detect faults that are displayed with parameterizable diagnostic messages, the diagnostic messages of the analog output module in STEP 7 must be released by appropriate parameterization.

Diagnostic message	LED	Scope of diagnostics	Parameter-izable
External load voltage missing	GF	Module	no
Configuration / parameterization fault	GF	Channel	yes
Short-circuit to ground	GF	Channel	yes
Wire-break	GF	Channel	yes

Table 12-2: Diagnostic messages of the analog output modules

12.8 Causes of error and remedies for the analog input modules

Diagnostic message	Possible cause of error	Remedy
External power supply missing	External PS L+ of the module missing	Connect and apply L+
Configuration / parameterization error	Wrong parameters transferred to module	Reparameterize module
Common-mode error	Potential difference U_{CM} between the inputs (M-) and reference potential of measurement circuit (M_{ANA}) too high	Connect M- with M_{ANA}
Wire-break	Sensor connection too high-resistance	Use other sensor type or wire differently, for example, use lines with greater cross-section
	Interruption of the line between the module and sensor	Establish cable connection
	Channel not connected (open)	Deactivate channel group (parameter "measuring type") Connect channel
Underflow	Input value underrange, fault possibly caused by wrong measuring range selection	Parameterize another measuring range
	Sensor possibly connected with reverse polarity in measuring ranges 4 to 20 mA and 1 to 5 V	Check connections
Overflow	Input value overrange	Parameterize another measuring range

Table 12-3: Causes of error of the analog input modules

12.9 Causes of error and remedies for the analog output modules

Diagnostic message	Possible cause of error	Remedy
External power supply missing	External PS L+ of the module missing	Connect and apply L+
Configuration / parameterization error	Wrong parameters transferred to module	Reparameterize module
Short-circuit to ground	Overload of the output	Remedy overload
	Short-circuit of output Q_V to M_{ANA}	Remedy short-circuit
Wire-break	Actuator is too high-resistance	Use another actuator type or wire differently, e.g. use cables with a larger cross-section
	Interruption of the line between the module and actor	Establish cable connection
	Channel not connected (open)	Deactivate channel group (parameter "Type of Output") Connect channel

Table 12-4: Causes of error of the analog output modules

12.10 Alarms of the analog modules

The main types of alarm are:

Diagnostic alarm

Process alarm

The following OBs and SFCs are described in more detail in the Online Help STEP 7®.

12.10.1 Enabling alarms

The alarms are not predefined, i.e. they are disabled if not parameterized. Alarm enabling is parameterized with STEP 7® (see Section 9).

12.10.2 Diagnostic alarm

If the diagnostic alarms are enabled, raised (first occurrence of a fault) and cleared fault events (message after fault rectification) are signalled by alarm.

The CPU interrupts user program execution and processes the diagnostic alarm block OB 82.

In the user program it is possible to call up SFC 51 or SFC 59 in the OB 82 to obtain detailed diagnostic information from the module.

The diagnostic information items are consistent until exiting the OB 82. On exiting the OB 82, the diagnostic alarm is acknowledged on the module.

12.10.3 Process alarm with trigger "upper or lower limit violated"



No process alarm will be triggered, if the upper limit has been parameterized above overrange or the lower limit has been parameterized below underrange.

Parameterizing an upper and lower limit value defines a working range. If the process signal (e.g. the temperature) of an analog module exits this working range, the module triggers an alarm if the process alarms are enabled.

The CPU interrupts user program execution and processes process alarm block OB 40.

In the user program of the OB 40 it is possible to define how the automation system will respond to violation of the upper or lower limit.

On exiting the OB 40, the process alarm is acknowledged on the module.

12.10.4 Structure of start information variable 0B40

Which channel has exceeded which limit value is entered in the start information of OB 40 in variable 0B40 POINT ADDR. Fig. 12-1 shows the assignment to the bits of the local data double word .8

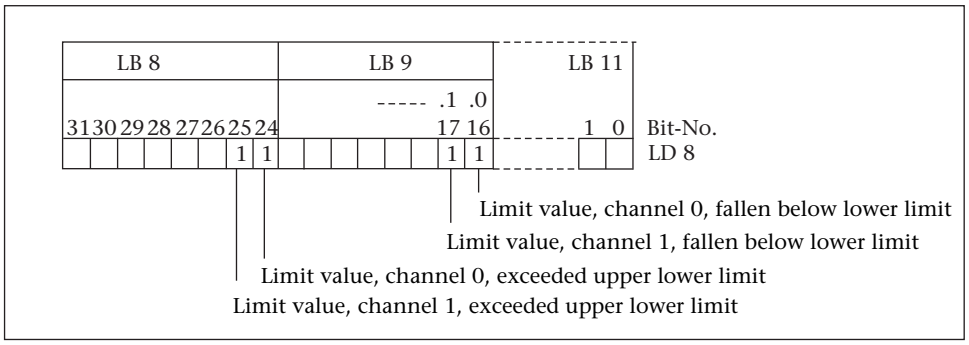


Fig. 12-1: Start information of the OB40 indicating which event triggered the process alarm at limit value

13 Technical Data

13.1 Analog input module 0 to 10 V

Order No.	700-331-0V010
Design	8 inputs
Measuring ranges	±80 mV / 10 MΩ ±250 mV / 10 MΩ ±500 mV / 10 MΩ ±1 V / 10 MΩ ±2.5 V / 100 kΩ ±5 V / 100 kΩ 1 ... 5 V / 100 kΩ ±10 V / 100 kΩ
Switchover	switchover of the voltage meas. ranges by means of relay
Integration times	parameterizable: 2.5 ms 16.6 ms 20 ms 100 ms
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time
Permissible cable lengths	shielded max. 200 m in measuring range ±80 mV max. 50 m
Power supply	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector (L+)
Current consumption	typ. 120 mA at 5 V (from backplane bus) max. 200 mA at 24 V (L+)
Reverse polarity protection	yes
Power loss	approx. 1.8 W
Isolation	isolated from backplane bus isolated from power supply L+
Permissible potential difference	
Between inputs U_{CM}	2.5 V DC
Between M_{ANA} and M_{intern} (U_{ISO})	75 V DC / 60 V AC
Fault signal	value 7FFFH irrespective of parameterization evaluation of parameterizable signals only with diagnostics enabled
Status, alarms, diagnostics	
Limit alarm	parameterizable channels 0 and 2
Diagnostic alarm	parameterizable
Diagnostic functions	parameterizable
Group fault display	red LED (GRP)
Diagnostic information	read-out possible
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm³
Weight	approx. 220 g

Analog value formation				
Measurement principle	integrating			
Integration / conversion time / resolution (per channel)	parameterizable			
Integration time [ms]	2.5	16 $^{2}/_{3}$	20	100
Basic conversion time incl. integration time [ms]	3	17	22	102
Resolution incl. under- / overrange				
unipolar range [bits]	9	12	12	14
bipolar range [bits]	9 + sign	12 +sign	12 +sign	14 +sign
Noise suppression, error limits				
Interference voltage suppression for interference frequency f1 [Hz]	400	60	50	10
Crosstalk between inputs [dB]	>50			
Error limits				
Operational limit	±0.6 % over entire temperature range with reference to nominal range			
Basic error limit	±0.5 % operational limit at 25 °C with reference to nominal range			
Temperature error	with reference to nominal range ±0.005 %/K			
Linearity error	with reference to nominal range ±0.05 %			
Repeatability in settled state at 25 °C	with reference to nominal range ±0.05 %			

Table 13-1: Technical data 700-331-0V010

13.2 Analog input module 4 to 20 mA

Order No.	700-331-4MA20
Design	8 inputs
Measuring ranges 4-wire transmitter 2-wire transmitter	 ±3.2 mA / 25 Ω ±10 mA / 25 Ω ±20 mA / 25 Ω 0 ... 20 mA / 25 Ω 4 ... 20 mA / 25 Ω 4 ... 20 mA / 25 Ω
Switchover	switchover of current measuring ranges by means of relay
Integration times	parameterizable: 2.5 ms 16.6 ms 20 ms 100 ms
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time
Permissible cable lengths	shielded max. 200 m
Power supply	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector (L+)
Current consumption	typ. 120 mA at 5 V (backplane bus) max. 200 mA at 24 V (L+)
Reverse polarity protection	yes
Power loss	approx. 1,8 W (without supply current for 2DMU)
Power supply for transducer	
Supply current	max. 60 mA per channelgroup
Short-circuit-proof	yes
Isolation	isolated from backplane bus isolated from power supply L+
Permissible potential difference	
Between M_{ANA} and M_{intern} (U_{ISO})	75 V DC / 60 V AC
Fault signal	value 7FFFH irrespective of parameterization evaluation of parameterizable signals only with diagnostics enabled
Status, alarms, diagnostics	
Limit alarm	parameterizable channels 0 and 2
Diagnostic alarm	parameterizable
Diagnostic functions	parameterizable
Group fault display	red LED (GRP)
Diagnostic information	read-out possible
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm³
Weight	approx. 220 g

Analog value formation				
Measurement principle	integrating			
Integration / conversion time / resolution (per channel)				
Parameterizable	yes			
Integration time [ms]	2.5	16 $^{2}/_{3}$	20	100
Basic conversion time incl. integration time [ms]	3	17	22	102
open-circuit monitoring per channel [ms]	0.5	0.5	0.5	0.5
Resolution incl. overrange				
unipolar range [bits]	9	12	12	14
bipolar range [bits]	9 +sign	12 +sign	12 +sign	14 +sign
Noise suppression, error limits				
Interference voltage suppression for interference frequency f1 [Hz]	400	60	50	10
Crosstalk between inputs [dB]	>50			
Error limits				
Operational limit	0.6 % over entire temperature range with reference to nominal range			
Basic error limit	0.5% operational limit at 25 °C with reference to nominal range			
Temperature error	with reference to nominal range ±0.005 %/K			
Linearity error	with reference to nominal range ±0.05 %/K			
Repeatability in settled state at 25 °C	with reference to nominal range ±0.05 %			

Table 13-2: Technical data 700-331-4MA20

13.3 Analog input module PT100

Order No.	700-331-PT100
Design	4 inputs, 4-wire connection
Measuring ranges	150 Ω / 10 MΩ 300 Ω / 10 MΩ 600 Ω / 10 MΩ Pt 100 Climate / 10 MΩ Pt 100 Std. / 10 MΩ Ni 100 Climate / 10 MΩ Ni 100 Std. / 10 MΩ
Integration times	parameterizable: 2.5 ms 16.6 ms 20 ms 100 ms
Resolutions	9 bits + sign for 2.5 ms integration time 12 bits + sign for 16.6 / 20 ms integr. time 14 bits + sign for 100 ms integration time
Permissible cable lengths	shielded max. 200 m
Power supply	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector (L+)
Current consumption	typ. 120 mA at 5 V (backplane bus) max. 200 mA at 24 V (L+)
Reverse polarity protection	yes
Power loss	approx. 1,8 W
Constant current for resistance sensors	
Typically	1.67 mA
Isolation	isolated from backplane bus isolated from power supply L+
Permissible potential difference	
between M_{ANA} and M_{intern} (U_{ISO})	75 V DC / 60 V AC
Fault signal	value 7FFFH irrespective of parameterization evaluation of parametrizable signals only with diagnostics enabled
Status, alarms, diagnostics	
Limit alarm	parameterizable channels 0 and 2
Diagnostic alarm	parameterizable
Diagnostic functions	parameterizable
Group fault display	red LED (GRP)
Diagnostic information	read-out possible
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm³
Weight	approx. 220 g

Analog value formation				
Measurement principle	integrating			
Integration / conversion time / resolution (per channel)				
Parameterizable	yes			
Integration time [ms]	2.5	16 $^{2}/_{3}$	20	100
Basic conversion time incl. integration time [ms]	3	17	22	102
Resolution incl. overrange				
Unipolar [bits]	9	12	12	14
Noise suppression, error limits				
Interference voltage suppression for interference frequency f1 [Hz]	400	60	50	10
Crosstalk between inputs [dB]	>50			
Error limits				
Operational limit	0.6% over entire temperature range with reference to nominal range			
Basic error limit	0.5% operational limit at 25 °C with reference to nominal range			
Temperature error	with reference to nominal range ±0.005 %/K			
Linearity error	with reference to nominal range ±0.05 %/K			
Repeatability in settled state at 25 °C	with reference to nominal range ±0.05 %			
Characteristic linearization parameterizable for:				
Resistance thermometer	Pt 100 (Standard, Climate range acc. to IEC 751) Ni 100 (Standard, Climate range)			

Table 13-3: Technical data 700-331-PT100

13.4 Analog input module AI 8 x 13 Bit

Order No.	700-331-1KF01
Measuring method	Voltage Current Resistance Temperature
Build • for voltage measurement • for current measurement • for resistance measurement • for resistance thermometers	8 inputs in 8 channel groups usability simultaneous 8 inputs 8 inputs 8 inputs 8 inputs
Measuring ranges • Voltage	 ±50 mV / 100 kΩ ±500 mV / 100 kΩ ±1 V / 100 kΩ ±5 V / 100 kΩ ±10 V / 100 kΩ 1 ... 5 V / 100 kΩ 0 ... 10 V / 100 kΩ
Measuring ranges • Current • 2- wire transmitter • 4- wire transmitter	 ±20 mA / 50 Ω 0 … 20 mA / 50 Ω 4 … 20 mA / 50 Ω supported, with external supply supported
Measuring ranges • Resistance • 2-wire connection • 3-wire connection • 4-wire connection	 0 … 6 kΩ / 100 MΩ 0 … 600 Ω / 100 MΩ supported supported supported
Resistance thermometers Standard and Climate • Characteristic linearization • Technical unit of temperature measurements: • 2-wire connection • 3-wire connection • 4-wire connection	 Pt 100 Ni 100 Ni 1000, LG-Ni 1000 programmable Degrees Centigrade, degrees Fahrenheit, Kelvin supported supported supported
Integration time • probrammable	 yes
• Noise suppression at interference frequency f1	50 Hz / 60 Hz
Integration time	60 ms / 50 ms
Basic conversion time, including the integration time	66 ms / 55 ms
Additional conversion time for resistance measurements	66 ms / 55 ms
Resolution, including overshoot range	13 Bit
Permissible cable length	Shielded max. 200 m Measuring range ±50 mV max. 50 m
Electrical isolation	between channels and the backplane bus not isolated between channels

Permissible potential difference	
Between inputs (U_{CM})	DC 2,0 V
Between M_{ANA} and M_{intern} (U_{ISO})	DC 75 V / AC 60 V
Permissible input voltage • Voltage input U+ • Voltage inputs M+, M-, S-	 destruction limit: max. 30 V continuous destruction limit: max. 12 V continuous max. 30 V max. 1 s
Permissible input current • Current input I+	 destruction limit: max. 40 mA cont.
Status, alarms, diagnostics Alarm Diagnostic functions	 none none
Power supply	
Nominal voltage	DC 5 V via backplane bus
Current consumption	typ. 160 mA at 5 V (backplane bus)
Power loss	approx. 0,8 W
Connection	32 bit-DEA 300 front connector (40-way)
Dimensions	40 x 125 x 117 mm³
Weight	approx 260 g
Surrounding air temperature	operation 0 °C ... +60 °C storage -25 °C ... +75 °C
Formation of analog values	
Measuring method	integrating
• Integration/conversion time/resolution (per channel) programmable • Noise suppression at interference frequency f1 [Hz] • Integration time [ms] • Basic conversion time, including the integration time [ms]	 yes 50/60 60/50 66/55
Additional conversion time for resistance measurements [ms] • Resolution including overshoot range [Bit]	 66/55 13/13
Supports clocked operation	no
Noise suppression at f = n (f1 ± 1 %), (f1 = interference frequency) n=1.2...	
• Common-mode noise (U_{CM} < 2 V) • Seriesmode interference	>86 dB >40 dB (peak value of disturbance < rated input range)
Crosstalk between inputs	>50 dB
Error limits	
Operational limit • Voltage input	across temperature range, relative to input range ±50 mV ±0,5 % ±500 mV ±0,5 % ±1 V ±0,5 % ±5 V ±0,6 % ±10 V ±0,5 % 1 ... 5 ±0,5 % 0 ... 10 V ±0,5 %

Operational limit • Current input	across temperature range, relative to input range ±20 mA ±0,5 % 0 … 20 mA ±0,5 % 4 … 20 mA ±0,5 %
Operational limit • Resistance	across temperature range, relative to input range 0 … 6 kΩ ±0,5 % 0 … 600 Ω ±0,5 %
Operational limit • Resistance thermometers	across temperature range Pt 100, Ni 100, Standard ±1,2 K Pt 100, Ni 100, Climate ±1 K Ni 1000, LG-Ni 1000, Standard ±1 K Ni 1000, LG-Ni 1000, Climate ±1 K
Basic error limit • Current input	operational error limit at 25 °C, relative to input range ±50 mV ±0,3 % ±500 mV ±0,3 % ±1 V ±0,3 % ±5 V ±0,4 % ±10 V ±0,3 % 1 ... 5 ±0,3 % 0 ... 10 V ±0,3 %
Basic error limit • Current input	operational error limit at 25 °C, relative to input range ±20 mA ±0,3 % 0 … 20 mA ±0,3 % 4 … 20 mA ±0,3 %
Basic error limit • Resistance	operational error limit at 25 °C, relative to input range 0 … 6 kΩ ±0,3 % 0 … 600 Ω ±0,3 %
Basic error limit • Resistance thermometers	operational error limit at 25 °C Pt 100/Ni 100 Standard ±1 K Pt 100/Ni 100 Climate ±0,8 K Ni 1000/LG-Ni 1000 Standard ±0,8 K Ni 1000/LG-Ni 1000 Climate ±0,8 K
Temperature error	relative to input range ±0,006 %/K / 0,006 K/K
Linearity error	relative to input range ±0,1 % / ±0,1 K
Repetition accuracy in transient state at 25 °C	relative to input range ±0,1 % / ±0,1 K

Table 13-4: Technical data 700-331-1KF01

13.5 Analog output module 2 outputs

Order No.	700-332-5HB01
Design	2 outputs for connecting analog actuators
Input ranges (Nominal range)	Voltage: ±10 V 0 to 10 V 1 to 5 V Current: ±20 mA 0 to 20 mA 4 to 20 mA
Connection of the actuators	For voltage output – 4-wire connection (meas. line) possible For current output – 2-wire connection
Load resistance (in nominal range of the output)	For voltage outputs min. 1 kΩ – capacitive load max. 1 µF For current outputs max. 500 Ω – for UCM < 1V max. 600 Ω – inductive load max. 10 mH
Voltage output	Short-circuit protection yes Short-circuit current max. 25 mA
Current output	Open-circuit voltage max. 18 V
Destruction limit against externally applied voltages/ currents	Voltage at the outputs against MANA max. ±18 V permanent; 75 V for max. 1 s (duty factor 1:20) Current max. DC 50 mA
Permissible cable lengths	shielded max. 200 m
Power supply	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector (L+)
Current consumption	typ. 100 mA at 5 V (backplane bus) max. 240 mA at 24 V (L+)
Reverse polarity protection	yes
Power loss	approx. 3 W
Isolation	isolated from backplane bus isolated from power supply L+
Permissible potential difference	
between M_{ANA} and M_{intern} (U_{ISO})	DC 75 V / AC 60 V
between S– and M_{ANA} (U_{CM})	DC 3 V
Fault signal	value 7FFFH irrespective of parameterization evaluation of parametrizable signals only with diagnostics enabled
Status, alarms, diagnostics	
Diagnostic alarm	parameterizable
Diagnostic functions	parameterizable
Group fault display	red LED (GRP)
Diagnostic information	read-out possible
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm³
Weight	approx. 220 g

Analog value formation	
Resolution (incl. overrange)	± 10 V; ± 20 mA; 4 to 20 mA; 1 to 5 V: 11 bits + sign 0 to 10 V; 0 to 20 mA: 12 Bit
Conversion time (per channel)	max. 0,8 ms
Settling time	for ohmic load 0.2 ms for capacitive load 3.3 ms for inductive load 0.5 ms (1 mH) 3.3 ms (10 mH)
Interference suppression, limits of error	
Cross-talk between the outputs	>40 dB
Limits of error	
Operational limit	Voltage output 0.5 % Current output 0.6 % In the overall temperature range with reference to output range
Basic error limit	Voltage output 0.4 % Current output 0.5 % Operational limit at 25 °C with reference to nominal range
Temperature error	With reference to output range 0.002 %/K
Linearity error	With reference to output range ±0.05 %/K
Repeatability in settled state at 25 °C	With reference to nominal range ±0.05 %
Output ripple; bandwidth	0 to 50 kHz, with reference to output range ±0.05 %

Table 13-5: Technical data 700-332-5HB01

13.6 Analog output module 4 outputs

Order No.	700-332-5HD01
Design	4 outputs for connecting analog actuators
Input ranges (Nominal range)	Voltage: ±10 V 0 to 10 V 1 to 5 V Current: ±20 mA 0 to 20 mA 4 to 20 mA
Connection of the actuators	For voltage output – 4-wire connection (meas. line) possible For current output – 2-wire connection
Load resistance (in nominal range of the output)	For voltage outputs min. 1 kΩ – capacitive load max. 1 µF For current outputs max. 500 Ω – for UCM < 1V max. 600 Ω – inductive load max. 10 mH
Voltage output	Short-circuit protection yes Short-circuit current max. 25 mA
Current output	Open-circuit voltage max. 18 V
Destruction limit against externally applied voltages/ currents	Voltage at the outputs against MANA max. ±18 V permanent; 75 V for max. 1 s (duty factor 1:20) Current max. DC 50 mA
Permissible cable lengths	shielded max. 200 m
Power supply	
Nominal voltage	5 V DC via backplane bus 24 V DC via front connector (L+)
Current consumption	typ. 100 mA at 5 V (backplane bus) max. 240 mA at 24 V (L+)
Reverse polarity protection	yes
Power loss	approx. 3 W
Isolation	isolated from backplane bus isolated from power supply L+
Permissible potential difference	
between M_{ANA} and M_{intern} (U_{ISO})	DC 75 V / AC 60 V
between S– and M_{ANA} (U_{CM})	DC 3 V
Fault signal	value 7FFFH irrespective of parameterization evaluation of parametrizable signals only with diagnostics enabled
Status, alarms, diagnostics	
Diagnostic alarm	parameterizable
Diagnostic functions	parameterizable
Group fault display	red LED (GRP)
Diagnostic information	read-out possible
Connection	16-bit DEA 300 front connector (20-way)
Dimensions	40 x 125 x 120 mm³
Weight	approx. 220 g

Analog value formation	
Resolution (incl. overrange)	± 10 V; ± 20 mA; 4 to 20 mA; 1 to 5 V: 11 bits + sign 0 to 10 V; 0 to 20 mA: 12 Bit
Conversion time (per channel)	max. 0,8 ms
Settling time	for ohmic load 0.2 ms for capacitive load 3.3 ms for inductive load 0.5 ms (1 mH) 3.3 ms (10 mH)
Interference suppression, limits of error	
Cross-talk between the outputs	>40 dB
Limits of error	
Operational limit	Voltage output 0.5 % Current output 0.6 % In the overall temperature range with reference to output range
Basic error limit	Voltage output 0.4 % Current output 0.5 % Operational limit at 25 °C with reference to nominal range
Temperature error	With reference to output range 0.002 %/K
Linearity error	With reference to output range ±0.05 %/K
Repeatability in settled state at 25 °C	With reference to nominal range ±0.05 %
Output ripple; bandwidth	0 to 50 kHz, with reference to output range ±0.05 %

Table 13-6: Technical data 700-332-5HD01

14 Starting Up Analog Input Modules

14.1 Analog input module 0 to 10 V

The functions of the 700-331-0V010 analog input module are set with the STEP 7® software. Parameterization is performed using the Siemens 6ES7-331-7KF02 module.

The module does not have a measuring range module, measuring range switchover operations are performed software-controlled via internal relays. Wire-break monitoring is not supported.

"E" must be set as the measuring type. Other measuring types are ignored by the 700-331-0V010 module or answered with a system error.

The selected integration time determines the possible resolution, see Technical Data.

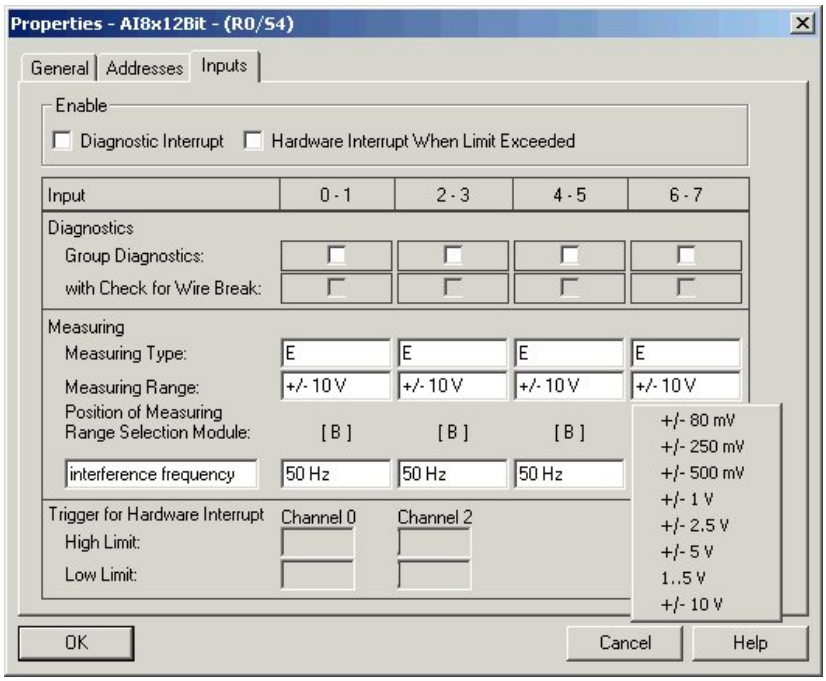


Fig. 14-1: Parameterization of the 700-331-0V010 analog input module

The 8 channels of the 700-331-0V010 analog input module are parameterized in 4 channel groups with 2 channels each. Table 14-1 contains the channel group numbers required for parameterization in the user program SFC (58).

Only channels 0 and 2 can be parameterized with limit value monitoring.

Channel 0 Channel 1	Channel group 0
Channel 2 Channel 3	Channel group 1
Channel 4 Channel 5	Channel group 2
Channel 6 Channel 7	Channel group 3

Table 14-1: Channel group numbers of the 700-331-0V010 module

Table 14-2 contains the settable parameters and their defaults.

Non-connected channels

Non-connected inputs (channels) must be connected in parallel to unused channels. Unused groups can be connected with ground M_{ANA} (terminal 11). Open inputs adversely affect the noise immunity of the entire module.

Reducing the cycle time of the module enables you to parameterize the unused channel groups as "deactivated" under Measurement - Measuring Type.

Parameter	Value range	Default	Type of parameter	Scope of action
Enable				
Diagnostic alarm	yes / no	no	dynamic	module
Process alarm on limit violation	yes / no	no	dynamic	module
Trigger for process alarm	restrictions due to measuring range possible			
Upper limit value	from -32512 to 32511	-	dynamic	channel
Lower limit value	from -32512 to 32511	-	dynamic	channel
Diagnostics				
Group diagnostics	yes / no	no	static	channel group
With wire-break check	yes / no	no	static	channel group
Measuring type	deactivated			
	E voltage	E	dynamic	channel
Measuring range	±80 mV ±250 mV ±500 mV ±1 V ±2.5 V ±5 V 1 ... 5 V ±10 V	±10 V		
Interference frequency suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

Table 14-2: Overview of parameter set for the 700-331-0V010 module

14.2 Analog input module 20 mA

The functions of the 700-331-4MA20 analog input module are set with the STEP 7® software. Parameterization is performed using the Siemens 6ES7-331-7KF02 module.

The module does not have a measuring range module, measuring range switchover operations are performed software-controlled via internal relays.

Open-circuit monitoring is possible in measuring range "4...20mA". If open-circuit monitoring is active, the module detects a current <1.185 mA. The wire-break is indicated by the group fault LED lighting up. The diagnostic bytes must be evaluated by the user.

If the diagnostic alarm is enabled, the module also triggers a diagnostic alarm. If the wire-break monitoring is not activated, the module will trigger a diagnostic alarm on reaching underflow.

"2DMU" must be set as the measuring type for 2-wire transmitter or "4DMU" for 4-wire transmitter. Other measuring types are ignored by the 700-331-4MA20 module or answered with a system error.

The selected integration time determines the possible resolution, see Technical Data.

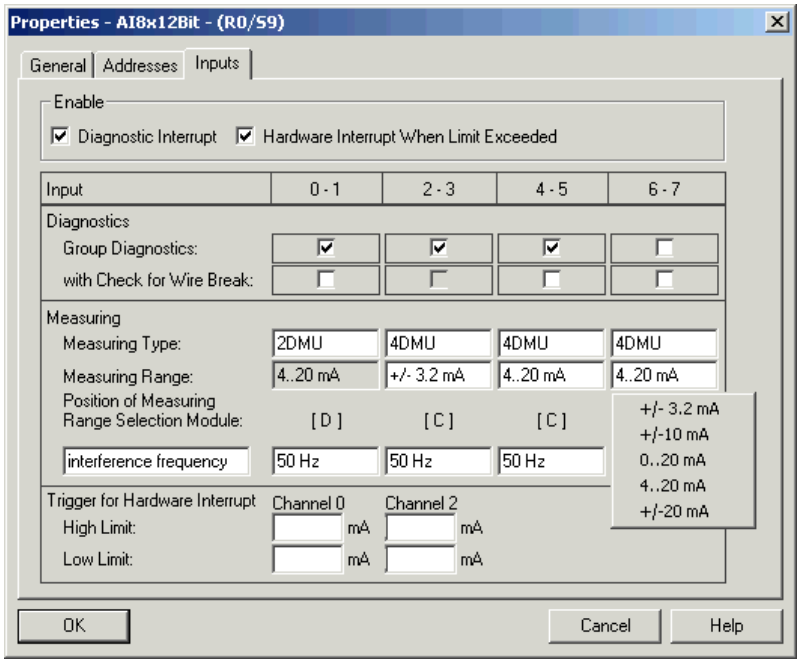


Fig. 14-2: Parameterization of the 700-331-4MA20 analog input module

Table 14-4 contains the settable parameters and their defaults.

The 8 channels of the 700-331-4MA20 analog input module are parameterized in 4 channel groups with 2 channels each. Table 14-3 contains the channel group numbers required for parameterization in the user program SFC (58).

Only channels 0 and 2 can be parameterized with limit value monitoring.

Channel 0 Channel 1	Channel group 0
Channel 2 Channel 3	Channel group 1
Channel 4 Channel 5	Channel group 2
Channel 6 Channel 7	Channel group 3

Table 14-3: Channel group numbers of the 700-331-4MA20 module

Parameter	**Value range**	**Default**	**Type of parameter**	**Scope of action**
Enable				
Diagnostic alarm	yes / no	no	dynamic	module
Process alarm on limit violation	yes / no	no	dynamic	module
Trigger for process alarm	restrictions due to measuring range possible			
Upper limit value	from -32512 to 32511	-	dynamic	channel
Lower limit value	from -32512 to 32511	-	dynamic	channel
Diagnostics				
Group diagnostics	yes / no	no	static	channel group
With wire-break check (open-circuit monitoring)	yes / no	no	static	channel group
Measurement				
Measuring type	deactivated	U		
	4DMU current (4-wire transmitter)		dynamic	channel
	2DMU current (2-wire transmitter)			
Measuring range	±0 ... 3.2 mA / 4DMU ±0 ... 10 mA / 4DMU ±0 ... 20 mA / 4DMU 4 ... 20 mA / 2DMU or 4DMU			
Interference frequency suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

Table 14-4: Overview of parameter set for the 700-331-4MA20 module

14.3 Analog input module PT100

The functions of the 700-331-PT100 analog input module are set with the STEP 7® software. Parameterization is performed using the Siemens 6ES7-331-7KF02 module.

The module does not have a measuring range module, measuring range switchover operations are performed software-controlled.

The wire-break is indicated by the group fault LED lighting up. The diagnostic bytes must be evaluated by the user.

If the diagnostic alarm is enabled, the module also triggers a diagnostic alarm. If the wire-break monitoring is not activated, the module will trigger a diagnostic alarm on reaching underflow.

"RT" or „R-4L“ must be set as the measuring type. Other measuring types are ignored by the 700-331-PT100 module or answered with a system error.

Channels 0 and 2 can be parameterized with limit value monitoring.

The selected integration time determines the possible resolution, see Technical Data.

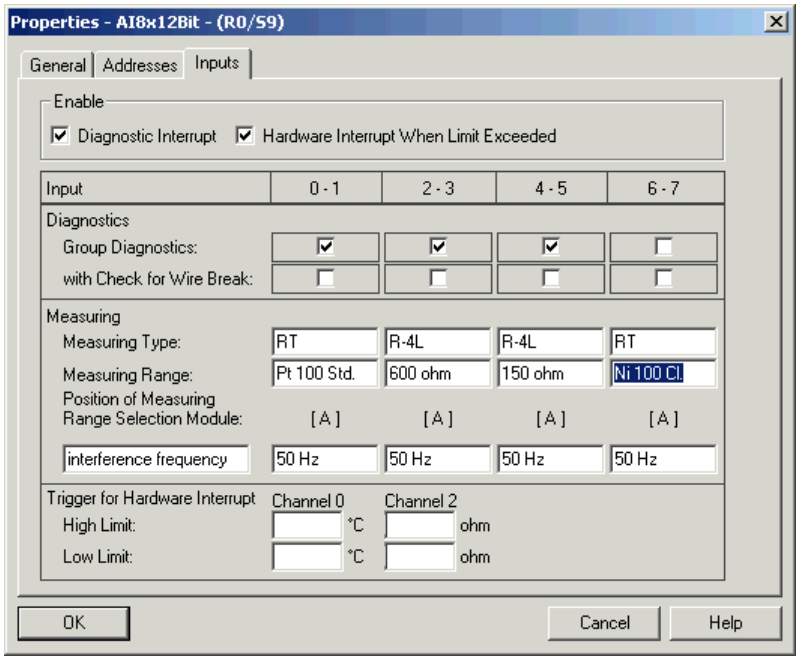


Fig. 14-3: Parameterization of the 700-331-PT100 analog input module

Table 14-5 contains the settable parameters and their defaults.

Only channels 0 and 2 can be parameterized with limit value monitoring.

Parameter	Value range	Default	Type of parameter	Scope of action
Enable				
Diagnostic alarm	yes / no	no	dynamic	module
Process alarm on limit violation	yes / no	no	dynamic	module
Trigger for process alarm	restrictions due to measuring range possible			
Upper limit value	from 0 to 32511	-	dynamic	channel
Lower limit value	from 0 to 32511	-	dynamic	channel
Diagnostics				
Group diagnostics	yes / no	no	static	channel group
With wire-break check (open-circuit monitoring)	yes / no	no	static	channel group
Measurement				
Measuring type	deactivated			
	RT R-4L	U	dynamic	channel
Measuring range	Pt 100 Std. Pt 100 Cl. Ni 100 Std. Ni 100 Cl. 150 Ω 300 Ω 600 Ω			
Interference frequency suppression	400 Hz; 60 Hz; 50 Hz; 10 Hz	50 Hz		

Table 14-5: Overview of parameter set for the 700-331-PT100 module

Channel groups for resistance measurement

In "resistance measurement" there is only one channel per group. The first channel of the group provides the measured value, the 2nd channel of the group is assigned the overflow value 7FFFH.

14.4 8 x 13 Bit Analog input module

The functions of the 700-331-1KF01 analog input module are set with the STEP 7® software. Parameterization is performed using the Siemens 6ES7-331-1KF01 module.

The type of measurement and the measurement range is adjusted with the parameter "type of measurement" in STEP7®.

Selectet measuring method	Range of values
Voltage U	±50 mV ±500 mV ±1 V ±5 V von 1 to 5 V von 0 to 10 V ±10 V
Current I	von 0 to 20 mA von 4 to 20 mA ±20 mA
Resistance (4-wire connection) R-4L	6 kΩ 600 Ω
Thermoelectric resistance RTD-4L (linear, 4-wire connection) (Temperature measurement)	PT 100 Climate/ Standard Ni 100 Climate / Standard Ni 1000 Climate / Standard LG-Ni 1000 Climate / Standard

Non-connected channels

Reducing the cycle time of the module enables you to parameterize the unused channel groups as "deactivated" under Measurement - Measuring Type.
The terminal connections M- of the not connected channels should be connected with each other.

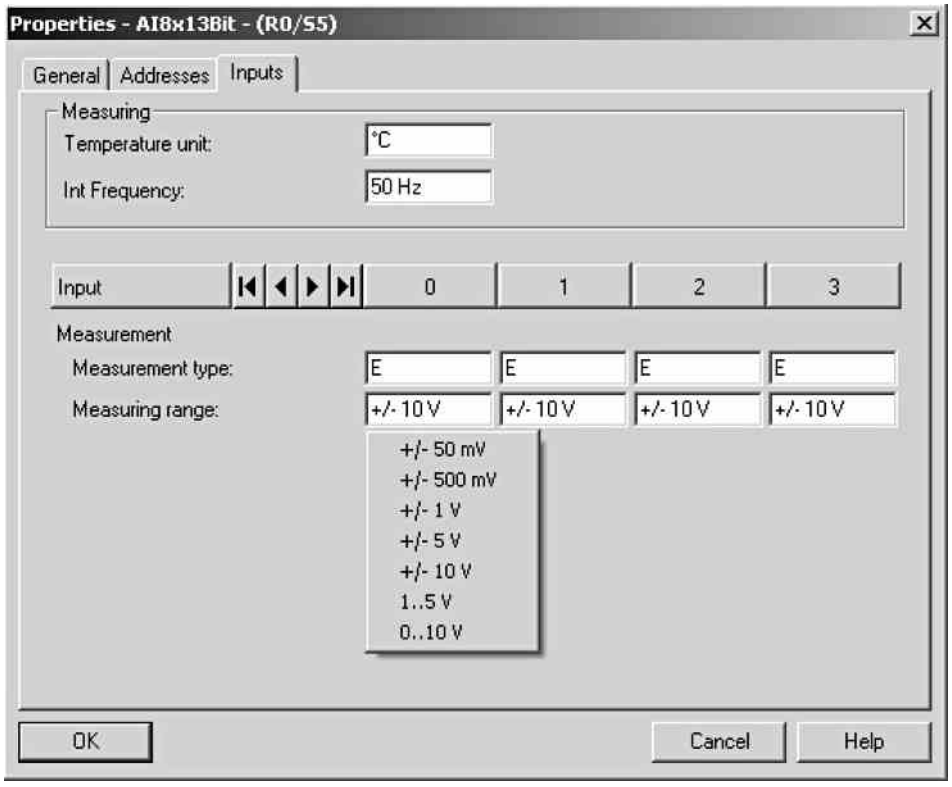


Fig. 14-4: Parameterization of the 700-331-1KF01 analog input module

Parameters	Range of values	Default	Parameter type	Scope
Measurement • Measuring method	disabled U voltage I current R resistance RTD thermoelectric resistance	U	Dynamic	Channel
• Measuring range	Voltage ±50 mV ±500 mV ±1 V 1 … 5 V ±5 V 0 … 10 V ±10 V	±10 V	Dynamic	Channel
	Current 0 … 20 mA 4 … 20 mA ±20 mA	±20 mA	Dynamic	Channel
	Resistance 0 … 600 Ω 0 … 6 kΩ	600 Ω	Dynamic	Channel
	Thermoelectric resistance (linear) Pt 100 Climate / Standard Ni 100 Climate / Standard Ni 1000 Climate / Standard LG-Ni 1000 Climate / Standard	Pt 100 standard	Dynamic	Channel
• Temperature coefficient	Pt 100 0,003850 Ω/Ω/ °C (IST-90) Ni 100 / Ni 1000 0,006180 Ω/Ω/ °C LG-Ni 1000 0,005000 Ω/Ω/ °C	0,003850	Dynamic	Channel
• Noise suppression	50 Hz 60 Hz	50 Hz	Dynamic	Module
• Temperature unit	Grad Celsius Grad Fahrenheit Kelvin*	Degrees Centigrade	Dynamic	Module
	* only Pt 100 Standard, Ni 100 Standard, Ni 1000 Standard, LG-Ni 1000 Standard			

Table 14-6: Overview of parameter set for the 700-331-1KF01 module

14.5 2 x 12 bits output module

When the nominal load voltage L+ is switched on/off, incorrect output values may be present at the output for approx. 10 ms.

The functions of the analog input module 700-332-5HB01 are set with the STEP 7® software. Parameterization is performed using the Siemens module 6ES7-332-5HB01.

Diagnostics
The diagnostic bytes must be evaluated by the user.

If the diagnostic alarm is enabled, the module also triggers a diagnostic alarm.

Wire-break check performed for current outputs only.
Short-circuit testing for voltage outputs only.

The module is preset to voltage output ±10 V.

Substitute values

The behavior of the module can be parameterized for STOP mode:

Outputs de-energized

Hold last value

Connect substitute values – the substitute values must be in the output range!

Substitute values for output ranges 1 … 5 V and 4 … 20 mA

To de-energize the output, substitute value E500H must be set.

Connection of the analog outputs

The outputs can be parameterized or deactivated as a voltage or current output with the "output type" parameter. When "deactivated", the output is de-energized and can be left open.

If output ranges are changed during operation of the 700-322-5HB01, incorrect intermediate values may arise at the output.

Parameter assignment to channels

Each output channel can be parameterized singly, i.e. each output channel can have its own parameters.

On parameterization with SFCs in the user program, the parameters are assigned to channel groups, each output channel being assigned to a channel group, e.g. output channel 0 = channel group 0.

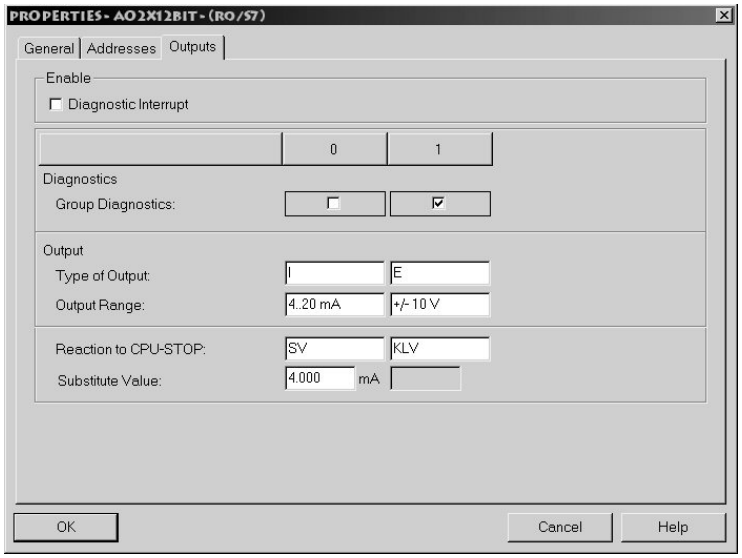


Fig. 14-5: Parameterization of the 700-332-5HB01 analog output module

Parameter	Value range	Default	Type of parameter	Scope of action
Enable				
Diagnostic alarm	yes / no	no	dynamic	module
Diagnostics	yes / no	no	dynamic	module
Group diagnostics	yes / no	no	static	channel group
With wire-break check (open-circuit monitoring)	yes / no	no	static	channel group
Output	voltage current deactivated	voltage	dynamic	channel group
Output range	1 … 5 V 0 … 10 V ±10 V 0 … 20 mA 4 … 20 mA ±20 mA	±10 V		

Table 14-7: Overview of parameter set for the 700-332-5HB01 module

14.6 4 x 12 bits output module

When the nominal load voltage L+ is switched on/off, incorrect output values may be present at the output for approx. 10 ms.

The functions of the analog input module 700-332-5HD01 are set with the STEP 7® software. Parameterization is performed using the Siemens module 6ES7-332-5HD01.

Diagnostics
The diagnostic bytes must be evaluated by the user.

If the diagnostic alarm is enabled, the module also triggers a diagnostic alarm.

Wire-break check performed for current outputs only.
Short-circuit testing for voltage outputs only.

The module is preset to voltage output ±10 V.

Substitute values

The behavior of the module can be parameterized for STOP mode:

Outputs de-energized

Hold last value

Connect substitute values – the substitute values must be in the output range!

Substitute values for output ranges 1 … 5 V and 4 … 20 mA

To de-energize the output, substitute value E5000H must be set.

Connection of the analog outputs

The outputs can be parameterized or deactivated as a voltage or current output with the "output type" parameter. When "deactivated", the output is de-energized and can be left open.

If output ranges are changed during operation of the 700-322-5HD01, incorrect intermediate values may arise at the output.

Parameter assignment to channels

Each output channel can be parameterized singly, i.e. each output channel can have its own parameters.

On parameterization with SFCs in the user program, the parameters are assigned to channel groups, each output channel being assigned to a channel group, e.g. output channel 0 = channel group 0.

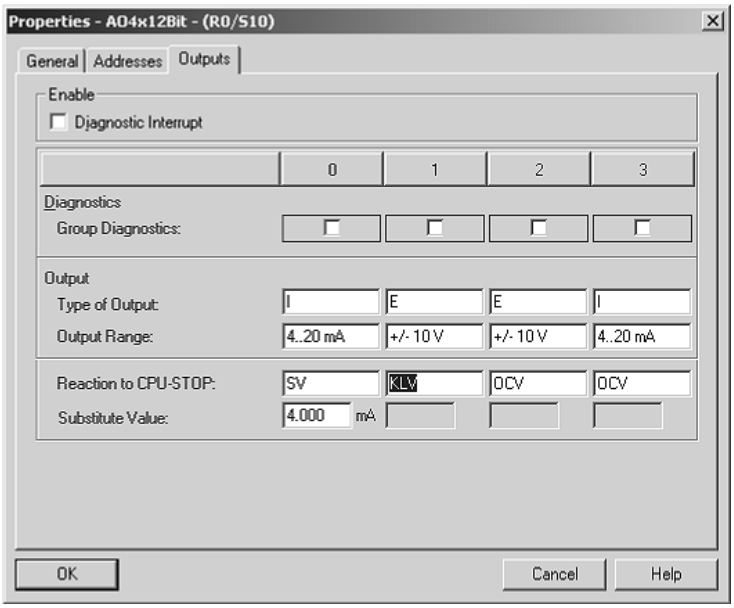


Fig. 14-6: Parameterization of the 700-332-5HD01 analog output module

Parameter	Value range	Default	Type of parameter	Scope of action
Enable				
Diagnostic alarm	yes / no	no	dynamic	module
Diagnostics	yes / no	no	dynamic	module
Group diagnostics	yes / no	no	static	channel group
With wire-break check (open-circuit monitoring)	yes / no	no	static	channel group
Output	voltage current deactivated	voltage	dynamic	channel group
Output range	1 … 5 V 0 … 10 V ±10 V 0 … 20 mA 4 … 20 mA ±20 mA	±10 V		

Table 14-8: Overview of parameter set for the 700-332-5HD01 module

15 Ordering data

	Systeme-Helmholz Order No.
Sectional rail	
Sectional rail length 160 mm	700-390-1AB60
Sectional rail length 482 mm	700-390-1AE80
Sectional rail length 530 mm	700-390-1AF30
Sectional rail length 830 mm	700-390-1AJ30
Sectional rail length 2000 mm	700-390-1BC00
Front connector	
20-way front connector with screw terminals	700-392-1AJ10
20-way front connector with spring-loaded terminals	700-392-1BJ00
40-way front connector with spring-type terminal	700-392-1BM01
40-way front connector with EasyConnect®	700-392-1AM10
40-way front connector with screw terminals	700-392-1AM00
Analog input module	
Analog input module 0 - 10 V	700-331-0V010
Analog input module 20 mA	700-331-4MA20
Analog input module PT100	700-331-PT100
Analog input module 8 x 13 Bit	700-331-1KF01
Analog output module	
Analog output module AO 2 x 12 Bit	700-332-5HB01
Analog output module AO 4 x 12 Bit	700-332-5HD01

List of tables

Table 5-1: Measured value resolution 37

Table 5-2: Bipolar input ranges 38

Table 5-3: Unipolar input ranges 38

Table 5-4: Analog value representation of the voltage measuring ranges ±10 V to ±1 V 39

Table 5-5: Analog value representation in the voltage measuring ranges ±500 mV to ±80 mV 40

Table 5-6: Analog value representation in the voltage measuring range 1 to 5 V and 0 to 10 V 40

Table 5-7: Analog value representation in the current measuring ranges ±20 mA to ±3.2 mA 41

Table 5-8: Analog value representation in the current measuring ranges 0 to 20 mA and 4 to 20 mA 41

Table 5-9: Analog value representation for resistance sensors from 150 Ω to 600 Ω 42

Table 5-10: Analog value representation for Pt 100 Standard resistance thermometers 42

Table 5-11: Analog value representation for resistance thermometers Pt 100 Climate 43

Table 5-12: Analog value representation for Ni 100 Standard resistance thermometers 43

Table 5-13: Analog value representation for Ni 100 Climate resistance thermometers 44

Table 5-14: Bipolar input ranges 45

Table 5-15: Unipolar input ranges 45

Table 5-16: Analog value representation in the output range ±10 V 46

Table 5-17: Analog value representation in the output range 0 …10 V / 1 … 5 V 46

Table 5-18: Analog value representation in the output range ±20 mA 47

Table 5-19: Analog value representation in the output range 0…20 mA / 4…20 mA 47

Table 6-1: Measured values and operating state of the CPU 48

Table 6-2: Messages of the individual input ranges 49

Table 7-1: Relative error with reference to the operational limit 50

Table 9-1: Parameters of the analog input modules 54

Table 9-2: Parameters of the analog output modules 55

Table 12-1: Diagnostic messages of the analog input modules 66

Table 12-2: Diagnostic messages of the analog output modules 66

Table 12-3: Causes of error of the analog input modules 67

Table 12-4: Causes of error of the analog output modules 67

Table 13-1: Technical data 700-331-0V010 71
Table 13-2: Technical data 700-331-4MA20 73
Table 13-3: Technical data 700-331-PT100 75
Table 13-4: Technical data 700-331-1KF01 78
Table 13-5: Technical data 700-332-5HB01 80
Table 13-4: Technical data 700-332-5HD01 82
Table 14-1: Channel group numbers of the 700-331-0V010 module 83
Table 14-2: Overview of parameter set for the 700-331-0V010 module 84
Table 14-3: Channel group numbers of the 700-331-4MA20 module 86
Table 14-4: Overview of parameter set for the 700-331-4MA20 module 86
Table 14-5: Overview of parameter set for the 700-331-PT100 module 88
Table 2-2: Overview of parameter set for the 700-331-1KF01 module 90
Table 14-6: Overview of parameter set for the 700-332-5HD01 module 92
Table 14-6: Overview of parameter set for the 700-332-5HD01 module 94