VIPA System 100V

EM | Manual

HB100E_EM | RE_134-4Ex | Rev. 13/05

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Note

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Contents

About this Manual

This manual describes the analog expansion module EM 134 of the System 100V from VIPA.

Here you may find every information for commissioning and operation.

Outline

Chapter 1: Basics

These basics include recommendations on the handling of the modules of the VIPA System 100V as central resp. decentral automation system.

Besides a system overview you will find general information of the System 100V like assembly dimensions, installation and environmental conditions.

The chapter is finished by the installation guidelines to ensure the EMC during installation.

Chapter 2: Hardware description and deployment

This chapter contains every information for the deployment of the analog expansion module of the System 100V.

Every Micro-PLC CPU has an interface for backplane bus connectors. This allows to connect System 100V expansion modules and modules of the System 200V family.

Objective and contents

This manual describes the System 100V Expansion modules EM 134 from VIPA. It contains a description of the construction, project implementation and usage.

This manual is part of the documentation package with order number HB100E_EM and relevant for:

Product	Order number	as of state: HW
EM 134	VIPA 134-4Ex	01

Target audience

The manual is targeted at users who have a background in automation technology.

Structure of the manual

The manual consists of chapters. Every chapter provides a self-contained description of a specific topic.

Guide to the document

The following guides are available in the manual:

- an overall table of contents at the beginning of the manual
- an overview of the topics for every chapter

Availability

The manual is available in:

- printed form, on paper
- in electronic form as PDF-file (Adobe Acrobat Reader)

Icons Headings

Important passages in the text are highlighted by following icons and headings:

Danger!
Immediate or likely danger.
Personal injury is possible.

Attention!
Damages to property is likely if these warnings are not heeded.

Note!
Supplementary information and useful tips.

Safety information

Applications conforming with specifications

The System 100V is constructed and manufactured for

- communication and process control
- general control and automation applications
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

Danger!

This device is not certified for applications in

- in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

The following conditions must be met before using or commissioning the components described in this manual:

- Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
- Installation and hardware modification only by properly trained personnel.
- The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

National rules and regulations apply to the disposal of the unit!

Chapter 1 Basics

Overview

These basics include recommendations on the handling of the modules of the VIPA System 100V as central resp. decentral automation system.

Besides a system overview you will find general information of the System 100V like assembly dimensions, installation and environmental conditions.

The chapter is finished by the installation guidelines to ensure the EMC during installation.

Content

Safety information for Users

Handling of electrostatic sensitive modules

VIPA modules make use of highly integrated components in MOS-technology. These components are extremely sensitive to over-voltages that can occur during electrostatic discharges.

The following symbol is attached to modules that can be destroyed by electrostatic discharges:

The symbol is located on the module, the module rack or on packing material and it indicates the presence of electrostatic sensitive equipment.

It is possible that electrostatic sensitive equipment is destroyed by energies and voltages that are far less than the human threshold of perception. These voltages can occur where persons do not discharge themselves before handling electrostatic sensitive modules and they can damage components thereby, causing the module to become inoperable or unusable. Modules that have been damaged by electrostatic discharges may fail after a temperature change, mechanical shock or changes in the electrical load.

Only the consequent implementation of protection devices and meticulous attention to the applicable rules and regulations for handling the respective equipment can prevent failures of electrostatic sensitive modules.

Shipping of electrostatic sensitive modules

Modules have to be shipped in the original packing material.

Measurements and alterations on electrostatic sensitive modules

When you are conducting measurements on electrostatic sensitive modules you should take the following precautions:

- Floating instruments must be discharged before use.
- Instruments must be grounded.

Modifying electrostatic sensitive modules you should only use soldering irons with grounded tips.

Attention!

Personnel and instruments should be grounded when working on electrostatic sensitive modules.

Overview System 100V

General

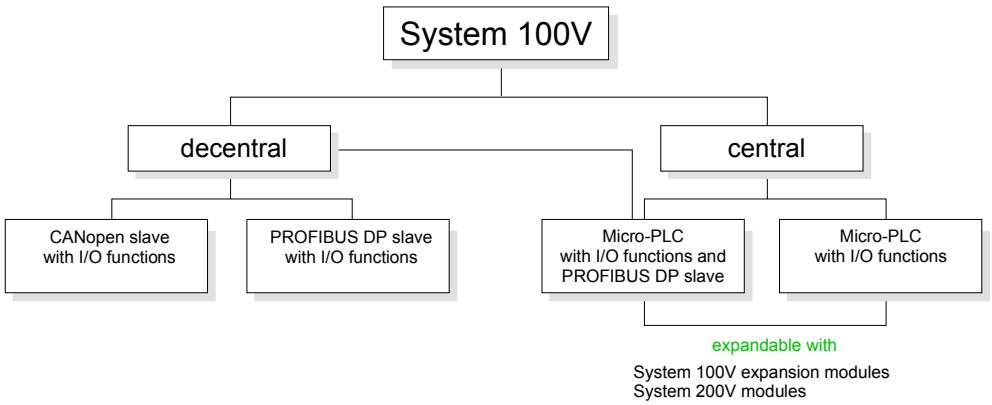
The System 100V from VIPA is a compact central and decentral usable automation system from VIPA. The system is recommended for lower and middle performance needs.

At a System 100V module, CPU res. bus coupler are integrated together with in-/output functions in one case.

System 100V modules are installed directly to a 35mm norm profile rail.

You may expand the number of I/Os of the Micro-PLC by means of expansion modules res. connect System 200V modules via bus couplers.

The following picture shows the performance range of the System 100V:



Central system

The central system is built of one CPU and integrated I/O-functions. The CPU is instruction compatible to the S7-300 from Siemens and may be programmed and projected by means of S7 programming tools from Siemens and VIPA via MPI.

By means of bus couplers you may connect modules of the System 200V family res. enlarge the number of I/Os by installing System 100V expansion modules.

The CPUs are available in different variants.

Central system with DP slave

At the central system besides the CPU and I/O functions, a PROFIBUS DP slave is included that acknowledges itself within the address range of the CPU.

Decentral system

This system contains a PROFIBUS DP res. CANopen slave with I/O functions instead of the CPU. The system is not expandable.

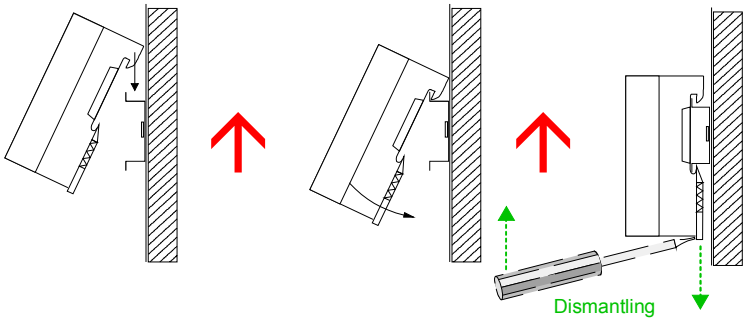
General Description of the System 100V

Structure and dimensions

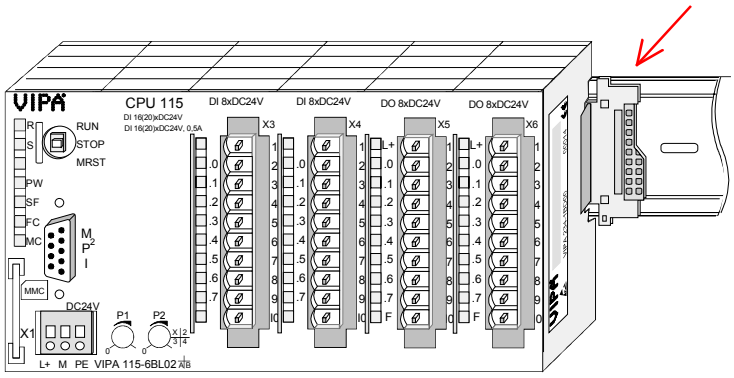
- Norm profile head rail 35mm
- Dimensions basic module:
  4tier width: (WxHxD) in mm: 101.6x76x48 / in inches: 4x3x1.9
  6tier width: (WxHxD) in mm: 152.4x76x48 / in Inches: 6x3x1.9

Installation

The installation of a System 100V module works via snapping on a norm profile head rail.



When using expansion modules, you have to clip the included 1tier bus connector at the right side to the module from behind before the installation.



Operation security

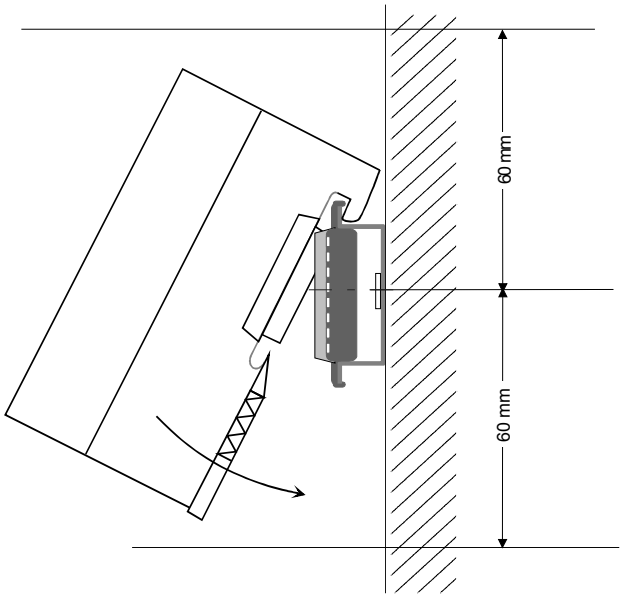
- Plug in via CageClamps, core cross-section 0.08...2.5mm^2
- Total isolation of the cables during module changes
- EMV resistance ESD/Burst acc. IEC 61000-4-2 / IEC 61000-4-4 (to level 3)
- Shock resistance acc. IEC 60068-2-6 / IEC 60068-2-27 (1G/12G)

Environmental conditions

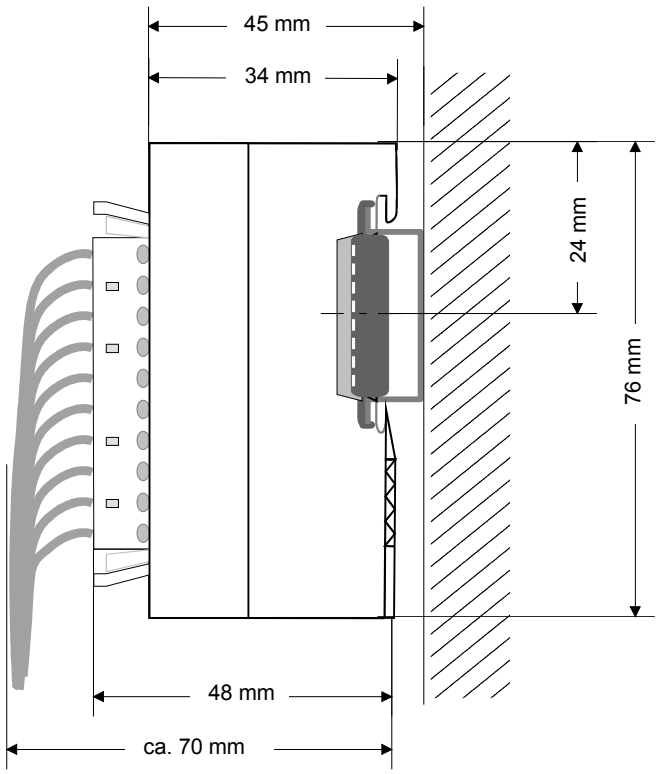
- Operating temperature: 0... + 60°C
- Storage temperature: -25... + 70°C
- Relative humidity: 5 ... 95% without condensation
- fan-less operation

Assembly dimensions

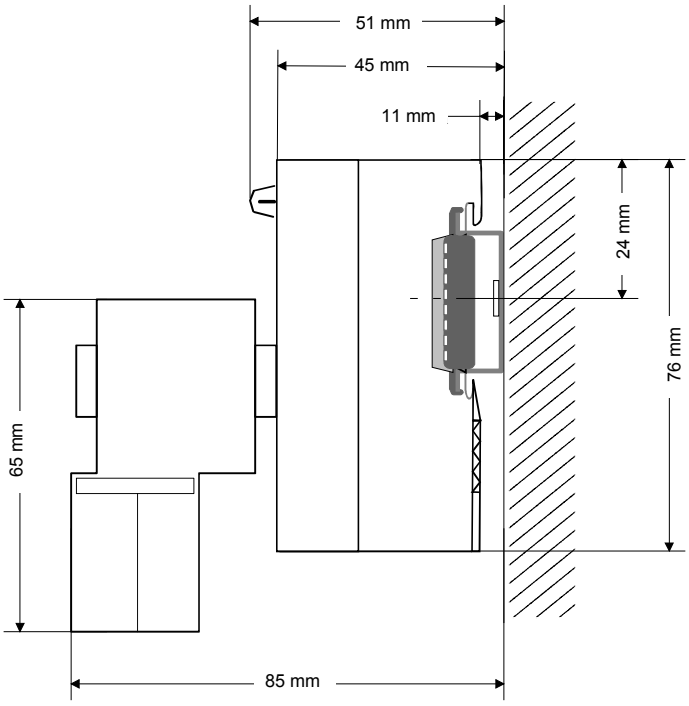
Installation dimensions



Installed and wired dimensions



CPU 11x with EasyConn from VIPA



Installation guidelines

General

The installation guidelines contain information about the interference free deployment of System 100V. There is the description of the ways, interference may occur in your control, how you can make sure the electromagnetic digestibility (EMC), and how you manage the isolation.

What means EMC?

Electromagnetic digestibility (EMC) means the ability of an electrical device, to function error free in an electromagnetic environment without being interferenced res. without interferencing the environment.

All System 100V components are developed for the deployment in industrial environments and fulfill high demands on the EMC. Nevertheless you should project an EMC planning before installing the components and take conceivable interference causes into account.

Possible interference causes

Electromagnetic interferences may interfere your control via different ways:

- Electromagnetic fields (RF coupling)
- Magnetic fields with power frequency
- I/O signal conductors
- Bus system
- Current supply
- Protected earth conductor

Depending on the spreading medium (lead bound or lead free) and the distance to the interference cause, interferences to your control occur by means of different coupling mechanisms.

One differs:

- galvanic coupling
- capacitive coupling
- inductive coupling
- radiant coupling

Basic rules for EMC

In the most times it is enough to take care of some elementary rules to guarantee the EMC. Please regard the following basic rules when installing your PLC.

- Take care of a correct area-wide grounding of the inactive metal parts when installing your components.
  - Install a central connection between the ground and the protected earth conductor system.
  - Connect all inactive metal extensive and impedance-low.
  - Please try not to use aluminum parts. Aluminum is easily oxidizing and is therefore less suitable for grounding.
- When cabling, take care of the correct line routing.
  - Organize your cabling in line groups (high voltage, current supply, signal and data lines).
  - Always lay your high voltage lines and signal res. data lines in separate channels or bundles.
  - Route the signal and data lines as near as possible beside ground areas (e.g. suspension bars, metal rails, tin cabinet).
- Proof the correct fixing of the lead isolation.
  - Data lines must be laid isolated (for details see below).
  - Analog lines must be laid isolated. When transmitting signals with small amplitudes the one sided laying of the isolation may be favorable.
  - Lay the line isolation extensively on an isolation/protected earth conductor rail directly after the cabinet entry and fix the isolation with cable clamps.
  - Make sure that the isolation/protected earth conductor rail is connected impedance-low with the cabinet.
  - Use metallic or metalized plug cases for isolated data lines.
- In special use cases you should appoint special EMC actions.
  - Wire all inductivities with erase links, which are not addressed by the System 100V modules.
  - For lightening cabinets you should avoid luminescent lamps.
- Create a homogeneous reference potential and ground all electrical operating supplies when possible.
  - Please take care for the targeted employment of the grounding actions. The grounding of the PLC is a protection and functionality activity.
  - Connect installation parts and cabinets with the System 100V in star topology with the isolation/protected earth conductor system. So you avoid ground loops.
  - If potential differences between installation parts and cabinets occur, lay sufficiently dimensioned potential compensation lines.

Isolation of conductors

Electrical, magnetically and electromagnetic interference fields are weakened by means of an isolation, one talks of absorption.

Via the isolation rail, that is connected conductive with the rack, interference currents are shunt via cable isolation to the ground. Hereby you have to make sure, that the connection to the protected earth conductor is impedance-low, because otherwise the interference currents may appear as interference cause.

When isolating cables you have to regard the following:

- If possible, use only cables with isolation tangle.
- The hiding power of the isolation should be higher than 80%.
- Normally you should always lay the isolation of cables on both sides. Only by means of the both-sided connection of the isolation you achieve high quality interference suppression in the higher frequency area.

  Only as exception you may also lay the isolation one-sided. Then you only achieve the absorption of the lower frequencies. A one-sided isolation connection may be convenient, if:
  - the conduction of a potential compensating line is not possible
  - analog signals (some mV res. µA) are transferred
  - foil isolations (static isolations) are used.
- With data lines always use metallic or metalized plugs for serial couplings. Fix the isolation of the data line at the plug rack.
- At stationary operation it is convenient to strip the insulated cable interruption free and lay it on the isolation/protected earth conductor line.
- To fix the isolation tangles use cable clamps out of metal. The clamps must clasp the isolation extensively and have well contact.
- Lay the isolation on an isolation rail directly after the entry of the cable in the cabinet. Lead the isolation further on to the module and **don't** lay it on there again!

Please regard at installation!

At potential differences between the grounding points, there may be a compensation current via the isolation connected at both sides.

Remedy: Potential compensation line

Chapter 2 Hardware description and deployment

Overview

This chapter contains every information for the deployment of the analog expansion module of the System 100V.

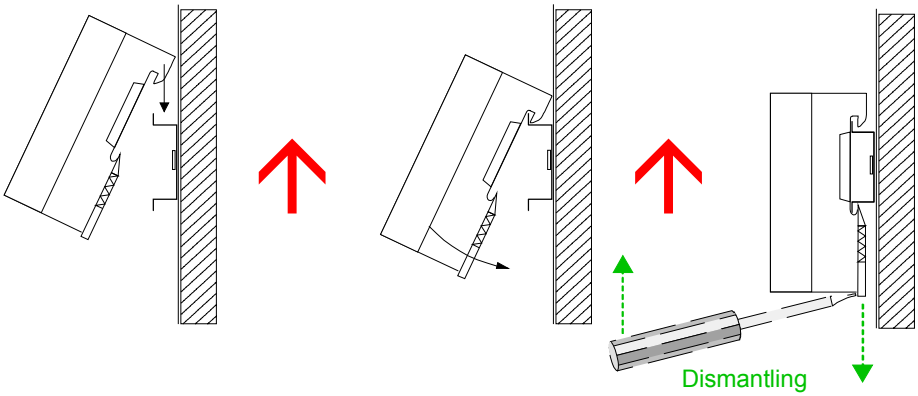
Every Micro-PLC CPU has an interface for backplane bus connectors. This allows to connect System 100V expansion modules and modules of the System 200V family.

Content

Installation

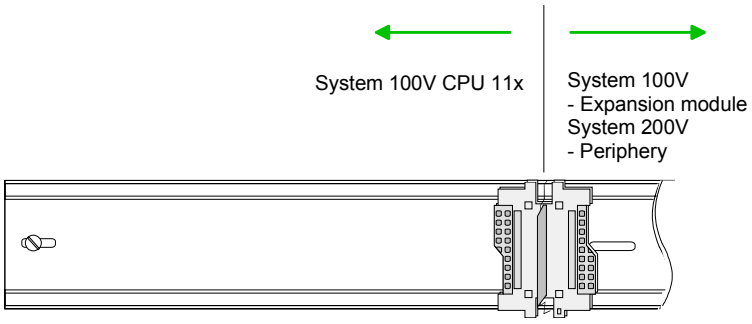
General things to assembly and dismantling

System 100V modules are clipped at a 35mm standard norm profile rail.
For dismantling, you have to pull the locker downwards with a screwdriver and lift the module up from the head rail.

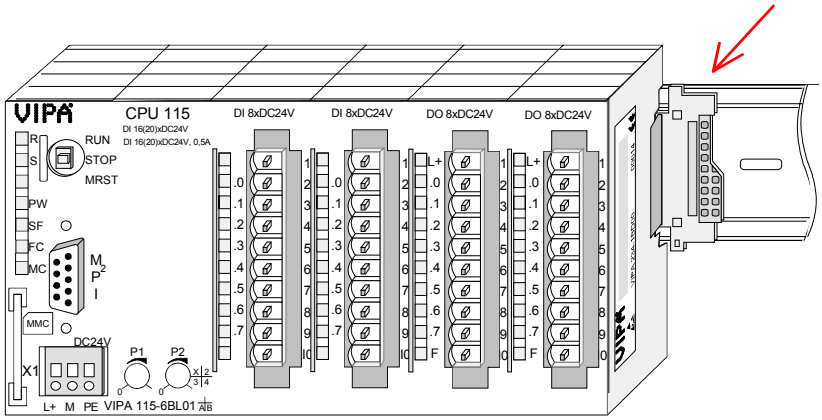


Assembly of analog modules

At deployment of expansion modules you have to fix the delivered bus coupler at the head rail before the assembly.

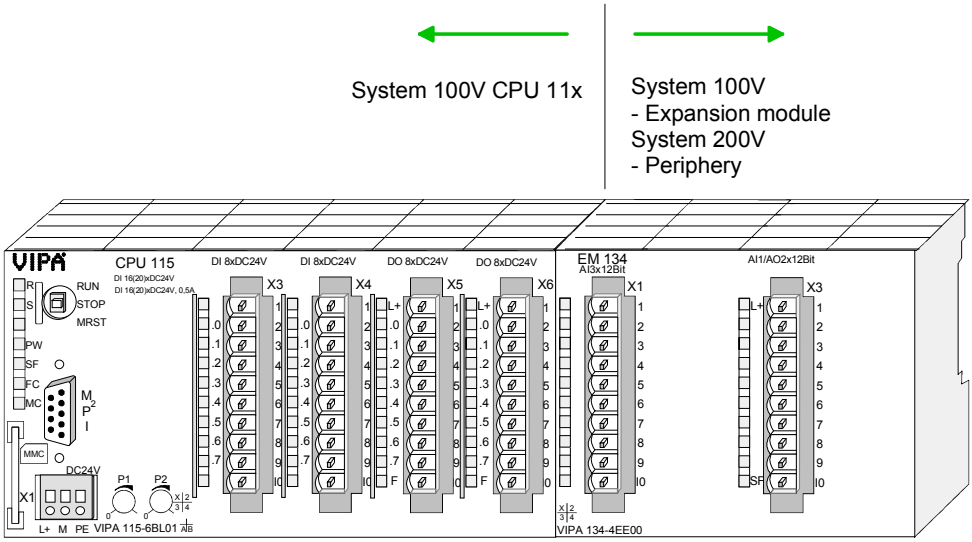


Plug in your System 100V CPU 11x until it snaps into position at the right side of the bus coupler.



Expansion module

Now you plug your System 100V expansion module left-justified.

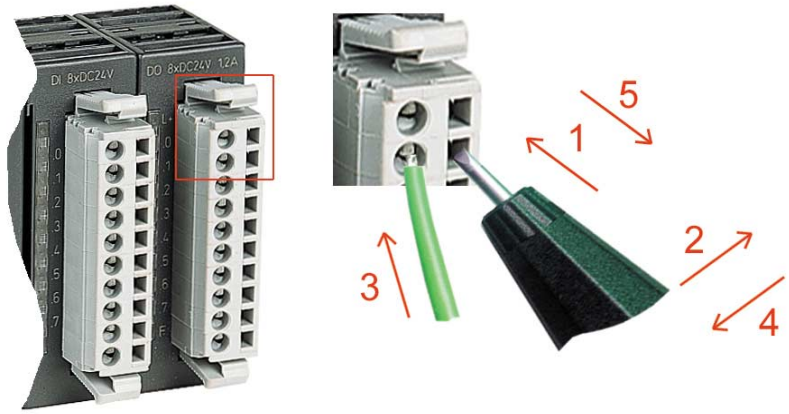


Repeat this procedure with further expansion modules by connecting them via a bus coupler to the right side.

Cabling

Take a fitting screwdriver and push the cage clamp in the rectangular opening to the back, then insert the cable into the round opening.

The cage clamp locks securely by removing the screwdriver.



Wiring the analog signals

Cables for analog signals

For analog signals you have to use isolated cables to reduce interference. The cable screening should be grounded at both ends. If there are differences in the potential between the cable ends, there may occur a potential compensating current that could disturb the analog signals. In this case you should ground the cable screening only at one end.

Connecting test probes

The analog input modules provide variant connecting possibilities for:

- Current sensor
- Voltage senor
- Resistance thermometer, Resistors (Pt, Ni, R)

Connecting current sensors

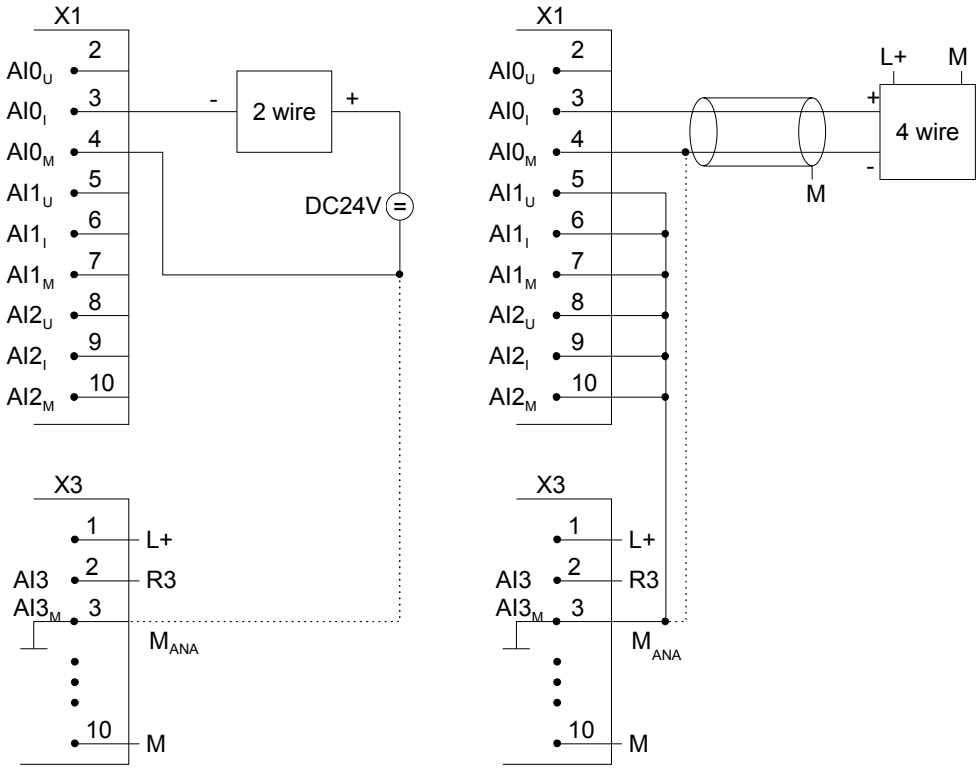
Current sensors as 2 wire or 4 wire measuring transducer.

Please regard that the measuring transducers have to be provided external.

Using 2 wire transducers an external power supply should be looped in.

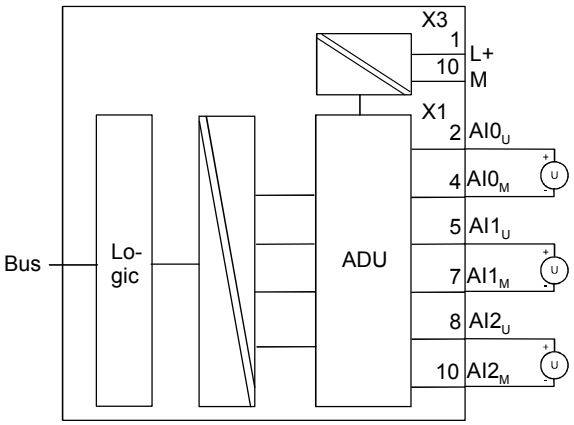
Please install short circuits at non-used inputs by connecting the positive contact with the channel ground. Bridging cannel ground and M_{ANA} is recommended.

The following picture illustrates the connection of 2 and 4 wire measuring transducers at channel 0:



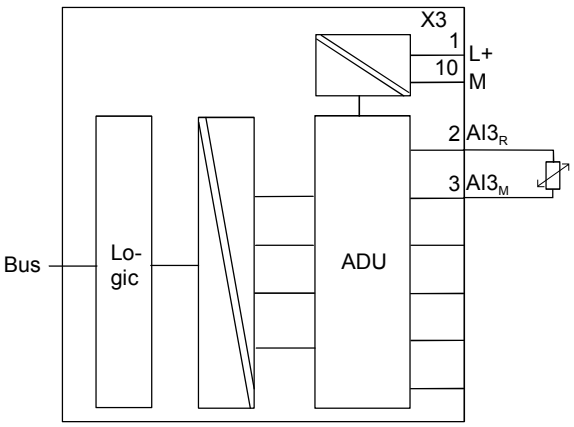
Connecting voltage sensors

The following figure shows the connection of voltage sensors:



Connecting resistance thermometer and sensors

The following figure shows the connection of resistance thermometer and sensors:

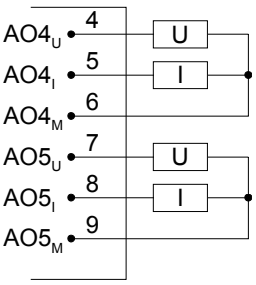


Wiring of the analog outputs

Loads and actors may be supplied with voltage or current by the analog part.

Please take always care of the correct polarity when connecting actuators!

Please leave the output pins of not used channels disconnected and configure the *output type* of the channel to "deactivated".



Structure

Order data AI 3xU/I, AI 1/AO 2x12Bit VIPA 134-4EE00

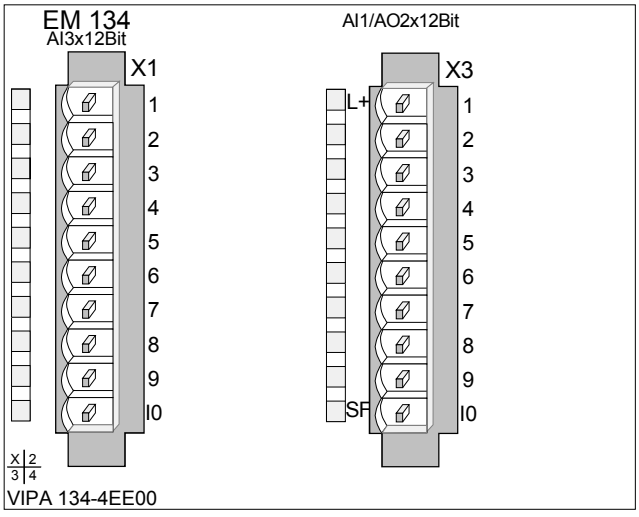
Description This module has 4 analog inputs and 2 analog outputs that may be configured individually. The module occupies a total of 8Byte of input and 4Byte of output data in the periphery area. Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers

Properties

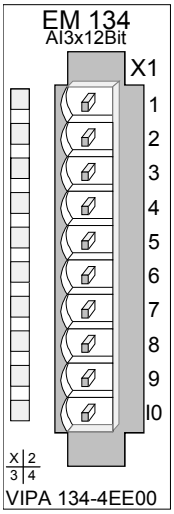
- 3 Analog inputs U/I, 1 Analog input Pt, Ni, R and 2 Analog outputs
- In-/Outputs with individually configurable functions
- Channel 0 to 2 suitable for encoder with input ranges of:
  voltage ±10V, 1 ... 5V, 0 ... 10V
  current ±20mA, 4...20mA or 0 ... 20mA
- Channel 3 suitable for encoder with input ranges of:
  Pt100, Pt1000, NI100, NI1000 and resistant measuring 600Ω, 3000Ω
- Channel 4 to 5 suitable for actuators with output ranges of:
  ±10V, 1 ... 5V, 0 ... 10V, ±20mA, 0 ... 20mA or 4 ... 20mA

VIPA 134-4EE00

Position X1	Position X2	Position X3	Position X4
AI 3x12Bit	not used	AI 1x12Bit AO 2x12Bit	not used



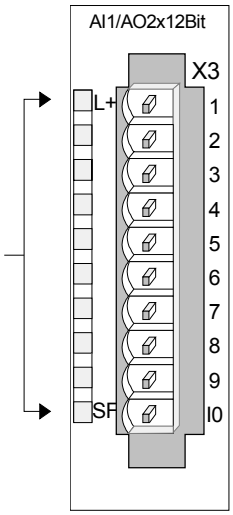
Status indicator 3x Analog inputs U/I
Pin assignment



Pin	Assignment
X1	
1	n. c.
2	Voltage measuring Channel 0
3	Current measuring Channel 0
4	Ground Channel 0
5	Voltage measuring Channel 1
6	Current measuring Channel 1
7	Ground Channel 1
8	Voltage measuring Channel 2
9	Current measuring Channel 2
10	Ground Channel 2

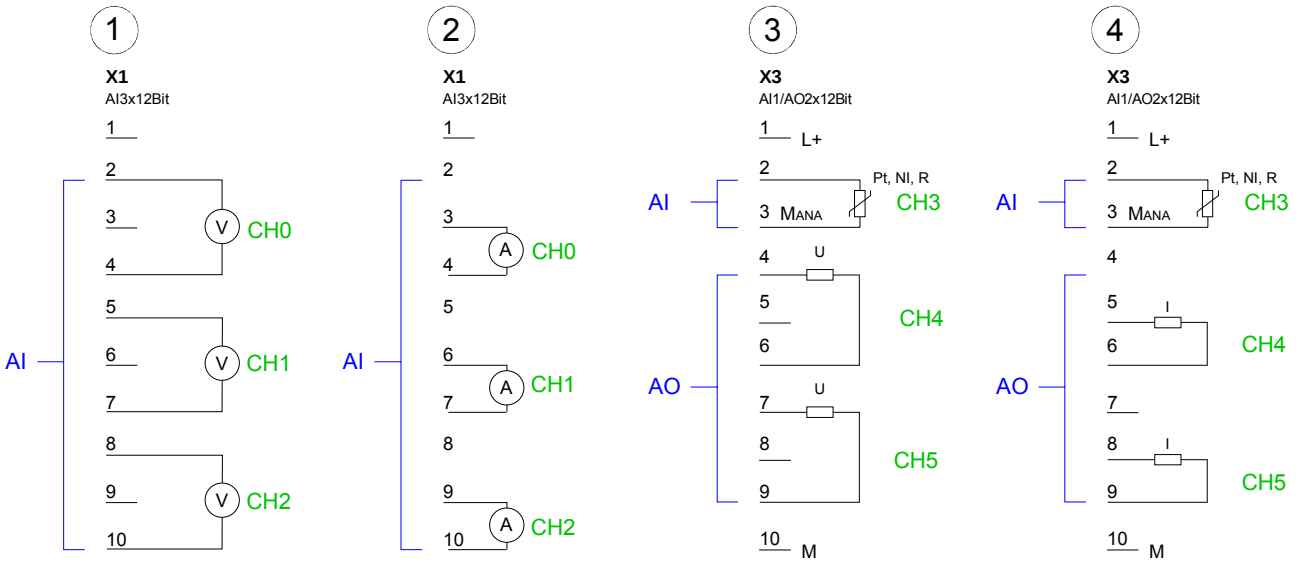
1x Analog input (Pt, Ni, R)
2x Analog outputs (U/I)

LED	Description
L+	LED (green) Power supply on and CPU is start up
SF	Sum error LED (red) turned on as soon as a channel error is detected res. an entry in the diagnostic bytes happened.

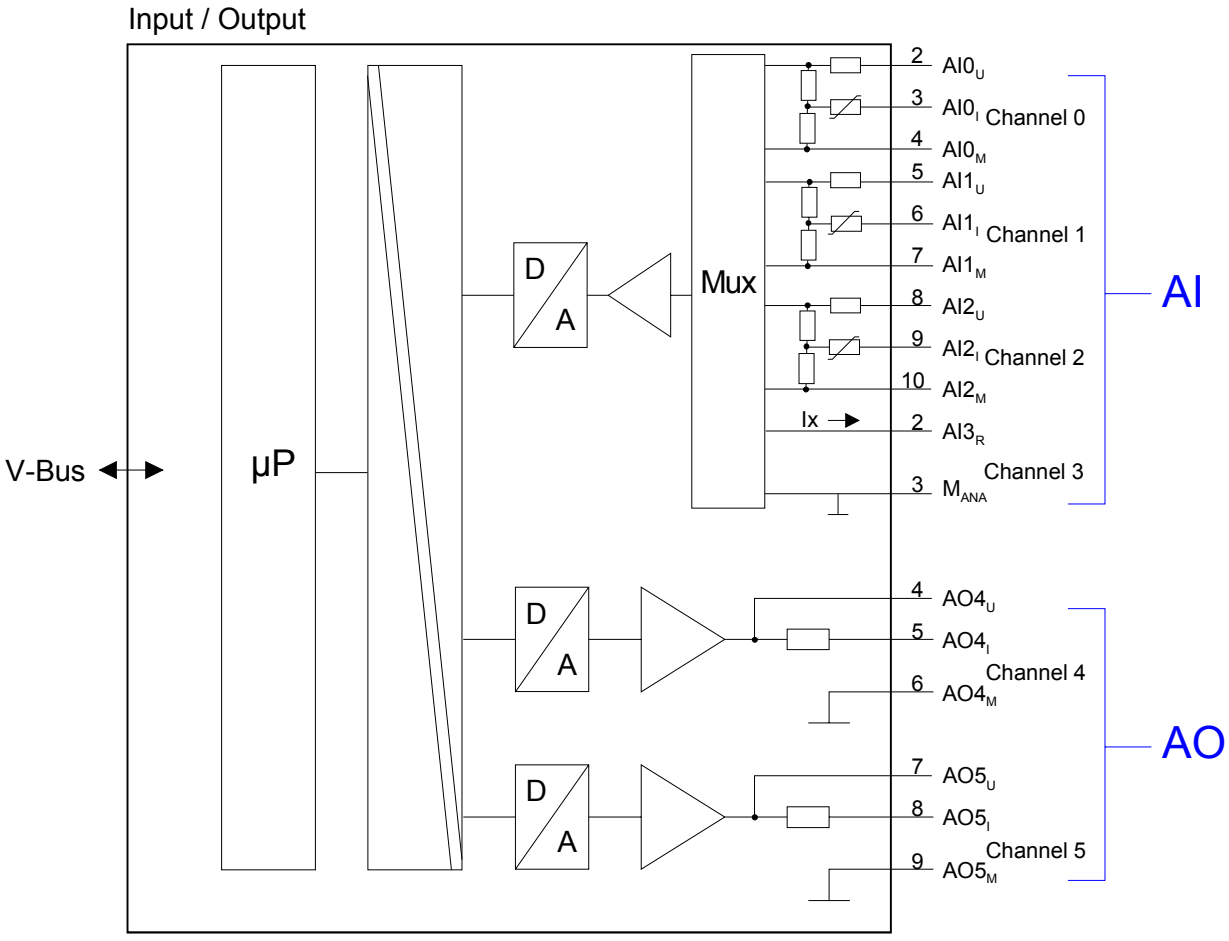


Pin	Assignment
X3	
1	DC 24V supply voltage
2	Pt, Ni, R - Channel 3
3	Ground Channel 3
4	Voltage output Channel 4
5	Current output Channel 4
6	Ground Channel 4
7	Voltage output Channel 5
8	Current output Channel 5
9	Ground Channel 5
10	Ground Supply voltage

Circuit diagram



Schematic diagram



Project engineering

Approach

The project engineering of a System 100V takes place in the Siemens SIMATIC manager by including of the System 100V GSD file VIPA_11x.gsd from VIPA.

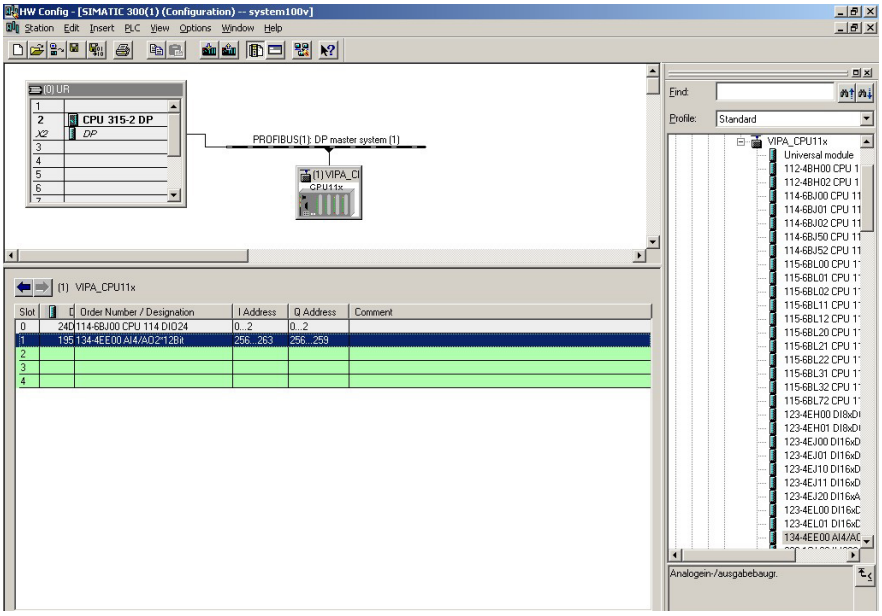
After inclusion of the GSD file and refreshing the hardware catalog, besides of each System 100V CPU, every expansion and System 200V module, which may be connected, may be found.

To be compatible with the Siemens SIMATIC manager, you have to execute the following steps:

- Project the PROFIBUS DP master system with CPU 315-2DP (6ES7 315-2AF03). Please use for the project engineering of the CPUs starting from Firmware V. 3.5.0 the CPU 6ES7-315-2AF03 V1.2 from Siemens.
- Insert the PROFIBUS slave VIPA_CPU11x with address 1.
- Place your CPU 11x at slot 0 of the slave system.

More about project of a System 100V CPU engineering may be found at the manual HB100_CPU at "Deployment CPU 11x".

After you have configured your CPU, the expansion modules are placed by choosing the module with the order number 134-4EE00 from the hardware catalog and dropping it to the slot below of the CPU.

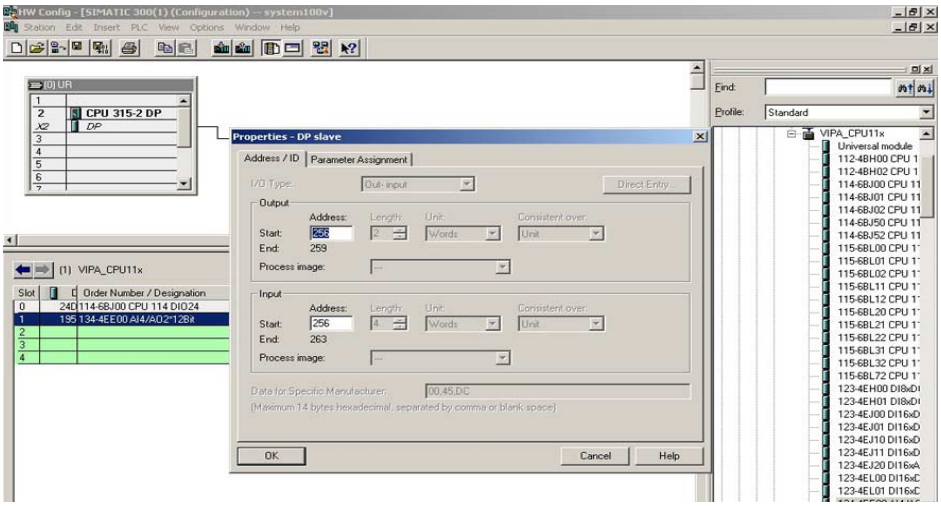


Note!

Every analog module occupies one slot!
Maximum 4 analog modules may be connected (max. 7 modules at VIPA 115-6BL72).

Addressing

The addressing is accessible via double click on the expansion module. Here you predefine start addresses for each module.



Data input/ data output range

Data input range:

During the measuring, the measuring values are stored in the data input area with the following assignment:

Byte	Bit 7 ... Bit 0
0	High-Byte channel 0
1	Low-Byte channel 0
2	High-Byte channel 1
3	Low-Byte channel 1
4	High-Byte channel 2
5	Low-Byte channel 2
6	High-Byte channel 3
7	Low-Byte channel 3

Data output range:

For output of the data you set a value in the data output area.

Byte	Bit 7 ... Bit 0
0	High-Byte channel 4
1	Low-Byte channel 4
2	High-Byte channel 5
3	Low-Byte channel 5

Parameter data

16Byte of parameter data are available for the configuration. These parameters are stored in non-volatile memory and are available after the unit has been powered off. By using the SFC 55 "WR_PARM" you may alter the parameterization in the module during runtime. The time needed until the new parameterization is valid can last up to 50ms. During this time, the measuring value output is 7FFFFh.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Wire break recognition channel 0 Bit 0: 0 = deactivated 1 = activated Wire break recognition channel 1 Bit 1: 0 = deactivated 1 = activated Wire break recognition channel 2 Bit 2: 0 = deactivated 1 = activated Wire break recognition channel 3 Bit 3: 0 = deactivated 1 = activated Bit 4, 5: reserved Diagnostic alarm Bit 6: 0 = diagnostic alarm inhibited 1 = diagnostic alarm enabled Bit 7: reserved	00h
1	Bit 3 … 0: reserved CPU-Stop reaction for channel 4 Bit 4: 0 = Set replacement value *) 1 = Store last value CPU-Stop reaction for channel 5 Bit 5: 0 = Set replacement value *) 1 = Store last value Bit 6, 7: reserved	00h
2	Function-no. channel 0 (see table input ranges)	28h
3	Function-no. channel 1 (see table input ranges)	28h
4	Function-no. channel 2 (see table input ranges)	28h
5	Function-no. channel 3 (see table input ranges)	01h
6	Channel 0: interference frequency suppression (see table)	00h
7	Channel 1: interference frequency suppression (see table)	00h
8	Channel 2: interference frequency suppression (see table)	00h
9	Channel 3: interference frequency suppression (see table)	00h
10	Function-no. channel 4 (see table output ranges)	09h
11	Function-no. channel 5 (see table output ranges)	09h
12	High-Byte replacement value channel 4	00h
13	Low-Byte replacement value channel 4	00h
14	High-Byte replacement value channel 5	00h
15	Low-Byte replacement value channel 5	00h

*) If you want to get 0A res. 0V as output value at CPU-STOP, you have to set the following replacement values at current output (4...20mA) res. voltage output (1...5V):
E500h for the S7 format from Siemens.

Parameter

Wire break recognition

Via the Bits 0 and 3 of Byte 0, the wire break recognition is activated for the input channels. The wire break recognition is only available for the current measuring range of 4...20mA and at (thermo) resistance measuring. A wire break is recognized when the current input during current measuring sinks under 1.18mA res. when the resistance at (thermo) resistance measuring reaches infinite. This causes an entry in the diagnosis area and is shown via the SF-LED.

If a diagnostic alarm is activated, a diagnosis message is sent to the superordinated system.

Diagnostic alarm

With the help of Bit 6 of Byte 0, you may release the diagnostic alarm. In case of an error like e.g. wire break, the superordinated system receives *record 0* (4Byte). For an extended diagnosis you may then call *record 1* (12Byte). More detailed information may be found below at "Diagnostic data".

CPU-Stop reaction and replacement value

With Bit 4 and 5 of Byte 1 and Byte 12 ... 15 you may set the reaction of the module at CPU-Stop for every output channel.

Via Byte 12 ... 15 you predefine a replacement value for the output channel as soon as the CPU switches to Stop.

By setting Bit 4 res. 5, the last output value remains in the output at CPU-Stop. A reset sets the replacement value.

Function-no.

Here you set the function-no. of your measuring res. output function for every channel. Please see the according table next page.

Interference frequency suppression

Structure interference frequency suppression:

Byte	Bit 7 ... Bit 0	Default
6 ... 9	Bit 5 ... 0: reserved Bit 7, 6: 00 50Hz 01 60Hz 10 400Hz	00h

Function-no. assignment

The assignment of a function-no. to a certain channel happens during parameterization. The function-no. 00h does not influence the function-no. stored in the permanent parameterization data.

By entering FFh you may deactivate the concerning channel.

The following tables list all functions that are supported by the depending channel.

You may find the connection type mentioned under "connection" at the "circuit diagram" above.

Note!

When exceeding the overdrive region, the value 7FFFh (32767) is thrown, at underrun of the underdrive region the value is 8000h (-32768).

Input range (channel 0 … 2)

No.	Function	Measuring range / representation	Connection
00h	Does not affect permanently stored configuration data.		
7Dh	Voltage 0 … 10V Siemens S7 format (two's complement)	-1.76 … 11.76V ***I*** 11.76V= End overdrive region (32511) 0...10V= nominal range (0...27648) -1.76V= End underdrive region (-4864)	(1)
7Ah	Voltage 1 … 5V Siemens S7 format (two's complement)	0.3 … 5.70V ***I*** 5.70V= End overdrive region (32511) 1...5V= nominal range (0...27648) 0.30V= End underdrive region (-4864)	(1)
28h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V ***I*** 11.76V= End overdrive region (32511) -10...10V= nominal range (-27648...27648) -11.76V= End underdrive region (-32512)	(1)
7EH	Current 0 … 20mA Siemens S7 format (two's complement)	-3.51 … 23.51mA ***I*** 23.51mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) -3.51mA = End underdrive region (-4864)	(2)
2Ch	Current ±20mA Siemens S7 format (two's complement)	±23.51mA ***I*** 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512)	(2)
2Dh	Current 4...20mA Siemens S7 format (two's complement)	1.185...+22.81mA ***I*** 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864)	(2)
FFh	Channel not active (turned off)		

Input range (channel 3)

No.	Function	Measuring range / representation	Conn.
00h	Does not affect permanently stored configuration data.		
01h	Pt100 in 2wire mode	-200 ... +850°C **/** in units of 1/10°C, two's complement	(3, 4)
02h	Pt1000 in 2wire mode	-200 ... +500°C **/** in units of 1/10°C, two's complement	(3, 4)
03h	NI100 in 2wire mode	-50 ... +250°C **/** in units of 1/10°C, two's complement	(3, 4)
04h	NI1000 in 2wire mode	-50 ... +250°C **/** in units of 1/10°C, two's complement	(3, 4)
06h	Resistance measurement 600Ohm 2wire	0 ... 600Ω **/** 705.53Ω = End overdrive region (32511) 0 ... 600Ω = nominal range (0...27648) no underdrive region available	(3, 4)
07h	Resistance measurement 3000Ohm 2wire	0 ... 3000Ω **/** 3527.7Ω = End overdrive region (32511) 0 ... 3000Ω = nominal range (0...27648) no underdrive region available	(3, 4)
FFh	Channel not active (turned off)		

Output range (channel 4, channel 5)

No.	Function	Output range	Conn.
00h	Does not affect permanently stored configuration data		
09h	Voltage ±10V Siemens S7 format (two's complement)	±11.76V 11.76V= End overdrive region (32511) -10V...10V = nominal range (-27648...27648) -11.76 = End underdrive region (-32512)	(3)
0Ah	Voltage 1...5V Siemens S7 format (two's complement)	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912)	(3)
0Dh	Voltage 0...10V Siemens S7 format (two's complement)	0...11.76V 11.76V= End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available	(3)
0Bh	Current ±20mA Siemens S7 format (two's complement)	±23.52mA 23.52mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.52mA = End underdrive region (-32512)	(4)
0Ch	Current 4...20mA Siemens S7 format (two's complement)	0...22.81mA 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 0mA = End underdrive region (-6912)	(4)
0Eh	Current 0...20mA Siemens S7 format (two's complement)	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available	(4)
FFh	Channel not active (turned off)		

Note!

When exceeding the predefined range, 0V res. 0A is shown as value!

Analog value representation

General

As soon as a measuring value exceeds the overdrive res. underdrive range, the following value is returned:

Measuring value > Overdrive range: 32767 (7FFFh)

Measuring value < Underdrive range: -32768 (8000h)

At parameterization error or de-activated analog part the measuring value 32767 (7FFFh) is returned. When leaving the defined range during analog output 0V respectively 0A is issued.

In the following all measuring ranges are specified, which are supported by the analog part. With the formulas it may be converted between measuring and analog value.

Numeric notation in Siemens S7 format

The analog values are represented in two's complement format.

	Analog value															
	High-Byte								Low-Byte							
Bit number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
11 Bit + sign	SG	Relevant output value											X*	X	X	X

* The lowest value irrelevant bits of the output value are marked with "X".

Algebraic sign bit (SG)

Bit 15 serves as algebraic sign bit. Here is:

Bit 15 = "0" → positive value

Bit 15 = "1" → negative value

Voltage measuring range +/-10V

Formulas for the conversion:

$Value = 27648 \cdot \frac{U}{10}$, $U = Value \cdot \frac{10}{27648}$ U: voltage, Value: decimal value

+/-10V	dez.	hex.	Range
> 11.759	32767	7FFFh	Overflow
11.759V . .	32511 . .	7EFFh . .	Overdrive range
10V . . -10V	27648 . . -27648	6C00h . . 9400h	Nominal range
. . . -11.759V	. . . -32512	. . . 8100h	Underdrive range
< -11.759V	-32767	7FFFh	Underflow

Voltage measuring range 0...10V

Formulas for the conversion:

$Value = 27648 \cdot \frac{U}{10}$, $U = Value \cdot \frac{10}{27648}$ U: voltage, Value: decimal value

0...10V	dez.	hex.	Range
> 11.759	32767	7FFFh	Overflow
11.759V . .	32511 . .	7EFFh . .	Overdrive range
10V . . 0V	27648 . . 0	6C00h . . 0	Nominal range
. . . -1.759V	. . . -4864	. . . ED00h	Nominal range
< -1.759V	-32768	8000h	Underflow

Voltage measuring range 1...5V

Formulas for the conversion:

$Value = 27648 \cdot \frac{U-1}{4}$, $U = Value \cdot \frac{4}{27648} + 1$ U: voltage, Value: decimal value

1...5V	dez.	hex.	Range
> 5,704V	32767	7FFFh	Overflow
5,704V . .	32511 . .	7EFFh . .	Overdrive range
5V . . 1V	27648 . . 0	6C00h . . 0	Nominal range
. . . -0,296V	. . . -4864	. . . ED00h	Nominal range
< -0,296V	-32768	8000h	Underflow

Current measuring range +/-20mA

Formulas for the conversion:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

+/-20mA	dez.	hex.	Range
> 23.52mA	32767	7FFFh	Overflow
23.52mA . .	32511 . .	7EFFh . .	Overdrive range
20mA . . -20mA	27648 . . -27648	6C00h . . 9400h	Nominal range
. . . -23.52mA	. . . -32512	. . . 8100h	Underdrive range
< -23.52mA	-32768	8000h	Underflow

Current measuring range 0...20mA

Formulas for the conversion:

$$Value = 27648 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{27648}$$

I: current, Value: decimal value

0...20mA	dez.	hex.	Range
> 23.52mA	32767	7FFFh	Overflow
23.52mA . .	32511 . .	7EFFh . .	Overdrive range
20mA . . 0mA	27648 . . 0	6C00h . . 0	Nominal range
. . . -3.52mA	. . . -4864	. . . ED00h	Underdrive range
< -3.52mA	-32768	8000h	Underflow

Current measuring range 4...20mA

Formulas for the conversion:

$$Value = 27648 \cdot \frac{I-4}{16}, \quad I = Value \cdot \frac{16}{27648} + 4$$

I: current, Value: decimal value

4...20mA	dez.	hex.	Range
> 22.81mA	32767	7FFFh	Overflow
22.81mA . .	32511 . .	7EFFh . .	Overdrive range
20mA . . 4mA	27648 . . 0	6C00h . . 0	Nominal range
. . . 1.185mA	. . . -4864	. . . ED00h	Underdrive range
< 1.185mA	-32768	8000h	Underflow

Resistance measurement 0...600Ω

Formulas for the conversion:

$Value = 27648 \cdot \frac{R}{600}$, $R = Value \cdot \frac{600}{27648}$ R: resistance value, Value: decimal value

600Ω	dez.	hex.	Range
> 705.53Ω	32767	7FFFh	Overflow
705.53Ω . .	32511 . .	7EFFh . .	Overdrive range
600Ω . . 0Ω	27648 . . 0	6C00h . . 0	Nominal range
(negative values physically not possible)			Underdrive range

Resistance measurement 0...3000Ω

Formulas for the conversion:

$Value = 27648 \cdot \frac{R}{3000}$, $R = value \cdot \frac{3000}{27648}$ R: resistance value, Value: decimal value

3000Ω	dez.	hex.	Range
> 3527,7Ω	32767	7FFFh	Overflow
3527,7Ω . .	32511 . .	7EFFh . .	Overdrive range
3000Ω . . 0Ω	27648 . . 0	6C00h . . 0	Nominal range
(negative values physically not possible)			Underdrive range

Resistance thermometer

With Pt100, Pt1000 or Ni100, Ni1000 the temperature is directly shown with the adjusted unit.
Here applies: 1 Digit = 0.1 temperature unit.

Measuring range	in °C (1digit=0,1°C)	Unit		Range
		dez.	hex.	
	>1000,0	32767	7FFFh	Overflow
	1000,0 . . .	10000 . . .	2710h . . .	Overdrive range
Pt100, Pt1000 standard	850,0 ... -200,0	8500 ... -2000	2134h ... F830h	Nominal range
	. . . -243,0	. . . -2430	. . . F682h	Underdrive range
	< -243,0	-32768	8000h	Underflow

Measuring range	in °C (1digit=0,1°C)	Unit		Range
		dez.	hex.	
	>155,00	32767	7FFFh	Overflow
	155,00 . . .	15500 . . .	3C8Ch . . .	Overdrive range
Pt100, Pt1000 klima	130,00 ... -120,00	13000 ... -12000	32C8h ... D120h	Nominal range
	. . . -145,00	. . . -14500	. . . C75Ch	Underdrive range
	< -145,00	-32768	8000h	Underflow

Measuring range	in °C (1digit=0,1°C)	Unit		Range
		dez.	hex.	
	>295,0	32767	7FFFh	Overflow
	295,0 . . .	2950 . . .	B86h . . .	Overdrive range
Ni100, Ni1000 LG-Ni 1000 standard	250,0 ... -60,0	2500 ... -600	9C4h ... FDA8h	Nominal range
	. . . -105,0	. . . -1050	. . . FBE6h	Underdrive range
	< -105,0	-32768	8000h	Underflow

Measuring range	in °C (1digit=0,1°C)	Unit		Range
		dez.	hex.	
	>295,0	32767	7FFFh	Overflow
	295,0 . . .	29500 . . .	733Ch . . .	Overdrive range
Ni100, Ni1000 klima	250,0 ... -60,0	25000 ... -6000	61A8h ... E890h	Nominal range
	. . . -105,0	. . . -10500	. . . D6FCh	Underdrive range
	< -105,0	-32768	8000h	Underflow

Diagnostic data

Overview

The analog module has diagnostics functions. The following errors may cause a diagnostics:

- Error in the project engineering res. parameterization
- Wire break at current measuring
- Measuring range overflow
- Measuring range underflow
- Wire break at current output res. short circuit at voltage output

Evaluate diagnosis

When you enable the diagnostic alarm in Byte 0 of the parameter area, modules will transfer *record set 0* to the superordinated system when an error is detected. At present diagnosis, the CPU interrupts the user application and branches into the OB 82. This OB gives you detailed diagnostic data via the SFCs 51 and 59 when programmed correctly.

After having processed the OB 82, the user application processing is continued. Until leaving the OB 82, the data remain consistent.

The diagnostic data uses 12byte and are stored in the record sets 0 and 1 of the system data area.

Record set 0

Record set 0 has a predefined content and a length of 4Byte. The content of the record set may be read in plain text via the diagnostic window of the CPU.

Record set 0 (Byte 0 to 3):

Byte	Bit 7 ... Bit 0	Default
0	Bit 0: Module malfunction Bit 1: reserved Bit 2: External error Bit 3: Channel error present Bit 4: External supply voltage is missing Bit 5, 6: reserved Bit 7: Wrong parameters in the module	00h
1	Bit 3 ... 0: Module class 0101 Analog module Bit 4: Channel information present Bit 7 ... 5: reserved	15h
2	reserved	00h
3	reserved	00h

Record set 1

The *record set 1* contains the 4Byte of record set 0 and additional 8Byte module specific diagnostic data.

The diagnostic bytes have the following assignment:

Record set 1 (Byte 0 to 11):

Byte	Bit 7 ... Bit 0	Default
0 ... 3	Content record set 0 (see page before)	-
4	Bit 6 ... 0: Channel type 70h: Digital input 71h: Analog input 72h: Digital output 73h: Analog output 74h: Analog in-/output Bit 7: reserved	74h
5	Bit 7 ... 0: Number of diagnostic bits of the module per channel	04h
6	Bit 7 ... 0: Number of identical channels of a module	06h
7	Bit 0: Channel error Channel 0 Bit 1: Channel error Channel 1 Bit 2: Channel error Channel 2 Bit 3: Channel error Channel 3 Bit 4: Channel error Channel 4 Bit 5: Channel error Channel 5 Bit 6, 7: reserved	00h
8	Bit 0: Wire break Channel 0 Bit 1: Parameterization error Channel 0 Bit 2: Measuring range underflow Channel 0 Bit 3: Measuring range overflow Channel 0 Bit 4: Wire break Channel 1 Bit 5: Parameterization error Channel 1 Bit 6: Measuring range underflow Channel 1 Bit 7: Measuring range overflow Channel 1	00h
9	Bit 0: Wire break Channel 2 Bit 1: Parameterization error Channel 2 Bit 2: Measuring range underflow Channel 2 Bit 3: Measuring range overflow Channel 2 Bit 4: Wire break Channel 3 Bit 5: Parameterization error Channel 3 Bit 6: Measuring range underflow Channel 3 Bit 7: Measuring range overflow Channel 3	00h
10	Bit 0: Wire break at current output res. short circuit at voltage output Channel 4 Bit 1: Parameterization error Channel 4 Bit 2, 3: reserved Bit 4: Wire break at current output res. short circuit at voltage output Channel 5 Bit 5: Parameterization error Channel 5 Bit 6, 7: reserved	00h
11	reserved	00h

Technical Data

Order no.	134-4EE00
Type	EM 134
Current consumption/power loss	
Current consumption from backplane bus	70 mA
Power loss	2 W
Technical data analog inputs	
Number of inputs	4
Cable length, shielded	-
Rated load voltage	DC 24 V
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	55 mA
Voltage inputs	✓
Min. input resistance (voltage range)	120 kΩ
Input voltage ranges	+1 V ... +5 V 0 V ... +10 V -10 V ... +10 V
Operational limit of voltage ranges	+/-0.3% ... +/-0.7%
Basic error limit voltage ranges with SFU	+/-0.2% ... +/-0.5%
Current inputs	✓
Max. input resistance (current range)	110 Ω
Input current ranges	+4 mA ... +20 mA -20 mA ... +20 mA 0 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.8%
Basic error limit current ranges with SFU	+/-0.2% ... +/-0.5%
Resistance inputs	✓
Resistance ranges	0 ... 600 Ohm 0 ... 3000 Ohm
Operational limit of resistor ranges	+/-0.4%
Basic error limit	+/-0.2%
Resistance thermometer inputs	✓
Resistance thermometer ranges	Pt100 Pt1000 Ni100 Ni1000
Operational limit of resistance thermometer ranges	+/-0.6% ... +/-1.0%
Basic error limit thermoresistor ranges	+/-0.4% ... +/-0.5%
Thermocouple inputs	-
Thermocouple ranges	-
Operational limit of thermocouple ranges	-
Basic error limit thermoelement ranges	-
Programmable temperature compensation	-
External temperature compensation	-
Internal temperature compensation	-
Resolution in bit	12
Measurement principle	successive approximation
Basic conversion time	3.2 ms / channel
Noise suppression for frequency	50 Hz, 60 Hz, 400 Hz
Initial data size	8 Byte
Technical data analog outputs	
Number of outputs	2
Cable length, shielded	-
Rated load voltage	DC 24 V

Order no.	**134-4EE00**
Reverse polarity protection of rated load voltage	✓
Current consumption from load voltage L+ (without load)	55 mA
Voltage output short-circuit protection	✓
Voltage outputs	✓
Min. load resistance (voltage range)	1 kΩ
Max. capacitive load (current range)	1 µF
Output voltage ranges	-10 V ... +10 V +1 V ... +5 V 0 V ... +10 V
Operational limit of voltage ranges	+/-0.4% ... +/-0.8%
Basic error limit voltage ranges with SFU	+/-0.2% ... +/-0.4%
Current outputs	✓
Max. in load resistance (current range)	500 Ω
Max. inductive load (current range)	10 mH
Output current ranges	0 mA ... +20 mA +4 mA ... +20 mA -20 mA ... +20 mA
Operational limit of current ranges	+/-0.3% ... +/-0.8%
Basic error limit current ranges with SFU	+/-0.2% ... +/-0.5%
Settling time for ohmic load	0.5 ms
Settling time for capacitive load	1 ms
Settling time for inductive load	1 ms
Resolution in bit	12
Conversion time	1.2 ms / channel
Substitute value can be applied	yes
Output data size	4 Byte
Status information, alarms, diagnostics	
Status display	none
Interrupts	yes
Process alarm	no
Diagnostic interrupt	yes, parameterizable
Diagnostic functions	yes
Diagnostics information read-out	possible
Supply voltage display	green LED
Group error display	red SF LED
Channel error display	none
Isolation	
Between channels	-
Between channels of groups to	-
Between channels and backplane bus	✓
Between channels and power supply	✓
Max. potential difference between circuits	-
Max. potential difference between inputs (Ucm)	DC 11 V
Max. potential difference between Mana and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between inputs and Mana (Ucm)	DC 11 V
Max. potential difference between inputs and Mintern (Uiso)	DC 75 V/ AC 60 V
Max. potential difference between Mintern and outputs	-
Insulation tested with	DC 500 V
Datasizes	
Input bytes	8
Output bytes	4
Parameter bytes	18
Diagnostic bytes	12

Order no.	134-4EE00
Housing	
Material	PPE / PA 6.6
Mounting	Profile rail 35 mm
Mechanical data	
Dimensions (WxHxD)	101.6 x 76 x 48 mm
Weight	230 g
Environmental conditions	
Operating temperature	0 °C to 60 °C
Storage temperature	-25 °C to 70 °C
Certifications	
UL508 certification	yes

Additional Technical data

Order no.		VIPA 134-4EE00
Suppression of interference, limits of error input channels		
Noise suppression for f=n x (f1 ±1%) (f1=interference frequency, n=1,2,...)		
Common-mode interference (U_{CM} < 5V)	> 80dB	
Series-mode noise (peak value of noise < nominal value of input range	> 80dB	
Crosstalk between the inputs	> 50dB	
Operational limit (only valid to 120W/s) (in the entire temperature range, referring to input range)		
Voltage input	Measuring range	Tolerance
	1 ... 5V	±0.7%
	0 ... 10V	±0.4%
	±10V	±0.3%
Current input	±20mA	±0.3%
	0 ... 20mA	±0.6%
	4 ... 20mA	±0.8%
Resistors	0 … 600Ω, 0 …3kΩ	±0.4%
Resistance thermometer	Pt100, Pt1000	±0.6%
	Ni100, Ni1000	±1.0%
Basic error limit (only valid to 120W/s) (during temperature is 25°C, referring to input range)		
Voltage input	Measuring range	Tolerance
	1 ... 5V	±0.5%
	0 ... 10V	±0.3%
	±10V	±0.2%
Current input	±20mA	±0.2%
	0 ... 20mA	±0.4%
	4 ... 20mA	±0.5%
Resistors	0 …600Ω, 0 … 3kΩ	±0.2%
Resistance thermometer	Pt100, Pt1000	±0.4%
	Ni100, Ni1000	±0.5%
Temperature error (with reference to the input range)	±0.005%/K	
Linearity error (with reference to the input range)	±0.02%	
Repeatability (in steady state at 25°C referred to the input range)	±0.05%	

Order no.		**VIPA 134-4EE00**
Suppression of interference, limits of error output channels		
Crosstalk between the outputs	> 40dB	
Operational limit (in the entire temperature range, referring to output range)		
Voltage output	Measuring range	Tolerance
	1 … 5V	±0.8%
	0 … 10V	±0.6%
	±10V	±0.4%
Current output	±20mA	±0.3%
	0 … 20mA	±0.6%
	4 … 20mA	±0.8%
Basic error limit (during temperature is 25°C, referring to output range)		
Voltage output	Measuring range	Tolerance
	1 … 5V	±0.4%
	0 … 10V	±0.3%
	±10V	±0.2%
Current output	±20mA	±0.2%
	0 … 20mA	±0.4%
	4 … 20mA	±0.5%
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.1%	
Repeatability (in steady state at 25°C referred to the output range)	±0.05%	
Output ripple; range 0 to 50kHz (referred to output range)	±0.05%	