

Chapter 8 Analog input/output modules

Overview This chapter contains a description of the construction and the operation of the VIPA analog input/output modules.

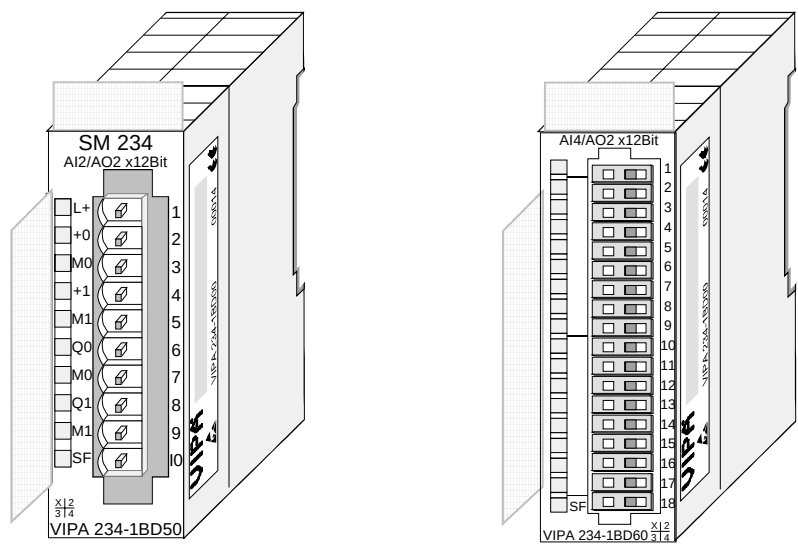
- Below follows a description of:
- A system overview of the analog input/output modules
 - Properties
 - Construction
 - Wiring and schematic diagram
 - Parameter data
 - Function number allocation
 - Technical data

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System overview

Input/output modules SM 234

Here follows a summary of the analog input/output modules that are currently available from VIPA:



Order data input/output modules

Type	Order number	Page
AI2/AO 2x12Bit, multiin-/output	VIPA 234-1BD50	8-4
AI4/AO 2x12Bit, multiin-/output	VIPA 234-1BD60	8-18

Security note for range allocation



Attention!

Please regard that the described modules have no hardware protection against wrong parameterization. The allocation of the according measuring res. output range is only during project engineering.

For example, the modules may be damaged when you connect a voltage at parameterized current measuring.

Please be extremely careful during project engineering.

General

Cabling for analog signals

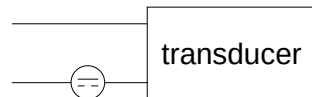
You must only use screened twisted-pair cable for analog signals. These cables reduce the effect of electrical interference. The screen of the analog signal cable should be grounded at both ends. In situations where the cable ends are at different electrical potentials, it is possible that a current will flow to equalize the potential difference. This current could interfere with the analog signals. Under these circumstances it is advisable to ground the screen of the signal cable at one end only.

Connecting sensors

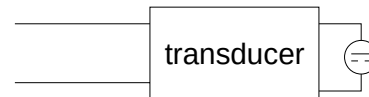
Our analog modules provide a large number of configuration options suitable for 2wire and 4wire transducers. Please remember that transducers require an external power source. You have to connect an external power supply in line with any 2wire transducer.

The following diagram explains the connection of 2- and 4wire transducers:

2wire interfacing



4wire interfacing



Connecting loads and actuators

Due to the fact that actuators also require a source of external power, they may also be connected with 2 or 4wires. Where control signals are supplied to 2wire actuators a power supply has to be connected in series with the control cable. 4wire actuators need an external power source.



Note!

Please ensure that you connect actuators to the correct polarity!
Unused output terminals must not be connected!

Parameterization and diagnosis during runtime

By using the SFCs 55, 56 and 57 you may change the parameters of the analog modules during runtime via the CPU 21x.

For diagnosis evaluation during runtime, you may use the SFCs 51 and 59. They allow you to request detailed diagnosis information and to react to it.



Attention!

Temporarily not used inputs have to be connected with the concerning ground at activated channel. When deactivating unused channels by means of FFh, this is not required.

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

234-1BD50 - AI 2/AO 2x12Bit - Multiin-/output

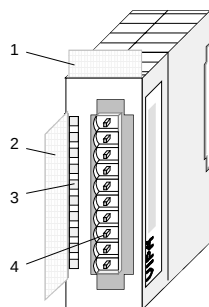
Order data AI 2/AO 2x12Bit Multiin-/output VIPA 234-1BD50

Description This module has 2 analog inputs and 2 analog outputs that may be configured individually. The module occupies a total of 4Byte of input and 4Byte of output data.

Galvanic isolation between the channels on the module and the backplane bus is provided by means of DC/DC converters and optocouplers. The module requires an external supply of DC 24V.

- Properties**
- 2 inputs and 2 outputs with common ground
 - In-/Outputs with individually configurable functions
 - Suitable for encoder res. actuators with in- res. output ranges of: $\pm 10V$, 1...5V, 0...10V, $\pm 20mA$, 0...20mA or 4...20mA
 - Diagnostic LED

Construction

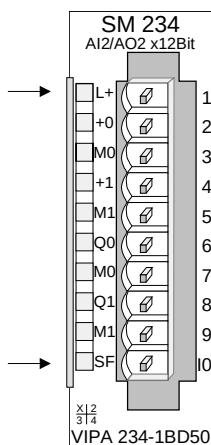


- [1] Label for the name of the module
- [2] Label for the bit address with description
- [3] LED status indicator
- [4] Edge connector

Status indicator Pin assignment

LED Description

- L+** LED (yellow)
Supply voltage present
- SF** Sum error LED (red)
turned on as soon as an channel error is detected
res. an entry in the diagnostic bytes happened

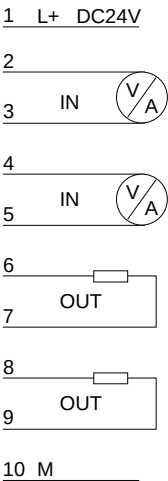


Pin Assignment

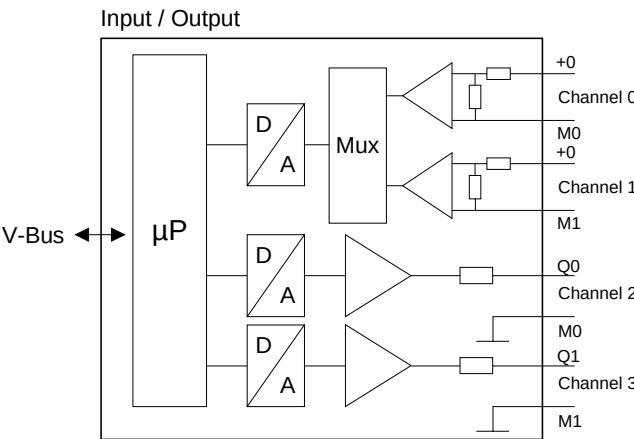
- | | |
|----|-----------------------|
| 1 | DC 24V supply voltage |
| 2 | pos. connection Ch.0 |
| 3 | Ground Channel 0 |
| 4 | pos. connection Ch.1 |
| 5 | Ground Channel 1 |
| 6 | pos. connection Ch.2 |
| 7 | Ground Channel 2 |
| 8 | pos. connection Ch.3 |
| 9 | Ground Channel 3 |
| 10 | Supply voltage Ground |

Circuit and schematic diagram

Circuit diagram



Schematic diagram



Attention!

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

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



Note!

At 3wire res. 4wire measuring, only channel 0 is used.

Data output range:

For output of the data you set a value in the data output area. The functionality can be set by means of function-no. for each channel.

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

Parameter data

12Byte 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.

The following table shows the structure of the parameter data:

Parameter area:

Byte	Bit 7 ... Bit 0	Default
0	Wire break recognition and diagnostic alarm: Bit 0: Wire break recognition channel 0 0: deactivated 1: activated Bit 1: Wire break recognition channel 1 0: deactivated 1: activated Bit 5 ... 2: reserved Bit 6: 0: diagnostic alarm inhibited 1: diagnostic alarm enabled Bit 7: reserved	00h
1	reserved Bit 0: reserved Bit 1: reserved Bit 2: CPU-Stop reaction for channel 2 0: Set replacement value channel 2 ^{*)} 1: Store last value channel 2 Bit 3: CPU-Stop reaction for channel 3 0: Set replacement value channel 3 1: Store last value channel 3 Bit 7 ... 4: 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)	09h
5	Function-no. channel 3 (see table input ranges)	09h
6	Meas. cycle channel 0	00h
7	Meas. cycle channel 1	00h
8	High-Byte replacement value channel 2	00h
9	Low-Byte replacement value channel 2	00h
10	High-Byte replacement value channel 3	00h
11	Low-Byte replacement value channel 3	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 and F000h for the S5 format from Siemens.

Parameter

Wire break recognition

The Bits 0 and 1 of Byte 0 allow you to activate the wire break recognition for the input channels. The wire break recognition is only available for the current measuring range of 4...20mA. A wire break is recognized when the current input during current measuring sinks under 1.18mA.

A wire break at activated wire break recognition causes an entry in the diagnosis area. This is shown via the SF-LED.

If additionally 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, the *record set 0* with a size of 4Byte is transferred to the superordinated system.

More detailed information is to find below under "Diagnostic data".

CPU-Stop reaction and replacement value

With Bit 2 and 3 of Byte 1 and Byte 8 ... 11 you may set the reaction of the module at CPU-Stop for every output channel.

Via Byte 8 ... 11 you predefine a replacement value for the output channel as soon as the CPU switches to Stop.

By setting Bit 2 res. 3, 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.

Meas. cycle

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower Bits (LSBs) are not longer relevant for the analog value.

Structure Meas. cycle Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 7	Bit 3 ... 0: Velocity per channel		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 123 conversions/s	14	
	0100 168 conversions/s	12	
	0101 202 conversions/s	10	
	0110 3,7 conversions/s	16	
	0111 7,5 conversions/s	16	
	Bit 7 ... 4: reserved		

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.



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, channel 1)

No.	Function	Measuring range / representation
00h	Does not affect permanently stored configuration data.	
3Bh	Voltage $\pm 10V$ Siemens S5 format	$\pm 12.5V$ / 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480) two's complement
2Bh	Voltage $\pm 10V$ Siemens S5 format	$\pm 12.5V$ / 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480) Value and sign
72h	Voltage 1...5V Siemens S5 format	0...6V 6V = End overdrive region (20480) 1...5V = nominal range (0...16384) 0V = End underdrive region (-4096) Value and sign
75h	Voltage 0...10V Siemens S5 format	0...12.5V 12.5V = End overdrive region (20480) 0...10V = nominal range (0...16384) no underdrive region available
28h	Voltage $\pm 10V$ Siemens S7 format	$\pm 11.76V$ / 11.76V = End overdrive region (32511) -10...10V = nominal range (-27648...27648) -11.76V = End underdrive region (-32512) two's complement
7Ah	Voltage 1...5V Siemens S7 format	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912) two's complement

continued ...

... continue function-no. input range (channel 0, channel 1)

No.	Function	Measuring range / representation
7Dh	Voltage 0...10V Siemens S7 format	0...11.76V 11.76V = End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
3Ah	Current ± 20 mA Siemens S5 format	± 25.0 mA / 25.0mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25.0mA = End underdrive region (-20480) two's complement
2Fh	Current ± 20 mA Siemens S5 format	± 25.0 mA / 25.0mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25.0mA = End underdrive region (-20480) value and sign
2Eh	Current 4...20mA Siemens S5 format	0.8...+24.0mA / 24.0mA = End overdrive region(20480) 4 ... 20mA = nominal range (0...16384) 0.8mA = End underdrive region (-3277) value and sign
76h	Current 0...20mA Siemens S5 format	0...25mA 25mA = End overdrive region (20480) 0...20mA = nominal range (0...16384) no underdrive region available
2Ch	Current ± 20 mA Siemens S7 format	± 23.51 mA / 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512) two's complement
2Dh	Current 4...20mA Siemens S7 format	1.185...+22.81mA / 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864) two's complement
7Eh	Current 0...20mA Siemens S7 format	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	



Note!

The module is preset to the range " ± 10 V voltage" in S7 format from Siemens.

Output range (Channel 2, Channel 3)

No.	Function	Output or input range
00h	Does not affect permanently stored configuration data	
01h	Voltage $\pm 10V$ Siemens S5 format	$\pm 12.5V$ 12.5V = End overdrive region (20480) -10...10V = nominal range (-16384...16384) -12.5V = End underdrive region (-20480)
02h	Voltage 1...5V Siemens S5 format	0...6V 6V = End overdrive region (20480) 1...5V = nominal range (0...16384) 0V = End underdrive region (-4096)
05h	Voltage 0...10V Siemens S5 format	0...12.5V 12.5V = End overdrive region (20480) 0...10V = nominal range (0...16384) no underdrive region available
09h	Voltage $\pm 10V$ Siemens S7 format	$\pm 11.76V$ 11.76V = End overdrive region (32511) -10V...10V = nominal range (-27648...27648) -11.76 = End underdrive region (-32512) two's complement
0Ah	Voltage 1...5V Siemens S7 format	0...5.704V 5.704V = End overdrive region (32511) 1...5V = nominal range (0...27648) 0V = End underdrive region (-6912) two's complement
0Dh	Voltage 0...10V Siemens S7 format	0...11.76V 11.76V = End overdrive region (32511) 0...10V = nominal range (0...27648) no underdrive region available
03h	Current $\pm 20mA$ Siemens S5 format	$\pm 25.0mA$ 25mA = End overdrive region (20480) -20...20mA = nominal range (-16384...16384) -25mA = End underdrive region (20480)
04h	Current 4...20mA Siemens S5 format	0...24mA 24mA = End overdrive region (20480) 4...20mA = nominal range (0...16384) 0mA = End underdrive region (-4096)

continued ...

... continue function-no. output range (channel 2, channel 3)

No.	Function	Output or input range
06h	Current 0...20mA Siemens S5 format	0...25mA 25mA = End overdrive region (20480) 0...20mA = nominal range (0...16384) no underdrive region available
0Bh	Current ± 20 mA Siemens S7 format	± 23.52 mA 23.52mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.52mA = End underdrive region (-32512) two's complement
0Ch	Current 4...20mA Siemens S7 format	0...22.81mA 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 0mA = End underdrive region (-6912) two's complement
0Eh	Current 0...20mA Siemens S7 format	0...23.52mA 23.52mA = End overdrive region (32511) 0...20mA = nominal range (0...27648) no underdrive region available
FFh	Channel not active (turned off)	



Note!

Leaving the defined range, the output is 0V res. 0A!

Numeric notation in Siemens S5 format

In Siemens S5 format, input data is saved into a word. The word consists of the binary value and the information bits.

Please regard only the Siemens S7 format (two's complement) is supported by the Siemens SIMATIC manager for decimal representation. When the Siemens S5 format is used the decimal values are incorrectly represented.

Numeric notation:

Byte	Bit 7 ... Bit 0
0	Bit 0: overflow bit 0: value within measuring range 1: measuring range exceeded Bit 1: error bit (set by internal errors) Bit 2: activity bit (always 0) Bit 7 ... 3: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign 0 positive 1 negative

+/- 10V (two's complement)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	E000
0V	0	0000
5V	8192	2000
10V	16384	4000

+/- 10V (value and sign)

Voltage	Decimal	Hex
-10V	-16384	C000
-5V	-8192	A000
0V	0	0000
5V	8192	2000
10V	16384	4000

4 ... 20mA / 1 ... 5V (value and sign)

Current / Voltage	Decimal	Hex
4mA / 1V	0	0000
12mA / 3V	8192	2000
20mA / 5V	16384	4000

+/- 20mA (two's complement)

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	E000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

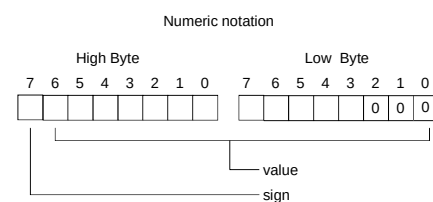
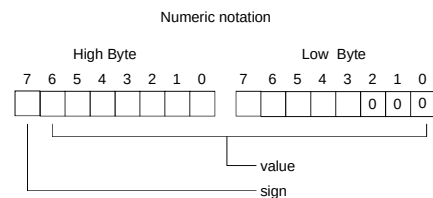
+/- 20mA (value and sign)

Current	Decimal	Hex
-20mA	-16384	C000
-10mA	-8192	A000
0mA	0	0000
10mA	8192	2000
20mA	16384	4000

Formulas for the calculation:

$$Value = 16384 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{16384}$$

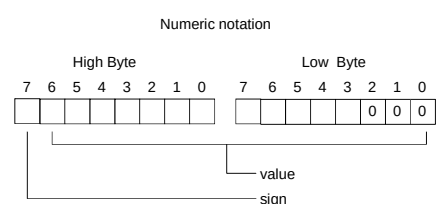
U: voltage, Value: Decimal value



Formula for the calculation:

$$Value = 16384 \cdot \frac{I}{20}, \quad I = Value \cdot \frac{20}{16384}$$

I: Current, Value: Decimal value



Numeric notation in Siemens S7 format

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

Numeric representation:

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured vale
1	Bit 6 ... 0: binary measured vale Bit 7: sign 0 positive 1 negative

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0000
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

4....20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

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

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

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

I: current, Value: decimal value

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

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.

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.

For extended diagnosis during runtime, you may evaluate the 12Byte wide *record set 1* via the SFCs 51 and 59.

Evaluate diagnosis 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.

Record set 0 *Byte 0 to 3:*

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

Byte 0 to 11:

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	08h
6	Bit 7 ... 0: Number of identical channels of a module	04h
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 7 ... 4: 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 7 ... 4: reserved	00h
9	Bit 0: Wire break Channel 1 Bit 1: Parameterization error Channel 1 Bit 2: Measuring range underflow Channel 1 Bit 3: Measuring range overflow Channel 1 Bit 7 ... 4: reserved	00h
10	Bit 0: Wire break at current output res. short circuit at voltage output Channel 2 Bit 1: Parameterization error Channel 2 Bit 7 ... 2: reserved	00h
11	Bit 0: Wire break at current output res. short circuit at voltage output Channel 3 Bit 1: Parameterization error Channel 3 Bit 7 ... 2: reserved	00h

Technical data

Electrical Data	VIPA 234-1BD50							
Number of in-/outputs	2/2							
Voltage supply	DC5V via backplane bus DC24V (20.4 ... 28.8V)							
Current consumption	Backplane bus: 100mA DC 24V extern: 100mA							
Short circuit current	30mA							
I/O ranges	$\pm 10V$, 1 ... 5V, 0 ... 10V, $\pm 20mA$, 0 ... 20mA, 4 ... 20mA							
Analog value calculation inputs	Calculation time/Resolution (per channel)							
Parameterized velocity (Hz)	3.7	7.5	15	30	60	123	168	202
Basic calculation time (ms)	268	135	69	35,5	19	10	8	6,75
Additional calculation time (executed once per cycle) (ms)	10	10	10	10	10	10	10	10
Additional calculation time for wire break recognition (ms)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Resolution in Bit	16	16	16	16	15	14	12	10
Analog value calculation outputs resolution (incl. overdrive region)	$\pm 10V$, $\pm 20mA$ 11Bit + sign 4 ... 20mA, 1 ... 5V 10Bit 0 ... 10V, 0 ... 20mA 11Bit							
Cycle time	2.5ms							
Settling time								
- Ohm resistive load	0.05ms							
- Capacitive load	0.5ms							
- Inductive load	0.1ms							
Error limits	Measuring range				Tolerance			
- Voltage in-/output	$\pm 10V$				$\pm 0.2\%$			
	0 ... 10V				$\pm 0.4\%$			
	1 ... 5V				$\pm 0.6\%$			
- Current in-/output	$\pm 20mA$				$\pm 0.3\%$			
	0 ... 20mA				$\pm 0.6\%$			
	4 ... 20mA				$\pm 0.8\%$			

continued ...

... continue

Electrical Data	
Data for choosing an encoder	
- Voltage input	100k Ω
- Current input	50 Ω
Data for choosing an actuator	Load resistor
- Voltage outputs	Ohm resistive load - min. 1k Ω Capacitive load - max. 1 μ F
- Current outputs	Ohm resistive load - max. 500 Ω Capacitive load - max. 10mH
Diagnose alarm	parameterizable
Potential separation	500Vrms (field voltage – backplane bus)
Status monitor	via LED's at the front side
Parameter data	
Input data	4Byte (1 Word per channel)
Output data	4Byte (1 Word per channel)
Parameter data	12Byte
Diagnostic data	12Byte
Measurements and Weight	
Measurements (WxHxD)	25.4x76x76mm
Weight	100g

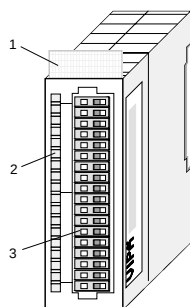
234-1BD60 - AI 4/AO 2x12Bit - Multiin-/output

Order data AI 4/AO 2x12Bit Multiin-/output VIPA 234-1BD60

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**
- 4inputs and 2 outputs with common ground
 - In-/Outputs with individually configurable functions
 - Channel 0 to 2 suitable for encoder with input ranges of:
voltage $\pm 10V$, 1 ... 5V, 0 ... 10V, $\pm 4V$, $\pm 400mV$
current $\pm 20mA$, 4...20mA or 0 ... 20mA
 - Channel 3 suitable for encoder with input ranges of:
Pt100, Pt1000, NI100, NI1000 and
resistant measuring 600 Ω , 3000 Ω
 - Channel 4 to 5 Suitable for actuators with output ranges of:
 $\pm 10V$, 1 ... 5V, 0 ... 10V, $\pm 20mA$, 0 ... 20mA or 4 ... 20mA

Construction

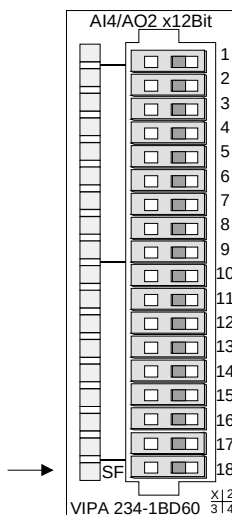


- [1] Label for the name of the module
[2] LED status indicator
[3] Edge connector

Status indicator Pin assignment

LED Description

SF Sum error LED (red)
turned on as soon as an
channel error is detected
res. an entry in the
diagnostic bytes happened

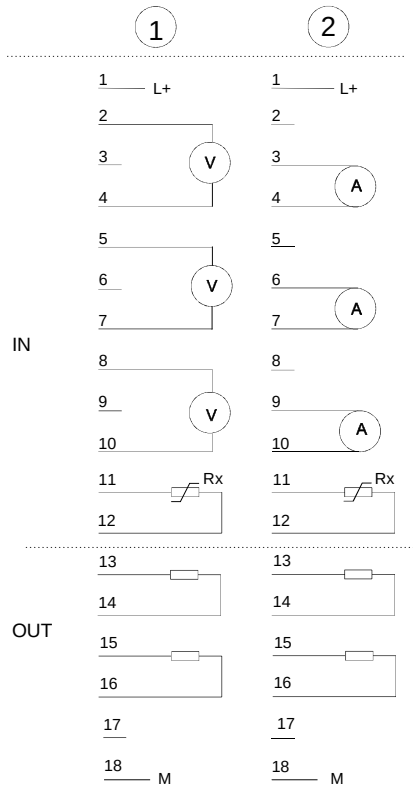


Pin Assignment

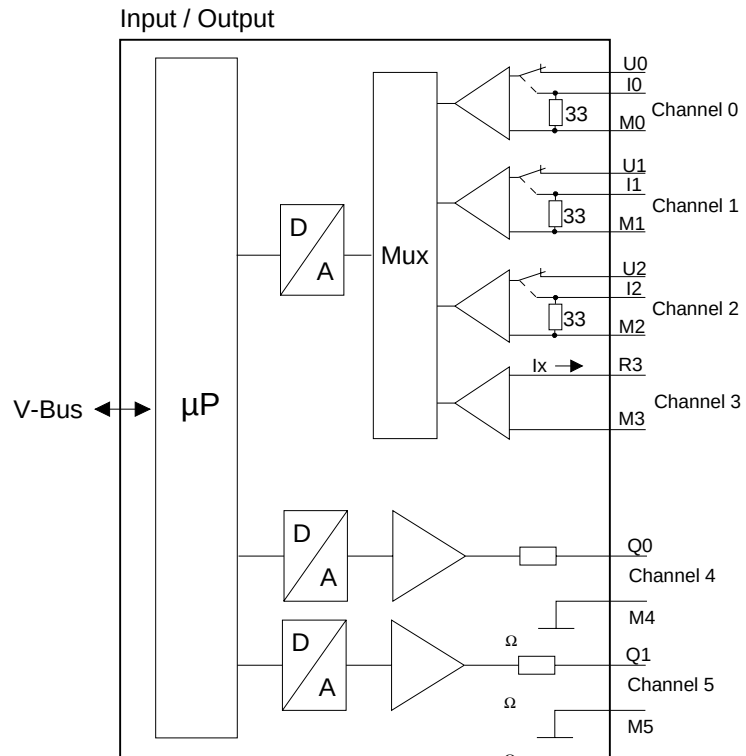
- | | |
|----|-----------------------------|
| 1 | DC 24V supply voltage |
| 2 | Voltage measuring Ch. 0 |
| 3 | Current measuring Ch. 0 |
| 4 | Ground Channel 0 |
| 5 | Voltage measuring Ch. 1 |
| 6 | Current measuring Ch. 1 |
| 7 | Ground Channel 1 |
| 8 | Voltage measuring Ch. 2 |
| 9 | Current measuring Ch. 2 |
| 10 | Ground channel 2 |
| 11 | Measuring Ch. 3 (Pt, Ni, R) |
| 12 | Ground 3 |
| 13 | Q0 output channel 4 |
| 14 | M4 output channel 4 |
| 15 | Q1 output channel 5 |
| 16 | M5 output channel 5 |
| 17 | reserved |
| 18 | Ground Supply voltage |

Circuit and schematic diagram

Circuit diagram



Schematic diagram



Attention!

The following circumstances may cause damages at the analog module:

- The external supply of the input (current/voltage) must not be present as long as the backplane bus of the CPU is still without current supply!
- Parameterization and connection of the input must be congruent!
- You must not apply a voltage >15V to the input!

**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	Option-Byte channel 0 (see table next page)	00h
7	Option-Byte channel 1 (see table next page)	00h
8	Option-Byte channel 2 (see table next page)	00h
9	Option-Byte channel 3 (see table next page)	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 is to find below under "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.

Meas. cycle

Here you may set the transducer velocity for every input channel. Please regard that a higher transducer velocity causes a lower resolution because of the lower integration time.

The data transfer format remains unchanged. Only the lower Bits (LSBs) are not longer relevant for the analog value.

Structure Meas. cycle Byte:

Byte	Bit 7 ... Bit 0	Resolution	Default
6 ... 7	Bit 3 ... 0: Velocity per channel		00h
	0000 15 conversions/s	16	
	0001 30 conversions/s	16	
	0010 60 conversions/s	15	
	0011 120 conversions/s	14	
	0100 170 conversions/s	12	
	0101 200 conversions/s	10	
	0110 3.7 conversions/s	16	
	0111 7.5 conversions/s	16	
	Bit 7 ... 4: reserved		

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	-1.76 ... 11.76V / 11.76V= End overdrive region (32511) 0...10V= nominal range (0...27648) -1.76V= End underdrive region (-4864) two's complement	(1)
7Ah	Voltage 1 ... 5V Siemens S7 format	0.3 ... 5.70V / 5.70V= End overdrive region (32511) 1...5V= nominal range (0...27648) 0.30V= End underdrive region (-4804) two's complement	(1)
28h	Voltage $\pm 10V$ Siemens S7 format	$\pm 11.76V$ / 11.76V= End overdrive region (32511) -10...10V= nominal range (-27648...27648) -11.76V= End underdrive region (-32512) two's complement	(1)
29h	Voltage $\pm 4V$ Siemens S7 format	$\pm 4.70V$ / 4.70V= End overdrive region (32511) -4...4V= nominal range (-27648...27648) -4.70V= End underdrive region (-32512) two's complement	(1)
2Ah	Voltage $\pm 400mV$ Siemens S7 format	$\pm 470mV$ / 470mV= End overdrive region (32511) -400...400mV= nominal range (-27648...27648) -470mV= End underdrive region (-32512) two's complement	(1)

continued ...

... continue function-no. input range (channel 0...2)

No.	Function	Measuring range / representation	Connection
7EH	Current 0 ... 20mA Siemens S7 format	-3.51 ... 23.51mA / 23.51mA = End overdrive region (32511) 0...20mA = nominal range (-27648...27648) -3.51mA = End underdrive region (-4864) two's complement	(2)
2Ch	Current ± 20 mA Siemens S7 format	± 23.51 mA / 23.51mA = End overdrive region (32511) -20...20mA = nominal range (-27648...27648) -23.51mA = End underdrive region (-32512) two's complement	(2)
2Dh	Current 4...20mA Siemens S7 format	1.185...+22.81mA / 22.81mA = End overdrive region (32511) 4...20mA = nominal range (0...27648) 1.18mA = End underdrive region (-4864) two's complement	(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	(1, 2)
02h	Pt1000 in 2wire mode	-200 .. +500°C / in units of 1/10°C, two's complement	(1, 2)
03h	NI100 in 2wire mode	-50 .. +250°C / in units of 1/10°C, two's complement	(1, 2)
04h	NI1000 in 2wire mode	-50 .. +250°C / in units of 1/10°C, two's complement	(1, 2)
06h	Resistance measurement 600Ohm 2wire	- / 600Ω = Limit value (32767)	(1, 2)
07h	Resistance measurement 3000Ohm 2wire	- / 3000Ω = Limit value (32767)	(1, 2)
FFh	Channel not active (turned off)		

Output range (channel 4, channel 5)

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

Note!

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

**Numeric notation
in Siemens
S7 format**

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

Byte	Bit 7 ... Bit 0
0	Bit 7 ... 0: binary measured value
1	Bit 6 ... 0: binary measured value Bit 7: sign (0: positive / 1: negative)

+/- 10V

Voltage	Decimal	Hex
-10V	-27648	9400
-5V	-13824	CA00
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

0...10V

Voltage	Decimal	Hex
0V	0	0
5V	13824	3600
10V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{10}, \quad U = Value \cdot \frac{10}{27648}$$

U: voltage, Value: decimal value

1...5V

Voltage	Decimal	Hex
1V	0	0
3V	13824	3600
5V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U-1}{4}, \quad U = Value \cdot \frac{4}{27648} + 1$$

U: voltage, Value: decimal value

+/-4V

Voltage	Decimal	Hex
-4V	-27648	9400
0V	0	0
4V	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{4}, \quad U = Value \cdot \frac{4}{27648}$$

U: voltage, Value: decimal value

+/-400mV

Voltage	Decimal	Hex
-400mV	-27648	9400
0V	0	0
400mV	27648	6C00

Formulas for the calculation:

$$Value = 27648 \cdot \frac{U}{400}, \quad U = Value \cdot \frac{400}{27648}$$

U: voltage, Value: decimal value

0...20mA

Current	Decimal	Hex
0mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

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

I: current, Value: decimal value

4...20mA

Current	Decimal	Hex
4mA	0	0
12mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

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

I: current, Value: decimal value

+/- 20mA

Current	Decimal	Hex
-20mA	-27648	9400
-10mA	-13824	CA00
0mA	0	0
10mA	13824	3600
20mA	27648	6C00

Formulas for the calculation:

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

I: current, Value: decimal value

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

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.

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.

For extended diagnosis during runtime, you may evaluate the 12Byte wide *record set 1* via the SFCs 51 and 59.

Evaluate diagnosis 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.

Record set 0 *Byte 0 to 3:*

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

Byte 0 to 11:

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

Electrical Data	VIPA 234-1BD60							
Number of Current-/Voltage input	3							
Number of resistance input	1							
Number of outputs	2							
Length of cable: shielded	200m							
Voltages, Currents, Potentials								
Supply voltage	DC 24V							
- reverse polarity protection	yes							
Constant current for resistance-type sensor	1.25mA							
Isolation								
- channels / backplane bus	yes							
- channel / power supply of the electronic	yes							
- between the channels	no							
Permitted potential difference								
- between the inputs (U _{CM})	DC4V							
- between the inputs and M _{INTERNAL} (U _{ISO})	DC75V/AC60V							
Isolation tested with	DC 500V							
Current consumption								
- from the backplane bus	100mA							
- from the power supply L+	60mA (no load)							
Power dissipation of the module	2W							
Analog value calculation input	Conversion time/Resolution (per channel)							
Measuring principle	Sigma-Delta							
Parameterizable	Yes							
Conversion rate (Hz)	200	170	120	60	30	15	7.5	3.7
Integration time (ms)	5	6	8	17	33	67	133	270
Basic conversion time (ms)	7	8	10	19	35	69	135	272
Resolution (Bit) incl. overrange	10	12	14	15	16	16	16	16
Noise suppression for frequency f1 (Hz)	no					50 and 60Hz		
Basic execution time of the module, in ms (all channels enabled)	28	32	40	76	140	276	540	1088
Smoothing of the measured values	none							
Analog value calculation output channels								
Resolution (incl. overrange)								
±10V, ±20mA	11Bit + sign							
4 ... 20mA, 1 ... 5V	10Bit							
0 ... 10V, 0 ... 20mA	11Bit							
Conversion time (per channel)	1.5ms							
Settling time								
- impedance load	0.3ms							
- capacitive load	1.0ms							
- inductive load	0.5ms							

continued ...

... continue

Suppression of interference, limits of error input channels		
Noise suppression for $f=n \times (f_1 \pm 1\%)$ (f_1 =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
	$\pm 400mV, \pm 4V, \pm 10V$	$\pm 0.3\%$
	1 ... 5V	$\pm 0.7\%$
current input	0 ... 10V	$\pm 0.4\%$
	$\pm 20mA$	$\pm 0.3\%$
	0 ... 20mA	$\pm 0.6\%$
Resistors	4 ... 20mA	$\pm 0.8\%$
	0 ... 600 Ω , 0 ... 3k Ω	$\pm 0.4\%$
	Pt100, Pt1000	$\pm 0.4\%$
Resistance thermometer	Ni100, Ni1000	$\pm 1.0\%$
Basic error limit (only valid to 120W/s) (during temperature is 25°C, referring to input range)		
Voltage input	Measuring range	Tolerance
	400mV, $\pm 4V, \pm 10V$	$\pm 0.2\%$
	1 .. 5V	$\pm 0.5\%$
Current input	0 ... 10V	$\pm 0.3\%$
	$\pm 20mA$	$\pm 0.2\%$
	0 ... 20mA	$\pm 0.4\%$
Resistors	4 ... 20mA	$\pm 0.5\%$
	0 ... 600 Ω , 0 ... 3k Ω	$\pm 0.2\%$
	Pt100, Pt1000	$\pm 0.2\%$
Resistance thermometer	Ni100, Ni1000	$\pm 0.5\%$
Temperature error (with reference to the input range) measuring current		$\pm 0.005\%/K$ $\pm 0.015\%/K$
Linearity error (with reference to the input range)		$\pm 0.02\%$
Repeatability (in steady state at 25°C referred to the input range)		$\pm 0.05\%$
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
	$\pm 10V$	$\pm 0.4\%^{1)}$
	0 ... 10V	$\pm 0.6\%^{1)}$
Current output	1 ... 5V	$\pm 0.8\%^{1)}$
	$\pm 20mA$	$\pm 0.3\%^{2)}$
	0 ... 20mA	$\pm 0.6\%^{2)}$
	4 ... 20mA	$\pm 0.8\%^{2)}$

continued ...

... continue

Basic error limit (during temperature is 25°C, referring to output range)		
Voltage output	Measuring range	Tolerance
	1 ... 5V	±0.4% ¹⁾
	0 ... 10V	±0.3% ¹⁾
Current output	±10V	±0.2% ¹⁾
	±20mA	±0.2% ²⁾
	0 ... 20mA	±0.4% ²⁾
	4 ... 20mA	±0.5% ²⁾
Temperature error (with reference to the output range)	±0.01%/K	
Linearity error (with reference to the output range)	±0.05%	
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%	
States, Alarms, Diagnosis		
Diagnosis alarm	parameterizable	
Diagnosis functions		
- Sum error monitor	red LED (SF)	
- Diagnostic information readable	possible	
Substitute value can be applied	yes	
Data for choosing an encoder		
Voltage input		
±400mV	10MΩ	
±4V, ±10V, 1 ... 5V, 0 ... 10V	120kΩ	
Current input		
±20mA, 0 ... 20mA, 4 ... 20mA	33Ω	
Resistors		
0...600Ω, 0...3kΩ	10MΩ	
Resistance thermometer		
Pt100, Pt1000, Ni100, Ni1000	10MΩ	
Maximum input voltage for voltage input (destruction limit)	25V	
Maximum input current for current input (destruction limit)	30mA	
Connection of the sensor		
For measuring voltage	yes	
For measuring current		
as 2wire transmitter	possible with external power supply	
as 4wire transmitter	yes	
For measuring resistance		
with 2conductor connection	yes	
Characteristic linearization for RTD	Pt100, Pt1000, Ni100, Ni1000	
Unit for temperature measurement	°C	

continued ...

... continue

Data for choosing an actuator	
Output ranges (rated values) Voltage Current	1 ... 5V, 0 ... 10V, $\pm 10V$ 4 ... 20mA, 0 ... 20mA, $\pm 20mA$
Load resistance (in nominal range of the output) At voltage outputs - capacitive load At current output - Inductive load	min. 1k Ω max. 1 μF max. 500 Ω max. 10mH
Voltage outputs Short-circuit protection Short-circuit current	yes max. 31mA
Current outputs No-load voltage	max. 13V
Destruction limit against voltages/currents applied from outside Voltage at outputs to M _{ANA} Current	max. 15V max. 30mA
Connection of actuators for voltage output for current output	2conductor connection 2conductor connection
Parameter data	
Input data Output data Parameter data Diagnostic data	8Byte (1 Word per channel) 4Byte (1 Word per channel) 16Byte 12Byte
Dimensions and weight	
Dimensions (WxHxD) in mm Weight	25.4x76x88mm 80g

¹⁾ The error limits are measured with a load of R=1G Ω . For voltage output the output impedance is 50 Ω .

²⁾ The error limits are measured with a load of R=10 Ω .