OPERATION MANUAL

Amplifier Module
Model 9243

from Serial-Nr. 308628

Valid from: 25.04.2019

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Warranty disclaimer

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The measurement solution.

EU-Konformitätserklärung (nach EN ISO/IEC 17050-1:2010)
EU-Declaration of conformity (in accordance with EN ISO/IEC 17050-1:2010)

Name des Ausstellers: *Issuer's name:* burster präzisionsmesstechnik gmbh & co kg

Anschrift des Ausstellers: *Issuer's address:* Talstr. 1-5, 76593 Gernsbach, Germany

Gegenstand der Erklärung: *Object of the declaration:* Verstärkermodul für DMS-, Potentiometrische und DC/DC-Sensoren
Amplifier Module for strain gauge and potentiometric sensors

Modellnummer(n) (Typ): 9243 / Zubehör 9243-Z001 + 9243-Z002
Model number / type: 9243 / Accessories 9243-Z001 + 9243-Z002

Diese Erklärung beinhaltet obengenannte Produkte mit allen Optionen
This declaration covers all options of the above product(s)

Das oben beschriebene Produkt ist konform mit den Anforderungen der folgenden Dokumente:
The object of the declaration described above is in conformity with the requirements of the following documents:

Dokument-Nr. *Documents No.*	**Titel** *Title*	**Ausgabe** *Edition*
2011/65/EU	Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten *Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment*	2011
2014/35/EU	Richtlinie zur Harmonisierung der Rechtsvorschriften der Mitgliedsstaaten über die Bereitstellung elektrischer Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen auf dem Markt *Directive on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits*	2014
2014/30/EU	Richtlinie zur Harmonisierung der Rechtsvorschriften der Mitgliedsstaaten über die Elektromagnetische Verträglichkeit *Directive on the harmonization of the laws of the Member States relating to electromagnetic compatibility*	2014
EN 61010-1	Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte – Teil 1: Allgemeine Anforderungen *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*	2010 + Cor.:2011
EN 61326-1	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*	2013
EN 55011	Industrielle, wissenschaftliche und medizinische Geräte – Funkstörungen – Grenzwerte und Messverfahren *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*	2009

Gernsbach	20.04.2016	i.V. Christian Karius
Ort / *place*	Datum / *date*	*Quality Manager*

Dieses Dokument ist entsprechend EN ISO/IEC 17050-1:2010 Abs. 6.1g **ohne Unterschrift** gültig
*According EN ISO/IEC 17050 this document **is valid without a signature.***

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Contents

1 For your safety

The following symbols on the 9243 amplifier module and in this operation manual warn of hazards.

1.1 Symbols used in this manual

1.1.1 Signal words

The following signal words are used in the operation manual according to the specified hazard classification.

DANGER
High degree of risk: indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING
Moderate degree of risk: indicates a hazardous situation which, if not avoided, may result in death or serious injury.
CAUTION
Low degree of risk: indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE
Property damage to the equipment or the surroundings will result if the hazard is not avoided.

Note: It is important to heed these safety notices in order to ensure you handle the 9243 amplifier module correctly.

IMPORTANT: Follow the information given in the operation manual.

1.1.2 Pictograms

	Electric shock hazard
	Electrostatic discharge. Do not touch! Take precautionary measures against static discharge.
	High Voltage! Danger to Life!
	Warning about dangerous electrical voltages.

!	Observe the advice for protecting the instrument.

2 Introduction

IMPORTANT: Read the operation manual carefully before using the equipment, and keep for future reference.

2.1 Intended use

DANGER

- The 9243 amplifier module **must not** be used in hazardous areas.
- The 9243 amplifier module **is not intended as a substitute** for safety devices and protective equipment. Use safety devices and protective equipment.
- The 9243 amplifier module amplifier is **not** suitable for medical applications or where people are at risk.
- Do not connect voltages that are higher than those permitted in the specification.
- **Not suitable** for safety-critical applications.

The 9243 amplifier module covers numerous areas of use. Designed for use with a variety of analog sensors, the 9243 amplifier module can capture a huge range of output signals for conditioning in fixed systems.

The intended use is defined to be:

- For industrial purposes
- For use in EMC-certified control cabinets
- For use solely with grounded DIN mounting rail

Industry-compatible connection and installation technologies make it easier for the user to adapt and integrate the unit in existing mechanical and electrical environments. The outstanding measurement quality also means it is ideal for use in both development and testing.

Typical applications of the 9243 amplifier module include:

- Production automation
- Integration of measurement data in a control environment
- Deployment in test and calibration laboratories
- Measuring and control equipment.

2.2 Customer service

2.2.1 Customer service department

For repair inquiries, please telephone our Service department on +49-7224-645-53, or email: service@burster.com (Germany only). If you are outside Germany, you should contact your burster agent (see also www.burster.com).

Please have the serial number to hand. The serial number is essential to establishing the definite technical status of the instrument and providing help quickly. You will find the serial number on the type plate of the 9243 amplifier module.

2.2.2 Contact person

If you have any questions relating to the 9243 amplifier module, please go directly to burster praezisionsmesstechnik gmbh & co. kg, or if outside Germany, please contact your burster agent (see also www.burster.com).

Head office

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Talstr. 1 - 5
76593 Gernsbach Germany

Telephone: +49-7224-645-0
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Email: info@burster.com

2.3 Download the test certificate

You have the option to download the test certificate for your 9243 amplifier module online. To do this, you need to register at http://www.burster.com/en/registration/. You can then download the test certificate directly by entering the serial number.

2.4 Ambient conditions

2.4.1 Storage conditions

The following requirements must be met when storing the 9243 amplifier module:

- Store at temperatures between -25°C and +70°C
- Store in a dry environment
- No condensation

2.4.2 Operating conditions

The following requirements must be met when operating the 9243 amplifier module:

- Always operate indoors
- Maximum height above sea level 2000 m
- Operate at temperatures between 0 °C and 60 °C
- Humidity: 80% up to +31 °C, decreasing linearly above that temperature to 50% at T_{max}, no condensation
- Class of protection: 3
- Transient overvoltage category: CAT II
- Supply voltage 11 ... 30 VDC

Note: Avoid condensation forming after transportation or storage.

2.4.3 Restrictions on use

The the 9243 amplifier module does not pose a hazard if used within its specification and in accordance with the safety regulations.

The manufacturer does not accept liability for any personal injury or property damage arising from misinterpretation of measurement results.

Note: The the 9243 amplifier module is not intended as a substitute for safety devices and protective equipment. Use safety devices and protective equipment.

2.4.4 Cleaning

DANGER

Electrical shock hazard
Disconnect the 9243 amplifier module from the power supply before cleaning.

Disconnect the 9243 amplifier module from the power supply and use a slightly damp cloth for cleaning the unit.

CAUTION

Do not immerse the 9243 amplifier module in water or hold it under running water. Do not use strong cleaning agents as these may damage the 9243 amplifier module. Use a slightly damp cloth to clean the 9243 amplifier module.

2.5 Personnel

Personnel must be familiar with the relevant regulations. They must follow these regulations. Only trained personnel who are familiar with the applicable safety regulations are permitted to operate the 9243 amplifier module.

burster is happy to provide your operating personnel with training on the 9243 amplifier module. To find out more, please look at our range of services at www.burster.com.

2.6 Contents of pack

The following components are supplied:

- 9243 amplifier module
- Operating manual
- Warranty document
- Test certificate

2.7 Unpacking

	DANGER
	Electrical shock hazard Never connect the 9243 amplifier module if it shows signs of damage incurred in transit. Only ever use the 9243 amplifier module if under the conditions specified in this operation manual.

Inspect the 9243 amplifier module if for damage. If you suspect that the unit has been damaged during shipping, notify the delivery company within 72 hours.

The 9243 amplifier module if should be shipped only in its original packaging or in packaging capable of providing an equivalent degree of protection.

2.8 Warranty

burster praezisionsmesstechnik gmbh & co kg provides a manufacturer's warranty for a period of 24 months after delivery.

Any repairs required during this time will be made without charge. This does not include damage arising from improper use.

Please note the following when sending the 9243 amplifier module if in for repair:

- If there is a problem with the 9243 amplifier module, please attach a note to the 9243 amplifier module case summarizing the fault.
- Technical specifications subject to change at any time without notice. We also state explicitly that we do not accept liability for consequential damage.
- The 9243 amplifier module must always be dispatched in suitable packaging.

2.9 Conversions and modifications

Note: The warranty shall be deemed void immediately if you open or dismantle 9243 amplifier module during the warranty period.

The 9243 amplifier module does not contain any parts that are intended to be serviced by the user. Only the manufacturer's own qualified personnel are permitted to open the 9243 amplifier module.

It is not permitted to make any changes to the 9243 amplifier module without the written agreement of burster praezisionsmesstechnik gmbh & co kg. burster praezisionsmesstechnik gmbh & co kg does not accept liability for damages or injury if this condition is disregarded.

3 Device design

3.1 Rail mounting module

- Dimensions [W x H x D]: 45 x 75 x 108 [mm]
- Weight: approx. 250 g
- Material: polyamide 6.6, color: green
- Connections: terminal connector, 2 x 8 terminals
- Assembly: on DIN EN 50 022 mount rails
- Protection class: IP20

3.2 IP65 version

- Dimensions [W x H x D]: 160 x 100 x 65 [mm]
- Weight: approx. 880 g
- Material: cast-aluminium
- Connection: terminal connector, 2 x 8 terminals
- Assembly: screw mounting
- Protection class: IP65
- Screen distance: 143 x 63 [mm]
  shaft screw ø 4.7 mm; screw ø 8.5 mm

3.3 Voltage supply

The device can be operated on AC as well as DC without the need for conversion.

Voltage supply:

- DC: 20 – 36 V unregulated
- AC: 14 – 26 VAC / 45 … 65 Hz / 3 VA

4 Controls and connections

4.1 Controls (Mounting rail version)

4.1.1 Front panel

The front panel contains two bores for accessing the potentiometers for fine adjustment of the zeropoint and the gain.

4.1.2 Rear panel

The rear panel contains two bores for accessing the potentiometers for fine adjustment of the sensor feed voltage and the 5-mV calibration source. The sensor feed voltage only requires calibration by the customer after it has been switched from the factory default setting (5 V) to a different value. In this case, the feed voltage can deviate by up to 0.2% from the setpoint value.

burster

4.1.3 Meaning of the DIP switches

4.1.3.1. Mounting rail version

IMPORTANT: The switch numbers indicated on the printed circuit board are valid.

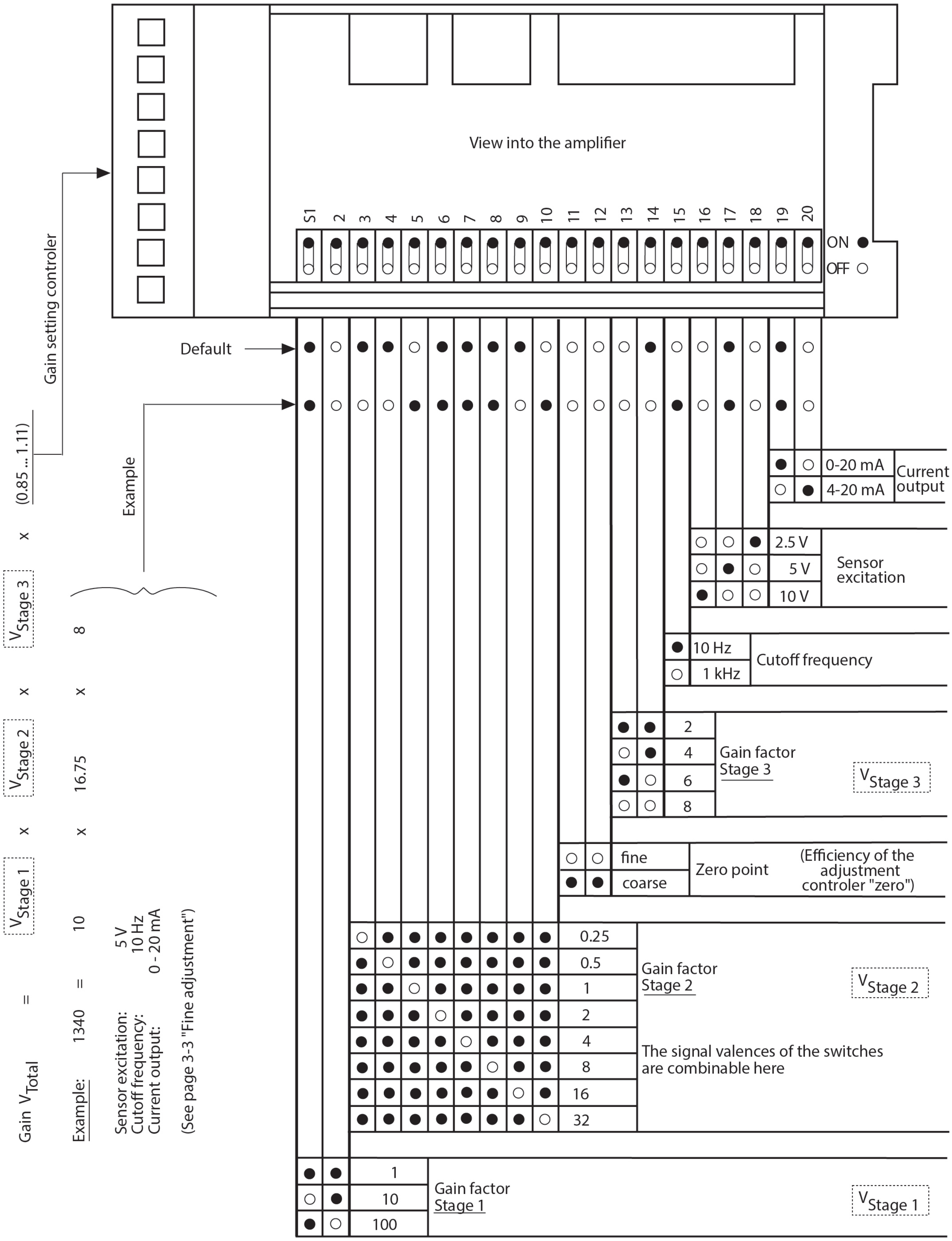


Figure 1: DIP switches of the mounting rail version

4.1.3.2. IP 65 version

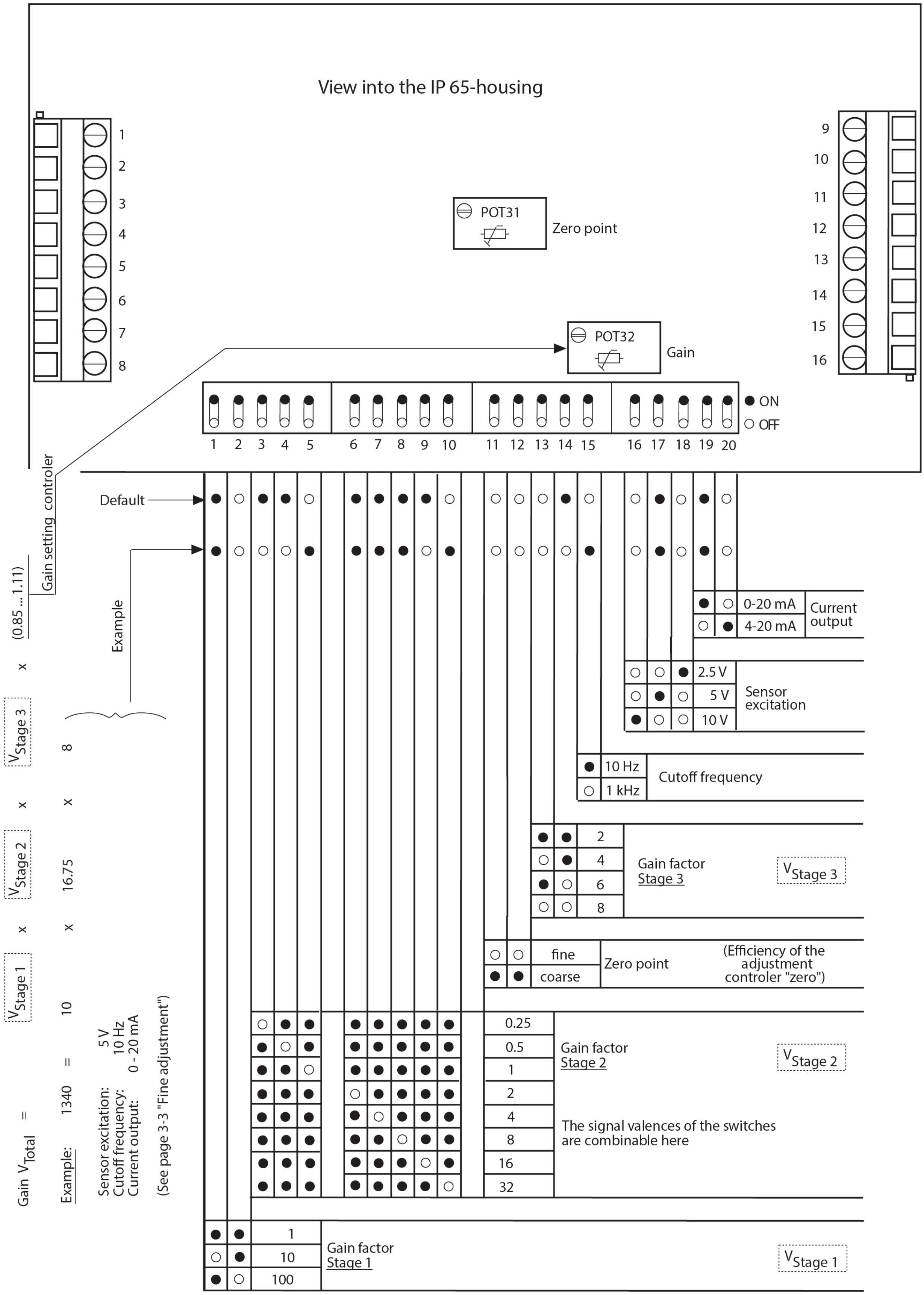


Figure 2: DIP switches of the IP 65 version

4.2 Terminal assignment

CAUTION

If possible, please use the 10 V-output (PIN6), even if you only adjust i.e. to 0-5 V!
If the adjustment is done at burster (order code 9243ABG), this output is always used for adjustment, if not particularly an adjustment on the current output is requested.

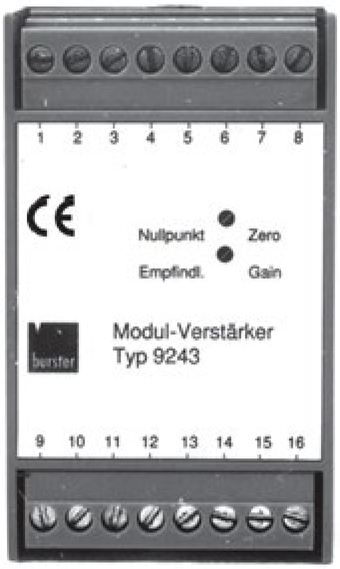


Figure 3:
Front view of housing

Terminal	Function	Description	
1	Input:	+ / ~	Supply voltage
2	Input:	- / ~	Supply voltage
3	Output:	-	Ground for the current
4	Output:	+	Current output
5	Output:	-	Ground for the voltage
6	Output:	+	*10 V output
7	Output:	+	±5 V monitor output
8	Output:	+	Calibration voltage 5 mV
9	Sensor:	-	Sensor excitation, shield
10	Sensor:	-	Sense
11	Sensor:	+	Sensor excitation
12	Sensor:	+	Sense
13	Sensor:	-	Signal input
14	Sensor:	+	Signal input
15	Input:		Calibration shunt
16	Input:		Calibration shunt

Table 1: Terminal assignment

4.2.1 Terminal assignment IP 65-version

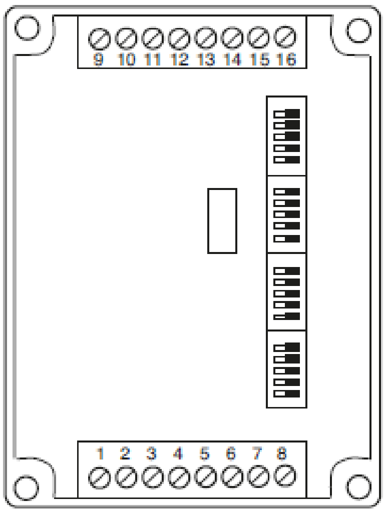


Figure 4:
Terminal assignment IP 65-version

Terminal	Function	Description	
1	Input:	+ / ~	Supply voltage
2	Input:	- / ~	Supply voltage
3	Output:	-	Ground for the current output
4	Output:	+	Current output
5	Output:	-	Ground for the voltage output
6	Output:	+	*10 V output
7	Output:	+	±5 V monitor output
8	Output:	+	Calibration voltage 5 mV
9	Sensor:	-	Sensor excitation, shield
10	Sensor:	-	Sense
11	Sensor:	+	Sensor excitation
12	Sensor:	+	Sense
13	Sensor:	-	Signal input
14	Sensor:	+	Signal input
15	Input:		Calibration shunt
16	Input:		Calibration shunt

Table 2: Terminal assignment IP 65-version

4.3 Grounding and potential binding

The 9243 amplifier module is ungrounded. The measurement inputs and outputs are isolated from the supply voltage. Observe the potential binding between the sensor, cable shield and downstream-connected electronics.

!	**CAUTION**
	Only applicable to low rated voltages.

4.4 Installation

The mounting rail version is installed on a DIN EN mounting rail.

5 Using the instrument for the first time

	DANGER
	Electrical shock hazard Never switch on the 9243 amplifier module if it shows signs of damage incurred in transit. Only ever use the 9243 amplifier module under the conditions specified in this operation manual.

	DANGER
	Electrical shock hazard Turn on the operating voltage only once all sensors and loads have been connected.

Only connect the device to power supply units which are equipped with a safety transformer complying with VDE 0551. Transmitters and other components connected in series with the 9243 amplifier module and powered from the mains should also be equipped with a safety transformer complying with VDE 0511.

6 Setting the amplifier

6.1 Sensor excitation

The sensor excitation voltage is asymmetric and referenced to ground. This also allows the shield of the sensor cable to be connected to the negative sensor feed. The excitation voltage is supplied via a 4-wire cable. This means that the voltage drops in the excitation lines can be compensated, provided that appropriate sensors are in use and the probe lines are connected. Only use 6-wire extension cables. The excitation lines and probe lines in the plug on a 4-wire sensor are bridged in each case. In the case of a 6-wire sensor, the two sensor lines are generally routed directly to the sensor element, so that bridging is not required.

The following excitation voltages can be set:

2.5 V, 5 V and 10 V

The default excitation voltage of 5 V can be used to operate most sensors. If 2.5 V or 10 V are selected, the device needs to be readjusted. The sensor excitation voltage is short-circuit proof; the maximum current consumption is 35 mA.

6.2 Zero Point

The zero point is adjusted with a potentiometer (zero) which can be accessed via a bore in the front panel.

The adjustment range of the potentiometers can be set with 2 DIP switches. The switch settings are described in Chapter 4.1.3 titled Meaning of the DIP switches Page 13. If both switches are OFF, the adjustment range is smallest. If both switches are ON, the adjustment range is largest. The switches can be set in any required combination, so that asymmetric adjustment ranges are also possible.

The zero point is adjusted between the second and third amplification stages. If the adjustment range is too small, the gain can be decreased in stage 2 and increased in stage 3. If the adustment range is too large, the gain can be increased in stage 2 and decreased in stage 3 (refer to Chapter 10.2 titled Block schematic Page 30).

6.3 Gain setting

6.3.1 Coarse adjustment

The gain is adjusted coarsely on three amplification stages (stages 1 - 3). DIP switches are assigned to each amplification stage. Multiplying the gain factors set on each stage results in the total coarse gain V_{Total} (also refer to Chapter 4.1.3.1 titled Mounting rail version Page 13).

Stage 1:

The gain can be set with DIP switches S1 – S2.

1

10

100

Only factors of 1, 10 and 100 are available here. It is not possible to combine these factors, forexample, to obtain 110.

Stage 2:

The gain can be set with DIP switchesS3 – S10.

0.25

0.5

0.75

1

2

4

8

16

32

The gain factor here can be adjusted with a resolution of 0.25. The switches can be set in any required combination to obtain, for example, a gain of 33.25.

Stage 3:

The gain here can be set with DIP switches S13 – S14.

2

4

6

8

Only factors of 2, 4, 6 and 8 are available here. Combinations are not possible.

The specified gain factors always refer to the 10-V output. The 5-V output and current output are derived from the 10-V output and are available simultaneously. During subsequent fine adjustment, only the output requiring the highest degree of precision is observed. The maximum deviation at the remaining outputs is then 0.2%.

The switch settings are described in detail in Chapter 4.1.3 titled Meaning of the DIP switches Page 13.

The effective gain factor is approximately 50000.
This applies to the following general relationship.

$$U_I = \frac{U_O}{v_{Total}}$$

U_I = Input signal
U_O = Output signal
V_{Total} = Gain

This results in a minimum input signal of 0.2 mV for the module amplifier.

6.3.2 Fine adjustment

The gain is adjusted finely with the corresponding control on the front panel.

$v_{Total} = v_{Stage1} \times v_{Stage2} \times v_{Stage3} \times (0.85 \ldots 1.11)^*$

*Fine adjustment

6.3.3 Calculating the gain

When calculating the gain, always use U_O = 10 V as the reference, even if the 5-V output is required.

Example:

Given:	Strain-gauge sensor	350 ohms
	Rated characteristic value	1.5 mV/V
	Sensor excitation voltage	5 V
	Required output voltage U_O from the amplifier	10V
Wanted:	Total gain	v

The amplifier input voltage UI generated by the sensor is determined as follows:

U_I = Rated characteristic value *x* reference excitation voltage

The relationship

$$V_{Total} = \frac{U_O}{U_I} = \frac{10\,V}{7.5\,mV}$$

results in a gain factor v = 1333 in this example. The fine adjustment covers 85 -111% of the gain adjusted coarsely in stages 1 - 3. In this example, the theoretical gain factor therefore lies between v = 1133 (85% of 1333) and v = 1480 (111% of 1333).

Calculated total gain:	v = 1333	(Stage 1 x Stage 2 x Stage 3)
Set total gain:	v = 1300	(100 x 6.5 x 2)
Fine adjustment range:	v = 1105 ... 1443	(0.85 x 1300 to 1.11 x 1300)

6.4 Input reference point

The signal amplifier acts as a differential amplifier. This means that the negative signal output is not connected to ground. If a ground connection is required, it must be established externally.

6.5 Cutoff frequency

Using DIP switches, the cutoff frequency can be switched between 10 Hz and 1 Hz (-3dB). The switch settings are described in Chapter 4.1.3 titled Meaning of the DIP switches Page 13.

6.6 Calibration source

The 9243 amplifier module is equipped with a 5.000 mV precision voltage source for the purpose of calibration. This voltage source is referenced to ground and must be connected externally when calibration is required.
Observe the following procedure for this:

This is how it works

1. Disconnect the sensor.
2. Connect pin 9 with pin 13 and pin 14.
3. Ajust "0 V" at the voltage output.
4. Connect pin 14 with pin 8.
5. Adjust the calculated voltage output.

Example:

Given:	Strain gauge sensor	350 ohms
	Rated characteristic value	1.5 mV/V
	Sensor excitation voltage	5 V
	Required output voltage U_O from the amplifier	10 V
Wanted:	The amplifier output voltage U_{OCAL} to be set for a calibration excitation voltage U_{ICAL} = 5.000 mV	
1st step:	Calculate and set the gain for 1.5 mV/V as described in the example in Chapter 6.	

When rough changes should be a repetition starting from step 2.

2nd step: Calculate the amplifier output UOCAL (to be fine-adjusted) when U_{ICAL} = 5.000 mV is applied instead of the input voltage U_I supplied by the sensor (7.5 mV in this example):

$$U_{OCAL} = \frac{U_O \times U_{ICAL}}{U_I} = \frac{10\,V \times 5\,mV}{7.5\,mV} = 6.666\,V$$

U_I = Output of the sensor x excitation voltage

U_O = Output of the amplifier with U_I

U_{ICAL} = 5.000 mV calibration voltage

U_{OCAL} = Output of the amplifier with U_{ICAL}

In this example, a voltage of 6.666V needs to be set at the amplifier output.

Needless to say, an external calibration source can also be used for this technique of calibration. Suitable devices (e.g. Model 4405, Model 4422) are listed in Section 4.

6.7 Calibration shunt

A calibration shunt can be connected directly between terminals 15 and 16. Such a shunt is generally used to tune a strain-gauge bridge according to requirements. The strain-gauge sensor must be connected for this purpose. If the value of the calibration shunt and the tuning step generated by it are known, then this technique can be used to calibrate the measuring chain. The specification sheets of most strain-gauge sensors state the value of the calibration resistance and the related tuning step as a percentage of the rated characteristic value or directly in mV/V.

Example:

Given:	Strain-gauge sensor	350 ohms
	Rated characteristic value	1.5 mV/V
	Tuning step	1.2 mV/V
	Calibration shunt	100 kohms
	Sensor excitation	5 V
	Required output voltage U_I from the amplifier	10 V

Wanted: The amplifier output voltage U_{OCAL} to be set if a 100-kohm calibration shunt has been connected.

1st step: Calculate and set the gain v for 1.5 mV/V as described in the example in Chapter 6

2nd step: Calculate the step in the input signal caused by the shunt

U_{ICAL} = Tuning step x excitation voltage

In this example: 6.000 mV

3rd step: Calculate the amplifier output voltage U_{OCAL} (to be fine-adjusted) when U_{ICAL} (= 6.000 mV in this example) is applied instead of the input voltage U_I supplied by the sensor (7.5 mV in this example):

$$U_{OCAL} = \frac{U_O x U_{ICAL}}{U_I} = \frac{10\,V\ x\ 0.006\,V}{0.0075\,V} = 8.000\,V$$

U_I = Output of the sensor x excitation voltage

U_O = Output of the amplifier with U_I

In this example , 8.000 V are to be set at the amplifier output.

The switch settings are described in Chapter 4.1.3 titled Meaning of the DIP switches Page 13.

6.7.1 Adjustment and calibration

The 9243 amplifier module can be calibrated using several different techniques. The device settings must be checked following adjustment.

6.7.1.1. Adjustment with a physical variable

Application: For all sensors.

Function: Using a scale as an example: Adjust the zero point with the scale in the unladen state. Then load the scale with a known, reference weight and set the final value.

Note: The entire measuring chain is calibrated in this case.

6.7.1.2. Adjustment with a high-precision voltage source (also refer to Chapter 6.6)

Application: For all sensors which generate voltages.

Function: The sensor is simulated by a high-precision voltage source. The integrated calibration source (5.000 mV) or an external source can be used.

Note: In the case of strain-gauge full-bridge sensors and potentiometeric sensors, the feed voltage influences the measurement results. If you want to verify the functionality of the device with voltage sources, you must measure the sensor feed voltage with a high-precision digital voltmeter and then calculate the calibration voltage.

IMPORTANT: This method cannot be used to check whether the sensor functions properly.

Suitable calibration devices (e.g. Model 4405, Model 4422) are listed in Section 4.

6.7.1.3. Adjustment with a strain-gauge simulator

In situations where strain-gauge sensors cannot be loaded in accordance with specific parameters, due to an absence of suitable weights, for example, the required measuring signal must be generated by a strain-gauge simulator. The irregular characteristic values exhibited by many strain-gauge sensors can usually not be set precisely by a simulator. In such cases, the simulator sets the next lower characteristic value. The corresponding voltage at the amplifier output is calculated as shown in the following example:

Given: A type 8438-100 kN sensor is to be simulated. According to the sensor specifications, its rated characteristic value is 1.678 mV/V. The required voltage at the amplifier output for a rated load of 100 kN is U_O = 10 V.

Wanted: The amplifier output voltage U_{OSIM} to be set after a strain-gauge simulator has been connected.

1st step: Set the strain-gauge simulator to the next lower characteristic value, in this case 1.5 mV/V.

2nd step: Calculate the amplifier output voltage to be set if only 1.5 mV/V are supplied by the simulator instead of 1.678 mV/V by the sensor. Remember: The 1.678 mV/V from the sensor should generate U_O=10 V at the amplifier output.

$$U_{Osim}\,[V] = \frac{U_O \; x \; C_{sim}}{C_{sens}} = \frac{10 \; x \; 1.5}{1.678} = 8.393$$

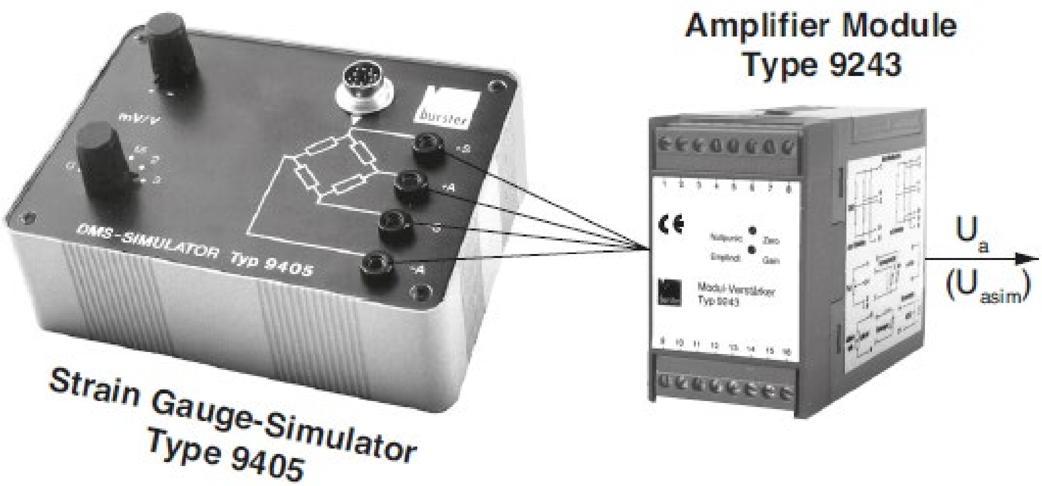
U_{Osim} = The voltage at the amplifier output when the simulator is connected.

U_O = The required amplifier output voltage with the rated sensor load.

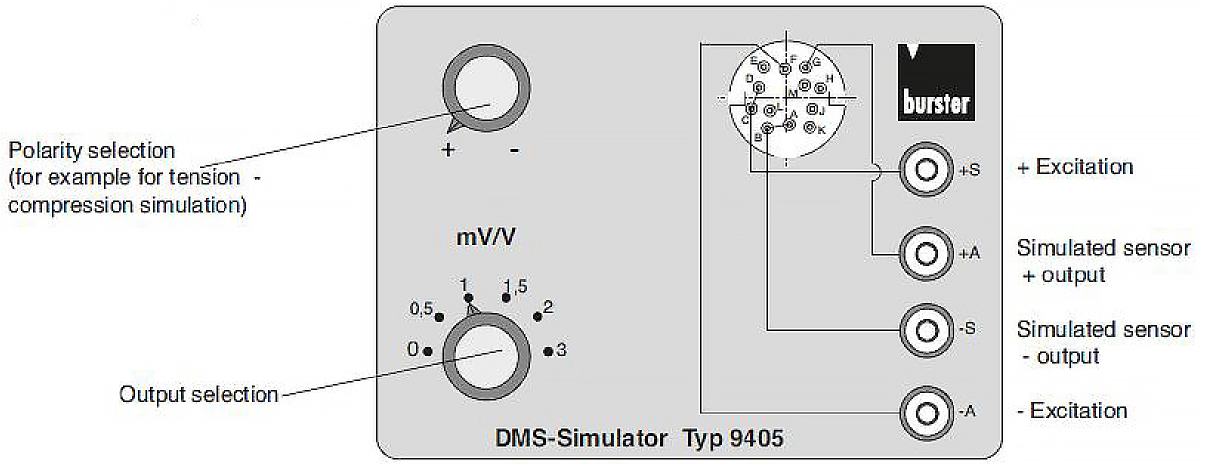
C_{sim} = The characteristic value set on the strain-gauge simulator.

C_{sens} = The characteristic value of the sensor to be simulated.

Once the strain-gauge simulator has been connected and the characteristic value has been set to 1.5 mV/V, set the amplifier output to 8.939 V.



Functions and Connection



6.8 Current output

Two voltage outputs and one current output are available simultaneously, but only one of them can be finely adjusted. The adjustment accuracy of the remaining outputs can deviate by up to 0.2%. The current outputs are derived from the 10-V voltage output. A range of 0 ... 20 mA or 4 ... 20 mA can be selected. There is a mathematical relationship between the current and voltage outputs: 0 V correspond to 0 or 4 mA, while 10 V correspond to 20 mA.

Note: Only positive voltages can be converted to equivalent currents.

Note: Negative voltages result in a current of zero.

When calculating the gain and setting the zero point of the device, proceed as though the 10-V range needs to be calibrated, but measure the current output by the device. If an ammeter is not available, you can alternatively measure the voltage at the 10-V output and then convert it into a current value.
Calibration and adjustment are performed basically as in the case of the voltage output.

The switch settings are described in Chapter 4.1.3 titled Meaning of the DIP switches Page 13.

7 Technical Data

The data sheet for the 9243 amplifier module contains the detailed technical specification. You can obtain the latest data sheet and additional information on the 9243 amplifier module from https://bit.ly/2UzySbv or simply use the QR code below:

Figure 5: QR code for the 9243 amplifier module product page

7.1 Electromagnetic compatibility

7.1.1 Interference immunity

Interference immunity in compliance with EN 61326-1:2013

Industrial environment

7.1.2 Interference emission

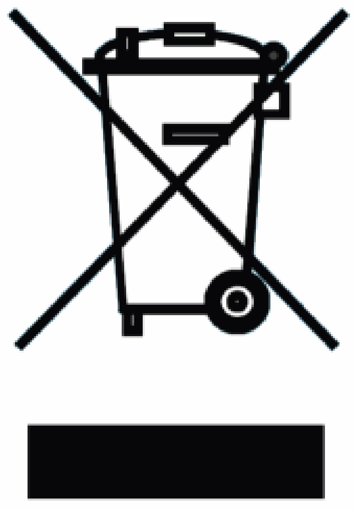
Interference emission in compliance with EN 61326-1:2013

8 Accessories

The data sheet for the 9243 amplifier module contains details of the accessories available. You can obtain the latest data sheet and additional information on the 9243 amplifier from https://bit.ly/2UzySbv or simply use the QR code below:

Figure 6: QR code for the 9243 amplifier module product page

9 Disposal



Battery disposal

In Germany, the end user is legally obliged to return all used batteries, and it is illegal to dispose of batteries in the household waste. This law may also affect you as purchaser of the instrument described here. Please dispose of your used batteries properly and in accordance with national statutory regulations. Either take them to the relevant collection point in your organization or to the collection points provided by your local authority, our company or any battery retail outlet.

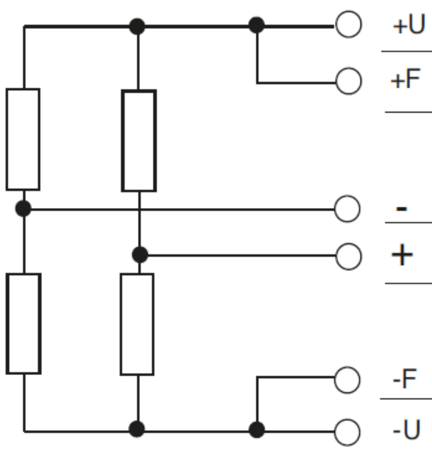
Instrument disposal

If your instrument is no longer usable, please comply with your legal obligations by disposing of the instrument described here in accordance with statutory regulations. You will then be helping to protect the environment!

10 Appendix

10.1 Sampleconnections

10.1.1 Strain-gauge full-bridge sensors



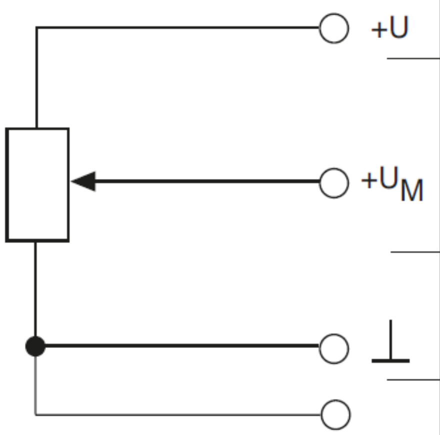
Sensor	Amplifier terminal	Description
+U	11	+ Excitation
+F	12	+ Sense
-	13	- Output
+	14	+ Output
-F	10	- Sense
-U	9	- Excitation

Figure 7: Strain-gauge full-bridge

Extension cable:

Even in the case of sensors without sense, use a 6-pole cable and bridge the sense lines of the extension cable with the excitation lines in the sensor plug.

10.1.2 Potentiometric sensors



Sensor	Amplifier terminal	Description
+U	11	+ Excitation
$+U_M$	14	+ Output
⊥	13	- Output
	9	- Excitation, shield

Figure 8: Potentiometric sensors

10.1.3 DC/DC sensors

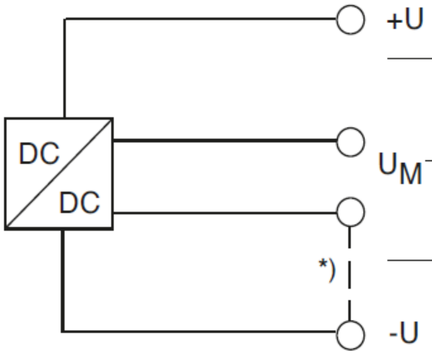
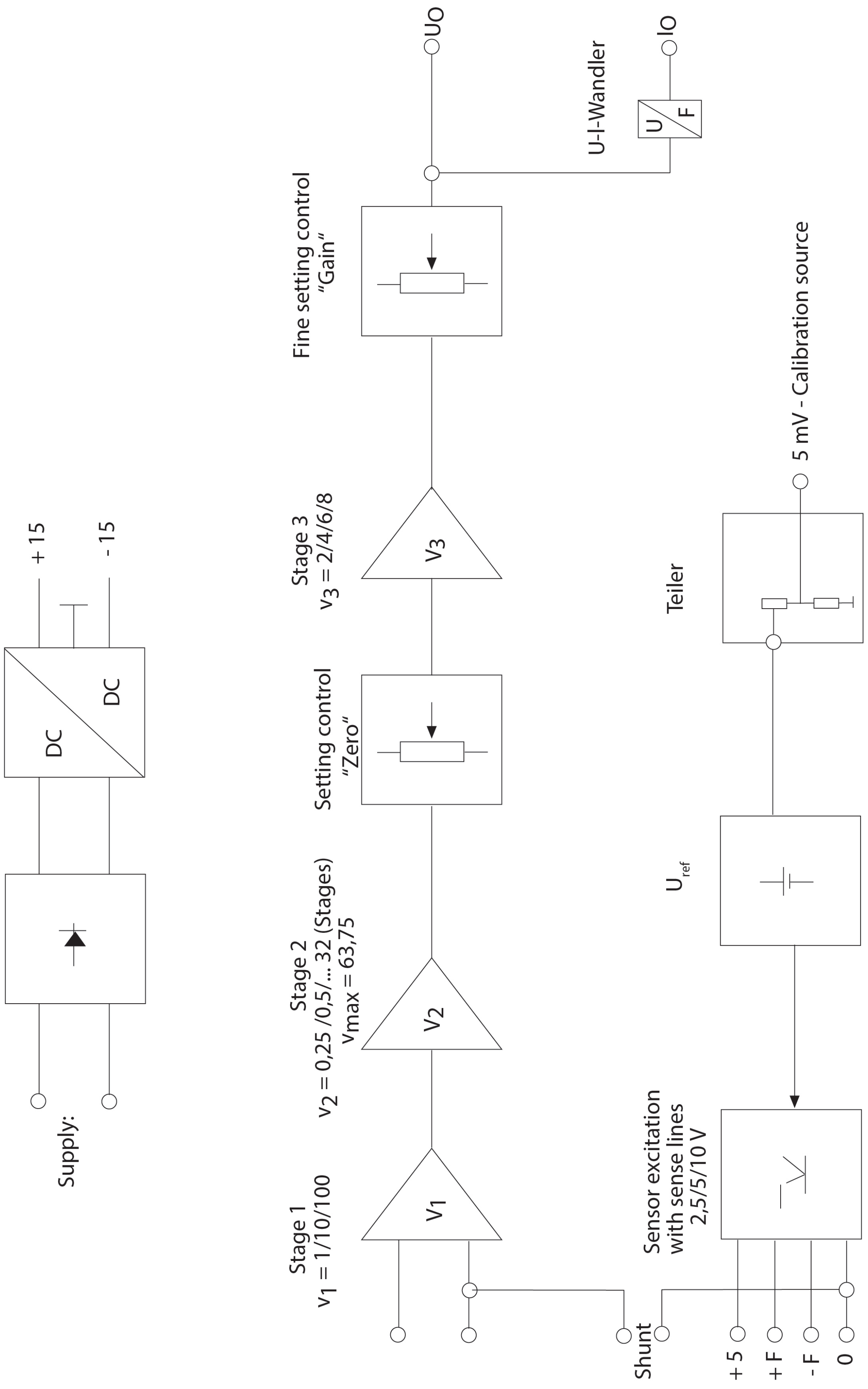
Sensor	Amplifier terminal	Description
	11	+ Excitation
	14	+ Output
	13	- Output
	9	- Excitation

Figure 9: DC-DC sensors

*) If there is not an electrical connection between exitation and output of the sensor please realize a bridge between clamp 9 and 13.

Assumption: The sensor is operated on 10 V (other voltages are external).

10.2 Block schematic



10.3 Output of the sensor

An important criterion for determining the gain is the measuring voltage supplied by the sensor in use. In this respect, the sensor specification format usually varies from one manufacturer to another.

A strain-gauge full-bridge sensor can have the following specifications, for example:

- Excitation: 5 V
  Output: 2 mV/V
- Sensor excitation: 10 V
  Output voltage: 10 mV
- Reference voltage: 5 V
  Sensitivity: 2 mV/V

In all 3 examples, the sensor output voltage at full deflection is 10 mV.

10.4 Parallel connection of sensors

For certain weighing applications, it is expedient to operate several strain-gauge full-bridge sensors connected in parallel. For this purpose, the feed lines, measuring lines and sensor lines are connected in parallel in each case. The sensors then act as a single electrical unit.

A prerequisite here is that all sensors should be completely identical in terms of their:

- Characteristic value
- Input resistance
- Output resistance

If this is not the case, then this technique could give rise to errors.

CAUTION

Ensure that the maximum permissible current is not exceeded.

Voltage	Number of 350 Ω sensors
2,5 V	4
5 V	2
10 V	1

Table 3: Parallel-connected sensors

Note: This does not apply to sensors in conjunction with safety barriers.

10.5 Tables for setting amplification stages

10.5.1 Settings for strain-gauge sensors

Applicable to all output voltage and current ranges

Sensor excitation [V]	Output [mV/V]	Calculated bridge voltage [mV]	Output (reference) [V]	Calculated gain	Stage 1 Set gain (decimal)	Stage 2 Set gain (0.25…63)	Stage 3 Set gain (2/4/6/8)
2.5	0.1	0.25	10	40.000.00	100	50	8
2.5	0.2	0.5	10	20.000.00	100	50	4
2.5	0.5	1.25	10	8.000.00	100	20	4
2.5	1	2.5	10	4.000.00	100	10	4
2.5	1.25	3.125	10	3.200.00	100	16	2
2.5	1.5	3.75	10	2.666.67	100	13.25	2
2.5	1.75	4.375	10	2.285.71	100	11.5	2
2.5	2	5	10	2.000.00	100	10	2
2.5	2.5	6.25	10	1.600.00	100	8	2
2.5	3	7.5	10	1.333.33	10	66	2
2.5	4	10	10	1.000.00	10	50	2
2.5	5	12.5	10	800.00	10	40	2
2.5	10	25	10	400.00	10	20	2
2.5	15	37.5	10	266.67	10	13.25	2
2.5	20	50	10	200.00	10	10	2
2.5	25	62.5	10	160.00	10	8	2
2.5	30	75	10	133.33	10	6.75	2
2.5	35	87.5	10	114.29	1	57	2
2.5	40	100	10	100.00	1	50	2
2.5	45	112.5	10	88.89	1	44.5	2
2.5	50	125	10	80.00	1	40	2
2.5	60	150	10	66.67	1	33.25	2
2.5	65	162.5	10	61.54	1	30.75	2
2.5	70	175	10	57.14	1	28.5	2
2.5	75	187.5	10	53.33	1	26.75	2
2.5	80	200	10	50.00	1	25	2
2.5	85	212.5	10	47.06	1	23.5	2
2.5	90	225	10	44.44	1	22.25	2
2.5	95	237.5	10	42.11	1	21	2
2.5	100	250	10	40.00	1	20	2

Table 4: Gain setting for strain-gauge full-bridge sensors

Sensor excitation [V]	Output [mV/V]	Calculated bridge voltage [mV]	Output (reference) [V]	Calculated gain	Stage 1 Set gain (decimal)	Stage 2 Set gain (0.25…63)	Stage 3 Set gain (2/4/6/8)
5	0.1	0.5	10	20.000.00	100	50	4
5	0.2	1	10	10.000.00	100	50	2
5	0.3	1.5	10	6.666.67	100	33.25	2
5	0.4	2	10	5.000.00	100	25	2
5	0.5	2.5	10	4.000.00	100	20	2
5	0.6	3	10	3.333.33	100	16.75	2
5	0.7	3.5	10	2.857.14	100	14.25	2
5	0.8	4	10	2.500.00	100	12.5	2
5	0.9	4.5	10	2.222.22	100	11	2
5	1	5	10	2.000.00	100	10	2
5	1.1	5.5	10	1.818.18	100	9	2
5	1.3	6.25	10	1.600.00	100	8	2
5	1.4	7	10	1.428.57	10	35.75	4
5	1.5	7.5	10	1.333.33	10	33	4
5	1.6	8	10	1.250.00	10	62.5	2
5	1.7	8.5	10	1.176.47	10	58.75	2
5	1.8	8.75	10	1.142.86	10	57	2
5	1.9	9.5	10	1.052.63	10	52.5	2
5	2	10	10	1.000.00	10	50	2
5	2.25	11.25	10	888.89	10	44.5	2
5	2.5	12.5	10	800.00	10	40	2
5	2.75	13.75	10	727.27	10	36.25	2
5	3	15	10	666.67	10	33	2

Table 5: Gain setting for strain-gauge full-bridge sensors

Sensor excitation [V]	Output [mV/V]	Calculated bridge voltage [mV]	Output (reference) [V]	Calculated gain	Stage 1 Set gain (decimal)	Stage 2 Set gain (0.25…63)	Stage 3 Set gain (2/4/6/8)
10	0.1	1	10	10.000.00	100	50	2
10	0.2	2	10	5.000.00	100	25	2
10	0.5	5	10	2.000.00	100	10	2
10	1	10	10	1.000.00	100	5	2
10	1.25	12.5	10	800.00	100	4	2
10	1.5	15	10	666.67	10	33.25	2
10	1.75	17.5	10	571.43	10	28.5	2
10	2	20	10	500.00	10	25	2
10	2.5	25	10	400.00	10	20	2
10	3	30	10	333.33	10	16.75	2

Table 6: Gain setting for strain-gauge full-bridge sensors

10.5.2 Settings for potentiometers and transmitters

Applicable to all output voltage and current ranges

Sensor	Meas. model	Excitation [V]	Sensor voltage [V]	Internal reference [V]	Calculated gain	Stage 1	Stage 2	Stage 3	Fine adjustment
Potentio.		Internal 5 V	5	10	2	1	0.25	8	1.00
Potentio.	50 % Offset	Internal 5 V	2.5 (2.5 V Offset)	10	4	1	0.5	8	1.00
Voltage		Internal or external	1	10	10.00	1	5	2	1.00
Voltage		Internal or external	2	10	5.00	1	2.25	2	1.11
Voltage		Internal or external	3	10	3.33	1	1.5	2	1.11
Voltage		Internal or external	4	10	2.50	1	1.25	2	1.00
Voltage		Internal or external	5	10	2.00	1	1	2	1.00
Voltage		Internal or external	6	10	1.67	1	0.25	6	1.11
Voltage		Internal or external	7	10	1.43	1	0.75	2	0.95
Voltage		Internal or external	8	10	1.25	1	0.75	2	0.8333
Voltage		Internal or external	9	10	1.11	1	0.5	2	1.11
Voltage		Internal or external	10	10	1.00	1	0.5	2	1.00

Table 7: Gain setting for high-level sensors