



# **Operating Instructions**

## **Miniature CF Measuring Amplifier**

### **Series MBI 46.13**

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## 1 General

### **Read carefully before use!**

Please read and always follow these operating instructions.

### **Retain for future reference!**

Please retain these operating instructions in a safe location for future reference.

### **Treat the identification plate on the device with care!**

If the device has to be repaired or replacement parts are needed, you must specify the model and the serial number. Both are indicated on the identification plate.

### **Warnings and safety instructions**

Observe the warnings and safety instructions in these operating instructions to avoid physical injury and property damage.

#### **1.1 Warranty and liability**

Warranty and liability claims against MESSOTRON cannot be raised if

- damage occurs because the operating instructions are not followed or
- modifications have been made that are not documented in the operating instructions.

#### **1.2 Technical support and contact details**

Please contact us if you have any questions. You can reach us at the following contact address:

MESSOTRON GmbH & Co KG  
Friedrich-Ebert-Str. 37  
64342 Seeheim-Jugenheim, Germany

Phone: +49 (0) 6257 999730

Email: [info@messotron.de](mailto:info@messotron.de)

For further information please visit our webpage: [www.messotron.com](http://www.messotron.com).

## 2 Safety Instructions

### 2.1 Intended use

The carrier frequency measuring amplifier MBI 46.13 (“the device”) must only be used to operate inductive displacement sensors of the differential transformer type (LVDTs) and differential inductors / half-bridge sensors (LVITs) as well as the associated signal processing equipment. The device must only be used with passive displacement sensors (i.e. sensors without active embedded electronics). Any other use is considered improper use.

Observe the legal and safety regulations required for the respective application. This also applies to the use of accessories.

In order to ensure proper and safe operation, the device must only be operated according to the information provided in these operating instructions.

### 2.2 Conditions at the installation site

Check the required conditions at the installation site (e.g. temperature and weather conditions). The limits for the device are specified in chapter 11 “Technical Specifications”.

Have the device checked by MESSOTRON before putting it back into service if foreign objects or liquids got inside the device.

Do not use the device near other devices, machines or equipment that generate strong electric or magnetic fields.

### 2.3 General hazards if the safety instructions are not followed

The device is designed to the state of the art and is safe when used as intended. However, if the device is used and operated improperly (e.g. by insufficiently qualified personnel), residual hazards may arise.

### 2.4 Qualified personnel

The device must only be placed into service and operated by trained skilled persons who are aware of the hazards involved. The skilled persons must be familiar with the national occupational health and safety regulations, accident prevention regulations as well as approved technical practices and guidelines.

## 2.5 Check for transport damage

Before unpacking, check the packaging of the device for damage. If the packaging has been damaged during transport and there is reason to believe that the device may be damaged, it must not be placed into service. In this case, have the device checked by MESSOTRON before use.

## 3 Warning and Other Messages

### 3.1 Use of warning messages

The following hazard levels according to ANSI Z 535 are used for warning messages:

Warning sign, signal word	Explanation
<b>DANGER</b>	Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.
<b>WARNING</b>	Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.
<b>CAUTION</b>	Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.
<b>NOTICE</b>	Indicates a potential property damage: The product could be damaged or the environment could be harmed.

Warning messages affecting your personal safety are very clearly marked. Always observe these warnings to avoid physical injury and property damage.

A warning message (for either Danger, Warning or Caution) looks like this:

	<b>WARNING</b>
Cause and potential consequences	
<ul style="list-style-type: none"> <li>How to avoid the hazard</li> </ul>	

### 3.2 Other messages

<b>NOTE</b>	Notes contain important information for optimum use of the device. Not observing a note may result in incorrect measurements; however, this will usually not result in damage to the device.
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## 4 Product Description

### 4.1 Glossary

Term	Definition
Carrier frequency measuring amplifier	Series MBI 46.13 CF measuring amplifiers are used in inductive measuring chains <ul style="list-style-type: none"> <li>to provide the inductive sensor with the required excitation voltage,</li> <li>to amplify the sensor output signal and</li> <li>to convert the output signal into a normalized analog voltage signal.</li> </ul>
<b>Types of displacement sensors</b>	
Displacement sensor	In these instructions the term “displacement sensor” often abbreviated to “sensor” is used. These devices are also known as “transducers” or “position sensors”. MESSOTRON differentiates the following three displacement sensor types:
Differential transformer (LVDT)	Differential transformers consist of a primary coil and two secondary coils placed around a movable magnetic core. The coils are coupled based on the transformer principle. The acronym LVDT stands for “Linear Variable Differential Transformer”.
Inductive half-bridge, differential inductor (LVIT)	Differential inductors represent a Wheatstone half-bridge with two measuring coils. The impedance of the two measuring coils is influenced in opposite directions by a movable magnetic core. They are also referred to as LVIT (Linear Variable

Term	Definition
	Inductance Transducer).
Long-stroke sensors based on the eddy current principle	Long-stroke sensors are inductive displacement sensors using a half-bridge circuit. Only one coil is used for measuring. The second coil is designed as a space-saving equivalent circuit. A movable measuring tube (made of a conductive material) changes the impedance of the measuring coil based on the eddy current principle.
<b>Construction</b>	
Symmetric sensor	The measuring coil halves of differential transformers and inductors are built in a symmetrically (mirrored) design. The el. zero is at the center of the nominal stroke.
Asymmetric sensor	The space-saving equivalent circuit of the 2 <sup>nd</sup> coil of the long-stroke sensors results in an asymmetric design enabling a more favorable displacement-to-length ratio. The electrical zero is at the start of the nominal stroke (when the measuring tube completely covers the measuring coil).
Immersion core (core with core rod)	The immersion core is a two-piece, rod-shaped part consisting of <ul style="list-style-type: none"> <li>• a magnetic core and</li> <li>• a core rod, i. e. a purely mechanical extension made of a non-magnetic material.</li> </ul>
Measuring tube	The measuring tube is made of aluminum. In asymmetric displacement sensors it is moved over the measuring coil drawing energy from the coil field proportional to the tube's position (eddy current effect).
<b>Characteristic data</b>	
Excitation voltage ( $U_{sp}$ )	AC voltage (typically 1...5 Vpp), supplying the inductive sensor.
Carrier frequency	Excitation frequency (usually 5 or 10 kHz) to drive the inductive displacement sensor.
Measurement voltage	Output signal proportional to the displacement (AC voltage in the mV range) provided by the inductive displacement sensor.

<b>Term</b>	<b>Definition</b>
Zero point	At the electrical zero, the output signal of the displacement sensor is zero. Refer to the data sheet of the displacement sensor for physical position of the zero point.
Rated output	<p>The rated output of the sensor is defined as the ratio of the sensor output voltage (measurement voltage) to the sensor input voltage (excitation voltage) at the end of the nominal stroke. For calibrated displacement sensors the rated output is e.g. 80 mV/V, independent of the nominal stroke of the displacement sensor.</p> <p>In older displacement sensor data sheets, the term “nominal output” is used.</p>
Sensitivity	<p>The sensitivity is defined as the ratio of the measurement voltage to the excitation voltage per mm of displacement (e.g. 10 mV/V/mm).</p> <p>For standardization purposes information on sensitivity and rated output for MESSOTRON displacement sensors is determined and provided independent of phase (i.e. without consideration of a phase shift).</p>
Phase (phase shift)	<p>With inductive sensors and/or long connecting cables, there will be a noticeable phase shift between the excitation voltage and the measurement voltage. This phase shift lowers the (effective) sensitivity of the sensor in the measuring chain.</p> <p>All MESSOTRON series MBI 46.13 measuring amplifiers can compensate a phase shift.</p>
Linearity error	The linearity error of measuring devices is the maximum deviation between the nominal characteristic (straight line) and the real characteristic of the measuring device. The error information is referenced to the total measuring range (FSO / Full Scale Output).

### **Signal output of the measuring amplifier**

(Nominal) output range	The (nominal) output range of the measuring amplifier indicates the range covered by the output signal, if the displacement sensor operates in the (nominal)
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	measuring range.
Voltage output	Analog voltage output of the measuring amplifier: a) typically $\pm 10$ V for symmetric displacement sensors b) typically 0-10V for asymmetric displacement sensors

## 4.2 Function and design

The MBI 46.13 generates the AC voltage (excitation voltage  $U_{sp}$ ) required for operating inductive displacement sensors. The frequency (carrier frequency) is typically 5 kHz (optionally 1...20 kHz).

The output signal proportional to the displacement (the measurement voltage) returned by the displacement sensor is preamplified by the measuring amplifier and evaluated ratiometrically, i.e. in relation to the excitation voltage. This way measurement errors are avoided that result from fluctuations of the excitation voltage, e.g. due to an impedance change of the displacement sensor.

In subsequent stages, the measurement signal is filtered and scaled to the desired output range for further processing.

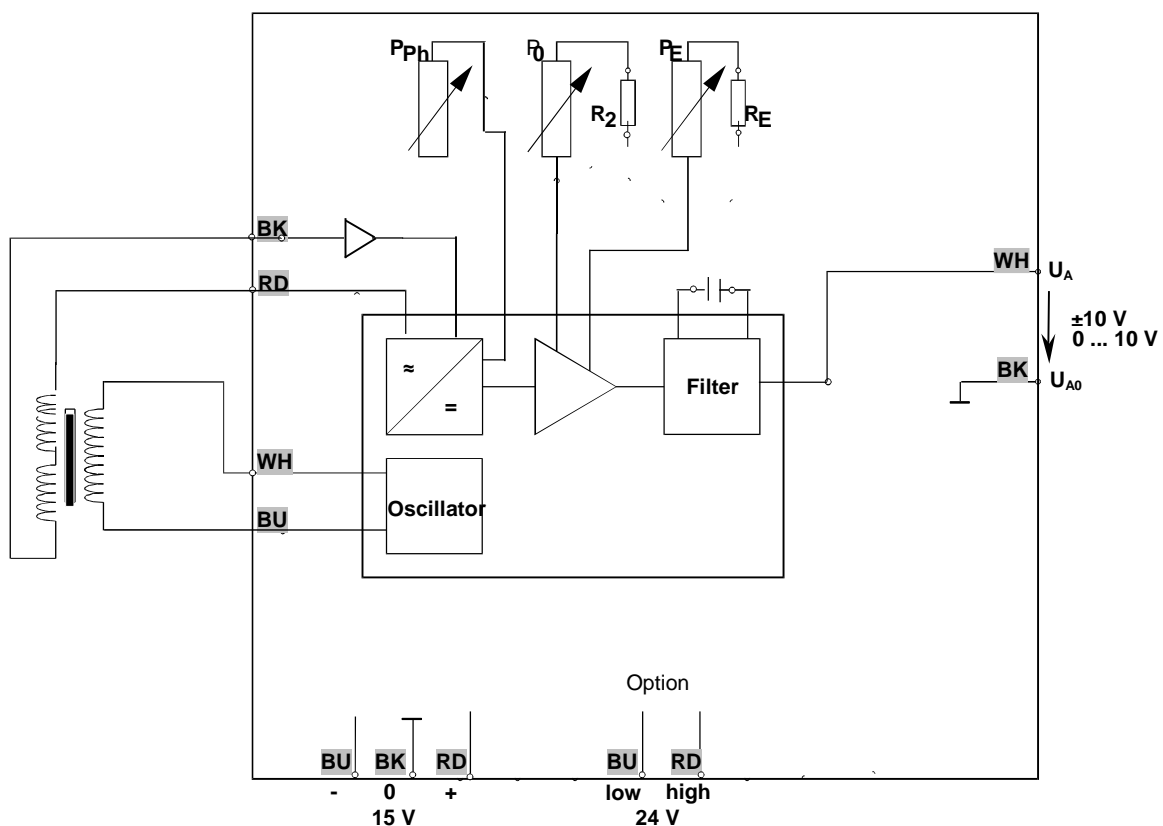


Figure 1 Block diagram with terminal assignment

- $P_E$  Trimmer potentiometer for gain adjustment
- $P_0$  Trimmer potentiometer for zero adjustment
- $P_{Ph}$  Trimmer potentiometer for phase compensation

### 4.3 Suitable displacement sensors

The MBI 46.13 CF measuring amplifier can be used with a variety of inductive sensors. For details on the requirements, refer to the technical specifications in chapter 11.

#### NOTE

In particular check the following:

- Electrical design (type of displacement sensor),
- Required carrier frequency,
- Excitation voltage and
- Rated output / sensitivity.

The following chapters describe the electrical design of the three displacement sensor types offered by MESSOTRON.

#### 4.3.1 Linear Variable Inductance Transducers (LVITs)

Electrically displacement sensors based on the differential inductor principle, also called LVITs, represent a Wheatstone half-bridge consisting of two measuring coils. If the core moving inside the coils is in its mid-position (electrical zero), both measuring coils will show the same impedance. The bridge circuit is balanced. The measurement voltage is zero.

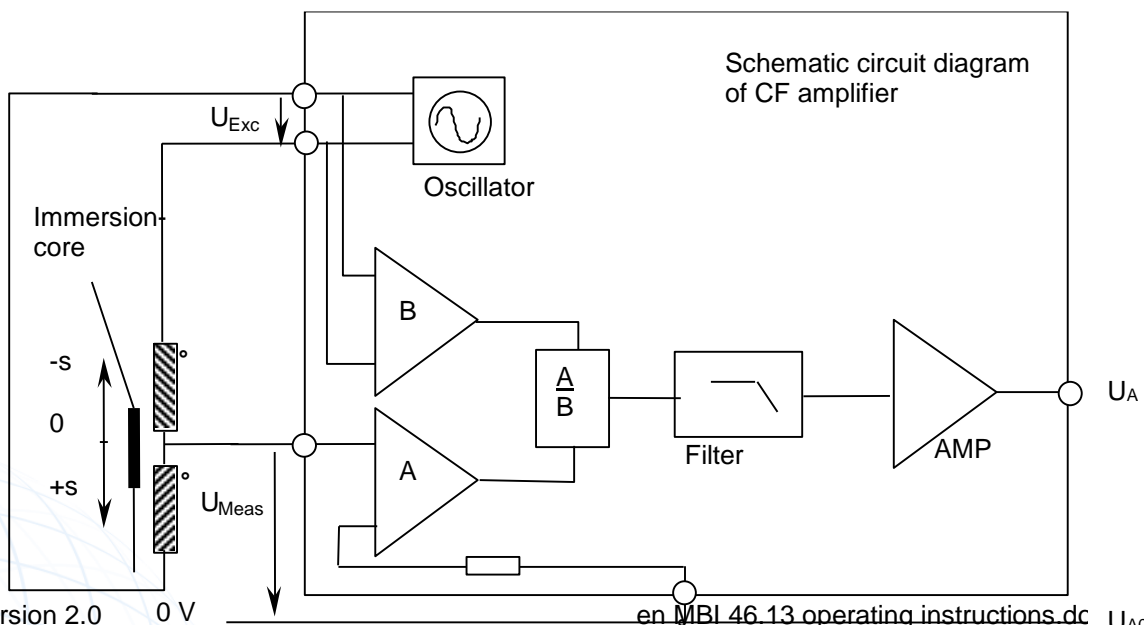


Figure 2 Measuring amplifier with differential inductor

If the core is moved out of its mid-position, the impedances of the two measuring coils change and the measurement voltage increases proportionally with the displacement within the measuring range.

#### 4.3.2 Linear Variable Differential Transformers (LVDTs)

Differential transformers consist of a primary coil and two secondary coils placed around an immersion core. The coils are coupled based on the transformer principle.

AC voltage drives the primary coil inducing a voltage in the secondary coils. When the immersion core is at its mid-position, this voltage is zero due to the symmetrically wound secondary coils. If the immersion core is moved, the measurement voltage changes proportionally to the displacement of the core.

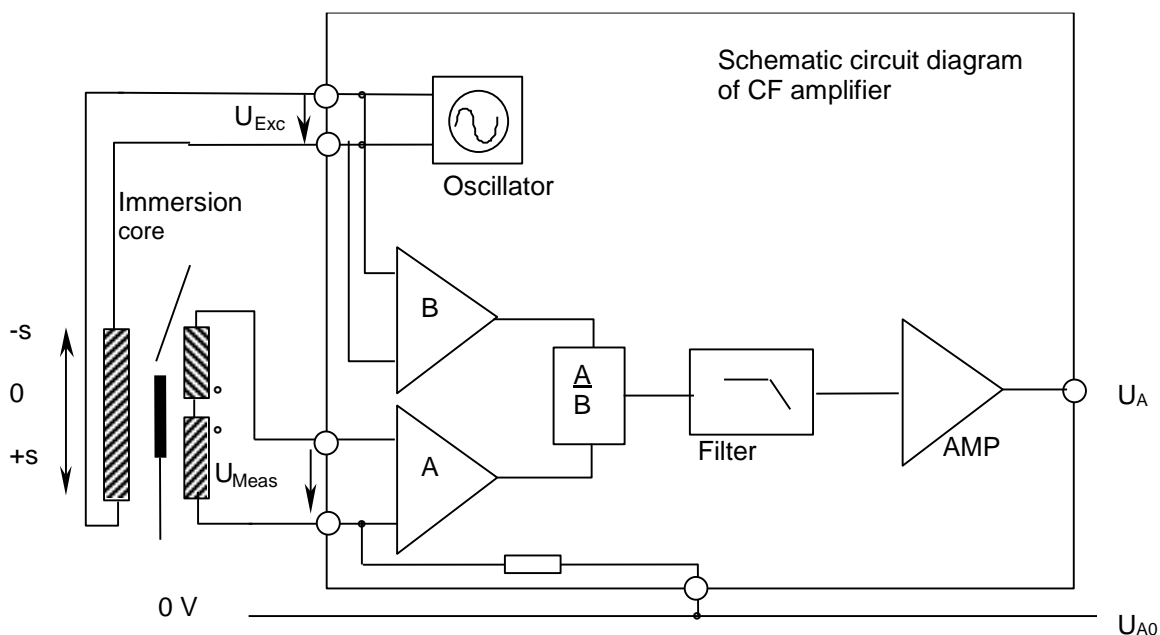


Figure 3 Measuring amplifier with differential transformer

#### 4.3.3 Long-stroke sensor (eddy current principle)

Long-stroke sensors are displacement sensors using a half-bridge circuit. Only one coil is used as the measuring coil. The second coil is designed as a space-saving equivalent circuit. A movable measuring tube (made of a conductive material) changes the impedance of the measuring coil based on the eddy current principle. In contrast to symmetric displacement sensors, the electrical zero of long-stroke sensors is at the start of the nominal stroke (the measuring tube completely covering the measuring coil).

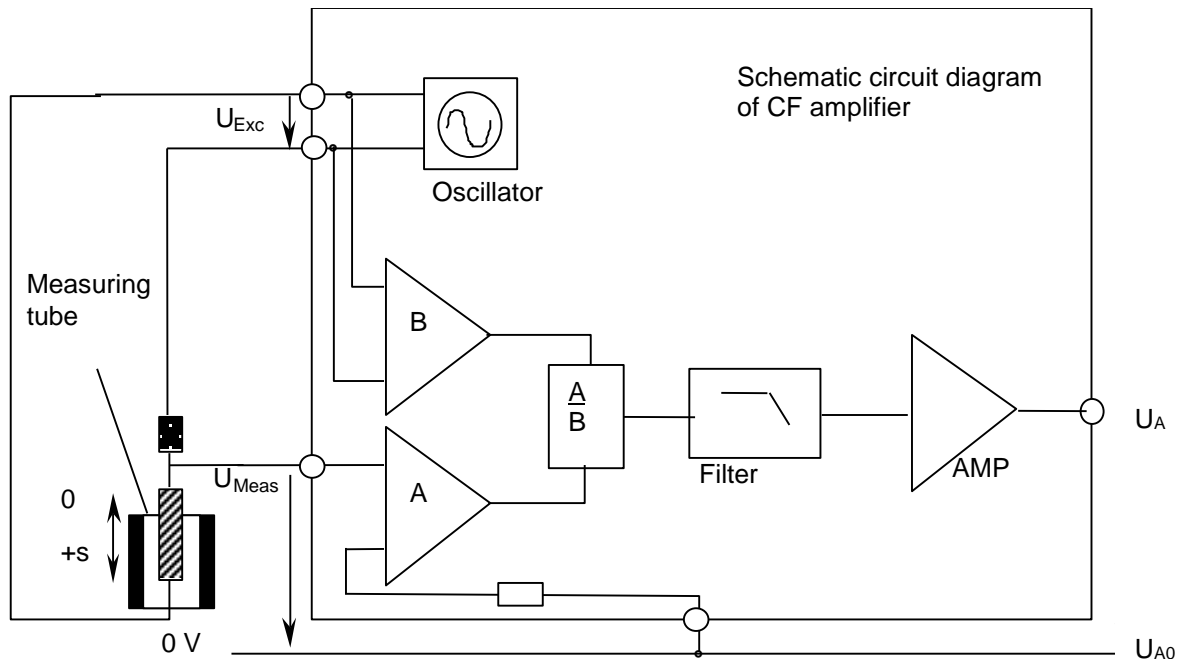


Figure 4 Measuring amplifier with long-stroke sensor

#### 4.4 Overview of types and options

The measuring amplifier is available in the following versions:

<b>MBI 46.13/ x y /zzz</b>	
<b>Power supply</b>	<b>Options</b>
$\pm 15$ VDC 1 5	<b>/nn kHz</b> Altern. carrier frequency in the range (1...20 kHz)
+24 VDC 2 4	<b>/0-10 V</b> Output signal 0...10 V
	<b>/ V6</b> with 6x-preamplifier for sensors with a rated output < 130 mV/V

## 5 Placing into Service

### NOTICE

Only qualified skilled persons are allowed to place the measuring amplifier into service.

### NOTICE

Electrostatic discharge at electronic assemblies can damage the components before they are placed into service. Therefore, take all necessary measures to avoid electrostatic charging (ESD protective measures).

Provided the sensor cable is routed professionally, the distance between the displacement sensor and the measuring amplifier can be 100 m and more.

### NOTE

Do not route the cable in parallel with power lines. In addition, maintain a sufficient distance to electric drives, transformers and frequency converters.

### 5.1 Pin assignment

### NOTICE

The connections are not protected against reverse polarity.

If connections are reversed or if an incorrect external voltage is applied, the device can be destroyed.

The displacement sensors must be connected to the measuring amplifier according to the pin assignment specified in the table below. The power supply, the output signal and the displacement sensor are connected using connecting blocks. Therefore, no soldering is required for installation.

The conductor color code corresponds to IEC 60757:

BU	–	blue
RD	–	red
WH	–	white
BK	–	black
BN	–	brown
YE	–	yellow

Cable	Wire strand	Connection		Assignment
In-Out	RD	+15 VDC	24 V high	Supply voltage
	BU	- 15 VDC	24 V low <sup>1)</sup>	
	BK	0 VDC $U_{A0}$	---- $U_{A0}$ <sup>1)</sup>	reference potential supply reference potential output
	WH	$U_A$		Voltage output $U_A$
Sen- sor	WH	S1		Excitation voltage +
	BU	S2		Excitation voltage –
	BK	M1		Amplifier input +
	RD	M2		reference potential of displacement sensor (LVDTs)

**Figure 5** Pin assignment of measuring amplifier

### NOTICE

1) Please note: At the 24 V-version  $U_{A0}$  and 24 V low are at different potential (difference approx. 12 V). Do not connect them!

If the displacement sensor is connected according to the table above, there is a positive (increasing) output signal, when the core moves out of the displacement sensor or the measuring tube moves downward from the sensor housing. If a negative (decreasing) signal is desired for this direction of movement, switch the connections terminal 5 and terminal 7.

Amplifier	Linear Variable Differential Transformers all Dxx			Linear Variable Inductance Transducer all Wxx except WP			Long-stroke sensor e.g. WP	
	Wire strand	Cable	Plug	Wire strand	Cable	Plug	Cable	Plug
WH	WH (BN)	WH	2 (B)	BU	BU	3 (C)	BU	C
BU	BU	BU	3 (C)	RD	RD	2 (B)	RD	B
BK	BK	BK	4 (D)	WH+YE	WH	1 (A)	WH	A
RD	RD	RD	1 (A)	-	-	-	-	-

**Figure 6** Connection of MESSOTRON displacement sensors

## 5.2 Setting options of the measuring amplifier

The measuring amplifier must be adapted to the displacement sensor used. The following parameters must be set:

- Position of the electrical zero point,
- Phase compensation (possibly caused by the sensor type and the connecting cable),
- Gain (adapt to sensor sensitivity).

At the factory, a **basic configuration** for all three parameters is set in the measuring amplifier. This is achieved by using a variable component assembly (resistors / capacitors) based on:

- a reference displacement sensor, if the sensor type is known,
- the sensor specification provided by the customer,
- the sensor that may have been ordered at MESSOTRON together with the amplifier or

The measuring amplifier must be **adjusted** to the sensor used on site using the trimming potentiometer (see chapter 5.3). The measuring amplifier will be fine-tuned at the MESSOTRON factory, if a sensor is ordered together with the measuring amplifier.

### 5.2.1 Position of the electrical zero point

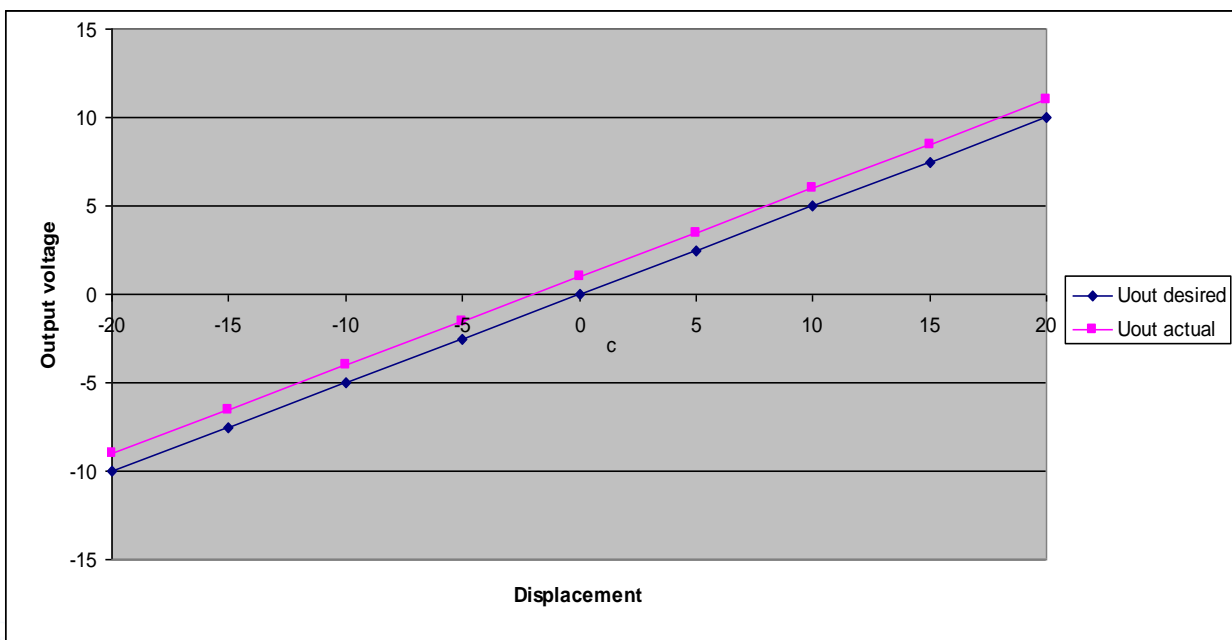


Figure 7 Correction of the zero point

The electric output signal of a real inductive displacement sensor is not always exactly zero at the mechanical zero-point (Dimension A for MESSOTRON displacement sensors). Material and manufacturing tolerances may cause small deviations, which can be compensated using the zero-point potentiometer. Small tolerances in mechanical adjustments of the displacement sensor can be compensated in the same way.

If the zero-point potentiometer is twisted, this will result in a vertical shift of the characteristic curve for measured displacement to output signal.

## 5.2.2 Phase compensation

Due to the design principle, inductive displacement sensors can show a phase shift between the excitation voltage and the measurement voltage.

The measuring amplifier evaluates the ratio of excitation voltage and measuring voltage to suppress any measurement errors due to fluctuations of the excitation voltage. If the phase shift is not compensated, the sensitivity of the sensor can deviate.

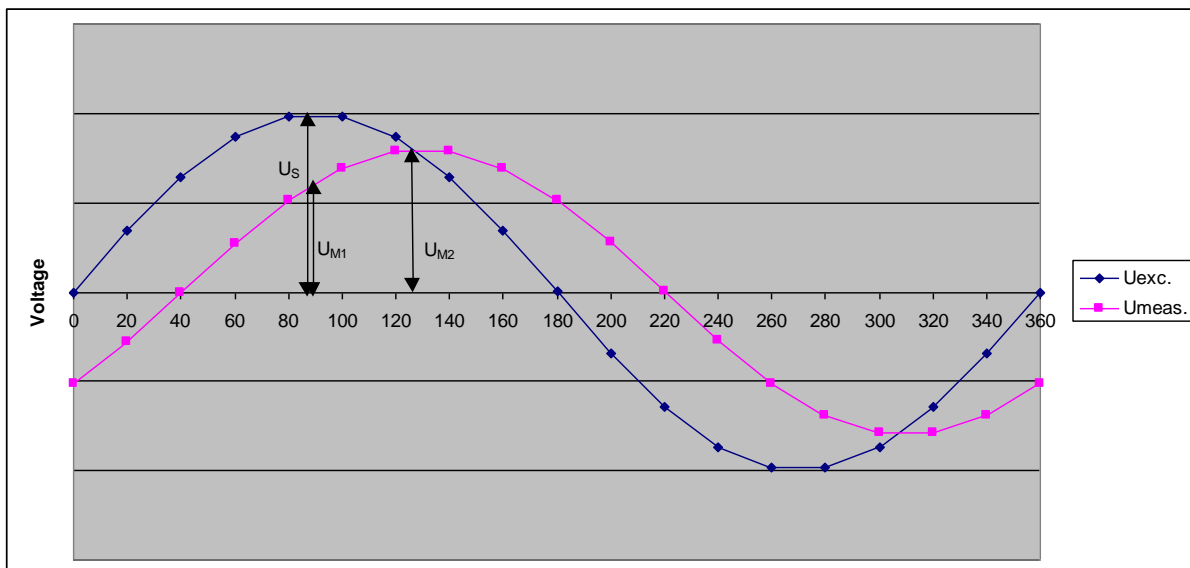


Figure 8 Phase shift

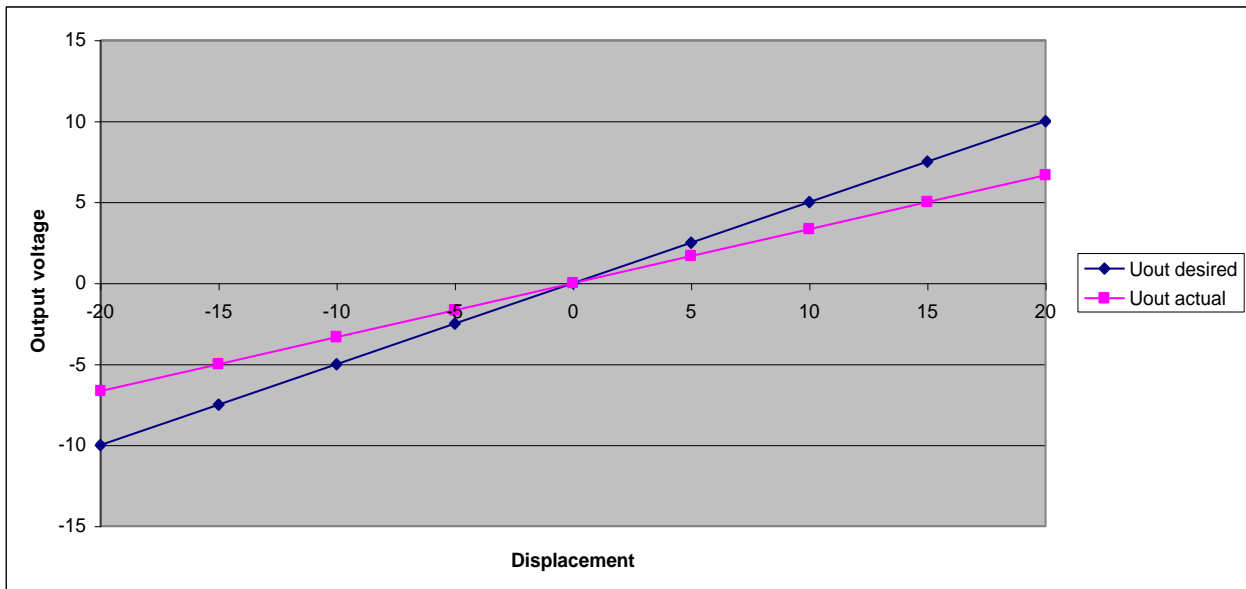
Figure 8 shows that there is a reduced voltage ratio of  $U_{M1}/U_s$  if there is no phase compensation. Phase compensation results in an optimized voltage ratio  $U_{M2}/U_s$ .

The phase compensation of the MBI 46.13 shifts the evaluation of the measurement voltage on the time axis in such a way that the phase position caused by the displacement sensor is compensated and the full sensitivity of the displacement sensor can be used.



### 5.2.3 Gain

To obtain the desired output signal, the gain of the measuring amplifier must be set depending on the rated output of the displacement sensor used. If the output signal does not reach the desired value, e.g. at the end of the nominal stroke, the gain must be increased.



Fig

#### ure 9 Gain correction

A larger gain causes an increase in the gradient of the displacement-to-output-signal characteristic curve (or a counter-clockwise rotation of the characteristic curve).

### 5.3 Adjustment using trimming potentiometer

**NOTE**

Make sure that the basic configuration of the measuring amplifier is suitable for the displacement sensor used.

Using the trimming potentiometers, the measuring amplifier can be adjusted to the displacement sensor within certain limits. Likewise, small tolerances in adjustments of the displacement sensor can be compensated in the same way.

**NOTE**

The measuring amplifier will only show its nominal characteristics after a warm-up time of approximately 15 minutes.

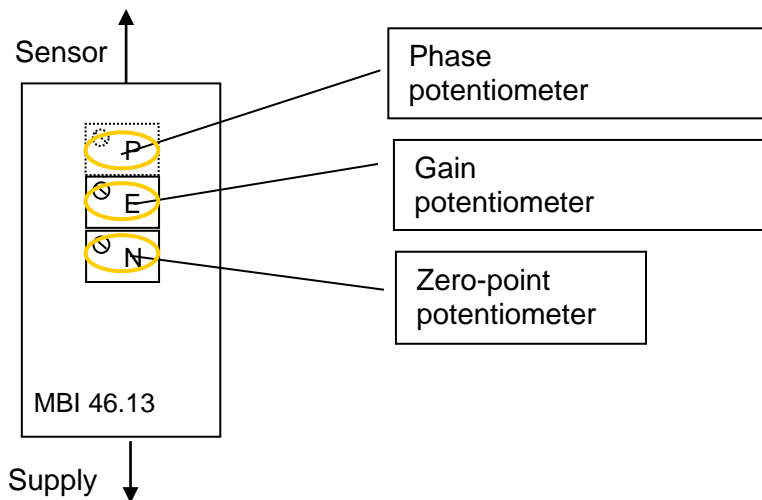


Figure 10 Location of trimming potentiometers

### 5.3.1 Adjustment for symmetric displacement sensors

With symmetric displacement sensors, the electrical zero is at the center of the nominal stroke. Typically, the voltage output of the measuring amplifier provides a symmetric output signal (-10 V...0 V...+10 V) for a symmetric displacement sensor.

- To **adjust the zero point**, remove the core from the sensor housing and set the output signal of the measuring amplifier to **0 V** using the zero-point potentiometer  $P_0$ . Reinsert the core into the displacement sensor and secure the core to retain the output signal. Small corrections are permitted when using the zero-point potentiometer after the mechanical adjustment

If you cannot set the zero point as described above, then alternatively bring the core into the position where the displacement sensor provides the same value with the usual connection as well as with switched excitation wires (terminal 5 and terminal 7).

- To **adjust the phase (option)**, move the core to a position just before the end of the (nominal) measuring range. Then set the maximum of the output signal using the phase potentiometer  $P_{Ph}$ . If the output signal is no longer close to the desired value, adjust the gain, if necessary.
- To **adjust the gain**, move the core to the end of the (nominal) measuring range and use the gain potentiometer  $P_E$  to set the voltage to the desired value (usually **10 V**). Then check the setting at the start of the nominal measuring range and correct slightly, if required.

### 5.3.2 Setting instruction for asymmetric displacement sensor (e.g. type WP)

The electrical zero of asymmetric displacement sensors is typically at the start of the nominal stroke. Usually measuring amplifiers for asymmetric displacement sensors are set to provide an output signal of 0...10 V in the (nominal) measuring range of the displacement sensor.

- To **adjust the zero point**, move the measuring tube of the displacement sensor into the mechanical zero position (dimension "A") according to the data sheet. Then set the output signal of the measuring amplifier to **0 V** using the zero-point potentiometer  $P_0$ .
- To **adjust the phase (option)**, move the measuring tube to a position just before the end of the (nominal) measuring range. Then set the maximum of the output signal using the phase potentiometer  $P_{Ph}$ . Adjust the gain, if necessary. Then check and correct the zero-point adjustment, if necessary.
- To **adjust the gain**, move the measuring tube to the end of the (nominal) measuring range and use the gain potentiometer  $P_E$  to set the output signal to the desired value (usually **10 V**).

### 5.4 Optimizing the linearity characteristic of the measuring chain

The procedure for adjustment described in the previous chapters applies to a measuring chain with an "ideal displacement sensor" without linearity deviation.

Some real displacement sensors show a distinctive "one-sided" linearity deviation. In these cases, the linearity behavior of the measuring chain can be further optimized taking into account the respective measuring task.

Figure 11 shows the typical linearity characteristic of a symmetric displacement sensor, as determined following the setting of the measuring amplifier as per the steps described above. The maximal linearity error in the measuring range considered is 0,5 %. It is zero in the middle and at the end of the measuring range.

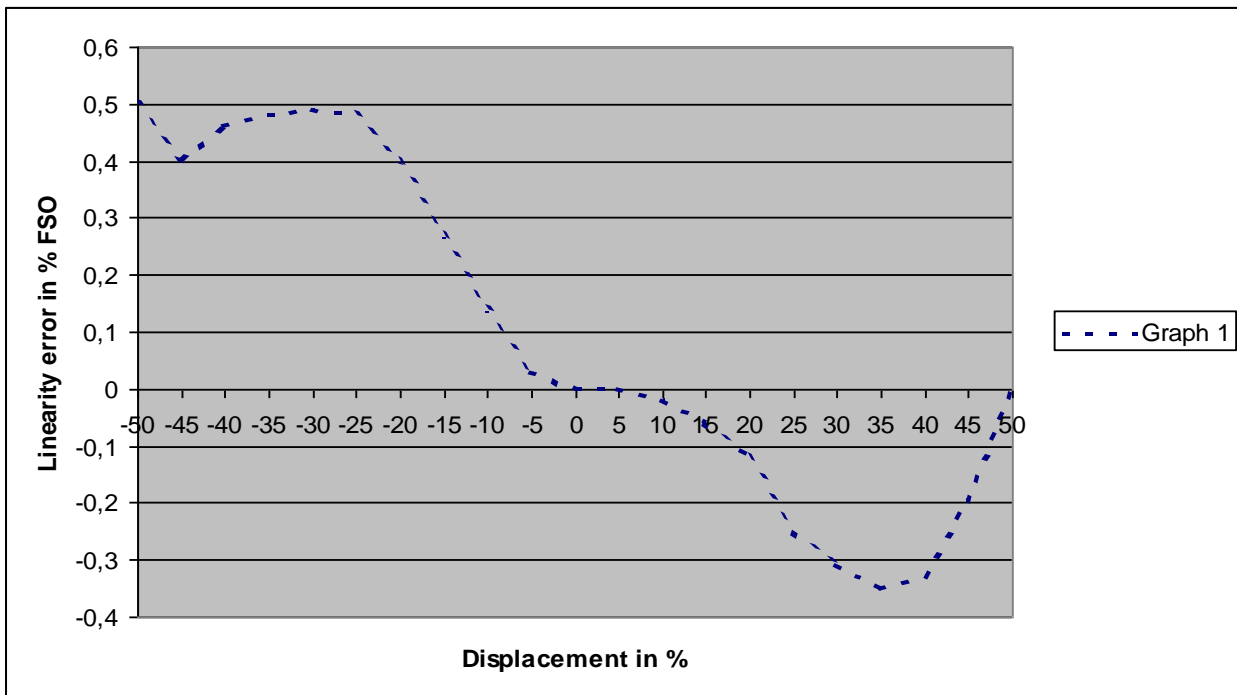


Figure 11 Typical error curve of a displacement sensor, zero-error setting at the zero point and at the end of the measuring range

### 5.4.1 Optimization with the smallest possible error in the zero point

If the measuring task mainly requires a minimum error at the zero point of the displacement sensor, then the maximum deviation needs to be reduced in the measuring range.

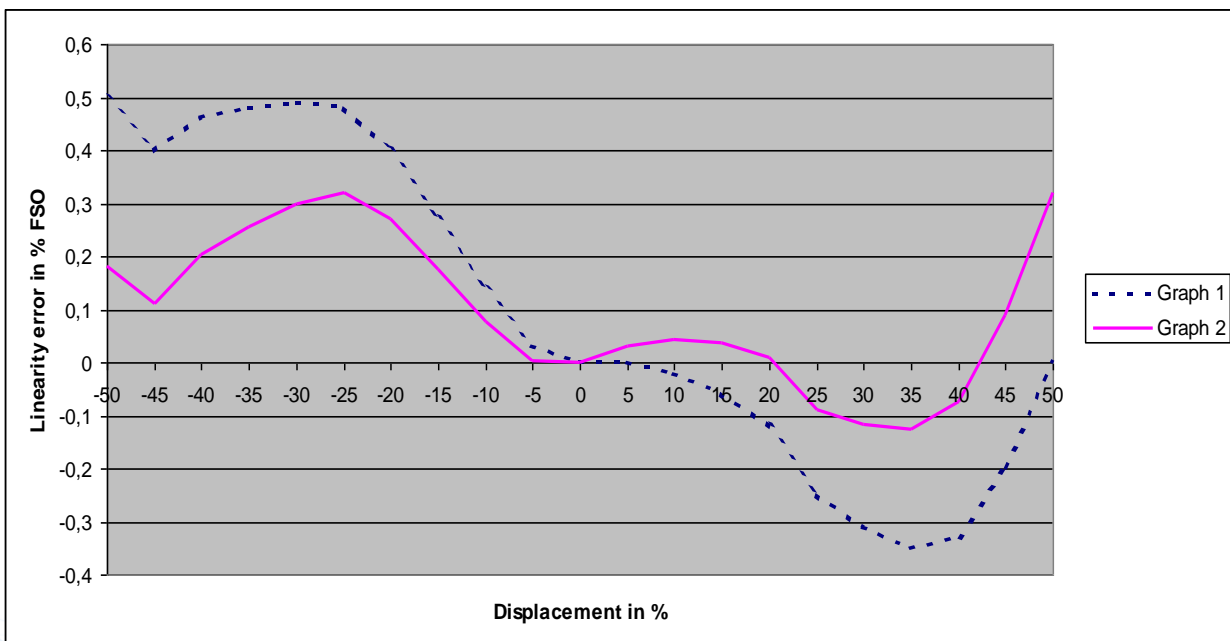


Figure 12 Ideal zero point, max. linearity error reduced to 0.32 %

- To do so, reduce the gain in small steps. This causes a “rotation” of the linearity curve around the zero point. The zero-error setting at the end of the measuring range is given up.

### 5.4.2 Minimal error over the entire measuring range

Some measuring tasks do not require a certain measuring point to show a higher accuracy than others. In these cases, you can reduce the maximum linearity error in the entire measuring range further by giving up the zero-error setting in the zero point.

- Offset the linearity curve by slightly adjusting the zero-point potentiometer, until the maximum positive and negative deviation are of equal in magnitude.

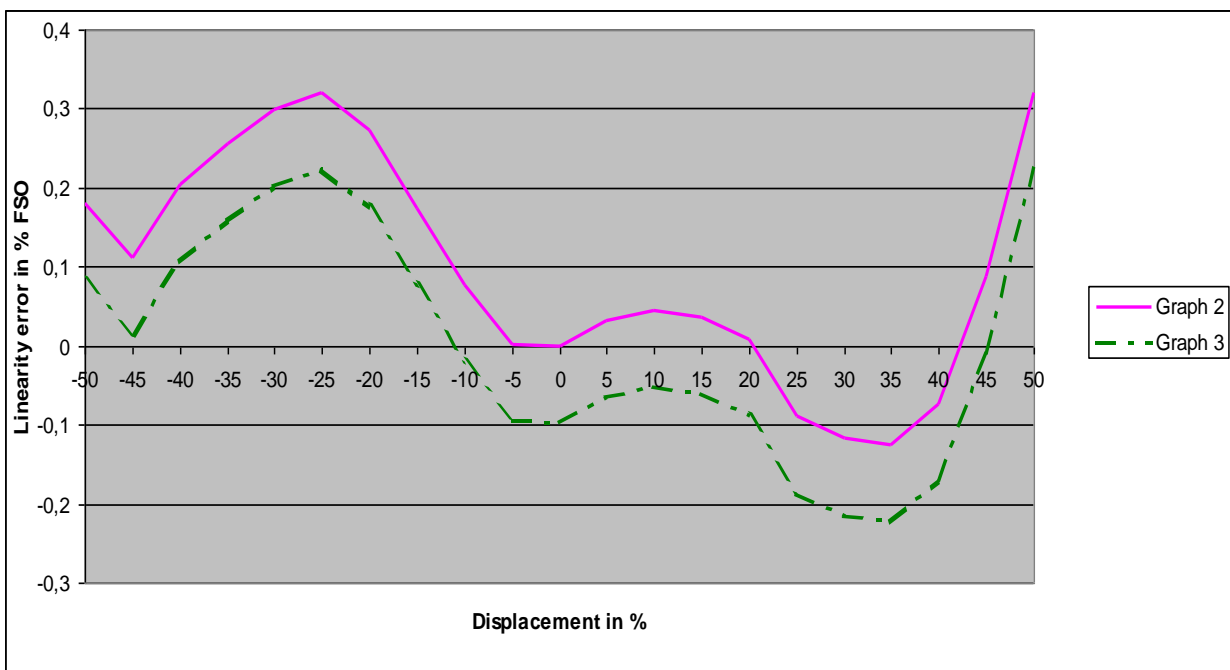


Figure 13 Smallest deviation (max. 0.22 %) over the entire measurement range

### 5.4.3 Other linearity optimizations

You can further optimize the system depending on the measuring task by similar methods to those described in chapter 5.2.1 and 5.2.2. For instance, graph 4 shows the linearity characteristic of the measuring chain if the measuring amplifier is set to minimum deviation at the beginning and the end of the measuring range.

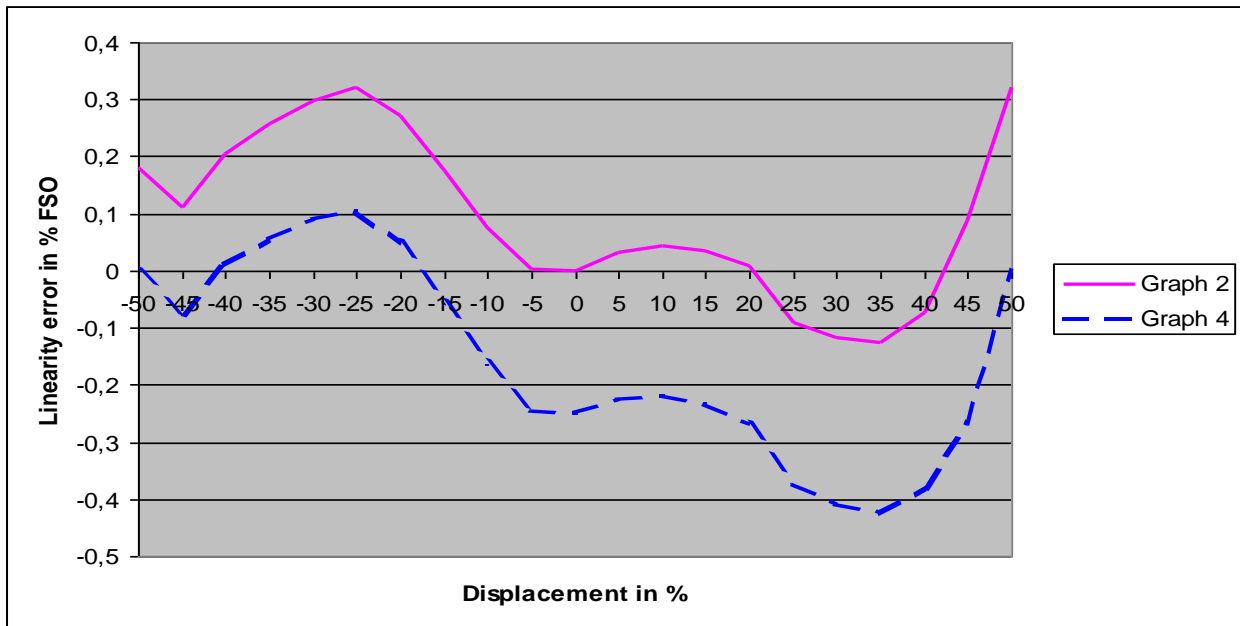


Figure 14 Zero-error setting at the beginning and the end of the measuring range

<b>NOTE</b>	To set the measuring amplifier according to these instructions, the linearity curve of the displacement sensor must be determined. As an option for all MESSOTRON displacement sensors, you can receive test reports with the linearity curve (according to 5.4.1).
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## 6 Operation

The MBI 46.13 measuring amplifier is designed for unattended continuous duty. To take the measuring amplifier out of service, it must be disconnected from its voltage supply.

## 7 Repairs

### **NOTICE**

Never try to repair a defective measuring amplifier. Repair attempts of any kind will immediately render warranty and liability claims invalid.

MESSOTRON electronics are designed for use in a rough industrial environment. They are designed for years of trouble-free operation.

In case of any malfunction or damage, please contact us by phone or email:

Phone: +49 (0) 6257 999 730

Email: [info@messotron.de](mailto:info@messotron.de)

If required, send the product (freight prepaid) to:

MESSOTRON GmbH & Co KG

Friedrich-Ebert-Str. 37

64342 Seeheim-Jugenheim, Germany

Please enclose a delivery note and a detailed description of the error with all return shipments.

The measuring amplifier can not be repaired. Due to better robustness it is entirely moulded.

## 8 Maintenance

### 8.1 Preventative maintenance

The MBI 46.13 measuring amplifier does not contain any serviceable parts.

### 8.2 Cleaning

When cleaning, note the following:

- To clean the enclosure, only use a soft, slightly moist cloth.

## 9 Disposal

The device, any accessories and the packaging must be disposed of in accordance with the respective national regulations. Observe the national and local regulations regarding environmental protection and the reclamation of raw materials.



## 10 Declaration of EU-Conformity

### EU – Konformitätserklärung Declaration of EU - Conformity / Déclaration de EU - Conformité

#### Hiermit erklären wir, dass die Produkte

Herewith we declare that the products / Nous déclarons que les produits

MBI 46.1x  
MBI 46.31.1x, 46.31.3x  
MBI 46.32.1x, 46.32.3x, 46.32.4x  
MBI 46.33.1x, 46,33.3x  
MBI 46.41.3x  
MBI 46.50.xx  
MBI 50.25.x  
MBI 50.33.x  
MNHCON, MNH $\mu$ CON

die grundlegenden Anforderungen folgender Europäischen Richtlinien erfüllt  
is in conformity with the following European Directives / est conforme à la dispositions de la Directive

**EMV-Richtlinie** 2014/30/EU  
EMC Directive / Directive CEM

nachgewiesen durch die Einhaltung der aufgeführten harmonisierten Normen  
verified by the compliance with the harmonised standards listed below /  
et justifié par le respect des normes harmonisées mentionnées ci-dessous


**EMV** DIN EN 61326-1 (2013)  
EMC / CEM

**Jahr der Anbringung der CE-Kennzeichnung** 2016  
year of declaration / année de déclaration du marquage

#### **MESSOTRON**

Hennig GmbH & Co KG

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## 11 Technical Specifications

### General information

Operating temperature	0...60 °C
Storage temperature	-25...85°C
Electromagnetic compatibility	DIN EN 61326-1

### Measuring amplifier

Linearity error	< 0,1 % FSO
Carrier frequency	5 kHz $\pm$ 5 % (sine); optional 1...20 kHz
Excitation voltage (primary)	approx. 2 V <sub>rms</sub> @ 5 kHz, sinusoidal max. 12 mA <sub>rms</sub>
Input resistance (secondary)	approx. 200 k $\Omega$
Output signal	$\pm$ 10 VDC, ballast resistor > 10 k $\Omega$
Noise level and residual carrier voltage	< 5 mV <sub>rms</sub>
Temperature coefficient of zero point	< $\pm$ 2x10 <sup>-4</sup> / K
Temperature coefficient of gain	< $\pm$ 3x10 <sup>-4</sup> / K
Dynamic bandwidth	500 Hz ( $\pm$ 3 dB) (max. 1/10 of carrier frequency)
Supply voltage	stabilized and filtered +/-15 VDC $\pm$ 10% or +23 ... 30 VDC
Power consumption	approx. 1 W
Electrical connection	cable with colour-coded leads
Dimensions	B x T x H = 38 x 20 x 20 mm
Weight	approx. 0,1 kg

### Suitable sensors

Inductive differential transformers (LVDTs)	with 4-wire technology
Differential inductor (LVITs) and long stroke sensor (eddy current design)	Inductive half bridges with 3-wire technology
Rated output	20...130 mV/ V => / V6 130...600 mV/ V => standard
Input impedance	100...1000 $\Omega$

Subject to alterations. Errors and omissions expected.

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