Mounting Instructions

Inductive displacement sensors

W1EL/0

B 25.W1EL.10 en

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Safety instructions

Use in accordance with the regulations

Displacement sensors in the W1EL series are intended for displacement measurements in situations such as test rigs, press-fit devices or the construction industry. Use for any additional purpose shall be deemed to be **not** in accordance with the intended use.

To ensure operational safety, the sensor should only be operated as described in the Mounting Instructions. It is also essential to observe the appropriate legal and safety regulations for the application concerned during use. The same applies to the use of accessories.

The sensor is not a safety element within the meaning of its use as intended. Proper and safe operation of this sensor requires proper transportation, correct storage, assembly and mounting and careful operation and maintenance.

General dangers due to non-observance of the safety instructions

The W1EL displacement sensor corresponds to the state of the art and is fail-safe.

The sensors can give rise to residual dangers if they are inappropriately installed and operated by untrained personnel.

Everyone involved with the installation, commissioning, maintenance or repair of a displacement sensor must have read and understood the Mounting Instructions and in particular the technical safety instructions.

Residual dangers

The scope of supply and performance of the sensor covers only a small area of displacement measurement technique. In addition, equipment planners, installers and operators should plan, implement and respond to the safety engineering considerations of displacement measurement technique in such a way as to minimize residual dangers. Prevailing regulations must be complied with at all times. There must be reference to the residual dangers connected with displacement measurement technique.

In these mounting instructions residual dangers are pointed out using the following symbols:

Symbol:  **DANGER**

Meaning: **Highest level of danger**

Warns of a **directly** dangerous situation in which failure to comply with safety requirements **will** lead to death or serious physical injury.

Symbol:  **WARNING**

Meaning: **Dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **can** lead to death or serious physical injury.

Symbol:  **CAUTION**

Meaning: **Possibly Dangerous situation**

Warns of a potentially dangerous situation in which failure to comply with safety requirements **could** lead to damage to property, slight or moderate physical injury.

Symbol:  **NOTE**

Refers to the fact that important information is being given about the product or its use.

Symbol: CE

Meaning: CE mark

The CE mark indicates a guarantee from the manufacturer that the product meets the requirements of the relevant EC directives.

Conversions and modifications

The sensor must not be modified from the design or safety engineering point of view except with our express agreement. Any modification shall exclude all liability on our part for any damage resulting therefrom.

Qualified personnel

This instrument is only to be installed by qualified personnel strictly in accordance with the specifications and with the safety rules and regulations which follow. It is also essential to observe the appropriate legal and safety regulations for the application concerned. The same applies to the use of accessories.

Qualified personnel means persons entrusted with the installation, fitting, commissioning and operation of the product who possess the appropriate qualifications for their function.

Accident prevention

The relevant accident prevention regulations of the trade safety associations must be taken into account.

1 Scope of supply

- W1EL/0 with clamp–on strand connection

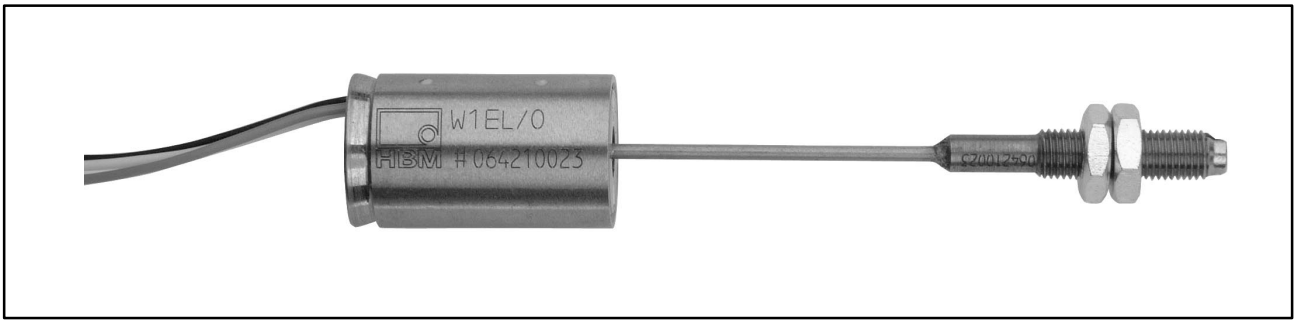


Fig. 1.1: W1EL/0 displacement sensor

2 Introduction

The type W1EL inductive displacement sensors are normally installed, for example in machines, test equipment and measuring instruments. The sensors are available with an accuracy class of 0.2 for 4.8 kHz carrier frequency. The plunger is tuned to the sensor and should not therefore be exchanged for other W1E plungers.

3 Structure, principle of measurement

The sensors comprise the plunger and core unit. The principle of measurement of the W1EL sensors is based on the differential choke principle. The sensor body contains two measuring coils arranged axially one after the other, forming an inductive half bridge. This is supplemented in the carrier frequency amplifier connected to form a full bridge.

The displacement measuring range covers both directions, starting from the zero position up to the nominal (rated) displacement. By moving the plunger, the inductance values of the two coils are changed. The difference in inductance is a measure of the displacement.

4 Instruction for mounting

The centerlines of the sensor body and the plunger must be aligned exactly in the direction of the displacement to be measured. Lateral movements should be avoided. Because of the open construction of the sensor it is possible to look into the core channel for centering the plunger.

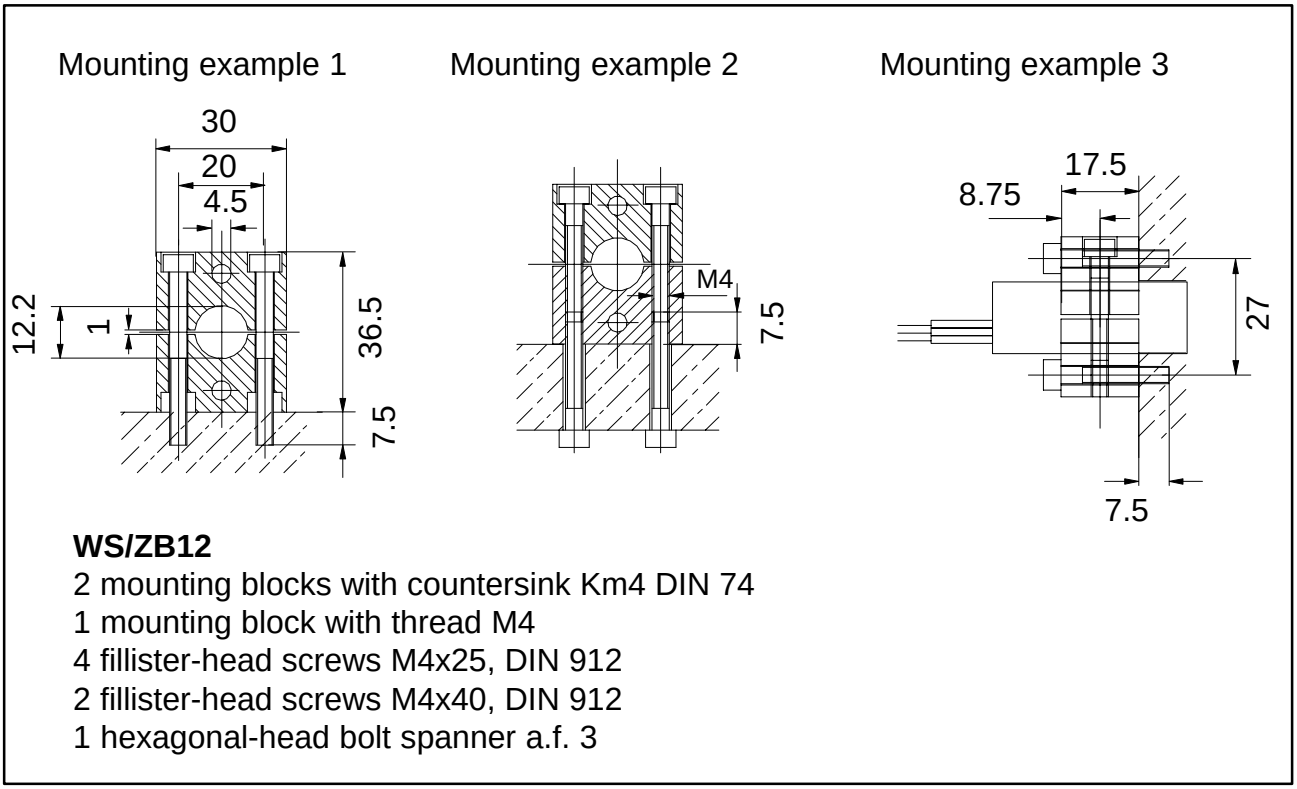
All types can be clamped on the sensor body (diameter 12h8).

The plunger is screwed onto the object to be measured using its threaded section. The thread is designed as a precision thread, permitting correct positioning of the plunger. Two nuts provide fixing and locking.

Fixing the sensor body

Use the W/ZB12 mounting block for fixing the sensor. With long sensors you will possibly have to use two mounting blocks.

Prior to fitting the plunger, connect the sensor body to the amplifier and make the zero balance (see chapter 6 or the resp. amplifier's operating manual). The displacement measuring range should not lie outside the nominal (rated) measuring span, which extends symmetrically on both sides of the plunger's center position.



WS/ZB12
2 mounting blocks with countersink Km4 DIN 74
1 mounting block with thread M4
4 fillister-head screws M4x25, DIN 912
2 fillister-head screws M4x40, DIN 912
1 hexagonal-head bolt spanner a.f. 3

Fig. 4.1: Mounting examples

5 Electrical connection

With the core inserted, there will be a positive unbalance in the bridge (insert in the direction of the connection strands, see Fig. 1.1). With the core extracted, there will be a negative unbalance in the bridge. In the middle of the measuring range the output voltage is zero.

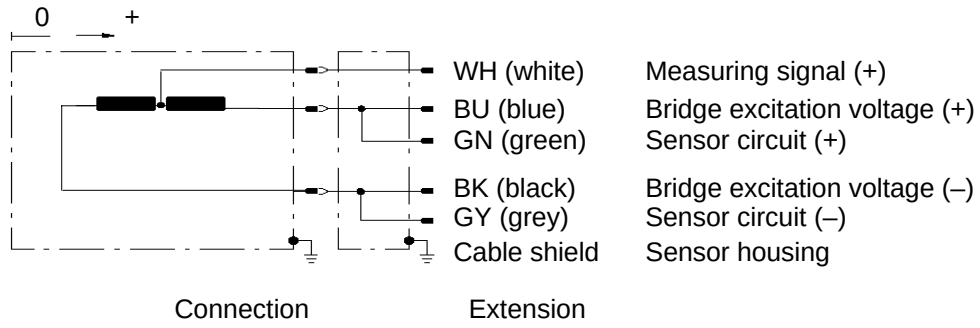


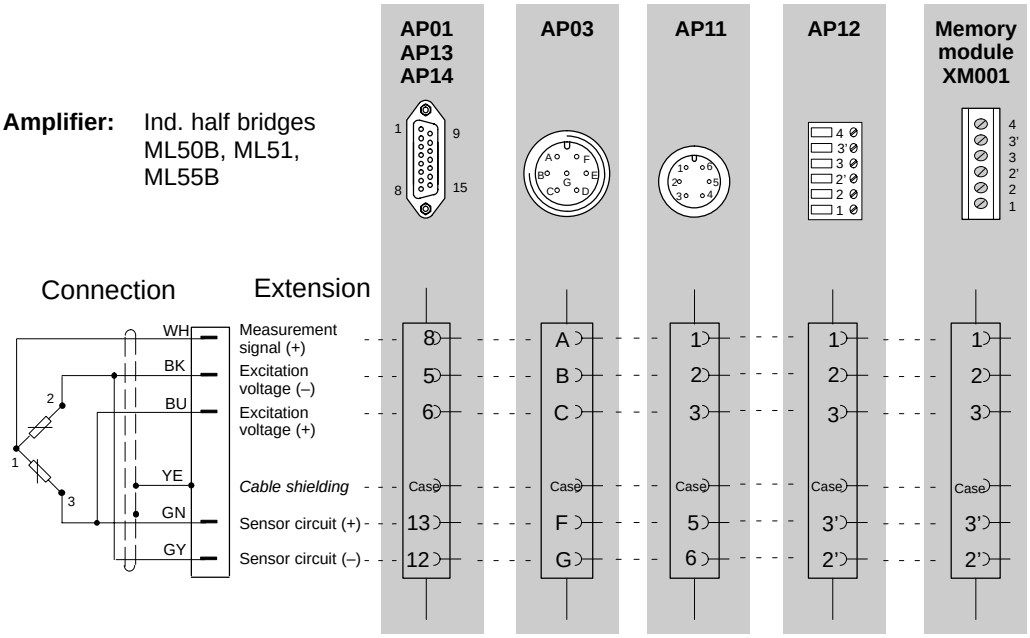
Fig. 5.1: Connection, 3–wire and 5–wire extension

To obtain a small size, the sensor has not been fitted with integrated sensor circuits for operation in six–wire circuit. For operation with a six–wire amplifier, the feedback inputs must be connected to the appropriate bridge excitation lines.

The factory calibration allows for the effect of the permanently mounted four–wire cable.

Cables of up to 100 m length have no noticeable effect on the sensitivity. Up to 600 m this effect is generally lower than 5 %. It can be compensated by direct calibration of the measuring system. The sensor cable should therefore be connected from the outset at the length envisaged for measurement operations.

A prerequisite for measurement is a measuring system (such as e.g. W1EL sensor; Kab 0302–6 cable; ML50, ML51, ML55 MGC amplifier) providing components that are tuned to one another.



Wire colours: WH= white; BK= black; BL= blue; RD= red; YE= yellow; GN= green; GR= grey

Fig. 5.2: Connection diagram

6 Measurement

6.1 Plunger in center position

In the mechanical center position, the output voltage of the amplifier is to be 0 V. This condition is achieved by the following procedure.

a) Fasten the sensor.

b) Connect the sensor (without plunger) to the amplifier.

c) Zero–balance the amplifier (see the amplifier's Operating Manual).

d) Fasten the plunger and insert it axially into the sensor body until the amplifier displays 0 mV/V for the unbalance.

e) If a new measuring range is selected at the amplifier, another zero balance is made in the case of a deviation from the zero point.

From the zero position thus established, you can measure on both sides within the nominal (rated) measuring span. At the amplifier output the nominal (rated) measuring span corresponds to the whole range of the nominal (rated) output voltage from negative to positive.

6.2 Plunger in off–center position

If you choose an initial position differing from the center position, the amplifier must be adjusted to display 0 mV/V for the unbalance in the selected zero position.

a) Determine the center position for which the unbalance at the amplifier input is 0 mV/V.

b) From this position, move the plunger by the desired amount.

c) Adjust the amplifier output signal to zero.

7 Disturbing effects

The carrier frequency method is by nature to a large extent immune to electrical interference. In spite of this, interference at high intensity can falsify the measurement. A typical disturbance arises if the amplifier cannot be zero–balanced at the zero position of the sensor.

The disturbance can enter the measuring circuit:

– electromagnetically – inductively

– galvanically

– mechanically

Recognizing the source of interference is the prerequisite for taking rational countermeasures. Interference is caused chiefly by:

– heavy current lines parallel to the measuring conductor

– relays (contactors) in the vicinity

– electric motors

– potential differences in the grounding system or multiple grounding of the measuring system

– vibrations

7.1 Shielding

Electrical interference in the high–frequency range can be reduced by using shielded cable. HBM measuring cable provides appropriate shielding and, in addition, a symmetric and low–capacitance design.

7.2 Grounding

Multiple grounding of sensor, amplifier and indicating instrument, might possibly result in “ground loops” that falsify the measurement result or make it impossible to measure small signals.

Prior to a measurement you should therefore check if there are any interferences caused by ground loops. For this purpose, first establish an electrically conductive connection between sensor and measuring object and bring the plunger into center position (observe the amplifier’s balancing range). If the sensor now can no longer be zero–balanced this interference signal might possibly be reduced by providing a positive ground.

8 Specifications (VDI/VDE2638)

Sensor type		**W1EL/0**
Nominal (rated) displacement (Nominal (rated) displ. span)	mm	±1 (2)
Nominal (rated) sensitivity (nominal (rated) output signal at nominal (rated) displacement, output not loaded)	mV/V	± 80
Sensitivity tolerance (deviation of sensitivity from nominal (rated) sensitivity)	%	± 1
Nominal (rated) output-signal range	mV/V	160
Temperature effect per 10 K in the nominal (rated) temperature range on the sensitivity (rel. to the actual value) on the zero signal (rel. to the nominal (rated) sensitivity)	 % %	 ±0.2 ±0.05
Linearity deviation (incl. hysteresis rel. to the nominal (rated) output-signal range)	%	±0.2
Nominal (rated) excitation voltage (rms value)	V	2.5 ± 5%
Operating range of the excitation voltage	V	1...6
Carrier frequency	kHz	4.8[1)]
Protection to EN 60529		IP 20
Nominal (rated) temperature range[1)]	°C [°F]	–55...+130 [–67...+266]
Operating temperature range[1)]	°C [°F]	–200...+130 [–328...266]
Sensor weight, approx.	g	11
Plunger weight, approx.	g	3

1) The specified standard connection cables may only be used in the temperature range from –20...+80 °C [–4...176 °F].

Permissible accelerations of the displacement sensors

Sensor type		**W1EL/0**
Permissible acceleration: sensor body	m/s^2	500
Permissible acceleration: plunger	m/s^2	1000

Hottinger Baldwin Messtechnik GmbH

Postfach 10 01 51, D-64201 Darmstadt
Im Tiefen See 45, D-64293 Darmstadt
Tel.: +49/61 51/ 8 03-0; Fax: +49/61 51/ 8039100
E–mail: support@hbm.com www.hbm.com

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