3 Application and design

3.1 Application

The inductive transducers PR9350 or the set K20-315 serve the measurement of static and dynamic displacements and in connection with carrier frequency measuring bridges – of physical quantities (tensile and compressive forces, pressure of gases and liquids, thickness of materials, transverse moments) which may in any way be converted to linear movements by using relevant accessories.

The special features of these transducers are a high resolution over the entire measuring range, small hysteresis, compact construction and the little mass of the tracing pin (solenoid plunger). Thus, the controlling forces on the measuring target may be neglected.

The temperature drift is extremely small because the compensation coil is wound directly over the measuring coil.

Installation of these transducers are imaginably easy. The transducer permits dynamic measurements up to 1250 Hz.

The differential coil of the PR9350 series consists of a coil form with two windings and a tracing pin with a ferromagnetic core which moves within the coil. If the tracing pin is placed precisely in the middle of the coil, the impedance of both windings are identical. The impedance of the windings will increase on one side and decrease on the other side – if the tracing pin with the ferromagnetic core moves from the middle position to one end of the transducer.

By complementing the windings with resistors to a Wheatstone bridge, and by supplying this bridge with a carrier frequency, the measuring output of the bridge reads a voltage which is proportional to the displacement of the tracing pin. The tracing pin is freely movable and has a threaded rod (M3) for the mechanical adaptation to the measuring target. On top of the housing there is a 3-pole Cannon socket for the electric connection. Inductive transducers of type PR9350 or the set K20-315 are preferably used with the A6500-LC LVDT Converter and the A6500-UM Universal Measurement Card.

The PR9350 is available with several measuring ranges from ±12 mm up to ±150 mm.

The set K20-315 consists of a PR9350 sensor mounted in a housing inclusive connection cable.

3.2 Design

Figure 3-1 shows the sensor PR9350/02 with a ±25mm measuring range. The sensor housing is hermetically encapsulated and equipped with a 3-pole Cannon connector. The tracing pin has a M3 thread at the tip for mechanical connection to the measuring object.

4 Mounting and installation

4.1 CSA – Conditions of acceptability

⚠ CAUTION

The sensor PR9350/xx may only be operated with devices that are supplied with safety low voltage (5 V). For this reason a power supply unit is required that meets the specifications of LPS (Low Power Source) according the EN/IEC 60950-1 or LV/LC (Low Voltage/Low Current) according the EN/IEC 61010-1.

In addition, care should be exercised in the physical installation of the sensor. Wrong polarity and/or improper installation can result in false signals, which do not represent actual measured quantities.

4.2 PR9350

For mounting, the sensor PR9350 is equipped with fixing holes with an internal M4 thread. The Figure 4-1 and Table 4-1 shows the dimension of the single sensor type and the position of the fixing holes. The tracing pin will be mechanical connected to the measuring target by means of the M3 thread at the tracing pin end.

Figure 4-1: Dimensions and position of fixing holes

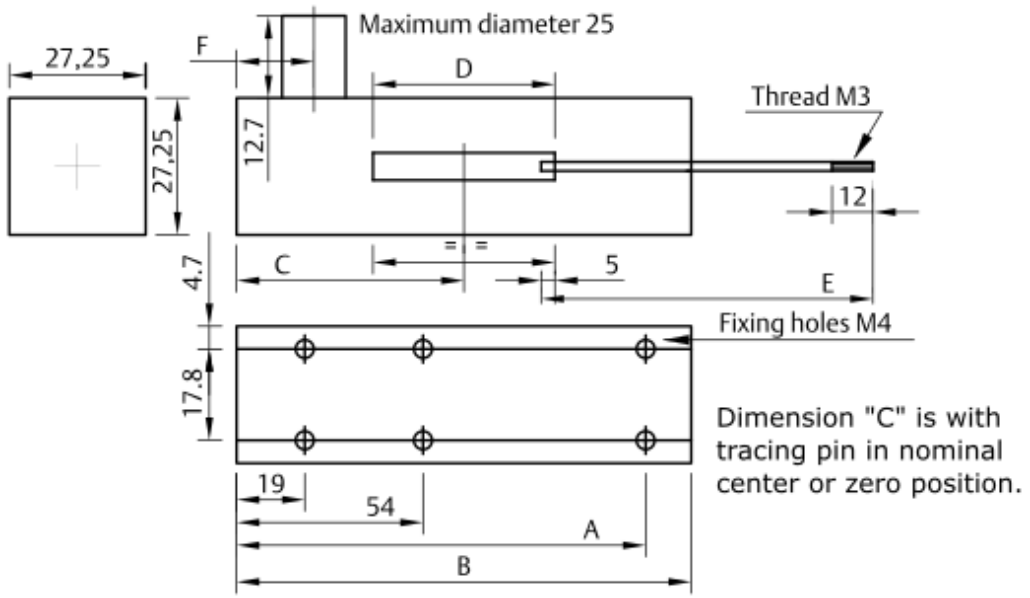
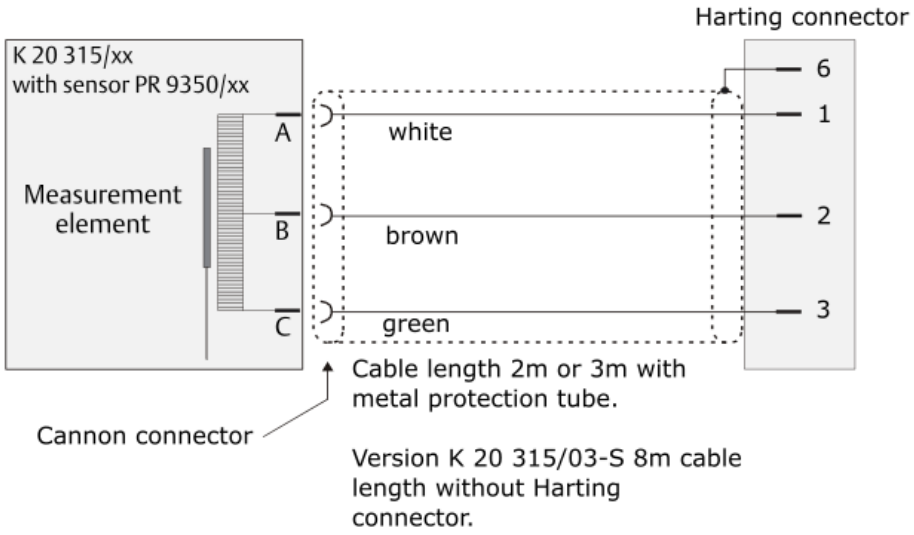


Figure 4-4: Connection diagram Harting connector



PR9350 versions with a fixed cable and open cable end

The following PR9350 versions have a fixed cable with open cable ends.

- PR9350/02-S
- PR9350/02-S1
- PR9350/02-S2
- PR9350/04-S2

The wire colors are assigned to the coil connections as shown in Table 4-3.

Table 4-3: Wire colors – PR9350 versions with open cable end

Color	Meaning
Brown	Coil connection A
White	Coil connection B
Green	Coil connection C
Black	Cable shield, not connected to the sensor housing

4.5 Commissioning

The manuals of the A6500-LC LVDT Converter and the manual of the A6500-UM Universal Measurement Card contain further information regarding commissioning and installation of PR9350 sensors and the K20-315 set.

5 Function check

The PR9350 sensor can be checked by measuring the internal sensor resistance at the connection terminals of the sensor (for pin assignment see Figure 4-3). This resistance is an indicator for sensor problems. Table 5-1 shows resistances and their meaning.

⚠ CAUTION

Before starting this work, inform the responsible specialist and, if necessary, let them deactivate the machine protection.

Having finished the work, the machine protection has to be reactivated immediately by the responsible staff.

Table 5-1: Coil resistance

Resistance	Meaning / Error
0 Ω	Short circuit
PR9350/01 ≈ 38.4 Ω ... 40.6 Ω [between A and C] ≈ 19.2 Ω ... 20.3 Ω [between A and B / B and C]	Internal resistance → OK
PR9350/02 ≈ 66.0 Ω ... 73.6 Ω [between A and C] ≈ 33.0 Ω ... 36.8 Ω [between A and B / B and C]	
PR9350/04 ≈ 46.0 Ω ... 54.0 Ω [between A and C] ≈ 23.0 Ω ... 27.0 Ω [between A and B / B and C]	
PR9350/06 ≈ 61.6 Ω ... 69.8 Ω [between A and C] ≈ 30.8 Ω ... 34.9 Ω [between A and B / B and C]	
PR9350/08 ≈ 65.4 Ω ... 70.6 Ω [between A and C] ≈ 32.7 Ω ... 35.3 Ω [between A and B / B and C]	
PR9350/12 ≈ 35.2 Ω ... 49.2 Ω [between A and C] ≈ 17.6 Ω ... 24.6 Ω [between A and B / B and C]	
∞ Ω	Cable break Connection to the sensor has been interrupted

6 Technical data

Only specifications with tolerances or limit values are guaranteed. Data without tolerances or without error limits are for information only and not guaranteed. Technical modifications are subject to changes without notice.

Sensitivity	
Diagonal voltage, bridge output per 1V supply voltage	
PR9350/01	110 mV/V
PR9350/02	270 mV/V
PR9350/04	270 mV/V
PR9350/06	310 mV/V
PR9350/08	310 mV/V
PR9350/12	340 mV/V

Measuring range	
PR9350/01	-12 mm ... 0 ...+12 mm
PR9350/02	-25 mm ... 0 ... +25 mm
PR9350/04	-50 mm ... 0 ... +50 mm
PR9350/06	-75 mm ... 0 ... +75 mm
PR9350/08	-100 mm ... 0 ... +100 mm
PR9350/12	-150 mm ... 0 ... +150 mm
K20-315/01	-12 mm ... 0 ...+12 mm
K20-315/02	-25 mm ... 0 ... +25 mm
K20-315/03	-25 mm ... 0 ... +25 mm
K20-315/03-S	-25 mm ... 0 ... +25 mm
K20-315/10	-50 mm ... 0 ... +50 mm
K20-315/11	-50 mm ... 0 ... +50 mm

Sensor supply	
Voltage	5 V_{rms}
Current	27 to 50 mA
Carrier frequency	3 to 5 kHz

Accuracy		
Type	**Linearity error at**	
	100% of measuring range	**60 % of measuring range**
PR9350/01	±3.5%	±1.0%
PR9350/02	±3.5%	±0.5%
PR9350/04	±2.5%	±0.5%
PR9350/06	±2.0%	±0.5%
PR9350/08	±2.0%	±0.2%
PR9350/12	±1.5%	±0.2%
Temperature influence		
On measuring value	< 3%, within whole temperature range -35°C to +120°C	

Nominal inductance (typical values A-C)	
PR9350/01	
Tracing pin ...	
... in middle position	13 mH
... maximum displacement	12 mH
... min displacement	12 mH
... driven out	5.0 mH
PR9350/02	
Tracing pin ...	
... in middle position	19 mH
... maximum displacement	17 mH
... min displacement	17 mH
... driven out	9.2 mH
PR9350/04	
Tracing pin ...	
... in middle position	16 mH
... maximum displacement	15 mH
... min displacement	15 mH
... driven out	7.8 mH
PR9350/06	
Tracing pin ...	
... in middle position	16 mH
... maximum displacement	14 mH
... min displacement	14 mH
... driven out	7.8 mH

Nominal inductance (typical values A-C)	
PR9350/08 Tracing pin ...	
... in middle position	12 mH
... maximum displacement	11 mH
... min displacement	12 mH
... driven out	6.3 mH
PR9350/12 Tracing pin ...	
... in middle position	10 mH
... maximum displacement	10 mH
... min displacement	10 mH
... driven out	5.4 mH

Resistance (Measured between A-B / B-C)	
PR9350/01	19.2 ... 20.3 Ω
PR9350/02	33.0 ... 36.8 Ω
PR9350/04	23.0 ... 27.0 Ω
PR9350/06	30.8 ... 34.9 Ω
PR9350/08	32.7 ... 35.3 Ω
PR9350/12	17.6 ... 24.6 Ω

Environmental conditions	
Permissible temperature	-20°C ... 0 ... +100°C
Temperature for storage and transport	-40°C ... 0 ... +70°C
Vibration and shock	Comply with EN 60068-2-6 and -2-29
Relative humidity	0 ... 95% (non-condensing)
Allowed degree of pollution	Category 2
Over voltage	Category II
Operating altitude	<2000 m above see level
Environmental area	Indoor use only

Mechanical design	
Dimensions	for PR9350/.. see Figure 4-1 for K20-315/.. see Figure 4-2
K20-315/.., spring force on measuring object	/01; /02; /03 and /03-S: max. 3.5 Nm /10 and /11: max. 5.0 Nm

Version	Specification
PR9350/02-S2	• Measuring range: ±25 mm • Fixed cable with open cable ends • Cable length: 10 m • Oil proof
PR9350/04-S2	• Measuring range: ±50 mm • Fixed cable with open cable ends • Cable length: 10 m • Oil proof