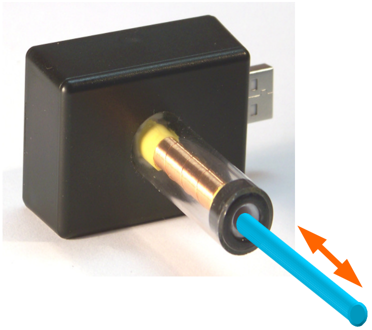
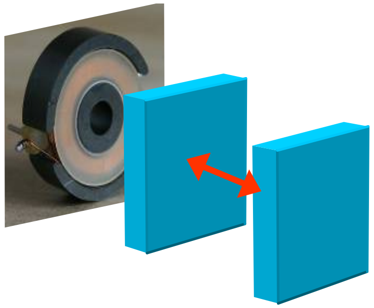
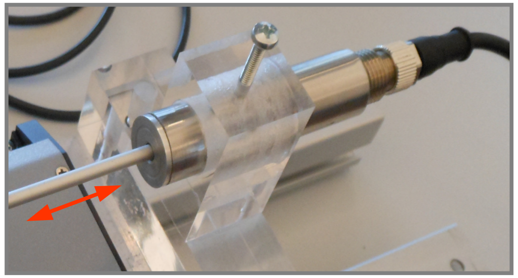
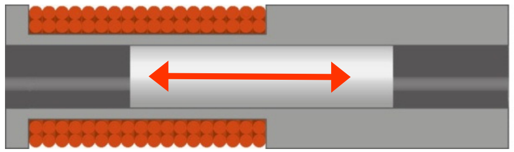
Eddy Current based Displacement / Position Sensing System









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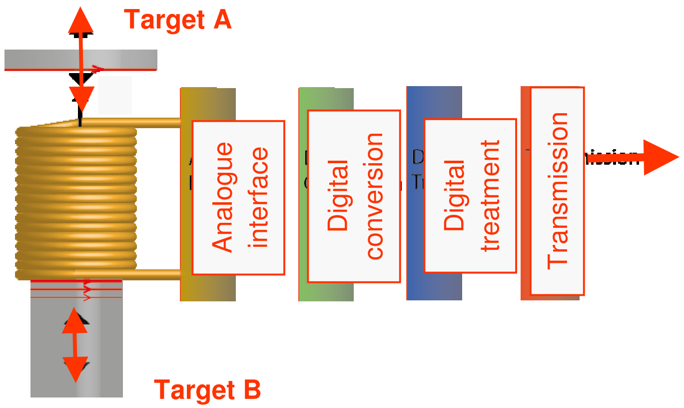
Messtechnik ● Sensorik ● Mechatronische Systeme ● Umweltsimulationstests

Principle of eddy current position sensing technology

An electromagnetic field generated in a coil will induce eddy currents in any electrically conductive target in the proximity of the coil. The resulting power loss in the oscillating circuit is related to several parameters:

- Distance and geometry of the target,
- Electrical conductivity of the target,
- Frequency of the oscillating circuit,
- Magnetic permeability of the target,
- Temperature of the target and the coil.



Due to non-linear dependence of many parameters and their complex interactions, design of the sensor for desired parameter has to eliminate the influence of the others. The easiest way is keeping some parameters constant and performing calibration at the production line.

Main benefits of the eddy current position sensing

- No hysteresis,
- Insensible to external magnetic fields,
- High signal dynamic above 70 dB from a few 100uV to a few Volts,
- Low EMC emission due to clean sine wave resonant frequancies,
- High band width (adjusted to the customer requirements),
- Insensible to dust, oil and other electrically non-conductive materials,
- Does not attract metallic particles,
- Aging is linked only to the aging of electronic components,
- Operating temperature:
  - Sensing head: - 55℃ … +200℃
  - Electronics: linked to the choice of electronic components (it ranges up to extreme high temperature),
- DC power Supply from 4V up to 30V (or more).

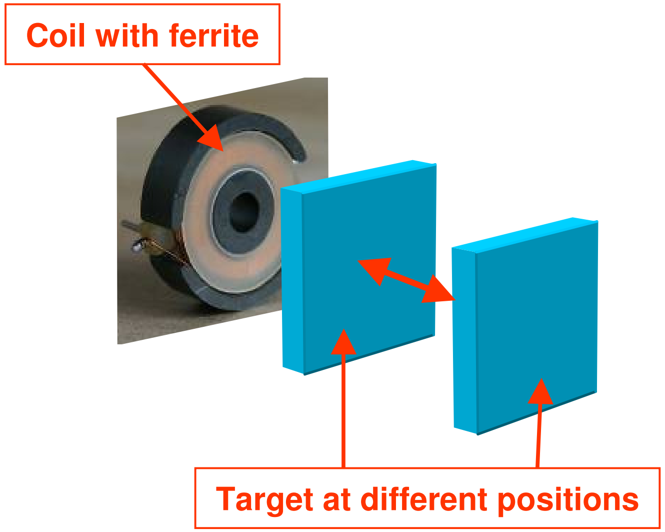
Additional benefits of our sensing system

- Built-in local intelligence,
- Built-in temperature sensor,
- Fast digital data treatment,
- Several sensing ranges can be defined for better accuracy,
- All calibration data stored in the system flash,
- Full self-diagnostics,
- Internal signal verification using two different signal conditioning methods,
- Real time calculation of the target velocity and acceleration,
- Various data transmission interfaces,
- Bi-directional data communication,
- Data transmission of all measured or calculated parameters is possible,
- Sleep down mode,
- DC power supply from 4V up to 30V or more.

Examples: Position sensing in the coil proximity

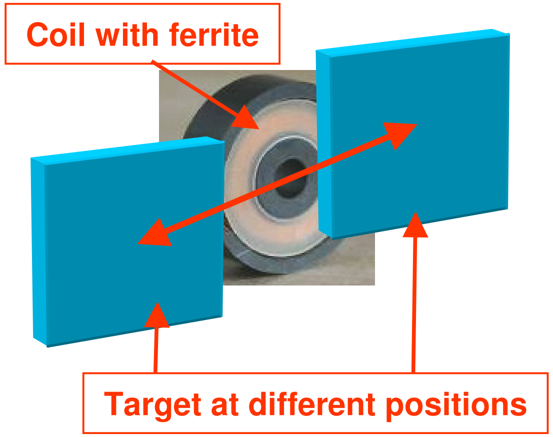
Position sensing example:

Target is moving axially in the coil proximity



Position sensing example:

Target is moving radially in the coil proximity



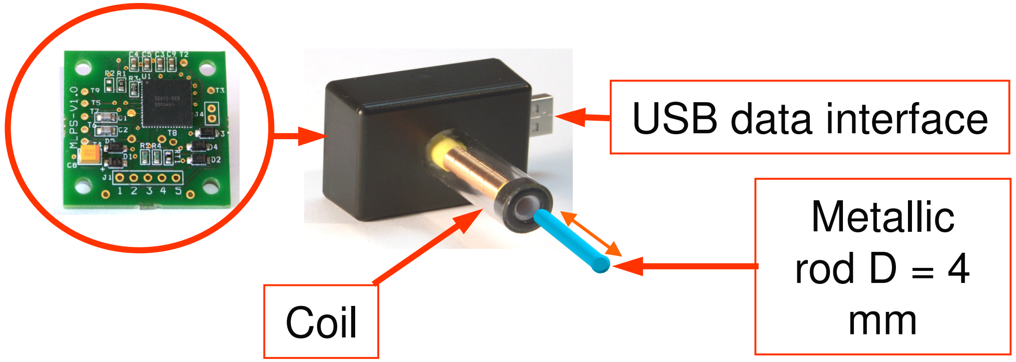
The wound coils as shown above are used up to 200 kHz excitation frequencies. They can be replaced by planar coils on the PCB or any substrate. Due to much lower inductances, planar coils should be driven at higher frequencies (typically 1 MHz to 2 MHz) to achieve high accuracy.

Example: Position sensing within the coil with MLPS

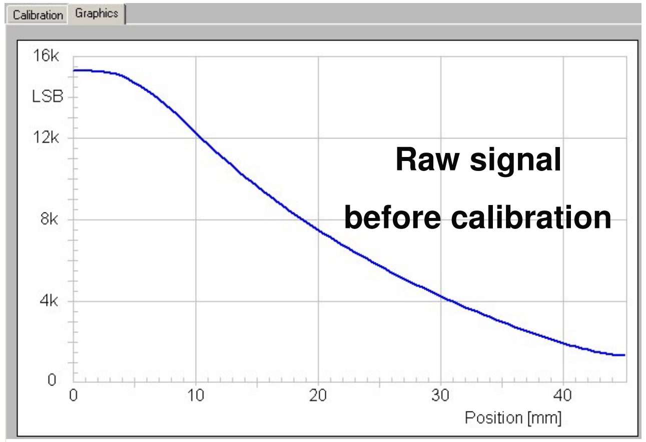
(*M*icroprecision *L*inear *P*osition *S*ensor)

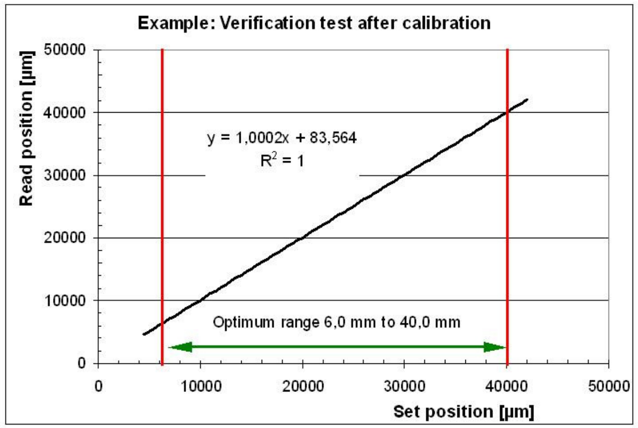
Application: Position sensing of a piston

Metalic rod is connected to a piston and inserted in a coil. The rod will change position according to the position of the piston. The position of the rod will influence damping oscillation in the coil due to eddy-currents created in the rod. The raw signal generated in the conditioning circuitry is not linear and it is influenced by several tolerances. After digital calibration, the measurement result is highly linear.

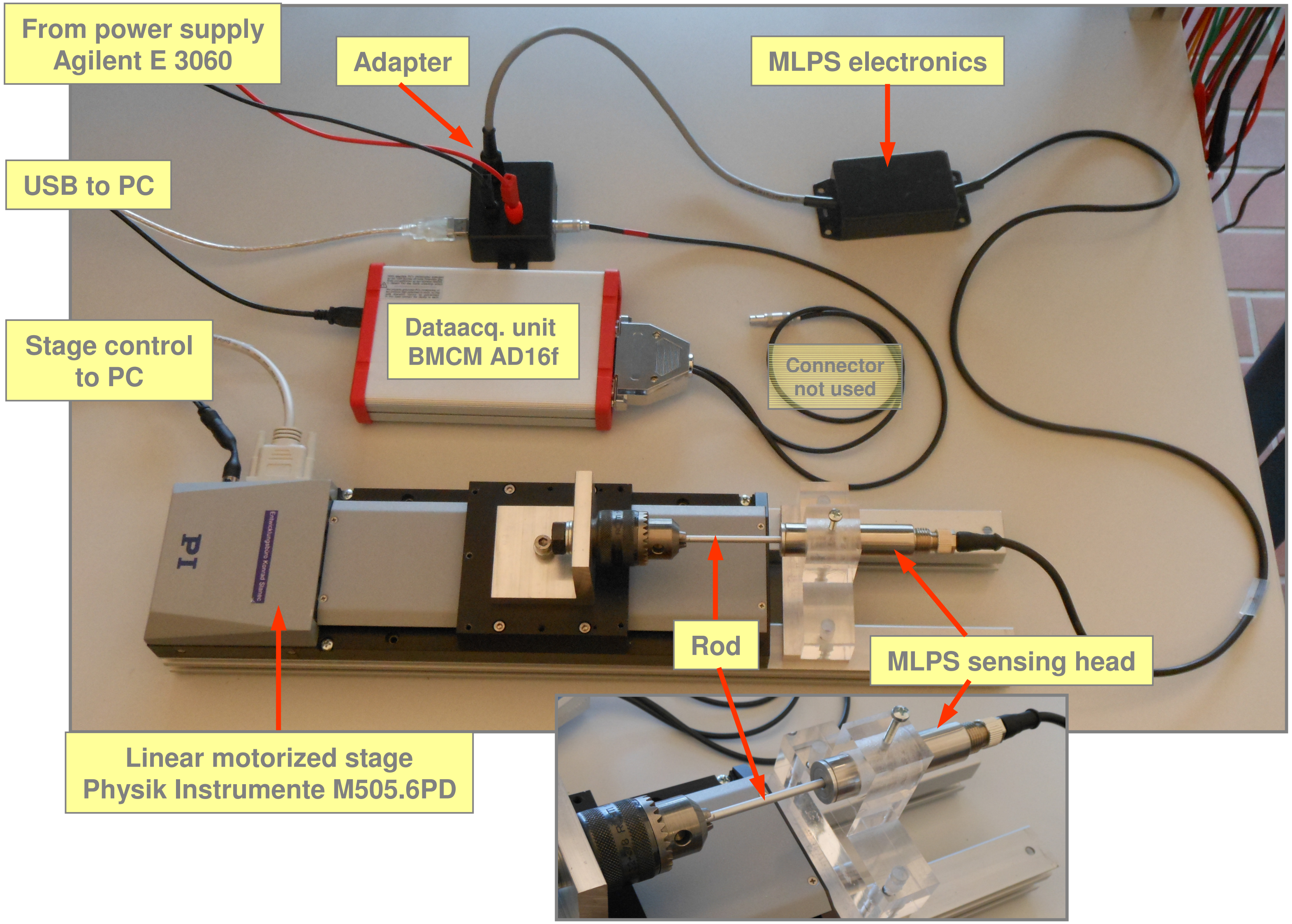


MLPS example:	Coil length = 43 mm		
Range [mm]	Accuracy [µm]	Resolution [µm]	Noise [µm]
40	< +/- 100	< 25	< 50
34	< +/- 50	< 10	< 50





Setup for bench testing and calibration for MLPS



Thank you for your attention!

We are looking forward to receive your requirements!