

## Strain Gage Amplifiers

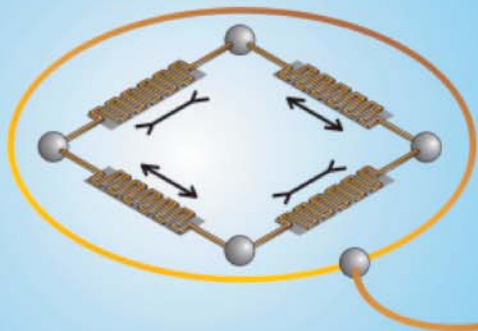
DMS 01

DMS 03

For

High Dynamic  
High Resolution  
Position Measurements

by Piezo Borne Strain  
Gage Detectors



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# Introduction

Strain gage circuits produce very small signals in the mV and  $\mu\text{V}$ -range. A high quality amplifier like the DMS device is needed to convert this original signal into a reasonable standard analog output voltage level (e.g. 5 V) or other kind of usable information.

PIEZOMECHANIK's high quality strain gage amplifiers can handle most strain gage arrangements.

- All kinds of strain gages with a resistance of 350 Ohms up to 5 kOhms can be operated by the DMS amplifiers.
  - The DMS amplifiers are a complete detection units comprising the strain gage electrical supply and the signal detection unit. No other attributes are necessary to run a strain gage measurement.
  - The DMS 01 and 03 amplifiers show high resolution capability down to a strain variation  $< 10^{-6}$  and high dynamics with a 30 kHz bandwidth.
  - The DMS amplifiers are stand-alone devices. This allows to locate the amplifiers rather near to the strain gage arrangement independently of other piezo-electronics. Hereby, any electrical noise pick up due to long distances from gage to amplifier is strongly reduced
- Therefore, the strain gage amplifiers DMS are excellently suitable to be combined with piezo actuator borne strain gages for high resolution, high dynamic position monitoring.

Check also PIEZOMECHANIK's actuator catalogues for option "position detection"



*Fig. 1  
Strain gage amplifier DMS 01  
connected to a piezo actuator with option position sensing and SVR piezo amplifier*

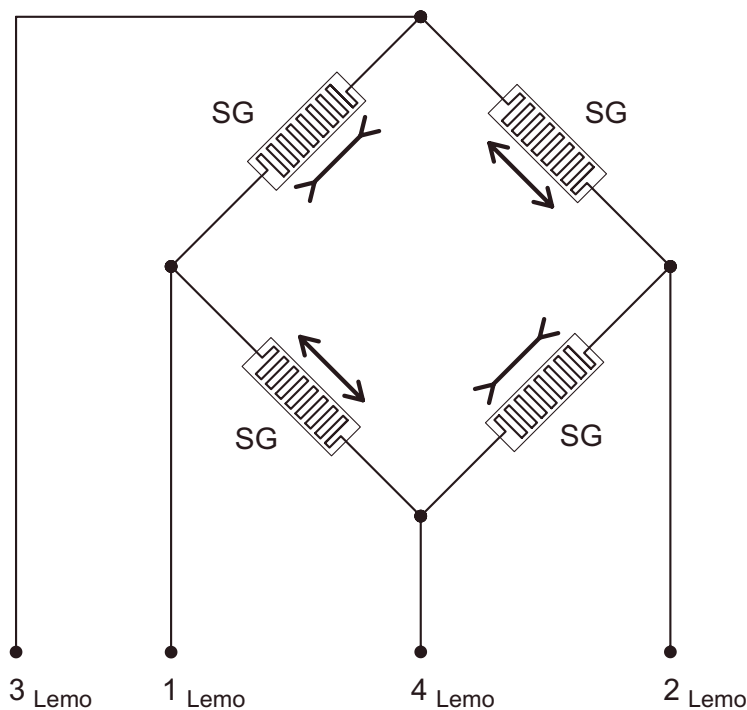
# Strain and Position Detection

Strain is the relative lengthening/deformation  $\Delta L/L$  of a solid body of length  $L$ . Such a deformation can be induced by the application of a mechanical load force or as for piezo actuators: by the application of an electrical signal to PZT ceramics.

Strain gages are highly sensitive elements with a strain resolution of  $10^{-6}$  or even better, provided an optimum matched signal electronics like the DMS is used for signal processing. A piezo stack actuator shows typically a strain of 0.1%. So strain gages are able to resolve the piezo motion down to  $10^{-3}$  or even better.

► Piezo motion can be detected with a sensitivity down to the nanometer range.

The response time of strain gages is very fast down to  $\mu$ -seconds. To make use of this feature, a strain gage amplifier like the DMS showing a sufficiently wide bandwidth is required.



*Fig. 2*  
*Schematic view of a Wheatstone strain gage bridge.*  
*The use of 4 active elements ensures highest strain sensitivity*  
*Connections 1, 2: gage supply voltage (e.g.+ 5 Volts)*  
*Connections 3, 4: bridge signal output ( $\mu$ V to mV range)*  
*(For other arrangements like half-bridges or 2-quarter bridges*  
*see manual or contact PIEZOMECHANIK).*

# Technical Data

- **General**

The DMS amplifier corresponds to the sensor signal processing unit of the "PosiCon" feedback control. The wiring schemes of the strain gage bridges are identical for both devices.

- **Strain gage connection**

Connector: 4-pole LEMO 0S.304

for connecting following functions

- supply of a highly stabilized +5 V driving voltage to strain gage bridge
- transfer of strain gage signal to amplifier

- **Analog Signal Output:**

0V/+5V equivalent piezo actuator's max. strain

Impedance: 1 kOhms

Connector BNC

- **Readout**

3 1/2 digit LC-display

## Amplifier adjusts via mini-potentiometers

- **Zero setting**

The absolute length of a piezo stack varies with the preload conditions during mounting, thermal status etc.

Therefore a zero point setting procedure can be carried out for piezo actuator's operation to compensates for all mechanical offsettings during the installation of the actuator.

- **Variable gain**

The original signal height of a strain gage arrangement depends mainly on the strain gage characteristics (k-factor) and the number of active bridge elements (full bridge, half bridge, 2-quarter Bridge etc).

The DMS-amplifiers shows a variable gain adjust for adapting the DMS output exactly to 0V / +5V range for a defined piezo stroke/strain.

- **Calibration of display for position readout in  $\mu\text{m}$**

A steady or slow varying position with sub-micrometer resolution is shown in terms of fractions of  $\mu\text{m}$  on a large LC-display.

A simple calibration procedure allows the user to adapt the readout to a distinct piezo actuator / sensor configuration.

## Power supply:

Stabilized 12 VDC

## Available Products

### DMS01

Single channel amplifier, dimensions W x D x H (mm) 120 x 120 x 60, weight 350 g (power supply included)

### DMS03

Triple channel amplifier, dimensions W x D x H (mm) 240 x 120 x 60, weight 550 g (power supply included)



Fig. 3  
Strain gage amplifiers DMS01 and DMS 03

### Accessories

- LEMO connectors 0S304 fitting to DMS signal input sockets
- 4-wire cables, shielded with one side LEMO 0S304 connector, 1 side blunt length 1.5 mm (other lengths on request)
- 4-wire extension cables, shielded with LEMO 0S304 connector/coupler length 2 m, 3 m, 4 m



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