How to install a strain gauges
Installation of an strain gauges

Planing the application

<table>
<thead>
<tr>
<th>measured variable:</th>
<th>measuring method:</th>
<th>surrounding:</th>
<th>conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strain</td>
<td>Strain Gauge</td>
<td>laboratory shed in field</td>
<td>stationary mobile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>measured quantity:</th>
<th>conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>material stresses force etc.</td>
<td>static/ dynamic duration frequency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>when</th>
</tr>
</thead>
<tbody>
<tr>
<td>time schedule preparation getting the material</td>
</tr>
</tbody>
</table>
# Installation of an strain gauges

## Planing the application

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Well trained persons available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Conditioning</td>
<td>Amplifier (carrier frequency or DC)</td>
</tr>
<tr>
<td>Strain Gauges (SG)</td>
<td>Selection of suitable gauges (SG-Catalogue)</td>
</tr>
<tr>
<td>Installation Plan</td>
<td>SG-Type, position of SG, selection of adhesive</td>
</tr>
<tr>
<td>Wiring scheme</td>
<td>wire, cable, material to fix the wires....</td>
</tr>
<tr>
<td>Protection for the SG</td>
<td>Protective coating, electrical shielding</td>
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</tbody>
</table>
**Installation of an strain gauges**

**Planing the application**

**Criteria for the selection of material**

<table>
<thead>
<tr>
<th>Strain Gauge</th>
<th>Adhesive</th>
<th>Coating</th>
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</thead>
<tbody>
<tr>
<td>stress state (?-axial)</td>
<td>surface of workpiece</td>
<td>temperature</td>
</tr>
<tr>
<td>temperature</td>
<td>temperature</td>
<td>environment</td>
</tr>
<tr>
<td>range of temperature</td>
<td>duration of measurement</td>
<td>duration of measurement</td>
</tr>
<tr>
<td>adjustment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>material of workpiece</td>
<td></td>
<td></td>
</tr>
<tr>
<td>accuracy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Installation of an strain gauges

Strain gauge application with cold curing adhesiv

• preparation of the workpiece`s surface
• preparation of the strain gauge (and solder tabs)
• bonding with Z70
• wiring
• optical and electrical check of the application
• (protection of the strain gauge application)
• connecting the amplifier CanHead + MGCplus
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Surface-preparation of the metal workpiece

- Initial removal of grease and dirt with household cleansing agent, if required.
- Complete mechanical removal of rust, Oxide etc.
- Levelling the surface by filing and sanding
- Cleaning with RMS1 (Isopropanol & Acetone).
- Roughening of the surface by sanding or sandblasting or chemical
- Marking the position of the strain gauge
- Final cleaning with RMS1 Solvant.
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Roughen the surface by sandblasting

• result: - ideal adhesion
• prerequisite: - pressured air, free of any oil or water
- new, unused blasting material
- material surface completely degreased
• blasting medium: - chose the right grain!
- Corundum (Aluminum Dioxide).
- Boron carbide for extremely hard material

Please follow the manual for the adhesive!
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Roughen by sanding

**Problem:** Sandblasting is impossible

**Solution:** Sanding

- clean the surface with RMS1 solvent to remove grease.
- move the sand paper in circles to avoid sanding orientation.
- always use new sanding paper.
- choose the right grain, for the adhesive and the hardness of the workpiece.

See instructions of the adhesive!
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Roughening and marking

Sanding has to be done in an extensive area around the installation area.
(for Z70 use grain 220)

Sanding has to be followed by **cleaning with RMS1**
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Marking ...

... the strain gauge position with an empty ballpoint.

Never use a sharp scribe.
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Final Cleaning of the Surface

• Clean an extensive area, then work towards the centre.
• Repeat cleaning, until the cleaning pads become dirt free.
• Do not blow away fluff (or similar) with your breath, as it contains grease.
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Preparation of strain gauges and solder tabs

• Cut off tape at one side of the prepared strain gauge, by using scissors or scalpel.

• Lift the strain gauge off and fixing the strain gauge at the material
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Bonding with Z70

Turn up the strain gauge including the solder tabs like a hinge, using your tweezers.

1 ... 2 mm

Strain gauge incl. solder tabs.
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Bonding with Z70

The Z70 cures very fast, therefore keep everything ready that is needed for bonding.

Put on one drop of Z70 and immediately spread with a plastic strip over the installation area.
Installation of an strain gauges

Bonding with Z70

• Put down the strain gauge.
• Cover with the teflon foil.
• Press down with your thumb for 1 minute.

Keep a **stable** pressure over the installation area.

Immediately

Use teflon foil, to prevent your thumb from sticking
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Bonding with Z70

Z70 needs about **10 Minutes** curing time before the tape can be lifted off.

Lift off the tape ...

...from strain gauge in the direction of the solder tabs.
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Testing the Application

Visual testing, look for:

• inclusion of air or particles below the strain gauge.
• insufficient adhesion at the edges of the gauge.
• poor soldering quality.
• residual flux, which may impair insulation resistance.

Insulation testing:

• resistance between the SG connections (120 ohms).
• resistance between the gauge and the workpiece.
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Testing the Application

Insulation resistance

- to be measured between the strain gauge and the workpiece with the Ohmmeter.
- insulation resistance should be about $20.000\,\Omega$ at room temperature.
- A change in the insulation resistance causes an output signal.

This is because the insulation and grid resistances are in a parallel circuit.

The higher the strain gauge resistance, the greater the influence on the insulation resistance, hence we select a lower resistance where possible.
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Testing the Application

Insulation resistance

Example: the reduction of the insulation resistance from 1000MΩ to 1MΩ causes a zero shift of:

- -60µm/m at a 120Ω SG
- -175µm/m at a 350Ω SG
- -350µm/m! at a 700Ω SG
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Protecting the Application

It is a **must** to protect the strain gauge installation from chemical and mechanical influences

What protection is necessary?

To reach **absolute** protection for **unlimited** time, **hermetical sealing** is the only answer
Installation of an strain gauges

Protecting the Application

Questions to ask:

• surrounding environment?

• the operating life of the application?

• the measurement precision required?
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Protecting the Application

Requirements to the coating:

• non corrosive cover - SG250 is acid free.
• must not cause any cheminal reaction with the workpiece, adhesive or strain gauge.
• must not be too stiff, so that it mechanically supports a weak workpiece
Installation of strain gauges

Protecting the Application

The coating should be applied ...

• ... immediately after the strain gauge installation, to avoid contamination.

• ... in a greater area than the adhesive zone, to seal all potential moisture paths.
Installation of an strain gauges

Connection to Amplifier / Testing in Operation
thank you...

... for your attention