Correlation between the resistance and the material of a wire

Set-up with the apparatus for resistance measurements

**Objects of the experiment**

1. Investigating the dependence of the resistance of a wire from its material.

**Evaluation**

The resistance of a wire depends on its material.

Remark:

The material of an electrical conductor is characterized by a matter-specific quantity. That quantity is called specific electrical resistance:

Symbol: $\rho$  
Unit: $\Omega \cdot \text{m} \cdot \text{m}^{-2}$

The resistance of an arbitrary conductor can be calculated from its specific electrical resistance $\rho$, its length $L$ and its cross-sectional area $A$ using: $R = \rho \frac{L}{A}$.

**Table values (at 20°C):**

<table>
<thead>
<tr>
<th>Material</th>
<th>$\rho$ in $\Omega \cdot \text{m} \cdot \text{m}^{-2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constantan</td>
<td>0,50</td>
</tr>
<tr>
<td>Brass (37 % Zn, 63 % Cu)</td>
<td>0,07</td>
</tr>
</tbody>
</table>

**Carrying out the experiment**

- Connect the constantan-wire ($d = 0,5 \text{ mm}$).
- Set a voltage of 0,5 V on the power supply.
- Read current and voltage from the multimeter and write it into the table.
- Repeat the measurement with a brass-wire of identical cross-sectional area and length.
- Calculate resistances $R$ from voltages $U$ and currents $I$ using ($R = \frac{U}{I}$).

**Measuring example**

<table>
<thead>
<tr>
<th>Material</th>
<th>Voltage $U$ in V</th>
<th>Current $I$ in A</th>
<th>Resistance $R$ in $\Omega$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constantan</td>
<td>0,50</td>
<td>0,20</td>
<td>2,50</td>
</tr>
<tr>
<td>Brass</td>
<td>0,50</td>
<td>1,40</td>
<td>0,36</td>
</tr>
</tbody>
</table>