Metso Conductivity Modules
2800 for sensor series 9400 and 9500

- Plug-in modules – easy service
- Exchangeable scales with concentration reading
- Remotely controlled range switch
- Bar graph indicator
- Individual temperature compensation
- Accurate mA output
- Tight enclosures of stainless steel or plastic
**4-electrode conductivity measurement**

The conductivity of liquor is determined by the concentration of free ions. The measurement of a specific conductivity can thus be used for concentration measurement and for testing the purity of water. Utilizing the 4-electrode principle for conductivity measuring instruments gives easy installation, minimum maintenance, and accurate on-line readings with short response time.

**Temperature compensation**
In an electrolyte, all ions present will contribute to the conductivity. Different ions will contribute with different amounts, and the amounts will vary with the temperature. When the conductivity is used for the calculation of a chemical concentration, it is necessary to calculate what the conductivity would be at a fixed temperature (the conductivity is temperature compensated). This conductivity is calculated from the measured conductivity and the temperature. As different ions have different temperature dependences, the temperature compensation must be selected to fit the actual application. The temperature is measured with a Pt 1000 resistor located in the sensor.

**Cell constant**
All sensors for module type 2822 are electrically adjusted to cell constant 1.00.

---

**The 4-electrode principle**
With the 4-electrode conductivity principle, the conductivity of the liquor is calculated from the ratio of the current through the liquor and the voltage across a separate pair of electrodes (VE).

The calculated conductivity is unaffected by scaling and polarisation at the electrodes, in other words: It is possible to make accurate conductivity measurements without making heavy demands on the electrode design.

4-electrode conductivity sensors can thus be constructed with a low capacitance between the electrodes to facilitate low conductivity measurements and with small dimensions to minimize mounting requirements.

---

**Conductivity**

![Fig. 2 Conductivity versus concentration for acid, lye and salt solutions in water at 25 °C. 1S/m = 1000 mS/m = 10 mS/cm.](image1)

![Fig. 3 Conductivity curves for beverage products at 25 °C, diluted with water having a conductivity of 100 mS/m (= 1 mS/cm).](image2)
General information
4-electrode conductivity module for mounting in a 19" rack system with eurocard module, height 3HE (132.53 mm), and connectors for use with series 9400 and 9500 sensors. The module has a 20-segment bar graph (50 mm), a current output, and a remotely controlled application switch. The conductivity range and the temperature compensation are set individually for each application.

Conductivity range switch
Switch pos.  0 1 2 3 4 5 6 7
Conductivity 0-1 2 5 10 20 50 100 200 mS/m
0-10 20 50 100 200 500 1000 2000 μS/cm
Switch pos.  8 9 A B C D E F
Conductivity 0-0.1 0.2 0.5 1 2 5 10 20 S/m
0-1 2 5 10 20 50 100 200 mS/cm
1 mS/m = 10 μS/cm. 1 S/m = 1000 mS/m = 10 mS/cm.

Temperature compensation switch
0 0 %/°C Without temperature compensation.
1 1.3 %/°C Acid 1 (HNO₃ 1 %) 0-125 °C
2 1.7 %/°C Lye (NaOH 1 %) 0-125 °C
3 2.1 %/°C STD salt (NaCl) 0-125 °C
4 0.7 %/°C Acid 4 (H₃PO₄ 1 %) 0-125 °C
5 1.0 %/°C Acid 5 (H₂O₂ 1 %) 0-125 °C
6 Sat salt (NaCl 26 %) 0-100 °C
Ref. temperature: Pos 1 to 5 = 25 °C, pos 6 = 10 °C

Indicator
20 segment bar graph, scale length 50 mm.

Application switching
Optocoupler input: 0 V (0 mA): Range A is active 6–26 V DC: Range B is active
Max. voltage versus ground: +/- 26 V.
Input current: 0.45 mA at 6 V, 2.6 mA at 26 V.

Supply voltage
24 V DC ± 20% or 24 V AC ± 20%. Power consumption approximately 1.8 W. The power input is galvanically isolated from the electronic circuit.
Maximum voltage versus ground: 48 V.
Fuse: 160 mA slow-blow (5 x 20 mm).
Power supply effect: <0.1 %.
**Temperature limits**
For specified accuracy: 0 to +55 °C
For operation: -10 to +65 °C
For storage: -40 °C to +70 °C

**Exchangeable scales (optional)**
The conductivity module can be supplied with one or two exchangeable scales to facilitate the reading of the bar graph. Each exchangeable scale specifies the setting of range switch, temperature compensation switch, and the lin / 0-x-∞ switch.

**Sensor cable**
Screened 16-wires, 0.25 mm². Kemotron type 70633. Cable errors approx. 0.02 mS/m (0.2 µS/cm) per cable metre, for cable length up to 35 metres.

**Sensors**
4-electrode conductivity sensors with Pt 1000 temperature element, one 15-pole D-connector.

**Series 9400**
Sanitary sensors, max. temperature 130–150 °C, max. pressure 20 bar.

**Series 9500**
Industrial sensors like series 9200, but with 15-pole D-connector, max. temperature 120–210 °C, max. pressure 20–50 bar.

**CE certification**
EN 50081-1, EN 50081-2, EN 50082-1, and EN 50082-2.

In order to comply with the EMC directive, the following must be observed: The module must be used with one of the following terminal backplanes: Type 419, 412, 414, 415, 416, 417, 418, 443, 445 and it must be connected to a series 9400 or 9500 sensor.
Exchangeable scales

<table>
<thead>
<tr>
<th>Type</th>
<th>Range</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>54010</td>
<td>DK Lin:</td>
<td>Mælk-vand</td>
</tr>
<tr>
<td>54011</td>
<td>DK 0-x-∞°</td>
<td>Mælk-lud-syre</td>
</tr>
<tr>
<td>54013</td>
<td>DL Lin:</td>
<td>Øl-vand</td>
</tr>
<tr>
<td>54014</td>
<td>DK 0-x-∞°</td>
<td>Øl-lud-syre</td>
</tr>
<tr>
<td>54020</td>
<td>S Lin:</td>
<td>Mjølk-vatten</td>
</tr>
<tr>
<td>54021</td>
<td>S 0-x-∞°</td>
<td>Mjølk-lut-syre</td>
</tr>
<tr>
<td>54023</td>
<td>S Lin:</td>
<td>Øl-vatten</td>
</tr>
<tr>
<td>54024</td>
<td>S 0-x-∞°</td>
<td>Øl-lut-syre</td>
</tr>
<tr>
<td>54030</td>
<td>GB Lin:</td>
<td>Miljø-vand</td>
</tr>
<tr>
<td>54031</td>
<td>GB 0-x-∞°</td>
<td>Miljø-caustic-acid</td>
</tr>
<tr>
<td>54033</td>
<td>GB Lin:</td>
<td>Beer-vand</td>
</tr>
<tr>
<td>54034</td>
<td>GB 0-x-∞°</td>
<td>Beer-caustic-acid</td>
</tr>
<tr>
<td>54035</td>
<td>GB 0-x-∞°</td>
<td>NaOH-H₂PO₄-water</td>
</tr>
<tr>
<td>54040</td>
<td>E Lin:</td>
<td>Leche-aqua</td>
</tr>
<tr>
<td>54041</td>
<td>E 0-x-∞°</td>
<td>Leche-lico-acido</td>
</tr>
<tr>
<td>54043</td>
<td>E Lin:</td>
<td>Cerveza-aqua</td>
</tr>
<tr>
<td>54044</td>
<td>E 0-x-∞°</td>
<td>Cerveza-lico-acido</td>
</tr>
<tr>
<td>54085</td>
<td>0-4.5%</td>
<td>H₂SO₄</td>
</tr>
<tr>
<td>54086</td>
<td>0-2.5%</td>
<td>H₃PO₄</td>
</tr>
<tr>
<td>54087</td>
<td>0-0.9%</td>
<td>H₃PO₄</td>
</tr>
<tr>
<td>54099</td>
<td>0-6%</td>
<td>NaOH</td>
</tr>
<tr>
<td>54101</td>
<td>0-4.4%</td>
<td>NaOH</td>
</tr>
<tr>
<td>54102</td>
<td>0-2%</td>
<td>NaOH</td>
</tr>
<tr>
<td>54103</td>
<td>0-1%</td>
<td>NaOH</td>
</tr>
<tr>
<td>54104</td>
<td>0-3.7%</td>
<td>HNO₃</td>
</tr>
<tr>
<td>54105</td>
<td>0-1.8%</td>
<td>HNO₃</td>
</tr>
<tr>
<td>54106</td>
<td>0-0.9%</td>
<td>HNO₃</td>
</tr>
<tr>
<td>54107</td>
<td>0-16%</td>
<td>NaCl</td>
</tr>
<tr>
<td>54108</td>
<td>0-6.5%</td>
<td>NaCl</td>
</tr>
<tr>
<td>54109</td>
<td>0-3%</td>
<td>NaCl</td>
</tr>
<tr>
<td>54094</td>
<td>0-11%</td>
<td>Salinity sea water</td>
</tr>
<tr>
<td>54184</td>
<td>0-200 mS/cm</td>
<td></td>
</tr>
<tr>
<td>54159</td>
<td>0-10 μS/cm</td>
<td></td>
</tr>
<tr>
<td>54199</td>
<td>Blank</td>
<td></td>
</tr>
</tbody>
</table>

Ask for other specific scales
Termination equipment and enclosures

490/2 card frame

Type 490 card frame (84TE) based on Eurocard system (DIN 41 494), 3HE (133.35 mm), 84TE (426.72 mm).

The card frame is delivered ready mounted.

Rails and internal connections are included in the frame, but terminal board 419, plug-in modules 2822, power supply, and blinds have to be ordered separately.

419 terminal board

Power supply

Blinds

Power supply for incorporation in enclosures to supply plug-in modules with 24 V AC, through the included transformer from 230 V or 115 V AC, 12 TE.
**Stainless steel enclosures with swing frame**

Cabinet of stainless steel with pane door. The cabinet is delivered ready-mounted with 19” subracks on the swing frame, which makes it easy to access the terminal strips on the backside of the subracks when opening the swing frame. Rails and internal connections are included in the cabinet, but mounting plates, plug-in modules, power supply, and blinds have to be ordered separately.

**Mounting plates**

Type 412 mounting plate is used for right side mounting of the 2822 module in a plastic junction box or other enclosures. Sensor adaptor - use a hole of min Ø 28.3 mm for a PG21 connection. Type 408 is a mirrored duplicate of type 412, for left side mounting.

**428 Bottom chassis**

Cabinet of stainless steel with pane door. The cabinet is delivered ready-mounted with 19” subracks on the swing frame, which makes it easy to access the terminal strips on the backside of the subracks when opening the swing frame. Rails and internal connections are included in the cabinet, but mounting plates, plug-in modules, power supply, and blinds have to be ordered separately.
Plastic enclosures

1-channel enclosures
Type 414 for wall mounting
Type 415 for panel mounting and
Type 416 for pipe mounting

Technical data
Material: ABS with neoprene packings.
Protection: IP65 splash-proof, DIN 40 050.
Temperature: –40 to +80 °C.
Fire class: 94 lt (combustible).
Power supply: 24 V AC/DC to be screened.
Power consumption: 2 VA.
Sensor connection: D-connector 15-pole.
Sensor cable: PVC type 70633 ~ 16 x 0.25 mm.
 Type 416 a: For pipe diameter 25–38 mm
 Type 416 b: For pipe diameter 35–52 mm
 Type 416 c: For pipe diameter 50–73 mm
 Type 416 d: For pipe diameter 72–94 mm
 Type 416 e: For pipe diameter 82–114 mm

Power supply
Type 494 external power supply 230/115 V to 24 V AC, 10 VA. Type 8981 Cable kit D-connector to D-socket. Type 8982 Cable kit D-connector to strip.

Multi-channel enclosures
Type 443 for wall mounting
(3-channels, 230/115 V AC)
Type 445 for wall mounting
(4-channels, 24V AC/DC)

Technical data
Material: ABS with neoprene packings.
Protection: IP65 splash-proof, DIN 40 050.
Temperature: –40 to +80 °C.
Fire class: 94 lt (combustible).
Power supply: Type 443 - 230/115 V AC.
 Type 445 - 24 V AC/DC to be screened.
Power consumption: Type 443 - 3 x 2 VA.
 Type 445 - 4 x 2 VA.
Sensor connection: D-connector 15-pole.
Sensor cable: PVC 16 x 0.25 mm², screened max. temperature 70°C, type 70633.

For more information, contact your local automation expert at Metso.

www.metso.com/conductivity

The information provided in this brochure contains descriptions or characteristics of performance which in case of actual use do not always apply as described or which may change as a result of further development of the products.

An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract. Availability and technical specifications are subject to change without notice.