

# Cross Referencing with FUJIKURA

AN004e-1 (02/2026)

## Scope

Comparing O<sub>2</sub>-Sensors from SENSORE and FUJIKURA, and basic guidelines for replacement.

### 1 Advantages at a Glance

<ul style="list-style-type: none"> <li>• Identical technology</li> <li>• Compact TO8 housing (slightly smaller)</li> <li>• Fits into FUJIKURA footprint</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed heater voltage</li> <li>• Better sensitivity</li> <li>• Better resolutions in low concentrations</li> </ul>
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## 2 Basic Comparison

### 2.1 Technological and mechanical comparison

	SENSORE SO-B0-xxx, SO-E2-xxx	FUJIKURA FCX-U(W)C, FCX-U(L)	comment
Technology	<b>limiting current, ZrO<sub>2</sub>-cell</b> 		same technology
Output characteristic	$I_S(O_2) = -k \cdot \ln \left( 1 - \frac{[O_2]}{100\%} \right)$ <p><i>I<sub>S</sub>(O<sub>2</sub>) is the oxygen dependent sensor current</i>  <i>k is a sensor specific constant</i>  <i>[O<sub>2</sub>] is the oxygen concentration in %</i></p>		same equation
Housing	TO-8, mesh on top of cap 	TO-8-like, mesh cap 	SENSORE has a <b>slightly smaller</b> sensor
Footprint	TO-8 grid: 4 pins, Ø 0.8mm	TO-8-like: 4 pins, Ø 1.0mm +1 pin for orientation only	<b>SENSORE fits into FUJIKURA footprint</b>

Mechanical wise SENSORE’s SO-B0-xxx and SO-E2-xxx **are compatible, they can be used in the FUJIKURA footprint**. The correct orientation is defined by a nose in the TO-8 housing, while Fujikura ensures orientation with a 5<sup>th</sup> pin.

If SO-B0-xxx and SO-E2-xxx are soldered directly on a PCB it is recommended to use an (thermal) isolating spacer (≥0,5mm thickness) or leave an air gap (2-3mm) between PCB and sensor housing.

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## 2.2 Notable differences between SENSORE and FUJIKURA O2-Sensors

### Sensor heater:

The SENSORE heater design has a very tight tolerance on the heater resistance, which offers a significant advantage compared to FUJIKURA:

SENSORE's O2-sensors can operate with a constant heater voltage for all sensors of a specific type, while Fujikura requires individual heater voltages for each sensor or an operation with a constant heater power control. The recommended heater voltage for SO-B0-xxx and SO-E2-xxx is 3.6Vdc, which is a bit higher than the voltage range specified by FUJIKURA 1.5-3.0Vdc. The power consumption is very similar for both: 1.5W. Due to the slightly different voltage specification of SENSORE, an adaptation of the electrical heater circuit might be necessary.

### Sensor cell:

SENSORE specifies significantly higher sensor currents than FUJIKURA for comparable O2-ranges, see tables below for further details. This can be compensated by adjusting the external amplification of the sensor currents.

### SENSORE offers two slightly different sensor types:

**SO-E2-xxx** is optimized for frequent heater power cycles (multiple times per day), while **SO-B0-xxx** offers a slightly better linearity.

## 2.3 Replacement support by SENSORE

Please contact [SENSORE](#) if you have general questions or if you need support for your replacement activities. SENSORE will offer:

- Help to find the closest matching replacement (sensor and also electronic board if needed)
- Support during design or modification of electronic sensor circuitry
- Customization of the sensor specification, e.g.
  - tweaking of the specification, e.g. reduced heater voltage for a better match with FUJIKURA
  - add a sensor cable with RAST 2.5 connector
  - More compact housing, i.e. reduced TO-8 cap height of 9.5mm instead of 13.7mm
  - Optimized design for O2-measurements below the lower detection limit
- Application support for special conditions like
  - high pressures (>1300mbara) or low pressures (<700mbara)
  - optimizations for wide operating temperature ranges (e.g. 10-200°C)
  - special balance gases e.g. Argon or CO2 instead of N2

### 3 Comparison of specific sensor types

#### 3.1 Comparison of 25% sensor types:

	<b>SENSORE SO-B0-250, SO-E2-250</b>	<b>FUJIKURA FCX-UC</b>	<b>comment</b>
<b>O2 range</b>	0.1-25%	0-25%	
<b>accuracy</b>	± 0.25%	± 0.5%	
<b>t<sub>90</sub></b>	<12s	<30s	
<b>Heater voltage</b>	3.6 Vdc same voltage for all sensors	1.7V -3.0V dc individual voltage for each sensor	SENSORE offers a <b>fixed heater voltage</b>
<b>Heater current</b>	~400mA	500~900mA	after heat-up
<b>Heater power</b>	~1.5W	~1.5W	
<b>Heat-up</b>	ramp up over 30s	ramp with 40mV/s	similar approach
<b>Housing temp.</b>	70°C	50-80°C	
<b>Bias voltage</b>	0.85V	1.3V	
<b>Sensor current at 20.9%</b>	100-200uA	60-80uA	SENSORE offers <b>better sensitivity</b>

#### 3.2 Comparison of 96% sensor types:

	<b>SENSORE SO-B0-960, SO-E2-960</b>	<b>FUJIKURA FCX-UWC</b>	<b>comment</b>
<b>O2 range</b>	1-96%	0.1-95%	
<b>accuracy</b>	±1% over 1-96%	± 0.5% over 73-95%	
<b>t<sub>90</sub></b>	<12s	<30s	
<b>Heater voltage</b>	3.6 Vdc same voltage for all sensors	1.5V -3.0Vdc individual voltage for each sensor	SENSORE offers a <b>fixed heater voltage</b>
<b>Heater current</b>	~400mA	500~900mA	after heat-up
<b>Heater power</b>	~1.5W	~1.5W	
<b>Heat-up</b>	ramp up over 30s	ramp with 40mV/s	similar approach
<b>Housing temp.</b>	70°C	50-80°C	
<b>Bias voltage</b>	1.0V	1.6 – 1.8V at 95% O2 1.0V at 20.9% O2	
<b>Sensor current at 20.9%</b>	15-30uA	8-20uA	SENSORE offers <b>better sensitivity</b>

**3.3 Comparison of 1000ppm sensor types:**

	<b>SENSORE SO-B0-001</b>	<b>FUJIKURA FCX-ULL</b>	<b>comment</b>
<b>O2 range</b>	10-1000ppm	0-1000ppm	
<b>accuracy</b>	± 20ppm	± 50ppm	SENSORE offers a significantly <b>higher accuracy</b>
<b>t<sub>90</sub></b>	<12s	<30s	
<b>Heater voltage</b>	3.6 Vdc same voltage for all sensors	1.7V -3.0Vdc individual voltage for each sensor	SENSORE offers a <b>fixed heater voltage</b>
<b>Heater current</b>	~400mA	600~1200mA	after heat-up
<b>Heater power</b>	~1.5W	~2.0W	
<b>Heat-up</b>	ramp up over 30s	ramp with 40mV/s	similar approach
<b>Housing temp.</b>	70°C	not specified	
<b>Bias voltage</b>	0.7V	0.9V	
<b>Sensor current at 1000ppm</b>	150-250uA	35-70uA	SENSORE offers <b>better sensitivity</b>

**4 Overview of all available**

SENSORE also offers sensor types and measurement ranges where no direct cross referencing with FUJIKURA sensors is possible.

**4.1 Available O2 measurement ranges**

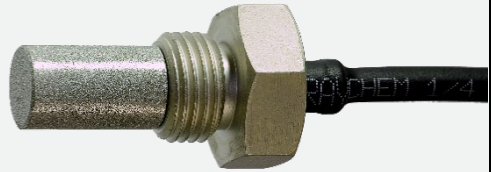



part number	Measuring range*	output current	at O2 concentration	Accuracy	Reproducibility	bias voltage
SO-xx-001	10 – 1000 ppm O2	150 – 250 µA	at 1000 ppm O2	± 20 ppm O2	< 10 ppm O2	0.7 VDC
SO-xx-010	0.01 – 1.0 % O2	150 – 250 µA	at 1.0 % O2	± 100 ppm O2	< 100 ppm O2	0.75 VDC
SO-xx-020	0.01 – 2.0 % O2	150 – 250 µA	at 2.0 % O2	± 200 ppm O2	< 100 ppm O2	0.75 VDC
SO-xx-050	0.05 – 5.0 % O2	150 – 250 µA	at 5.0 % O2	± 500 ppm O2	< 250 ppm O2	0.8 VDC
SO-xx-250	0.10 – 25.0 % O2	100 – 200 µA	at 20.9 % O2	± 0.25 % O2	< 0.1 % O2	0.85 VDC
SO-xx-960	1.0 – 96.0 % O2	15 – 30 µA	at 20.9 % O2	± 1.00 % O2	< 0.2 % O2	1.0 VDC

\*Operation outside the specified measuring range can cause permanent damage to the electrode

**4.2 Oxygen sensors based on TO-8 socket (board mounted or with attached cable)**




part number	Description	
<a href="#">SO-B0-xxx</a> <a href="#">SO-E2-xxx</a>	<p>TO-8 housing, nickel plated cap with stainless steel mesh, gold-plated pins and gold-plated baseplate</p> <p>SO-E2-xxx is optimized for frequent power cycles                      SO-B0-xxx offers a slightly better linearity                      Maximum operating temperature: 350°C</p>	<p>cap height ~13.7mm</p>
<a href="#">SO-B0-xxx-D040C</a> , <a href="#">SO-B0-xxx-D012C</a> <a href="#">SO-E2-xxx-D040C</a> , <a href="#">SO-E2-xxx-D012C</a>	<p>TO-8 housing with detachable sensor cable and Rast 2.5 connector for PCB edge connection.</p> <p>D040C...40cm length with Rast 2.5 connector                      D012C...12cm length with Rast 2.5 connector</p> <p>Maximum operating temperature: 125°C                      temperature restriction due to cable configuration</p>	
<a href="#">SO-B1-xxx</a> <a href="#">SO-B1-xxx-A100C</a> <a href="#">SO-B1-xxx-A300C</a>	<p>TO-8 housing + flange, with/without welded cable</p> <p>A100C...100cm length with Rast 2.5 connector                      A300C...300cm length with Rast 2.5 connector</p> <p>Maximum operating temperature:                      350°C (without cable) or 200°C (with cable)</p>	<p>flange hole distance ~36 mm</p>
customization options	<p>Contact <a href="#">SENSORE</a> for customization options, e.g. smaller cap height (9.5mm), cable length, cable temperature rating or even customized tweaking of the electrical specification</p>	<p>cap height ~9.5mm</p>

### 4.3 Oxygen sensors with threaded housings and cable (1m or 3m)

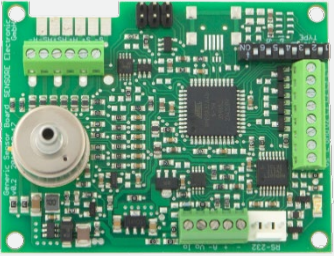

part number	Description	
<a href="#">SO-D0-xxx-A100C</a> <a href="#">SO-D0-xxx-A300C</a>	M16-threaded nickel-plated steel housing, with a stainless-steel sinter cap.  1 or 3 m cable with RAST 2.5 connector Maximum operating temperature: 200°C	
<a href="#">SO-D1-xxx-A100C</a> <a href="#">SO-D1-xxx-A300C</a>	M10-threaded nickel-plated steel housing, with a stainless-steel sinter cap.  1 or 3 m cable with RAST 2.5 connector Maximum operating temperature: 200°C	
<a href="#">SO-D2-xxx-A100C</a> <a href="#">SO-D2-xxx-A300C</a>	M16-threaded aluminum housing, with a stainless-steel sinter disk  1 or 3 m cable with RAST 2.5 connector Maximum operating temperature: 200°C	
<a href="#">SO-D3-xxx-A100C</a> <a href="#">SO-D3-xxx-A300C</a>	M18-threaded aluminum housing, with a stainless-steel sinter cap  1 or 3 m cable with RAST 2.5 connector Maximum operating temperature: 200°C	

Note: A100C ...1m, A300C...3m, for other cable lengths please contact [SENSORE](#)

### 4.4 Oxygen sensors for flow through applications

part number	Description	
<a href="#">SO-E3-xxx</a>	TO-8, single hose connection with barb, gas outlet via small hole on top of the housing  for low airflows: 0.1 to 0.5 LPM (liter per minute)	
<a href="#">SO-E61-xxx</a>	TO-8, dual hose connection without barb, e.g. for operation with a suction/micro pump  for very low airflows: ≤0.1 LPM (liter per minute)	
<a href="#">1601001-0-L</a> <a href="#">no fittings included</a>	M18 flow-through housing for SO-D3-xxx-Ax00C two G1/8 threads for gas in- and outlet G1/8 fittings are not included  For airflows up to 2 LPM (liter per minute)	

5 Oxygen Transmitters (O2-Sensor + Electronic)

System	Description	
<a href="#">Generic Sensor Board (GSB)</a>	sub system for integration into larger devices <ul style="list-style-type: none"> <li>For board mounted and cabled sensors</li> <li>Compact size 50mm x 65mm</li> <li>Supply: 12Vdc / 200mA</li> <li>Analog outputs: 4-20mA and 0-5V</li> <li>Digital output: RS232</li> <li>Sensor calibration is stored on the board                             <ul style="list-style-type: none"> <li>Standard delivery: factory calibration</li> <li>allows also customer/field calibration</li> </ul> </li> <li>Further customization possible, e.g.:                             <ul style="list-style-type: none"> <li>O2-treshold levels via digital I/O</li> <li>customized connectors</li> </ul> </li> </ul>	
<a href="#">OXY-ProXT (single channel)</a>  <a href="#">OXY-ProXT2 (dual channel)</a>  for <a href="#">pre-calibrated smart sensors (M12 connector)</a>	Oxygen Transmitter for industrial environments <ul style="list-style-type: none"> <li>for use with pre-calibrated smart sensors                             <ul style="list-style-type: none"> <li>calibration is stored in M12 connector</li> <li>only available for cabled sensors</li> <li>easy sensor replacement in the field (plug and play approach)</li> </ul> </li> <li>DIN-rail housing</li> <li>Supply: 24Vdc / 250mA per channel</li> <li>Analog outputs per channel:                             <ul style="list-style-type: none"> <li>4-20mA and 0-5V</li> </ul> </li> <li>Digital output: RS485 Modbus RTU                             <ul style="list-style-type: none"> <li>1 address per channel</li> </ul> </li> <li>1 relay contact output per channel                             <ul style="list-style-type: none"> <li>user programmable O2 alarm</li> </ul> </li> <li>fully compliant with EC-machinery directive</li> </ul>	
<a href="#">Microx ProSafe SIL2 Dual-Channel – Oxygen Transmitter</a>	Oxygen Transmitter with <a href="#">SIL 2 / PL d</a> rating <ul style="list-style-type: none"> <li>for safety critical inertisation monitoring</li> <li>fully compliant with EC-machinery directive <a href="#">EC type examination by TUV AUSTRIA No. IN-AT-AS-MRL-20-00297A</a></li> <li>Dual channel system:                             <ul style="list-style-type: none"> <li>ch1 - coarse range: 0.1 - 23.5% O2</li> <li>ch2: fine range: 0.01 - 2.35% O2</li> </ul> </li> <li>typical SIL 2 alarm level: 2%O2                             <ul style="list-style-type: none"> <li>interlock relays will open on &gt;2%O2</li> </ul> </li> <li>for use with pre-calibrated smart sensors                             <ul style="list-style-type: none"> <li>calibration is stored in M12 connector</li> <li>only available for SO-D3 sensors</li> <li>easy sensor replacement in the field (plug and play approach)</li> </ul> </li> <li>DIN-rail housing</li> <li>Supply: 24Vdc / 250mA per channel</li> <li>Analog outputs per channel:                             <ul style="list-style-type: none"> <li>4-20mA and 0-5V</li> </ul> </li> <li>Digital output: RS485 Modbus RTU                             <ul style="list-style-type: none"> <li>1 address per channel</li> </ul> </li> <li>1 relay contact output per channel                             <ul style="list-style-type: none"> <li>user programmable O2 alarm</li> </ul> </li> </ul>	