Cross Referencing with FUJIKURA

AN004e-1 (02/2026)

Scope

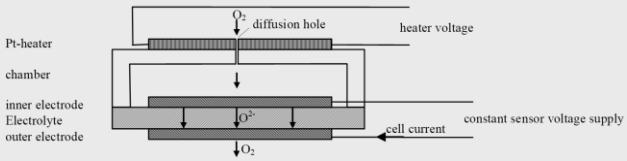
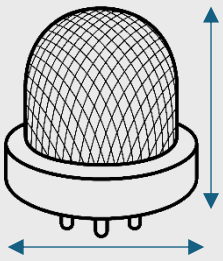
Comparing O2-Sensors from SENSORE and FUJIKURA, and basic guidelines for replacement.

1 Advantages at a Glance

- Identical technology
- Compact TO8 housing (slightly smaller)
- Fits into FUJIKURA footprint
- Fixed heater voltage
- Better sensitivity
- Better resolutions in low concentrations

2 Basic Comparison

2.1 Technological and mechanical comparison

	SENSORE SO-B0-xxx, SO-E2-xxx	FUJIKURA FCX-U(W)C, FCX-ULL	comment
Technology	**limiting current, ZrO2-cell**  		**same technology**
Output characteristic	$Is(O_2) = -k \cdot \ln\left(1 - \frac{[O_2]}{100\ \%}\right)$ *Is(O_2) is the oxygen dependent sensor current* *k* is a sensor specific constant *[O_2] is the oxygen concentration in %*		**same equation**
Housing	TO-8, mesh on top of cap  cap height ~13.7mm ~ Ø 15.3mm	TO-8-like, mesh cap  cap height ~17.0mm ~ Ø 19.2mm	SENSORE has a **slightly smaller** sensor
Footprint	TO-8 grid: 4 pins, Ø 0.8mm	TO-8-like: 4 pins, Ø 1.0mm +1 pin for orientation only	**SENSORE fits into FUJIKURA footprint**

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 5th 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.

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 operation with a constant heater voltage for all sensor 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 adaption 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:

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

3.2 Comparison of 96% sensor types:

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

3.3 Comparison of 1000ppm sensor types:

	SENSORE SO-B0-001	FUJIKURA FCX-ULL	comment
O2 range	10-1000ppm	0-1000ppm	
accuracy	± 20ppm	± 50ppm	SENSORE offers a significantly **higher accuracy**
t_{90}	<12s	<30s	
Heater voltage	3.6 Vdc same voltage for all sensors	1.7V -3.0Vdc individual voltage for each sensor	SENSORE offers a **fixed heater voltage**
Heater current	~400mA	600~1200mA	after heat-up
Heater power	~1.5W	~2.0W	
Heat-up	ramp up over 30s	ramp with 40mV/s	similar approach
Housing temp.	70°C	not specified	
Bias voltage	0.7V	0.9V	
Sensor current at 20.9%	150-250uA	35-70uA	SENSORE offers **better sensitivity**

4 Overview of all available

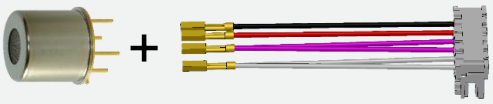
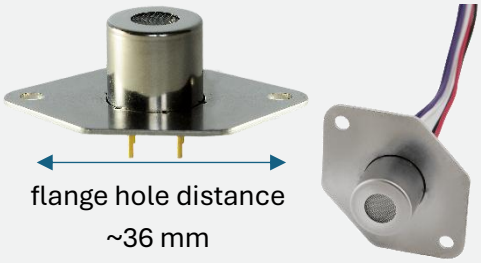
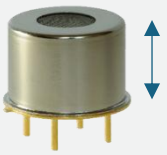
SENSORE also offers sensor types and measurement ranges where no direct cross referencing with FUJIKURA sensors is possible.

4.1 Available O2 measurement ranges

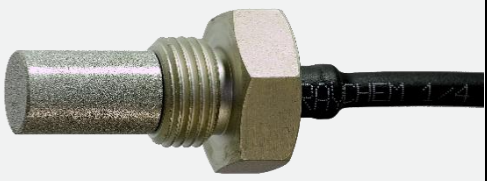
part number	Measuring range*	output current	at	O2 concentration	Accuracy	Reproducibility	bias voltage
SO-xx-001	10 – 1000 ppm O2	150 – 250 µA	at	1000 ppm O2	± 20 ppm O2	< 10 ppm O2	0.7 VDC
SO-xx-010	0.01 – 1.0 % O2	150 – 250 µA	at	1.0 % O2	± 100 ppm O2	< 100 ppm O2	0.75 VDC
SO-xx-020	0.01 – 2.0 % O2	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	
SO-B0-xxx, SO-E2-xxx	TO-8 housing, nickel plated cap with stainless steel mesh, gold-plated pins and gold-plated baseplate SO-E2-xxx is optimized for frequent power cycles SO-B0-xxx offers a slightly better linearity Maximum operating temperature: 350°C	 cap height ~13.7mm
SO-B0-xxx-D040C, SO-B0-xxx-D012C SO-E2-xxx-D040C, SO-E2-xxx-D012C	TO-8 housing with detachable sensor cable and Rast 2.5 connector for PCB edge connection. D040C…40cm length with Rast 2.5 connector D012C…12cm length with Rast 2.5 connector Maximum operating temperature: 125°C temperature restriction due to cable configuration	
SO-B1-xxx SO-B1-xxx-A100C SO-B1-xxx-A300C	TO-8 housing + flange, with/without welded cable A100C…100cm length with Rast 2.5 connector A300C…300cm length with Rast 2.5 connector Maximum operating temperature: 350°C (without cable) or 200°C (with cable)	 flange hole distance ~36 mm
customization options	Contact SENSORE for customization options, e.g. smaller cap height (9.5mm), cable length, cable temperature rating or even customized tweaking of the electrical specification	 cap height ~9.5mm

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

part number	Description	
SO-D0-xxx-A100C SO-D0-xxx-A300C	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	
SO-D1-xxx-A100C SO-D1-xxx-A300C	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	
SO-D2-xxx-A100C SO-D2-xxx-A300C	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	
SO-D3-xxx-A100C SO-D3-xxx-A300C	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	

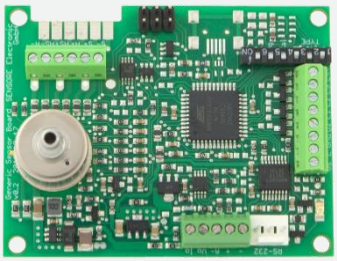
Note: A100C ...1m, A300C...3m, for other cable lengths please contact SENSORE

4.4 Oxygen sensors for flow through applications

part number	Description	
SO-E3-xxx	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)	
SO-E61-xxx	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)	
1601001-0-L no fittings included	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	

Generic Sensor Board (GSB)	sub system for integration into larger devices
	• For board mounted and cabled sensors
	• Compact size 50mm x 65mm
	• Supply: 12Vdc / 200mA
	• Analog outputs: 4-20mA and 0-5V
	• Digital output: RS232
	• Sensor calibration is stored on the board
	  ○ Standard delivery: factory calibration
	  ○ allows also customer/field calibration
	• Further customization possible, e.g.:
	  ○ O2-treshold levels via digital I/O
	  ○ customized connectors
		

OXY-ProXT (single channel)
 	
OXY-ProXT2 (dual channel)
 	
for
 	
pre-calibrated smart sensors (M12 connector)
	Oxygen Transmitter for industrial environments
	• for use with pre-calibrated smart sensors
	  ○ calibration is stored in M12 connector
	  ○ only available for cabled sensors
	  ○ easy sensor replacement in the field (plug and play approach)
	• DIN-rail housing
	• Supply: 24Vdc / 250mA per channel
	• Analog outputs per channel:
	  ○ 4-20mA and 0-5V
	• Digital output: RS485 Modbus RTU
	  ○ 1 address per channel
	• 1 relay contact output per channel
	  ○ user programmable O2 alarm
	• fully compliant with EC-machinery directive
		

Microx ProSafe SIL2 Dual-Channel – Oxygen Transmitter	Oxygen Transmitter with SIL 2 / PL d rating
	• for safety critical inertisation monitoring
	• fully compliant with EC-machinery directive
	EC type examination by TUV AUSTRIA
	No. IN-AT-AS-MRL-20-00297A
	• Dual channel system:
	  ○ ch1 - coarse range: 0.1 - 23.5% O2
	  ○ ch2: fine range: 0.01 - 2.35% O2
	• typical SIL 2 alarm level: 2%O2
	  ○ interlock relays will open on >2%O2
	• for use with pre-calibrated smart sensors
	  ○ calibration is stored in M12 connector
	  ○ only available for SO-D3 sensors
	  ○ easy sensor replacement in the field (plug and play approach)
	• DIN-rail housing
	• Supply: 24Vdc / 250mA per channel
	• Analog outputs per channel:
	  ○ 4-20mA and 0-5V
	• Digital output: RS485 Modbus RTU
	  ○ 1 address per channel
	• 1 relay contact output per channel
	  ○ user programmable O2 alarm