
RESONETICS
FIBER OPTIC SENSORS
In MedTech

MEDICAL PRESSURE MONITORING



We provide leading-edge fiber optic development capabilities and advanced manufacturing experience to support high-volume production of complex fiber optic products for the medical device market. Resonetics Fiber Optic sensors provide reliable solutions for measuring parameters such as pressure, temperature, force, displacement, and position.

Key Features

- **Minimally Invasive**
- **Flexible and Kink Resistant**
- **Lightweight**
- **Great pushability and tracking in a tortuous path**
- **Accurate under MRI, EMI, and Radiotherapies**



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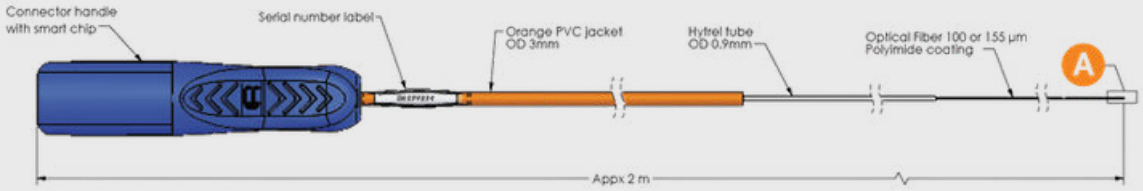
PRESSURE SENSOR

Applications

- **Cardiovascular: LV pressure, flow assessment, mechanical circulatory support**
- **Pharmacology: Drug and fluid injection**
- **Neurosciences: Intracranial pressure, aneurysm pressure change**
- **Spine/Bones: Intradiscal/Intramedullary pressure**
- **Urology: Bladder/Ureter pressure**
- **Ophthalmology: Intraocular pressure for anterior and posterior chamber**
- **Arterial blood or LV pressure for image gating**
- **Respiratory/Pulmonology**
- **Endoscopy**



Fiber Optic Pressure Sensors:
distal tip as small as 200µm



Customizable options

We offer the most comprehensive line of fiber optic pressure sensors for medical devices, including options such as:

Sensor element diameter

Based on the same design, we offer three sizes of sensor elements with similar specifications. The sensor elements developed are:

- FOP-MIV (OD 0.022” / 550µm)
- FOP-M260 (OD 0.010” / 260µm)
- FOP-M200 (OD 0.008” / 200µm)

Protection of the sensor

Different sheaths can be added to protect the sensor element, to increase the durability during usage, or for the ease of manufacturing of the medical device. The options are:

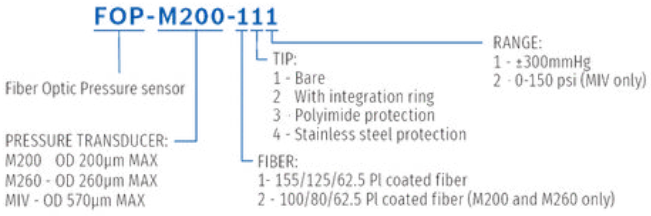
- Bare
- Polyimide tubing
- Stainless Steel
- Radio-opaque

The configuration

The length, the type of material, and the connectors are all customizable. Customization is done with our customers through a well established development process.
The configurations include:

- Connector type, SC/APC with bulkhead containing a smart chip to communicate the serial number and calibration data
- Jacket length, diameter, and coating material (standard PVC)
- Fiber length, diameter, and coating material

Item number nomenclature



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Not sure which one you need?
Contact us to be guided through the selection of the right pressure sensor for your project.

PRESSURE SENSOR

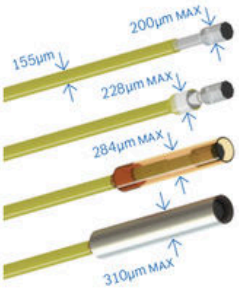
FOP-M200 | MEDICAL

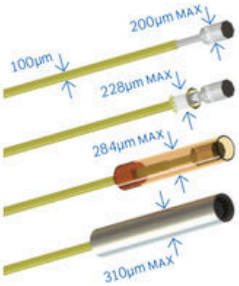
Key Features

- **The fiber optic pressure sensors M200 are the smallest sensing element offered by Resonetics.**
- **They present similar specifications and are thus the perfect choice when size is critical.**



Models

Fiber 155 µm	Tip	Item #
	Bare	FOP-M200-111
	With integration ring	FOP-M200-121
	Polyimide protection	FOP-M200-131
	Stainless steel protection	FOP-M200-141

Fiber 100 µm	Tip	Item #
	Bare	FOP-M200-211
	With integration ring	FOP-M200-221
	Polyimide protection	FOP-M200-231
	Stainless steel protection	FOP-M200-241

Specifications

Pressure range[1]	± 300mmHg relative to atmospheric pressure
Resolution[2]	0.3mmHg
System accuracy[3]	± 3mmHg or 3% of reading
Sensitivity thermal effect[4]	< 0.3mmHg /C
Proof pressure	> 4500mmHg
Operating conditions	Humidity: 0-100%; Temperature: 15C-45C
Storage conditions	Humidity:0-95%; Temperature:-30C-85C
Tip termination	Bare/Ring/Sheathed with polyimide or SS
Sensor length	2m
Connector[5]	Proprietary bulkhead over SC-APC

1. Can be customized
2. With an SKR module and a filter of 30Hz applied
3. With sensors and reading modules combined. Includes reproducibility (sensor/module exchange), repeatability and hysteresis, non-linearity, scale error, offset error, and reading module temperature compensation error.
4. Determined between 10-70C at atmospheric pressure (~760mmHg)
5. SCAI connector with a smart chip communicating calibration data to the reading module

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PRESSURE SENSOR

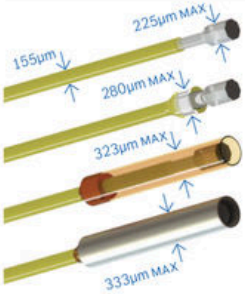
FOP-M260 | MEDICAL

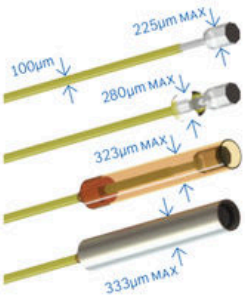
Key Features

- **The fiber optic pressure sensors M260 are a perfect compromise for size vs sturdiness.**
- **The default specifications satisfy various applications and can be customized if needed.**



Models

Fiber 155 µm	Tip	Item #
	Bare	FOP-M260-111
	With integration ring	FOP-M260-121
	Polyimide protection	FOP-M260-131
	Stainless steel protection	FOP-M260-141

Fiber 100 µm	Tip	Item #
	Bare	FOP-M260-211
	With integration ring	FOP-M260-211
	Polyimide protection	FOP-M260-211
	Stainless steel protection	FOP-M260-211

Specifications

Pressure range[1]	± 300mmHg relative to atmospheric pressure
Resolution[2]	0.3mmHg
System accuracy[3]	± 3mmHg or 3% of reading
Sensitivity thermal effect[4]	< 0.3mmHg /C
Proof pressure	> 4500mmHg
Operating conditions	Humidity: 0-100%; Temperature: 15C-45C
Storage conditions	Humidity:0-95%; Temperature:-30C-85C
Tip termination	Bare/Ring/Sheathed with polyimide or SS
Sensor length	2m
Connector[5]	Proprietary bulkhead over SC-APC

1. Can be customized
2. With an SKR module and a filter of 30Hz applied
3. With sensors and reading modules combined. Includes reproducibility (sensor/module exchange), repeatability and hysteresis, non-linearity, scale error, offset error, and reading module temperature compensation error.
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5. SCAI connector with a smart chip communicating calibration data to the reading module

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PRESSURE SENSOR

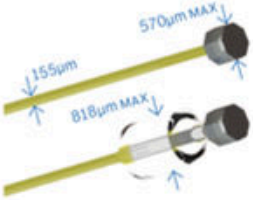
FOP- MIV | MEDICAL

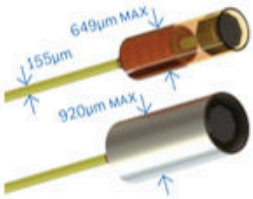
Key Features

- **The fiber optic pressure sensors MIV are the most mature product.**
- **Its production is fully automated.**
- **It is the sturdiest option.**
- **It offers a wider range of pressure.**



Models

Fiber 155 µm	Tip	Item #
	Bare	FOP-MIV-11
	With integration ring	FOP-MIV-12

Fiber 155 µm	Tip	Item #
	Polyimide protection	FOP-MIV-13
	Stainless steel protection	FOP-MIV-14

Specifications

Model	FOP-MIV-10,20,21	FOP-MIV-30,40,41
Pressure range[1]	±300mmHg relative to atmospheric pressure	-300mmHg to 7500mmHg relative to atmospheric pressure
Resolution[2]	<0.3mmHg	2.6mmHg
System accuracy[3]	±3mmHg or 3% of reading	±50mmHg
Sensitivity thermal effect[4]	< 0.3mmHg /C	<3mmHg/C
Proof pressure	>4000mmHg	>22500mmHg
Operating conditions	Humidity: 0-100%; Temperature: 15C-45C	
Storage conditions	Humidity:0-95%; Temperature:-30C-85C	
Tip termination	Bare/Ring/Sheathed with polyimide or SS	
Sensor length	2m	
Connector[5]	Proprietary bulkhead over SC-APC	

1. Can be customized
2. With an SKR module and a filter of 30Hz applied
3. With sensors and reading modules combined. Includes reproducibility (sensor/module exchange), repeatability and hysteresis, non-linearity, scale error, offset error, and reading module temperature compensation error.
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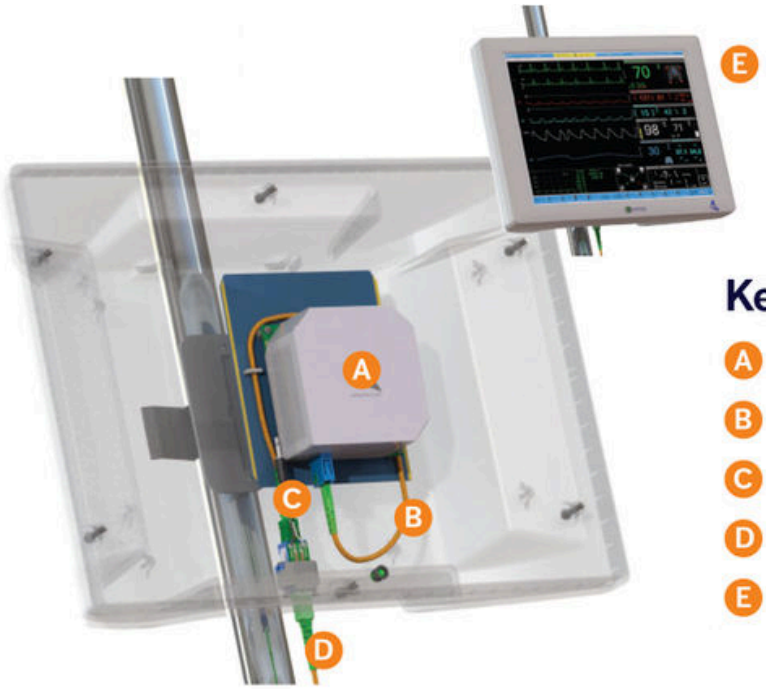
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READING MODULE

The Original Equipment Manufacturer (OEM) module is an optoelectronic reading unit with set-up, control, and data acquisition enabled through an electrical interface. Designed for embedding in hospital consoles, the module possesses robust communication capabilities, fast sampling rates, and is RoHS compliant. Resonetics provides documentation related to detailed electrical, mechanical, and communication protocol requirements to interface with the module.

Key Features

- **Low heat emitted from LED light source**
- **LED technology with a lifetime greater than 20,000 hours**
- **Atmospheric self-compensation available**
- **Full bandwidth via analog output connectors**
- **Up to 3 channels**



Key Parts of a Console[1]:

- A OEM reading module
- B Internal Optical Extension
- C Bulkhead Optical Adapters and Internal Electrical Extension
- D Optical and Electrical External Extension Cable (optional)
- E Customer's Console

1. Descriptions and part numbers on page 9

READING MODULE

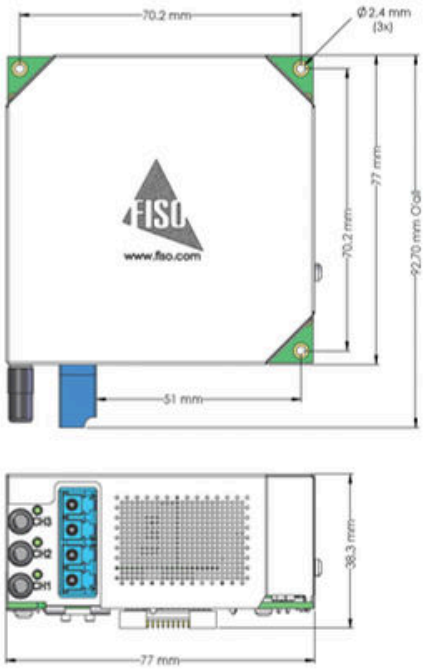
SKR - OEM



One, two, and three channel OEM modules pictured sequentially



OEM module underside showing the 34-pin connector



OEM module dimensions

Specifications	
Number of channels item's part number	SKR-OEM-001 SKR-OEM-002 SKR-OEM-003
Power Consumption	1.8W (typical) 2.2W (max)
Operating Condition	Temperature: 10-55C
Dimensions	W: 77mm H: 38.3mm L:77/92.7mm

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SKR- OEM EXTENSIONS

Internal Optical Extensions

Use this robust optical extension, with a cable outer diameter of 3mm, to connect the front panel of the console to the embedded OEM reading module.

Part number	Length
1200047	0.5m
1200048	1.0m
1200049	2.0m





Bulkhead Optical Adapters with Internal Electrical Extensions

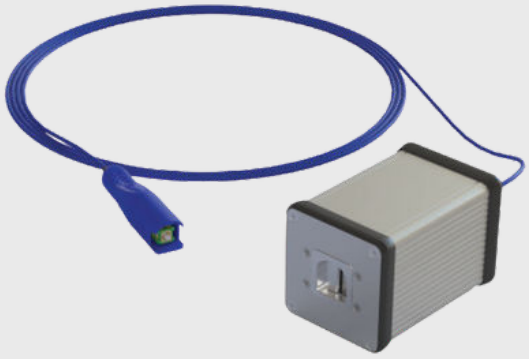
Resonetics' bulkhead adapters with electrical extension assemblies are available to transmit the calibration data from the customer console's bulkhead adapter to the embedded SKR-OEM module.

Part number	Length	Type
FSP-093	45mm	A: protruding

Optical and Electrical External Extension

A cable extension with an optical and electrical SCAI connector is also available. This extension is useful when a longer working distance is required during testing in the product development phase.

Part number	Length
CFO-LS-3M-30	3m



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READING MODULE

SKR-DEV DEVELOPMENT KIT

The development kit is designed for Original Equipment Manufacturer (OEM) testing, prototype integration, and firmware development. This development kit SKR-DEV is geared toward customers who wish to evaluate and test the pressure monitoring system, both the sensors and the reading units, in preparation for integration into their hospital console. The SKR-DEV is compatible with FISO's Evolution application software.

SKR-DEV includes the following components:

- USB-C cable for powering and communications
- BNC-SMA cable for analog output
- EVOLUTION software and user guide
- Cleaning kit

To embed the OEM module in a console, just take the module out of the SKR-DEV casing and connect to the prototype OEM motherboard via the 34-pin connector. RESONETICS provides the communication protocol necessary to establish communication between the host system and the OEM module either through analog or digital means.

Specifications	
Number of channels item's part number	SKR-DEV-201 SKR-DEV-203
Sampling rate	250Hz
Analog reading output	0-4.96V
Digital reading output	16bits resolution
Power Consumption	3.3W (typical) 3.7W (max)
Operating Conditions	Temperature: 10-35C
Storage Conditions	Temperature:-40-70C
Dimensions	W: 103mm H: 53mm L:160/175.7mm
Communication	USB



Development kit, 3 channels
(SKR-DEV-203 model pictured above)



Back of the Development kit enclosure



Exploded view of the Development kit with its internal module

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EVOLUTION SOFTWARE

The application software allows users to configure and control the reading module, perform simple monitoring, real-time graphing, and export data. Users may choose between reading the single measurement (monitoring) and plotting the data with user-specified screen refresh rates and graphing options. Finally, the data may be recorded and saved in multiple file formats including CSV and XLS, while graph images may also be saved in various file formats such as TIF or JPEG.

Monitoring and real-time results

Users may choose to read the actual measurement or plot the real-time results with the user's specified screen refresh rates.



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RESONETICS DEVELOPMENT PROCESS



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