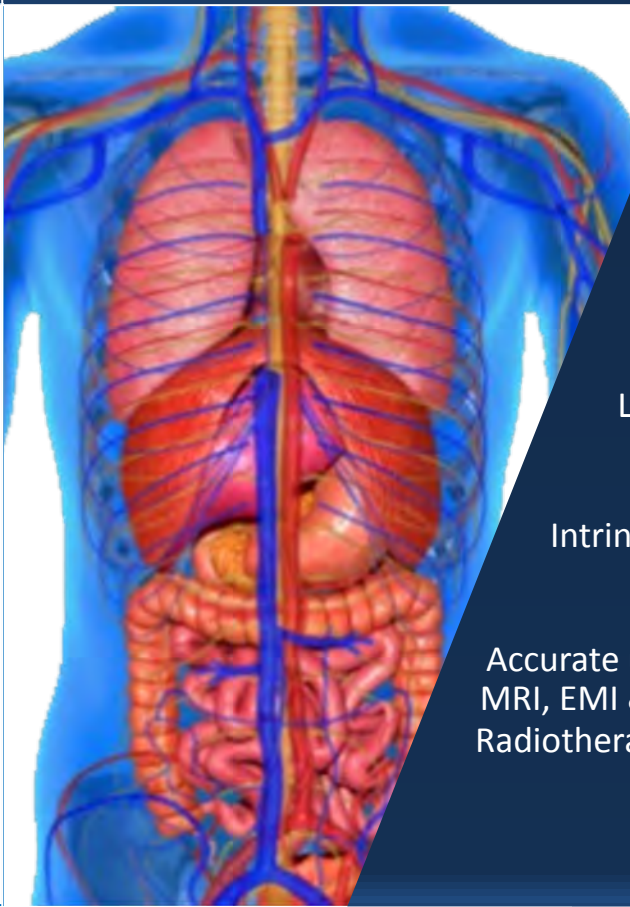


The logo for FISO, consisting of the letters 'FISO' in a bold, white, sans-serif font, positioned on a white triangular background that points downwards.

MEDICAL TEMPERATURE MONITORING

FISO offers the smallest fiber optic temperature and pressure sensors probes for medical devices available in the market today.

Through the use of robots and automated work stations, FISO produces hundreds of thousands of sensors a year, making FISO the world leader in the supply of fiber-optic sensors for OEM medical devices.



Minimally Invasive

Flexible &
Kink Resistant

Lightweight

Intrinsically Safe

Accurate under
MRI, EMI &
Radiotherapies



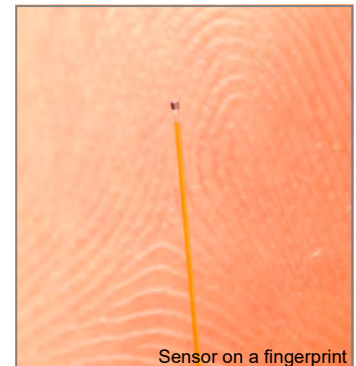


CAPABILITIES

FISO is a pioneer in the introduction of fiber optic sensing technologies in medical applications. We have also built a strong reputation in laboratories and medical research centers with the versatility of the solutions it can offer.

In addition, the automation level reached in the assembly processes allowed FISO to reach the status of world leader as OEM supplier of fiber optic sensors with over 300,000 units sold on a yearly basis.

FISO offers the most complete line of fiber optic temperature probes for medical devices.



Sensor on a fingerprint

APPLICATIONS



HYPERTHERMIA AND ABLATION

FISO's temperature probes have been designed to meet the maneuverability and reliability required by scientists and researchers active in hyperthermia and thermal therapy worldwide.

- ▶ Ease of insertion
- ▶ Long-term fidelity
- ▶ Immune to electromagnetic interference, therefore temperature measurements can be made without interrupting procedure
- ▶ No need to recalibrate between each use

Ask for FISO related publications



RF INDUCED HEATING

The sensor is designed and constructed in consideration of the future standard F2182 (Measurement of Radio Frequency Induced Heating on or Near Passive Implants During Magnetic Resonance Imaging) currently under development.

- ▶ Temperature resolution
- ▶ Small probe size
- ▶ Excellent repeatability



PATIENT MONITORING

For many years, FISO's temperature probes, integrated into FDA approved devices, have monitored hundreds of patients undergoing MRI examination. When quality and manufacturing capabilities are needed FISO marks the path.

- ▶ Quality system
- ▶ Reliable supplier
- ▶ Experienced engineering
- ▶ FISO offers OEM solutions



THE PRINCIPLE

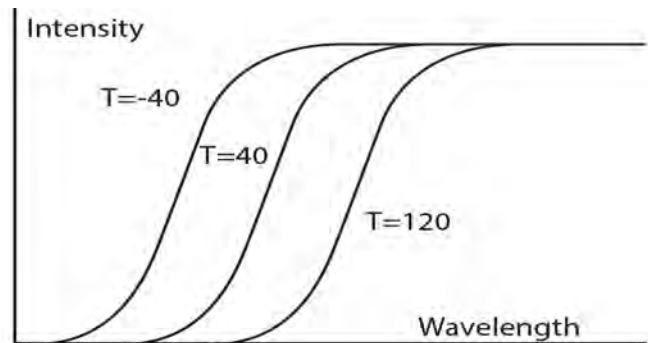
FISO's temperature probes for medical applications are based on white light absorption and transmission by a GaAs (gallium arsenide) semiconductor. The effects of the temperature variations on this semiconductor are well-known and predictable. As the temperature of the semiconductor increases, the transmission spectrum (i.e. the light that is not absorbed) is reduced by longer wavelengths (i.e. more longer wavelengths are absorbed). At any given temperature, transmission essentially jumps from 0% to 100% at a specific wavelength. This jump is called the absorption shift, and the relationship between a specific wavelength -where the absorption shift takes place- and the temperature is therefore predictable.

This shift occurs because of the variation into the semiconductor's energy band gap. This "gap" refers to the energy required to bump the electrons in the material into an excited state (as opposed to the relaxed, steady state). As more energy enters the semiconductor, in the form of heat as its temperature rises, the gap gets narrower -which means that less additional energy is required to excite an electron. The photons (particles of light) entering the semiconductor are what actually excite the electrons. If a photon is carrying enough energy to get an electron across the gap, it will be absorbed. If it does not carry enough energy, then it will be transmitted. The shorter a photon's wavelength is, the more energy it carries. Since the band gap narrows as the semiconductor's temperature increases, less energy will be required to jump across the gap, and photons with less and less energy (longer and longer wavelengths) will be absorbed "by the band", as they say. Consequently, measuring the position of the absorption shift gives a measure of the semiconductor's temperature. It is important to note that this technology is wavelength dependent instead of intensity dependent.

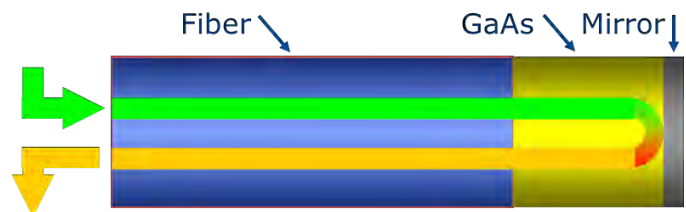
THE TEMPERATURE SENSOR

FISO's temperature probes are based on the direct contact. Traditional temperature sensors such as thermocouples and RTDs (resistance temperature devices) work on the same principle. In other words, the semiconducting material must be touching the object or be immersed in the liquid or gas to be measured in order to give a reading. The more intimate the contact and the smaller the thermal mass of the sensing tip are, the faster the semiconductor will respond to temperature changes.

Tiny GaAs semiconductor is bonded to one end of an optical fiber. On one side of this semiconductor, a reflective dielectric film (material that does not conduct electricity) is installed. All the materials share this property ("high dielectric strength"), which is one of the principal advantages over traditional temperature which use wire to convey an electrical signal. The length of the optical fiber is covered with a protective nylon, polyimide, PTFE or custom cable, making it resistant to handling.



The computation of the absorption shift does not depend on signal intensity for this particular technology, but only the wavelengths of the light are of interest. Thus, the various factors that contribute to the signal attenuation in the optical fiber (fiber length, number and quality of connections, fiber diameter and composition, bending) do not impose any serious constraints to the system. FISO's approach gives reliable, repeatable temperature measurements without the errors that may result from a loss of power in the connectors or a sharp bend in the optical fiber.



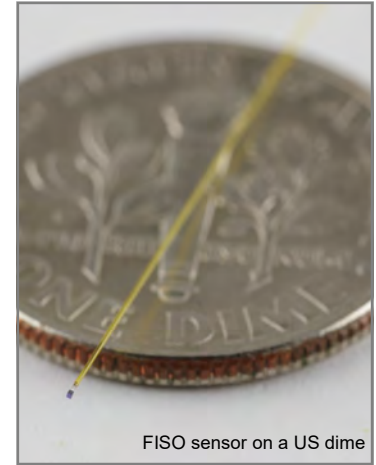


Single Point Temperature Sensors

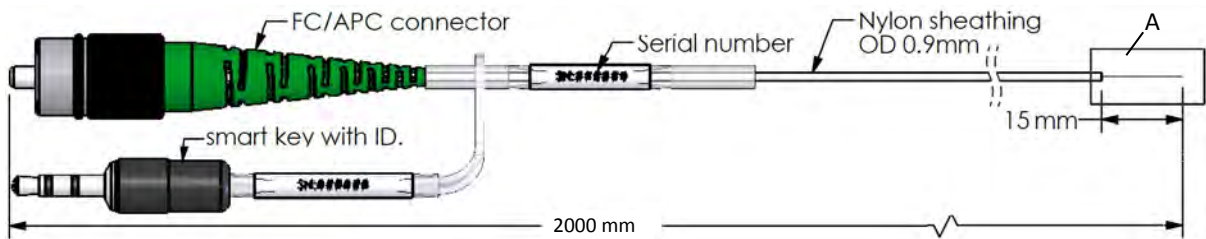
MEDICAL

SPECIFICATIONS

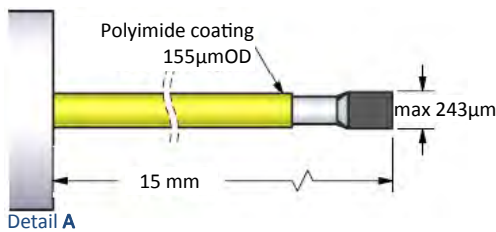
Temperature range	10°C to 90°C (range may be extended to -20 to 200 °C) ¹
Resolution	0.1°C rms
System accuracy ²	±0.5°C
Bending radius	10mm
Response time ³	25msec / 100msec
Cable sheathing	Nylon Sheathing, OD: 0.9 mm; custom cable are possible
Tip termination	Bare / Sheathed with gel / Custom design possible
Standard sensor length	2 meters / Custom length possible
Connector	FC-APC with smart key communicating calibration data to the reading module.



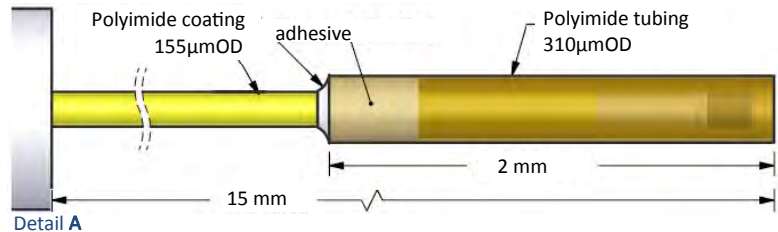
SINGLE POINT Sensor - Light cable



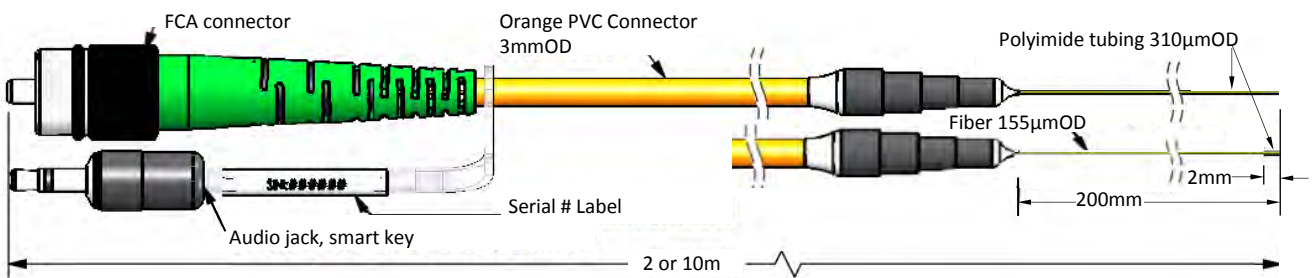
Bare sensor: Item #[THR-NS-1165C](#)



Polyimide sheath with gel: Item# [THR-NS-1165E](#)



SINGLE POINT Sensor - Strong cable - tip PI 200mm: Item #[THR-NS-1165B](#)(2m), [THR-NS-1165F](#)(10m) - tip PI 2mm: Item #[THR-NS-1165G](#)(2m), [THR-NS-1165H](#)(10m)



Preliminary

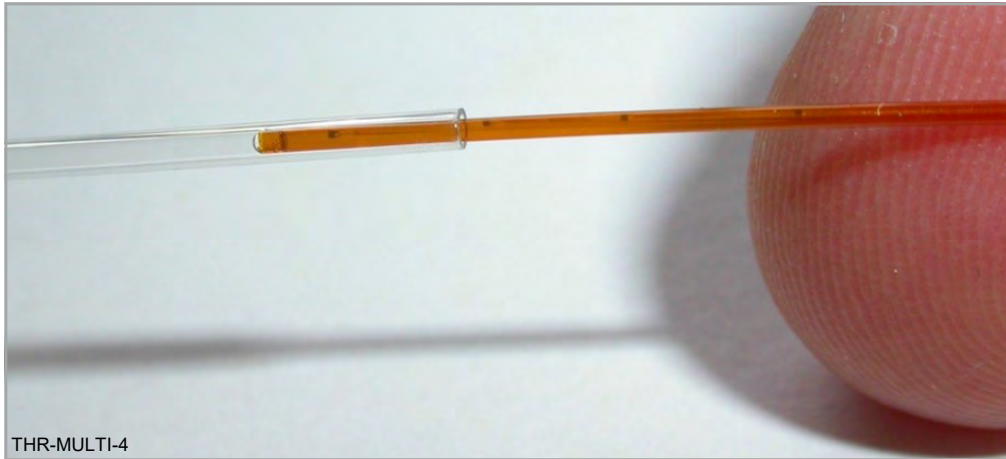
1. Custom temperature range may impact accuracy and resolution. Contact your representative for more details.
2. THR sensor and SPC-HR between 10 to 90°C: includes reproducibility (sensor/module interchangeability), repeatability and hysteresis, non-linearity, scale error, offset error, conditioner temperature compensation error.
3. Model dependent—contact your representative for more details



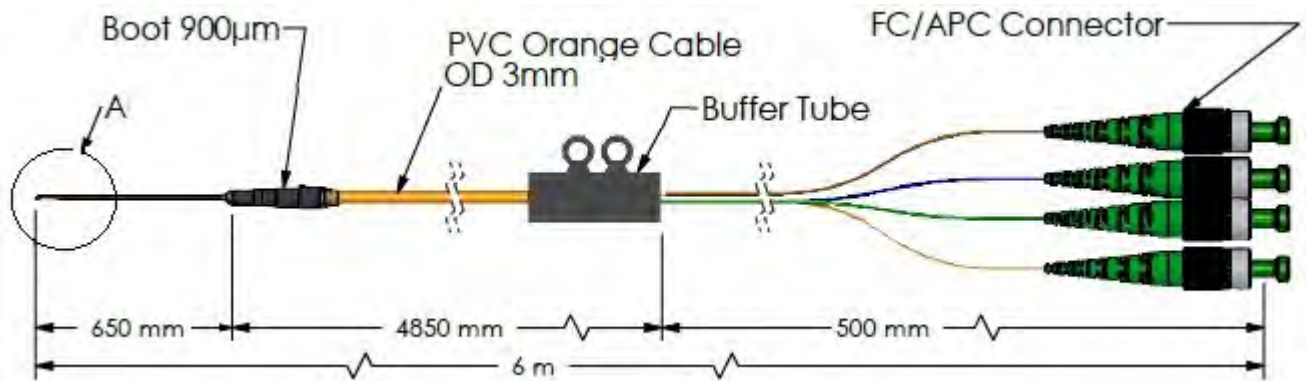
Multi-Points Temperature Sensors

MEDICAL

MULTI-POINT SENSORS



MULTI-POINT SENSORS



Detail A of multi-point sensor distal tip¹



¹The number of temperature points can also be customised, and more or less distance between sensors, please contact your FISO representative.

Preliminary



The SPC-HR reading module is designed for research and OEM applications

Description

The SPC-HR, like all FISO FPI Modules, is compatible with **evolution** chassis and with the **evolution** software¹.

The SPC-HR is suitable for medical temperature measurements.

It can be used with the same chassis as other FISO FPI Modules and used at the same time on an EVO platform.

The light source life expectancy is above 20,000hrs.

The SPC-HR is RoHS compliant.

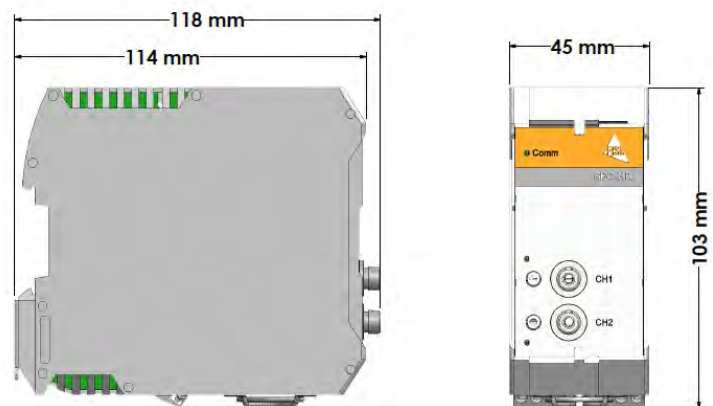
EVOLUTION Chassis Configurations

- ▶ EVO-SD-2 (up to 2 modules)
- ▶ EVO-SD-5 (up to 5 modules)
- ▶ EVO-RM-8 (up to 8 modules)

Specifications

	SPC-HR
Number of channel(s)	2 channels
Sampling rate up to	125Hz
Analog output	0 to 5V 16 bit resolution
Analog output delay response ²	16ms
Power consumption	24VDC, 5 Watts
Operating temperature	10°C to 50°C
Storage temperature	-30°C to 80°C
Communication	USB via EVO chassis, TS 35 DIN RAIL

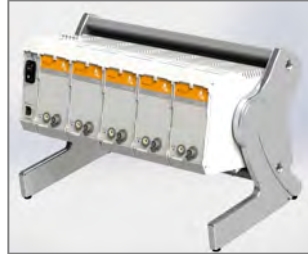
Dimensions



1. The evolution software is included with the evolution chassis.
2. Delay between the physical phenomenon and the analog output change.



The **evolution** chassis is the easiest way to configure and use **evolution** modules.



Description

The **evolution** chassis footprint, communication capabilities and speed make it the ideal tool for laboratory and on-site test environments.

The **evolution** chassis can house different module types with different channel capabilities to combine results from a single acquisition source.

The **evolution** chassis has a different number of module slots, depending on the model.

USB communication interface is available on all chassis.

The SD-2, SD-5 and RM **evolution** chassis package includes the following components:

- **evolution** chassis unit,
- **i-vo** module,
- Power supply adaptor and cord,
- USB interface cable,
- Module removal tool,
- User guide,
- CD containing software driver and manual (pdf).

Key Features

- i-vo module for communication and for power supply distribution
- USB communication
- Evolution software for sensor and module configuration and for data acquisition up to 5k samples/sec. total.
- External data acquisition system required for acquisition rates > 5k samples/sec.
- Full bandwidth via analog output connectors

Applications

- Laboratory measurements with evolution modules
- Easy set-up of evolution modules before migrating modules into your own equipment

Specifications

Model	EVO-SD-2	EVO-SD-5	EVO-RM
Communication	USB	USB	USB
Data logging	Via computer	Via computer	Via computer
Number of modules	Up to 2	Up to 5	Up to 8
Power supply	24 VDC 70 W	24 VDC 70 W	24 VDC 150 W
Evolution software	Included	Included	Included
Maximum rate of acquisition ¹	5 k samples/sec. total	5 k samples/sec. total	5 k samples/sec. total
Dimensions	W:133 x H:177 x D:156mm	W:269 x H:177 x D:156mm	W:483 x H:132 x D:175mm

¹. With the **evolution** software and chassis. Analog output is available directly on the reading modules, offering full acquisition rate. Ex. FPI-HS plugged on analog is at 15Ksamples/sec.

Preliminary

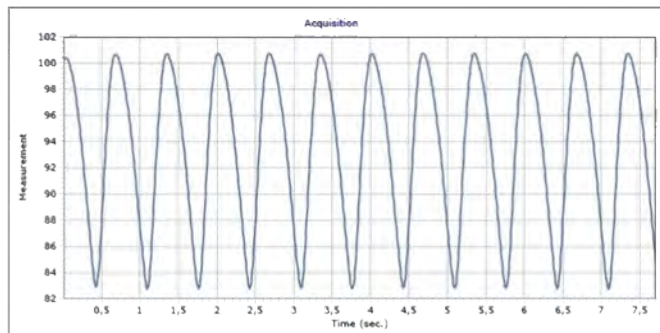


EVOLUTION Software

The application software allows users to configure and control the reading module, perform simple monitoring and real-time graphing, and also export data. Users may choose between reading the actual single measurement (monitoring) or 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 multiple formats such as TIF or JPEG.

Monitoring & real-time results

Users may choose reading the actual measurement, or plot in real-time with user's specified screen refresh rates.



Example of "live" plot diagram.

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 module.

- Item #: CFO-NS-1164D (5 meters FCA to FCA extension)
- CFO-NS-1164B (10 meters FCA to FCA extension)



FCA to FCA connectors extension.

FISO SALES PROCESS



Define your needs

Discuss with our sales engineers and explain your project. They will guide you through the best options available.

Choose sensor type

Our engineers will help you find a matching solution through our many types of sensors, sizes, measurement ranges, cable types, lengths, robustness and more.

Technology Assessment

Familiarize yourself with the FISO system by working with the SKR-DEV and real sensors. Build device prototypes with sensors and evaluate performance.

Customization

To enable mass production, FISO can customize the cable type, fiber length, tip protection and testing to match the requirements of the OEM medical device.

Products designed, manufacture and sold by FISO Technologies Inc. ("FISO"), or it's authorized distributors, agents or resellers, are not and shall not be considered or represented as being medical instruments. Such products have not been approved or certified, nor submitted for approval or certification, by applicable regulatory bodies including, without limitation, the office of device evaluation of the U.S. Food and Drug Administration of the Therapeutic Products Directorate of Health Canada. Products Purchased with the intent or for the purpose of being used as medical devices or components shall be done at purchasers or user's own risk. FISO disclaims all liability with respect to any and all use of its products as medical devices or components, or in any medical application or procedure including, without limitation, in vitro or in vivo uses. FISO products are scientific instruments whose misuse is potentially dangerous. They are intended to be installed and used only by qualified personnel. FISO's liability to purchaser for claims related to the purchase, transportation, installation or use of its products shall be limited to the aggregate value of the purchase price of the products as stated in FISO's invoice to purchaser. In no event shall FISO be liable for any direct, indirect, punitive, special incidental, or consequential damages in connection with or related to the purchase, transportation, installation or use of its products (including loss of profits, use, or other economic advantage), however arising, whether for breach of warranty or in tort, even if FISO has been previously advised of the intended use of its products or of the possibility of such damage.

