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FOTS100 FIBER OPTIC TEMPERATURE SYSTEM

FOTS100 Control Unit
TSD180/182/181 Fiber Optic Temperature Probes

This is a standalone system, but it can also be interfaced to BIOPAC modules using BIOPAC interface cables. Use with high-accuracy, MRI-conditional fiber optic temperature probes TSD180, TSD182, or TSD181.

FOTS100 includes control unit with RS-232 port, ± 5 V analog output. Power via 12 V AC/DC wall transformer adapter. (Battery operation no longer supported.)

The analog output parameters comprise the scale factor and the offset. The scale factor corresponds to the physical unit per Volt (unit/V) output by the system, while the offset corresponds to the physical value the user wants the analog output to be at zero volt.

For example, with a scale factor set to 10° C / V and the offset set to 5° C, the temperature as a function of the analog output voltage is given by:

Temperature = [Voltage output] x 10° C / V + 5° C.

The default value of the scale factor is 50° C / V (or its equivalent in °F) and the default value of the offset is 0° C (or its equivalent in °F). During a No Signal condition, the analog output and the serial ports output constant values as follow:

Output	No Signal condition output value
Analog	0 Volt
RS-232	65 536.0

For more details, please see the complete FOTS100 User Manual, available online.

FOTS100 Specifications

Output interface:	Display, ±5 Volts Analog output, and RS-232 standard
Interface for MP160 System:	Add CBL101 3.5 mm mono phone plug to male RCA + CBL122 unisolated RJ11 to 3.5 mm jack (purchased separately)
Interface for MP150/100 System:	Add CBL101 3.5 mm mono phone plug to male RCA (purchased separately)
Interface for MP36/35 System:	Add SS70LA isolated BNC interface and a BNC-to-RCA cable (purchased separately)
Channels:	One
Compatibility:	TSD180, TSD182 and TSD181 high accuracy fiber-optic temperature sensors
Accuracy:	±0.3° C (Total accuracy - includes both signal conditioner and transducer errors)
Temperature range:	20° C to 60° C (higher range also available)
Resolution:	0.1° C
Sampling rate:	50 Hz (20 ms)
Communication protocol:	SCPI (default)
Input power:	12 VDC (AC/DC wall-transformer adapter included)
Consumption:	1.8 Watts typical
Enclosure:	Plastic casing
Dimensions:	45 mm (H) x 105 mm (W) x 165 mm (L)
Storage temperature:	-40° C to 65° C
Operating temperature:	0° C to 45° C
Humidity:	95% non-condensing
Light source life span:	> 150,000 hours (> 17 years) MTBF

MAGNETIC SENSITIVITY

FOTS100

Pico-M signal conditioner – GaAs temperature sensing technology

When exposed to strong magnetic field, the GaAs sensor used with the FOTS100 will see an artificial shift in temperature:

Magnetic field	Shift in T° (approximately)
0 T	0 °C
1.5 T	< 0.2 °C
3 T	-0.4 °C
7 T	-2.5 °C
9.4 T	-4.5 °C

This shift does not depend on field orientation and is very reproducible in a given setup, hence it can be easily factored out by the user.

The values at field strength come from the following article: Buchenberg, W.B., Dadakova, T., Groebner, J., Bock, M. and Jung, B. (2015), Comparison of two fiber-optical temperature measurement systems in magnetic fields up to 9.4 Tesla. Magn. Reson. Med., 73: 2047-2051. doi:10.1002/mrm.25314

FOTS200

AccuSens signal conditioner—WLPI temperature sensing technology

- WLPI stands for “White-Light Polarimetric Interferometry”

The TSD380 series sensor probes associated with the FOTS200 readout unit have an optical sensing element that is insensitive to magnetic field, hence, there is no maximum magnetic field specification, which is a nice advantage in high-field MRI applications.

However, this technology has some disadvantages: it is more expensive; the probe cannot be made to a diameter smaller than 1.2 mmm O.D.

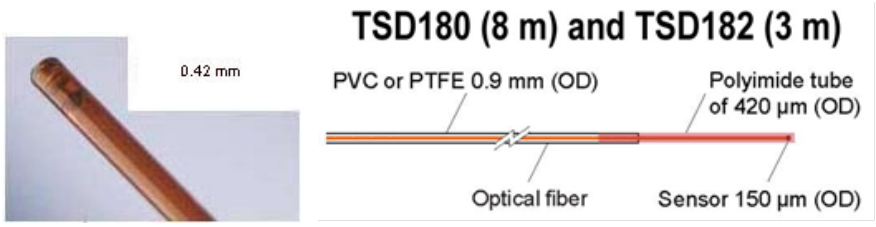
PROBES

MRI Use: MR Conditional

Condition: Max MR field strength 3T; FOTS100 module stays in the control room.

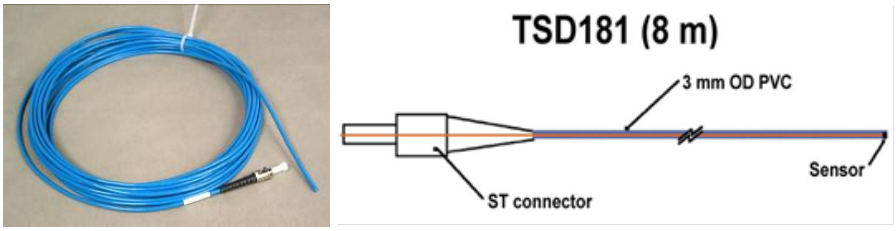
TSD180 & TSD182 FO TEMPERATURE PROBE

For mice and rats, 420 µm OD Polyimide tubing, 900 µm OD tight buffer PVC, 8 m (TSD180), 3 m (TSD182). The Polyimide round tubing protects the sensing element while its flexibility and rigidity provide excellent pushability.



TSD181 FO TEMPERATURE PROBE

For cats, dogs, primates; 3 mm OD Kevlar reinforced PVC cable; 8 m cable. Cable sheath rated up to 85° C.



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TSD180, TSD182 and TSD181 Specifications

SPECS	TSD180 and TSD182	TSD181
Temperature range:	0° C to +85° C (other ranges AUR)	
Response Time:	250 ms and better	1.5 sec. typical
Temperature operating & calibrated range:	20° C to 45° C (other ranges AUR)	
Accuracy:	±0.2° C (Total accuracy over the calibrated range including both signal conditioner and sensor errors)	±0.3° C (Total accuracy over the calibrated range including both signal conditioner and sensor errors)
Resolution:	0.05° C	
Operating humidity range:	0-100%	
MRI/EMI/RFI susceptibility:	Complete immunity	
Calibration:	NIST traceable	
Optical connector:	ST standard	
Cable sheathing:	420 µm OD of Polyimide tubing; 900 µm OD tight buffer PVC	3 mm OD Kevlar reinforced PVC cable
Cable length:	8 m (TSD180/181) 3 m (TSD182)	
Signal conditioner compatibility:	FOTS100 system	
Interface:	FOTS100 is a standalone Fiber Optic Temperature System	
Optional interface:	MP160 or MP150 System via FOTS100 and CBL101	