FOTEMP1-OEM-MNT Manual

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Revision A3

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Revision History

Revision	Date	Notes
A	12/20/2016	Original Release
A1	10/17/2017	Added FOTEMP1-OEM-MNT-4 (with 4-20mA output option)
A2	3/21/2018	Corrected polarity of 4-20mA output connections
A3	7/11/2023	Updated for Micronor Sensors Inc.

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1. Product Description

1.1 FOTEMP1-OEM-MNT

Figure 1. FOTEMP1-OEM-MNT PCB-Based Signal Conditioner/Controller.

The FOTEMP-OEM-MNT is a small form factor PCB-sandwich module designed for low cost insertion of high precision GaAs-based fiber optic temperature sensor technology into OEM applications where common electrical temperature sensors and thermocouples cannot be used.

This OEM product is compatible with all TS series fiber optic temperature probes. The sensors are entirely non-metallic and electrically passive, providing immunity to EMI, RFI, NMR, high voltage, microwaves and radiation

The FOTEMP1-OEM-MNT PCB signal conditioner incorporates three digital interface; USB, RS232, and SPI. USB interface is Type B jack while RS232 and SPI share electrical interface connections via a DB9 connector.

1.2 Fields of Applications

- EMI, RFI, and Microwave Environments
- High Voltage Environments
- Harsh and Hazardous Environments
- Nuclear Environments
- Aerospace Applications
- Process Monitoring
- Medical Applications (MR)

1.3 Features

- Designed for OEM Integration
- Very Small Size, Small Footprint
- Modular Electronics Support Various Device Configurations
- High Accuracy
- Built in USB, RS232, and SPI Interface
- Attractive OEM Volume Discounts

1.4 Ordering Codes

Standard configurations typically available from stock:

FOTEMP1-OEM-MNT	1-Channel Controller, USB/RS232/SPI, No Analog Output
FOTEMP1-OEM-MNT-4	1-Channel Controller, USB/RS232/SPI, 4-20mA Output

Contact Micronor sales concerning other configurations.

2. Specifications

Table 1: FOTEMP-OEM-MNT Specifications

Parameter	Specification
Optical Interface	ST plug, Single input compatible with all TS Series fiber optic temperature probes
Fiber	200/220, 0.22NA Step Index Multimode Fiber
Measuring Range	Standard Calibration: -40°C to +300°C Extended Calibration: -200°C to +300°C
Internal Accuracy	+/- 0.2°C
Internal Sampling Rate	2 Hz
Internal Resolution	0.1°C
SPI Communication Protocol	SPI, Slave, Output Only, 16-bit packet (TI TMP123 format)
SPI Clock	1 MHz max **OR** 10 MHz max with 1µs delay between bytes
Power Required	12 VDC, 350 mA
Electrical Interface	Power Connector (2-pin Molex): +V, GND DB9 (Female): SPI (Ground, Clock, Serial Out, Chip Select); RS232 (RxD and TxD) USB via Type B receptacle 4-20mA (only available on FOTEMP1-OEM-MNT-4, 2pin Molex))
Operating Temperature	Operating 0°C to +50°C, Storage -20°C to +70°C
Humidity	0-95%, Non-condensing
Ingress Protection	IP00
Dimensions	100mm L x 80mm W x 34mm H

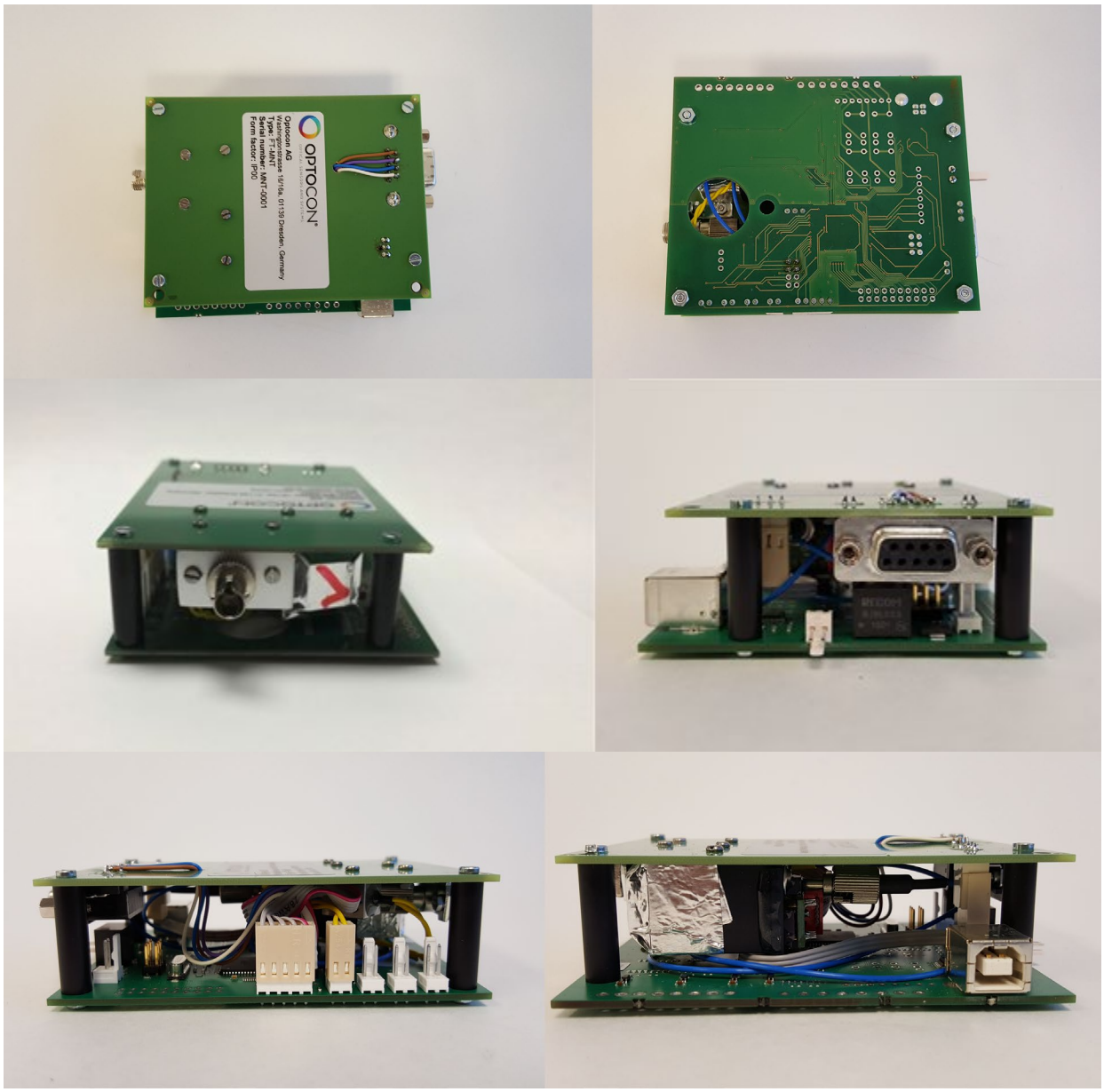

Figure 2: Various Views of Signal Conditioner

2.1 OPTOCON SPI Protocol

The OPTOCON FOTEMP-OEM-MNT offers various interface options.

The SPI interface is specifically designed to be compatible with the Texas Instruments TMP123 temperature sensor chip.

The temperature read is started by pulling /SS low and clocking out a 16-bit word with the high byte read first. Only the high order 13 bits are relevant to the temperature reading. The 13 bits are standard two's complement for a signed integer. The most significant bit is the sign while the following 12 bits represents temperature in 1/16°C increments. The lowest three bits are not used. See *Table 2* for binary output format of the temperature reading.

The following limitations apply:

- Maximum read out clock speed is 1MHz, or 10MHz with a 1µs "inter byte spacing" clock delay.
- The value of the three least significant bits are always 0.

Table 2: Temperature Conversion

Temperature (Degree C)	Digital Code
150 C	0x4B00
125 C	0x3E80
25 C	0x0C80
0.0625 C	0x0008
0 C	0x0000
-0.625 C	0xFFF8
-25 C	0xF380
-55 C	0xE480
No Sensor Connected	0x9600

Figures 3 and 4 illustrate the "data gap" or "inter byte spacing". The time between the first and second data byte must be 1µs and be guaranteed > 750ns.

2.2 Timing Diagrams

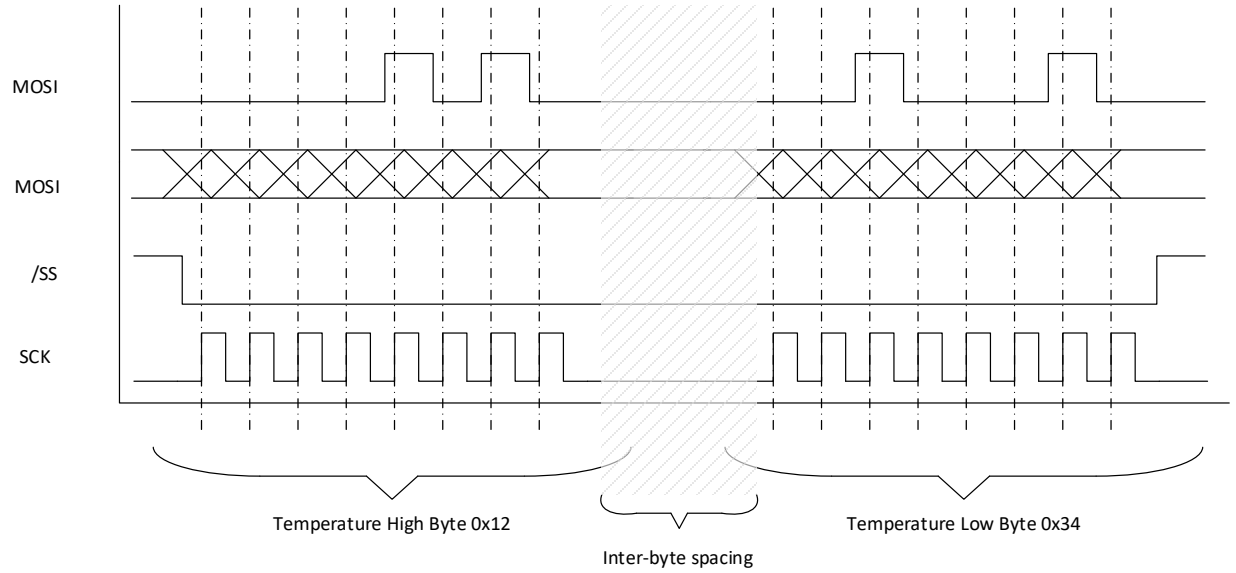

Figure 3: Timing Diagram of One Complete Read Access

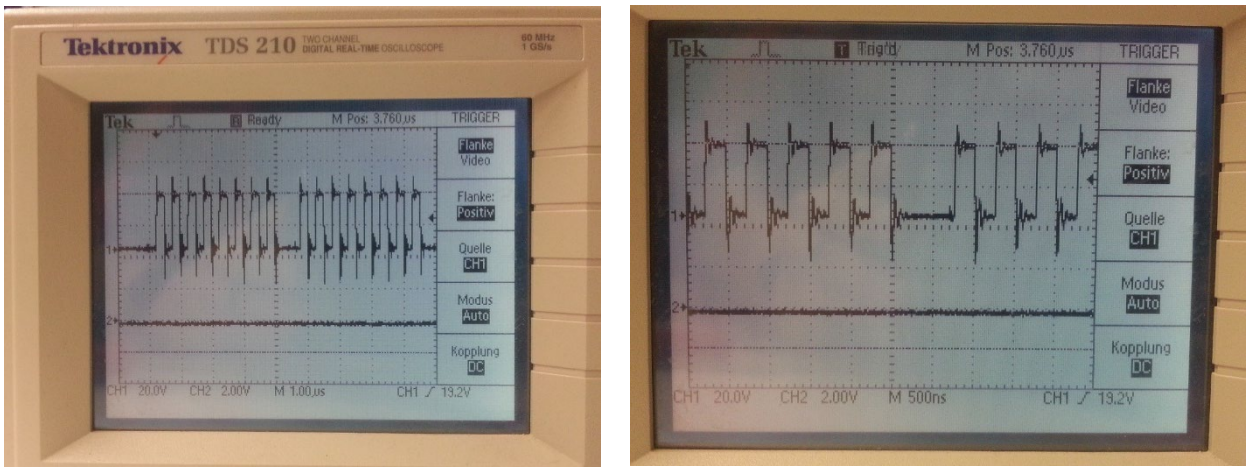

Figure 4: Oscilloscope Display Shows the "Data Gap" Between the Two Bytes

2.3 Digital Input/Output Signal Requirements

Table 3: Digital Input/Output Electrical Characteristics

Signal	Condition	Min	Max
Input Logic Levels			
VIH	VCC = 2.7 - 3.6V	2	--
VIL		--	0.8V
Output Logic Levels			
VOL (IOL=2mA)		--	0.4V
VOH (IOH=-2mA)	VCC = 2.7 - 3.6V	2.4V	--
SPI Clock Frequency		--	1 MHz or 10 MHz with 1µs Spacing

2.4 Connections

Figure 5: FOTEMP1-OEM-MNT Interface Connections

2.5 Application Specific Connections

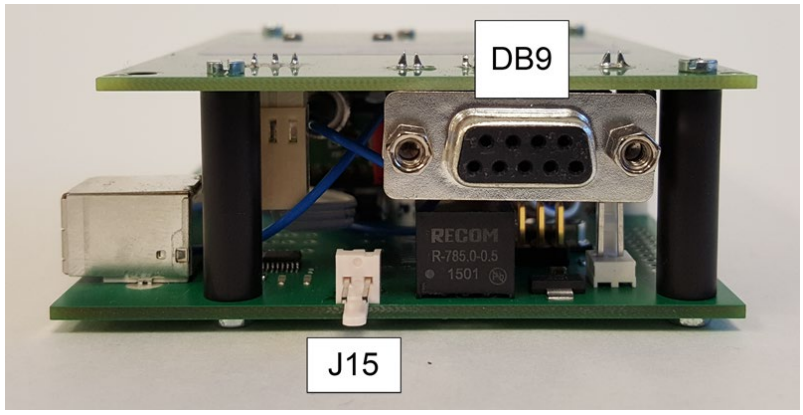

Figure 6: Location of DB9 RS232/SPI and J16 Power Connector

Function: SPI and RS232
Connector: DB9, Female with 9x Socket Contacts
Mating Connector: DB9 Male Plug with 9x Pin Contacts

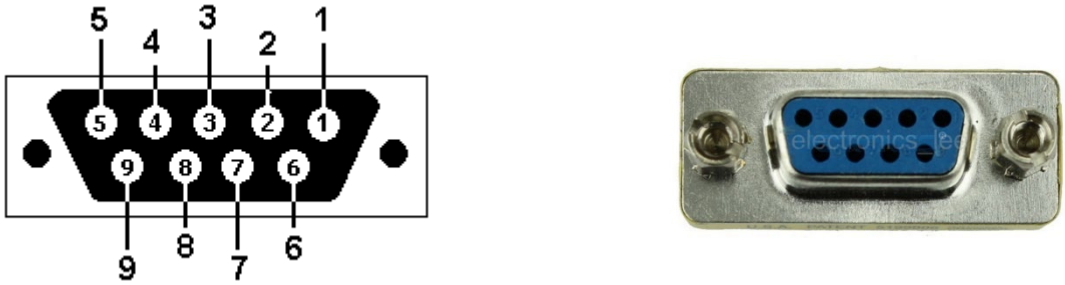

Figure 7: Front View and Pin-Outs of Female D89 Connector

IMPORTANT NOTE:
The RS232 signals uses 12V signals. A special cable must be used that does not connect pins 6-9 as the normal RS232 12V handshake signals appearing on these pins may damage the SPI 5V signals.

Table 4: D89 Signal Connections

Pin	Signal	Notes
1	Not connected	
2	RxD (RS232)	Data Out, RS232, DCE, 12V
3	TxD (RS232)	Data In, RS232, DCE, 12V
4	Not connected	
5	GND	GND
6	MOSI (SPI)	L2C, SPI, 5V
7	/SS (SPI)	L1C, SPI, 5V
8	SCK (SPI)	L4C, SPI, 5V
9	MISO (SPI)	L3C, SPI, 5V

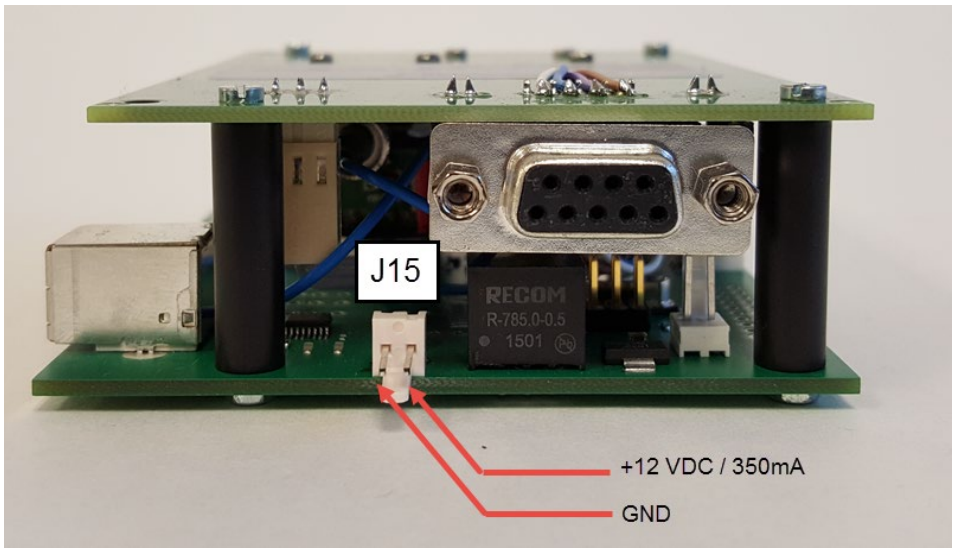

Figure 8: Power Connections to J15 on FOTEMP-OEM-MNT

Function: Power, J15
Connector: 2C Pin Header,
Mating Connector: 2C, Socket Plug

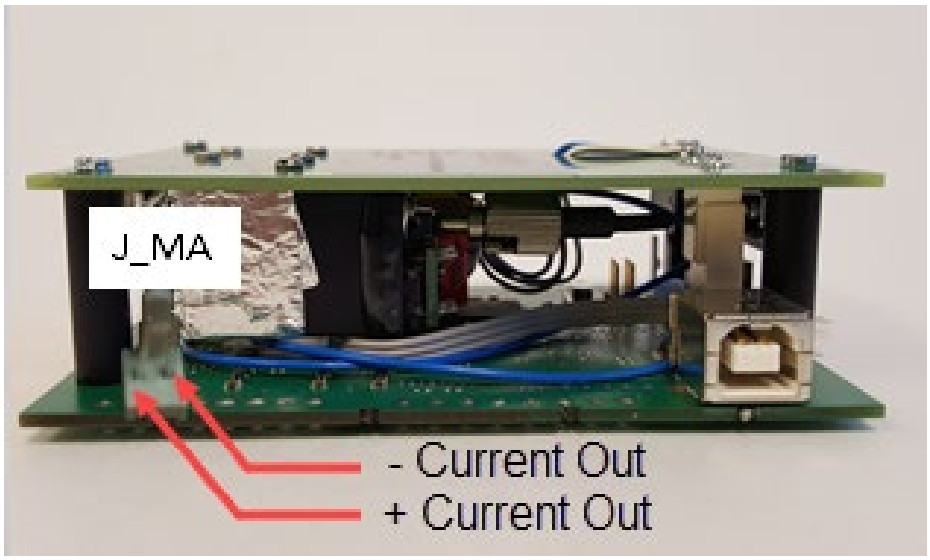

Figure 9: Connections to 4-20mA output on FOTEMP-OEM-MNT-4

Function: 4-20mA Analog Output, J_MA
Connector: 2C Pin Header,
Mating Connector: 2C, Socket Plug

3. Operation

3.1 Contents

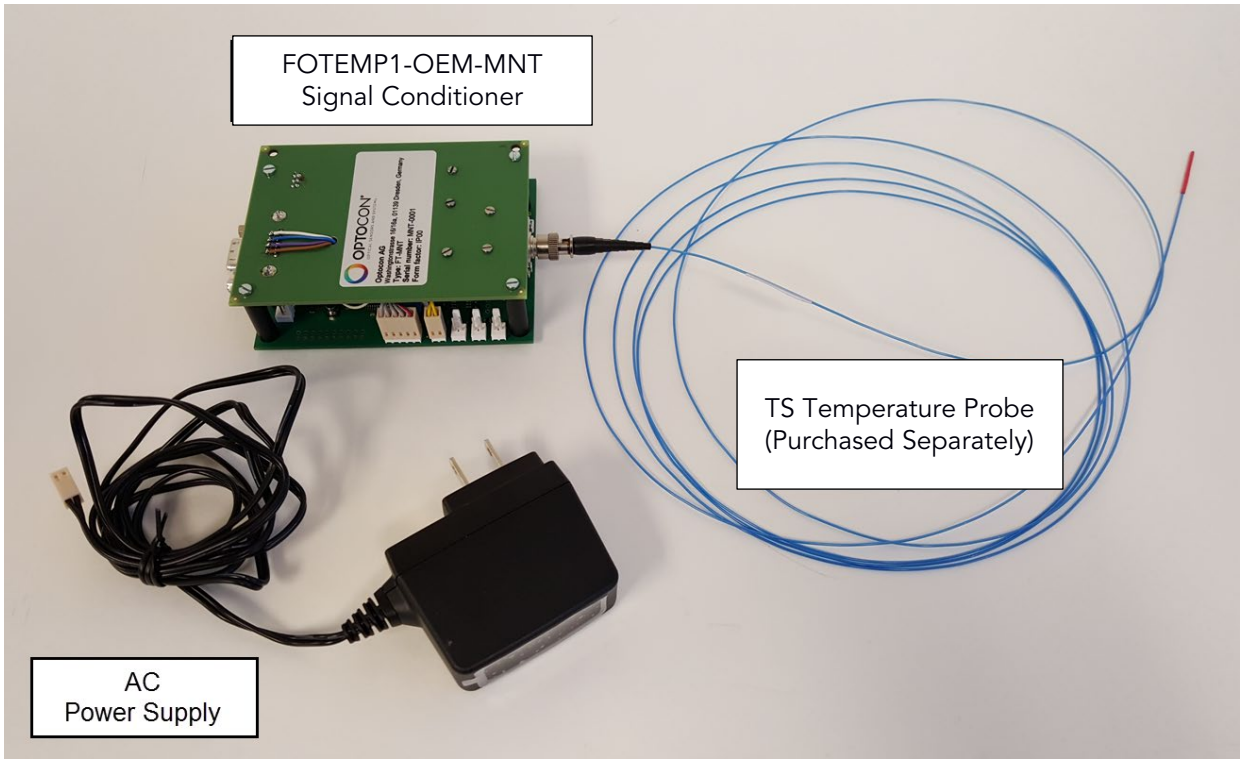

Figure 10: Key Contents of the FOTEMP Temperature System

The FOTEMP1-OEM-MNT system contains the following:

- FOTEMP1-OEM-MNT Signal Conditioner
- AC Power Supply (Upon request for engineering evaluation applications only)
- CDROM with FOTEMP-ASSISTANT Software, USB Drivers and other support documentation (not shown)

Available Separately:

- TS Series Temperature Probes

3.2 SPI Test Connections

The system was connected and tested as shown in *Figure 10*. The Micronor SPI Master Emulator displays the both the TMP123-type binary reading and temperature in °C. From the FOTEMP signal conditioner.

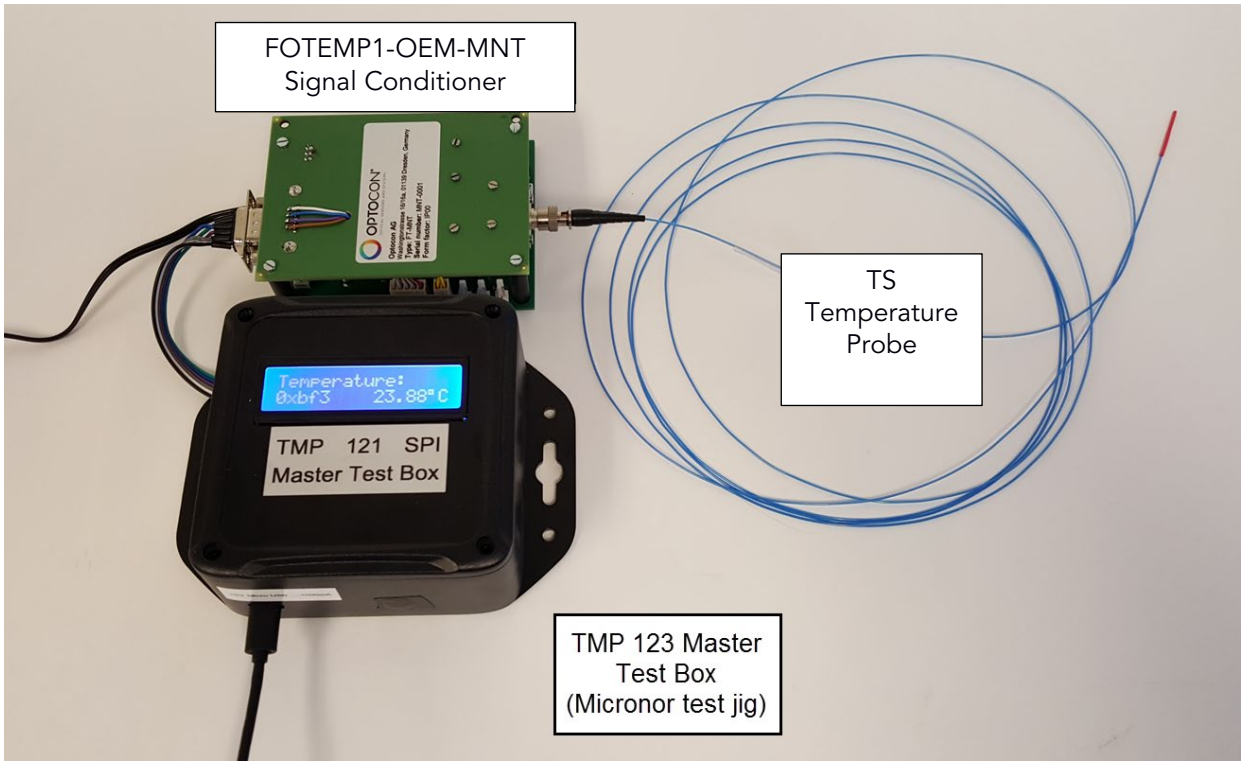

Figure 11: Test Setup Shown With Micronor SPI Master Test Box

Steps

1. Connect TS2 temperature probe to ST optical interface
2. Connect 12 V Power to J15 pin header
3. Connect SPI interface using DB9 Male Connector With Pin Contacts

3.3 Temperature Calibration Using FOTEMP-ASSISTANT Software

The FOTEMP1 will need to be calibrated with the actual temperature sensor used. This is achieved using a PC running the supplied FOTEMP-ASSISTANT graphical display/data logging software and connecting to the FOTEMP1 signal conditioner either via RS232 or USB interface.

For more information regarding calibration using FOTEMP-Assistant please refer to the FOTEMP-ASSITANT2 Manual.

3.4 FOTEMP-Assistant Software Installation

The FOTEMP-ASSISTANT V2 software is provided on the supplied CDROM. It will work with either USB or RS232 Interface

For more information regarding the installation of FOTEMP-Assistant please refer to the FOTEMP-ASSITANT2 Manual.

For RS232 operation

1. Connect the FOTEMP1 signal conditioner to the PC using Specially Wired RS232 cable. This special cable has Pins 6-9 disconnected so that the 12V RS232 signals do not damage the 5V SPI signals wired to these DB9 pins.
2. Click on the Program File and then [PortSettings]. Be sure that COM1 is selected.
3. Select [OK] and then [Connect] to start the program. After a few seconds, the program should start and display temperature.

For USB operation

1. Connect the FOTEMP1 signal conditioner to the PC using supplied USB cable. If Windows tells you that the device has been properly installed, then continue to Step 3.
2. Disconnect the USB cable. Windows was not able to load the correct Virtual Comm Port (VCP) drivers for the FTDI serial interface chip. You will need to install VCP drivers (either 32-bit or 64-bit depending on your system) supplied on the CD. Then repeat Step 1.
3. Click on the Program File and then [PortSettings]. Select the COMx port that corresponds to VCP assigned to the FOTEMP unit.
4. Select [OK] and then [Connect] to start the program. After a few seconds, the program should start and display temperature.
5. If the program will not start, then contact Micronor for assistance.

Note:
If developing custom communications software, contact Micronor for ASCII Protocol. Sample National Instruments LabVIEW™ Driver is also available.

4. Warranty Information

Warranty

MICRONOR SENSORS INC. warrants this product to be free from defects in material and workmanship for a period of 1 (one) year from date of shipment. During the warranty period we will, at our option, either repair or replace any product that proves to be defective.

To exercise this warranty, write or call MICRONOR SENORS INC. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitations of Warranty
This warranty does not apply to defects resulting from unauthorized modification or misuse of any product or part. This warranty also does not apply to Fiber Optic Connector interfaces, fuses or AC line cords. This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability of fitness for a particular use. MICRONOR SENSORS INC. shall not be liable for any indirect, special or consequent damages.

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5. Mechanical Reference Drawing