

INSTRUCTION MANUAL

FOTEMP T20

Fiber optic temperature measurement system



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General

The fiber optic temperature measurement system described in the operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production.

These operating instructions contain important information on handling the instrument. Working safely requires that all safety instructions and work instructions are observed.

Observe the relevant local accident prevention regulations and general safety regulations for the instrument's range of use.

The operating instructions are part of the product and must be kept in the immediate vicinity of the instrument and readily accessible to skilled personnel at any time. Skilled personnel must have carefully read and understood the operating instructions prior to beginning any work.

The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, noncompliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorized modifications to the instrument.

The general terms and conditions contained in the sales documentation shall apply.

Subject to technical modifications.

Further information at: www.comem.com.

Safety

Safety instructions

This manual contains important information to ensure personal safety and to prevent damage. Explanation of symbols:

	WARNING
Indicates a potentially dangerous situation that can result in injury or death, if not avoided.	

	CAUTION
Indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.	

	NOTE
Points out useful tips, recommendations, and information for efficient and trouble-free operation.	

Skilled personnel:

Personnel who, based on their technical training, knowledge of measurement and control technology and their experience and knowledge of country-specific regulations, current standards, and directives, can carry out the work described and independently recognizing potential hazards.

Intended use:

The instrument has been designed and built solely for the intended use described here and may only be used accordingly. The technical specifications contained in these operating instructions must be observed.

Unpacking, inspection, service

When unpacking and inspecting your system components, you need to do the following:

1. Check all materials against the enclosed packing list.
2. Carefully unpack and inspect all components for visible damage.
3. Save all packing materials, until you have inspected all components and find that there is no obvious or hidden damage.
4. Before shipment, each instrument is assembled, calibrated, and tested. If you note any damage or suspect damage, immediately contact us.
5. In case of a malfunction or service request please use our technical support.

Technical support

Email: customerservice@it.comem.com

TD +49 351 843 599 0

Equipment return address

COMEM Optocon GmbH
Washingtonstrasse 16/16a
01139 Dresden, Germany

Disposal

Inoperable instruments must be disposed of in compliance with local regulations for electronic materials.

Introduction

The FOTEMP T20 fiber optic temperature measurement system with its design is intended for use in power transformers. With fiber optic sensors it is ideal for measuring transformers winding hot spots in real time, allowing an optimized operation of the asset at safe load capacity during normal and emergency condition.

FOTEMP T20 can be used for many fields of application, e.g.:

- EHV/UHV/HVDC transformers
- Power and distribution transformers
- Reactors and generators
- Load tap charger

The probes used for temperature measurement consist of a PTFE-housed glass fiber with a GaAs crystal (gallium arsenide) at the tip. The probe is completely non-metallic and therefore completely non-conductive.

COMEMs fiber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, intrinsic safety, and non-invasive use. The probes are also designed to withstand harsh and corrosive environments.

Starting at a light wavelength of 850nm GaAs becomes optical translucent. Since the position of the band gap is temperature dependent, it shifts about 0.4nm/Kelvin. The measurement device contains a light source and a device for the spectral detection of the band gap. This guarantees fast, repeatable, and reproducible measurements.

Thanks to its accompanying software FOTEMP Assistant 2, measurement results can be easily controlled and monitored.

Over the entire life of the system re-calibration is not required to remain within the specifications. Inoperable instruments must be disposed of in compliance with local regulations for electronic materials.

Product specification

Measurement	
Measurement Range	-200 °C to 300 °C
Measuring Time	< 250 ms per Channel
Accuracy (Standard Deviation)	1.0 K
Resolution	0.1 K
Probes	Compatible with all COMEM fiber optic temperature probes

Environment	
Communication Protocols	ASCII, Modbus
Interfaces	RS485, USB, Ethernet
Operating Temperature	-20 °C to 60 °C
Storage Temperature	-20 °C to 70 °C
Connector Type	ST

Device	
Channel	2 to 16
Display	4.3" LCD
Additional Interfaces	---
Data Logging	Continuous or timed temperature logging
Power Supply	24 VDC
Dimension	209 x 203 x 109 mm
Weight	2.0 kg

Calibration

For accurate temperature measurements in critical areas, we provide a comprehensive calibration service for our fiber optic temperature measurement devices. Our modern labs and our qualified staff ensure very accurate and fast calibration.

You will receive your unit back within a few days, ready to start your fiber optic measurement projects. Your fiber optic thermometer comes factory-calibrated. An annual re-calibration is not necessary, unless required by internal company regulations. All calibrations are performed at our factory.

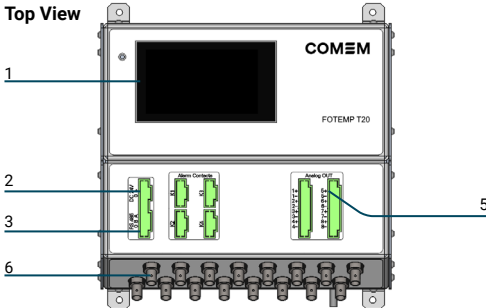
We provide a full certificate of test results for each calibrated device.

For more information contact us:
customerservice@it.comem.com

Quick start

This quick reference guide gives you an overview for quick usage. However, it cannot replace extensive literature with important information and safety warnings.

Top View



1. Display

The LCD display shows the temperature readings and other information for the user.

2. Power supply

Connector for external power supply. Ensure that you only use power supply units that comply with the specifications.

3. Terminal Plug

Port for RS485 bus.

4. Relay header

1WDT, 1 sensor, 2 free programmable relays

5. Analogue

16 pins for 8 channel-bound analogue outputs

6. Sensor connection

These are ST type connectors, mating to each of the optical temperature sensors. If you need to extend the fiber optic temperature sensor, please use the extension cables also available from COMEM.

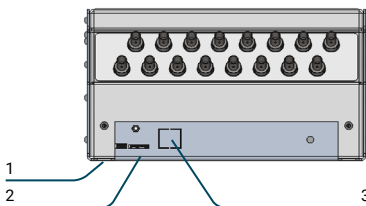
Front View

1. USB interface

USB-Micro Port for communication.

2. Micro SD-Card slot

3. Ethernet interface



Installation

1. Plug the fiber optic temperature sensors to the ST-socket.
2. Connect the USB for communication and power supply.
3. If you want to supply the device with power externally, please connect it to an appropriate power supply. (Optional)
4. After you have connected the power supply, the device starts and the LED lights up green.
5. Now the device is ready for measurement.



NOTE

If no sensor is connected or the signal quality is too low, the LED will light up red.



CAUTION

The fiber optical temperature measurement systems only function with COMEM fiber optic temperature sensors. Please do not use temperature sensors of other brands.

General installation guidelines:

Please read the instructions for installing the fiber optic instrument carefully. Please note especially the order of the instructions exactly.

Sensor connection (page 6)

The temperature sensors are connected via the ST-plugs to the ST-socket. Please note to insert the plugs pushing slightly against the spring pressure and to turn with a clockwise rotation. All fiber optical temperature sensors of COMEM can be connected.

Sensor handling (page 7)

The sensor consists of a ST-plug at the end and a gallium arsenide crystal at the tip of the sensor. The crystal is sensitive and should not be exposed to excessive mechanical stress. Please note the information about the bending radius of the sensor. A forcible bending of the sensor leads to breakage of the fiber. In this case the sensor is damaged and needs to be repaired / replaced.

Relays (page 8)

The device offers 24 relays for different functions.

Logging (page 9)

It is possible to write all measured values to an SD card.

Serial communication (page 9)

The device can be connected to a PC via RS232 (TTL), RS485 or USB.

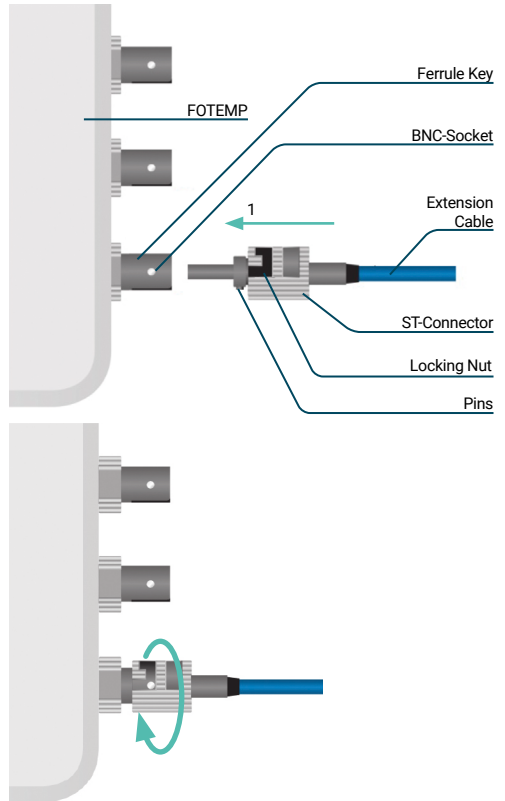
Automatic Integration Time Adjustment

Due to factors such as excessive bending/looping of the fiber or mechanical damage, the light signal received by the measuring device may be reduced (below 50%), which is usually a limiting factor for measuring devices. However, to ensure accurate measurements even with high attenuation, FOTEMP devices are equipped with a special function that automatically maintains a high signal strength.

With the "Automatic Integration Time Adjustment" function, highly attenuated signals can be optimized and maintained within a range of 35% to 100% and continue to be used for temperature measurement. Signal levels can be monitored via the FOTEMP Assistant software or, for devices with an integrated display, are shown directly on the user interface.

If the signal strength falls below 35%, an error is displayed in the FOTEMP Assistant software or on the device display (if available). In this case, the sensor or device must be checked for troubleshooting. Please refer to document AN206_FOTEMP_Device_Troubleshooting for more information.

Sensor connection



To ensure accurate measurements and long life of the fiber optic sensors and instruments, it is necessary to clean them regularly. More information about cleaning can be found on page X.

	NOTE
Any unused channels must be protected with supplied dust caps.	

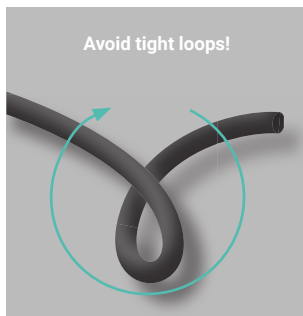
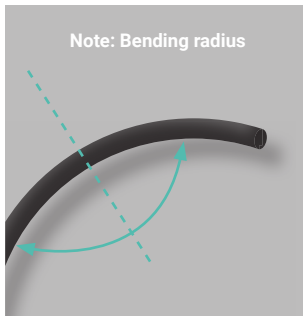
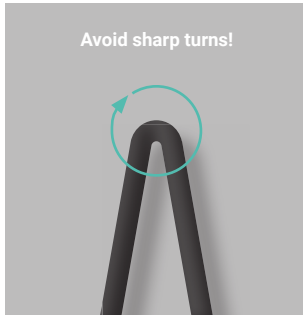
Test of sensor functionality

To test the functionality of the sensor, you can place the sensor into a test liquid, of which the temperature is known (e.g. boiling water). The sensor will respond with the given temperature within a few seconds.

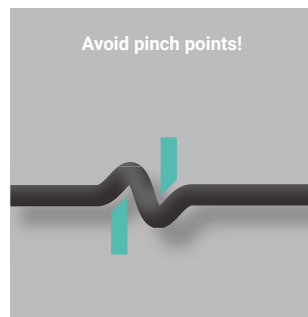
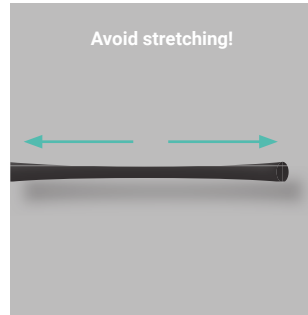
Sensor handling

Bending radius:

Fibers with a core diameter of 200 μm have a short time (≤ 10 min) bending radius of 10,0 mm and a long time (>10 min) bending radius of 27,0 mm.



Mechanical load:



Storage:

When not in use, the sensor should be carefully stored in its delivery box or suitable storage container to prevent bending or crushing. Apply the delivered dust cap to the ST connector.

Sensor/connector cleaning



Instructions

Clean the ST connector of the sensor with the connector cleaner. Softly press the connector on the cloth tape and rotate across the tape while rotating the connector. You can clean up to 6 connectors before advancing the tape. Tear off excess tape as required. Take a swab and wet it with the isopropanol wipes. In rotating motion smoothly insert swab into the internal connector of the conditioner. Avoid using cotton swabs.

Relays

Watchdog relay

The relay is based on the internal watchdog and closes if the device run in some issues and must reboot.



NOTE

The relay can be released by acknowledging the watchdog flag.

Sensor error relay

The relay is based on the operability of the sensors and closes if one or more of the channels get no valid spectrum for the temperature calculation. If a channel is disabled, it will not be considered.

Channel relays

The relay configuration consists of two steps. In the first step you must configure the channel parameters, whereas in the second one you have to sign the channels to the relays.

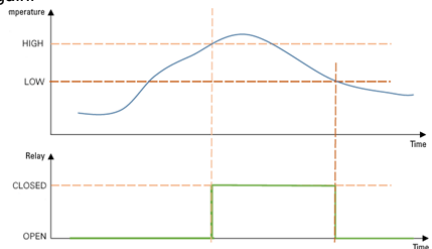
• Channel parameters configuration

- High and low temperature for the relay limits, configurable between -200°C and 300°C.
- High and low flag to activate the temperatures for the limitation.
- Invert flag for the close and open operation of the channel logic.

• Activation mode

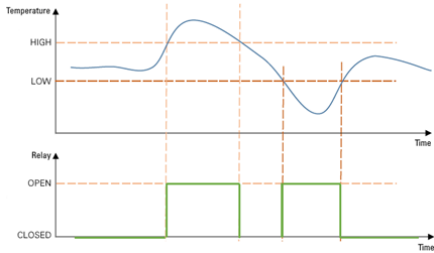
When the high and low flags are disabled the channel logic will work on the following model.

In this model, the temperature must exceed the high temperature to switch the relay and only when the temperature falls below the low temperature, the relay switches again.



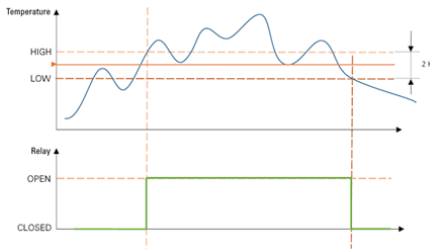
• **Limitation mode**

If one of the flags are enabled the channel logic will work on the following model. If the temperature exceeded a limit in its specific direction the relay opens to activate some downstream devices. You can choose an upper or lower limit, or both.



• **Hysteresis**

Around the limits it was implement a hysteresis of two Kelvin to avoid a fluttering of the relays.



• **Relay configuration**

You can assign each channel to both relays which implement an OR logic between them. If a channel is disabled or has an error, it will not be considered.

• **Configuration**

The temperatures limits and configuration flags can be found in the device configuration menu. For more information, see the FOTEMP ASSISTANT 2 Manual.

• **Modbus**

The temperatures limits can be found in the analog output holding registers and the flags in the discrete output coils. For more information, see the FOTEMP Modbus Data Map.

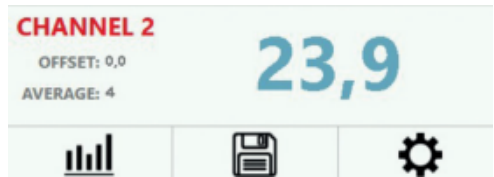
• **ASCII**

For more information, see the FOTEMP Ascii Commands.

Logging

Temperature logging

The device can store the temperature at set time intervals or continuously after each measurement. The recorded values are stored in a CSV file on the SD card.



You can adjust the time interval in the device menu from 0 (continuous) to 10 seconds.



The device stores spectra on the SD card as individual snapshots in a CSV file. To save the spectra again, you need to initiate the process once more.



Serial communication

You can connect the device to your computer using a USB-C cable. Once connected, you can use our free software FOTEMP Assistant 2, to view temperatures on your computer, customize settings, log temperatures, and display them in charts.

Alternatively, you can communicate with the device using our open ASCII protocol or Modbus

Troubleshooting

For more information please contact us or consult the Application note AN206: FOTEMP Device Troubleshooting <https://comem.com/en/library/>

COMEM SpA

Localita' Signolo 22, S.R. 11
36054 Montebello Vicentino
Vicenza - Italy
Tel +39 0444 449 311

COMEM Optocon GmbH

Washingtonstraße 16/16a
D-01139 Dresden
Germany
Tel +49 (0)351 8435990

This installation manual contains essential information for the user required to install & operate the product. In case you need any further information, contact us at customerservice@it.comem.com

www.comem.com

The data and illustrations are not binding. We reserve the right to modify the contents of this document without prior notice following the technical and product developments.

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