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InsuLogix® T Fiber Optic Probes and Extensions Installation Guide

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1. Product Warranty

The InsuLogix® T instrument is warranted (Parts and Workmanship) for two full years from the date of purchase. Upon written notification of any defect, Weidmann will either repair or replace any faulty product or components thereof. A Return Authorization Number (RMA) must be obtained from Weidmann or authorized distributor prior to any merchandise return.

The manufacturer's warranty is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with these operating instructions, assignment of insufficiently qualified skilled personnel or unauthorised modifications to the instrument. The general terms and conditions contained in the technical documentation shall apply.

The fiber optic probes are not warranted due to their unique nature.

2. Unpacking, Inspection and Service

Unpacking and Inspection

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 Weidmann.

Service

In case of a malfunction or service request please use our technical support which can be contacted by telephone Monday-Friday between 8:30 to 17:00 o'clock MET: +49 (351) 8435990 or email: info@optocon.de

RMA shipments must be sent to:

Weidmann Technologies Deutschland GmbH
Washingtonstrasse 16/16A17, 01139 Dresden
Germany

Product disposal

The unusable material must be disposed of in compliance with local regulations for electronic materials.

3. Fiber Optic Probes Design and Operation

Design

The outer jacket of the fiber optic temperature probes is made out of teflon. A GaAs crystal (Gallium Arsenide) sensor is attached at the tip of the probe.

The probe sensor is completely non-conductive. Weidmann's fiber optic sensors offer complete immunity to RF and microwave radiation with high temperature operating capability, intrinsic

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safety, and non-invasive use. The probes are also designed to withstand harsh and corrosive environments.

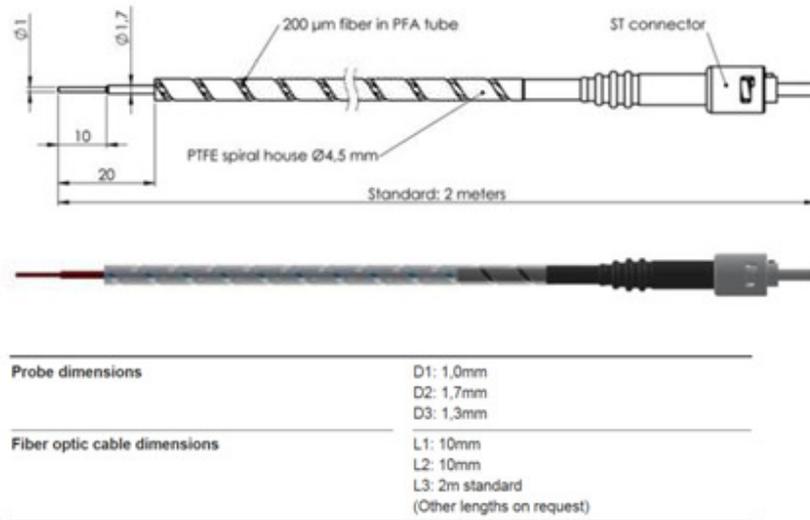


Figure 1 Fiber optic probe design and dimensions

Fiber Optic in Oil Connector (Optional)

DIMENSIONS

All dimensions in mm

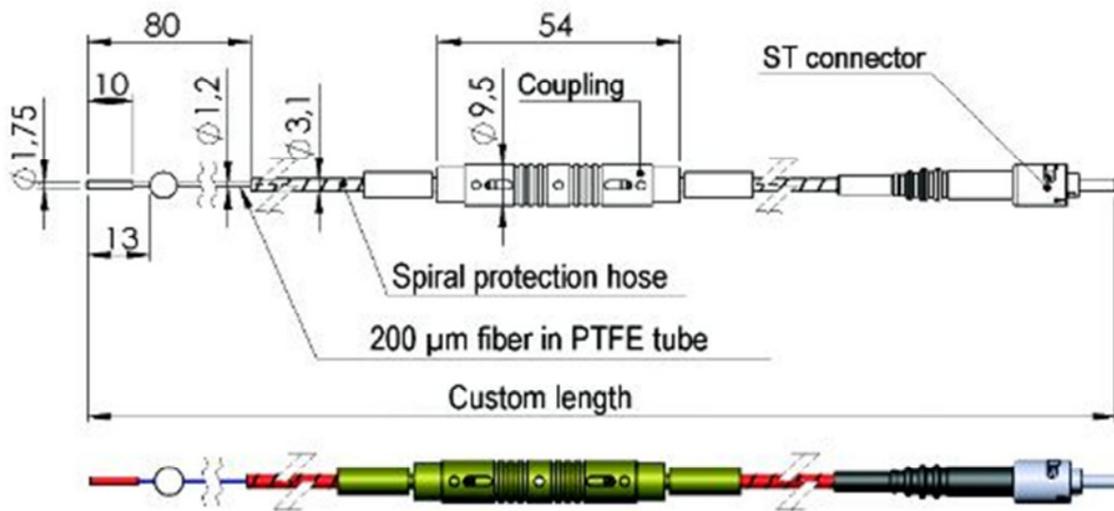


Figure 2 Fiber Optic in Oil Connector (optional)

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Operation

Starting at a light wave length of 850nm GaAs sensor becomes optical translucent. Since the position of the band gap is temperature dependent, it shifts about 0.4nm/kelvin.

The measurement device (InsuLogix® T monitor) contains a light source and a device for the spectral detection of the band gap. This guaranties fast, repeatable and reproducible measurements.

Calibration is done at the factory. Recalibration is not required over the entire life of the system.

4. Handling the fiber optic cables

Bending radius

200µm silica core fiber

Short time (max. 24h) bending radius: not less than 4 cm.

Permanent installation bending radius: not less than 8cm.

400µm silica core fiber

Short time (max. 24h) bending radius: not less than 8 cm.

Permanent installation bending radius: not less than 16 cm.

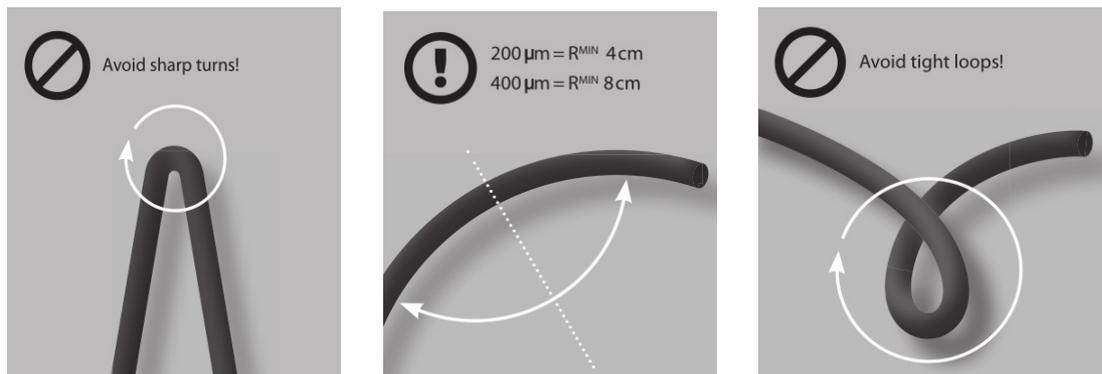


Figure 3 Bending restrictions

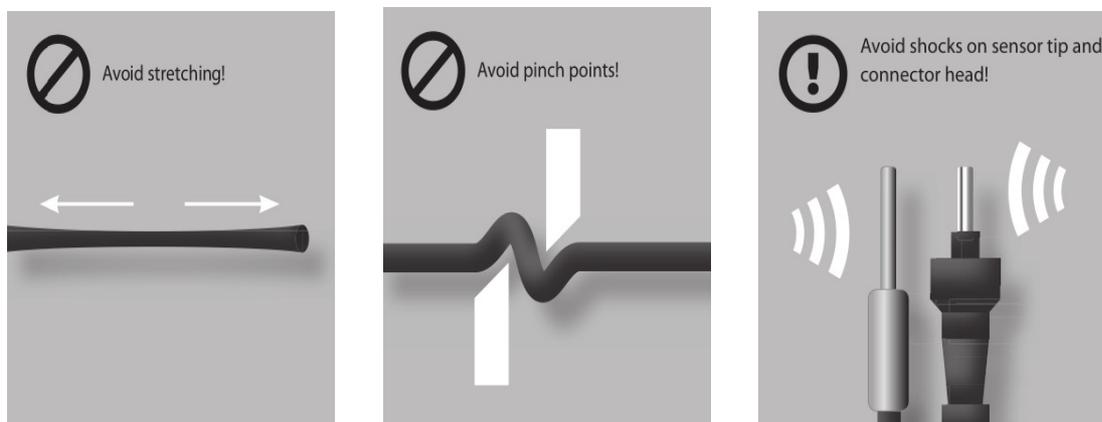


Figure 4 Mechanical restrictions

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5. Probe Installation in Windings

The ultimate responsibility for the probe installation and performance remains with the transformer manufacturer.

The probes can be installed in windings as follows:

- A. During winding process
- B. After winding process and before winding compression

The OEM is generally choosing the time when to install the probes based on transformer design and based previous experience with fiber optic probes installation.

Weidmann Smart Spacer™

As an insulation designer and manufacturer Weidmann has in-house expertise to assembly and test the fiber optic probe-key spacer to make sure the assembly does not induce supplementary stress at the location where is installed.

The Smart Spacer™ is an assembly consisting of fiber optic probe mounted in a key spacer conform to OEMs specific design. The probe mounting in key spacer and testing of finalized product are done at Weidmann facility, following that the OEM will receive the final product along with a Testing and Performance Certificate. This eliminates the assembly and testing processes that normally the OEM is doing before installing the fiber optic in transformer windings using key spacer solution.

Smart Spacers can be manufactured by Weidmann based on transformer insulation package design specifics. Several examples for key spacer preparation for mounting the fiber optic probe are shown below.



Figure 5 Examples of key spacers prepared for fiber optic probe installation

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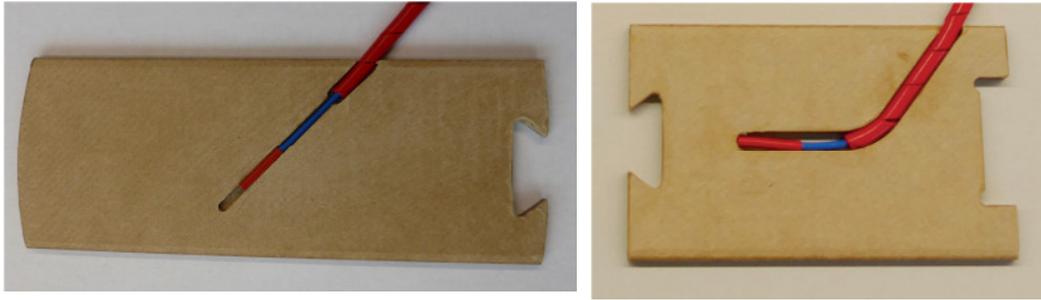


Figure 6 Examples of fiber optic probe mounting in key spacer (Smart Spacer assembly)

Attaching the Fiber Optic Probe and Routing it Inside the Tank

Hot Spot location: The hottest spot of the winding is determined based on transformer specific design and can be found in transformer manufacturer design documentation.

Make sure the fiber optic connector protection caps are left on for the entire manipulation process and up to connection to connectors located on the plate. Follow the cleaning procedure included in this document before connecting the connectors to their mates.

Attaching the Probes to Transformer Components

In cases when is necessary attaching the probe to a conductor then tape should be used with the probe being attached side-on to the conductor for better thermal contact. We recommend using crepe paper for protecting the sensor when the fiber optic probe is attached to the conductor.

Special attention must be paid to securing the fiber optic probe to winding structure in such a way so the cable or the sensor is not crushed by coil's sudden contraction. Is preferable using cotton strapping in order to attach the fiber optic to transformer insulation or metallic components.

Unused parts of fiber optic probes should be attached to transformer components in loops with radius not smaller than 20 centimeters.

Special attention must be paid to not let connectors or fiber optic hanging freely during the winding manipulation (assembly and drying processes). We recommend using cotton strapping.

Routing the Probes to Feed-Through Connectors Located on the Plate

Generally the probes can all be run along the tops of the windings to one of the tank's walls.

The probes can be routed through rigid tubing or secured by using cotton strapping to any supporting structure.

Pay special attention to using tubing and strapping materials that can significantly change their properties in contact with hot oil or under thermal stress becoming stiffer or creating sharp edges. Do not over-tie the cotton straps.

Feedthrough connectors installation

Weidmann is supplying the transformer tank wall plate with the connectors pre-installed on it.

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6. Fiber Optic Extensions installation

The fiber optic extensions are fiber optic cables with connectors at both ends. Their role is to make the connection between the fiber optic connectors mounted on the feedtru plate and the InsuLogix® T monitor.

The transformer OEM must install a conduit - metallic or flexible but stiff enough to provide mechanical and environment protection - between the feedtru plate J-Box protection housing and the transformer cabinet where the InsuLogix® T monitor is installed. The fiber optic extensions must be routed from the feedtru plate to transformer control cabinet through the conduit.

Make sure to separate the fiber optic extensions from other wiring and cabling going into/from the transformer control cabinet, in this way reducing the possibility of pinching, crushing or breaking the fiber optic extensions. The conduit containing the fiber optic extensions must be connected to transformer cabinet through its own gland, separately from the other conduits and as close as possible to where the InsuLogix® T monitor is installed.

Ideally the OEM should route the extensions through their own conduit also inside the transformer control cabinet. If this is not done then Weidmann strongly recommends that fiber optic extensions sections located inside the transformer control cabinet be clearly identified by the transformer OEM with tags as "**Fiber Optic - Fragile**" and "**Allowed bending radius - not less than 8 centimeters**". The fiber extensions must be secured in a single bundle until close to instrument where they can be split in order to be connected to InsuLogix® T monitor fiber optic connectors.

Do not use plastic tie-wraps to secure the fiber optic extensions inside the transformer cabinet. If possible use soft rubber material tie-wraps (or equivalent) at least one centimeter in width. **Do not** over tighten.

7. Connectors Cleaning

Weidmann is optionally supplying a fiber optic one-click cleaner. The tool is simple and quick to use as is shown in image below.



Figure 7 Fiber optic connector cleaning tool

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8. Testing

During the transformer manufacturing and testing processes the fiber optic probes must be tested at the following steps:

1. Before winding is compressed
2. After winding is compressed
3. After the outer winding installation over the inner winding
4. After drying process
5. Before and after connecting to feedthrough (remember to clean up the fiber end inside the connectors first).
6. Before and during all heat run procedures.

The probes can be tested using the InsuLogix® T monitor. If the monitor device is not available or has not been purchased then a single channel portable InsuLogix® T can be used.

Weidmann strongly recommends purchasing and keeping inn winding production shop at least one InsuLogix® T portable unit to be used for testing the fiber optic monitoring systems.