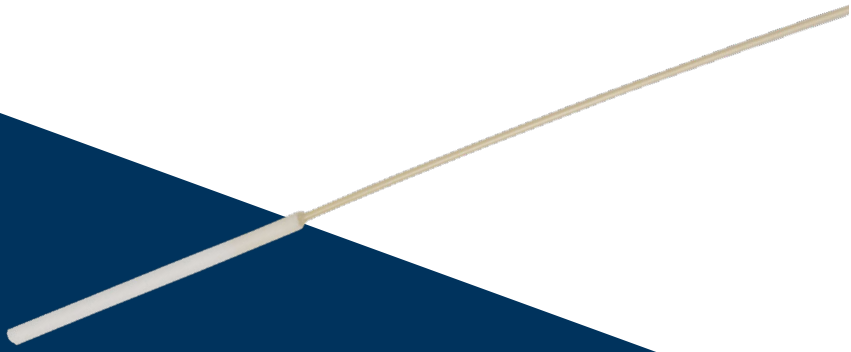
HBK FIBERSENSING

ENGLISH

Mounting Instructions



FS63DTP, FS73DTP

Dielectric Temperature Probe

HBM

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1 GENERAL INFORMATION

The following instructions refer to the installation of FS63DTP Dielectric Temperature Probes.

These individual sensors (FS63DTP) are delivered as bundle of several sensors (FS73DTP) for easy installation of a setup for measuring temperature at multiple locations.

Material Numbers
K-FS73DTP

1.1 Marking used in this document

Important instructions for your safety are specifically identified. It is essential to follow these instructions to prevent accidents and property damage.

Symbol	Significance
⚠ **CAUTION**	This marking warns of a *potentially* dangerous situation in which failure to comply with safety requirements *can* result in slight or moderate physical injury.
Notice	This marking draws your attention to a situation in which failure to comply with safety requirements *can* lead to damage to property.
Important	This marking draws your attention to *important* information about the product or about handling the product.
Tip	This marking indicates application tips or other information that is useful to you.
Information	This marking draws your attention to information about the product or about handling the product.
Emphasis *See …*	Italics are used to emphasize and highlight text and identify references to sections, diagrams, or external documents and files.
▶	This marking indicates an action in a procedure

2 INSTALLATION PROCEDURE

2.1 List of materials

Included Material
FS63DTP sensors

Needed Equipment
Optical Splitter (Optional)

Needed Material
Polyimide Tape. Recommended HBK: 1-KLEBAND

2.2 Sensor Installation

The FS63DTP Dielectric Temperature Probes are non metallic resistant sensors, designed to be immune to mechanical stresses. Nevertheless, limit pressure and bending radius of the sensor has to be observed during installation.

Depending on the device under test it might be needed that the sensor is secured either by gluing or taping. On other occasions, pressure around the sensor after installation is sufficient for securing it in place.

2.2.1 Unpacking

Carefully remove the bundle from the box.

- Cut the plastic tyes fixing the connectors.
- Cut the plastic tyes fixing the cables.
- Start uncoiling the bundle from the connectors end to the probes.
- Remove each probe from the foam with care.

Fig. 2.1 Packaged Sensor Bundle

Each sensor is covered with a tag containing its individual serial number. This cover identifies the sensor and its wavelength. The same reference is fixed on the corresponding cable next to the optical connector.

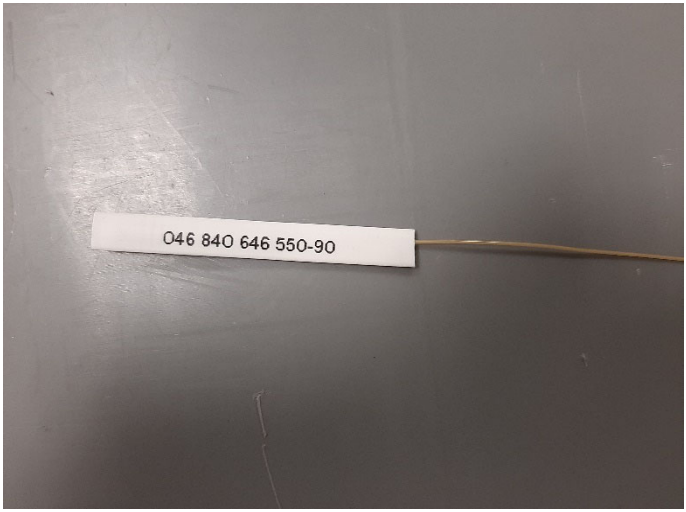

Fig. 2.2 Label over the sensor tip

2.2.2 Positioning the sensor

The FS63DTP has a 20 mm length tip. The center of the sensing element, however, is positioned at 8 mm from the probe tip (typical FBG length is 5 mm).

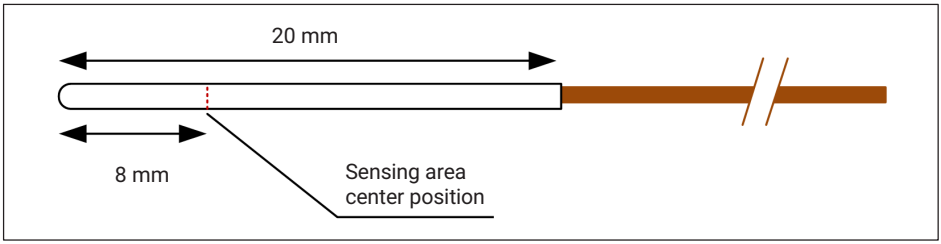

Fig. 2.3 Sensing point position

- Select the sensor location considering that the sensor head cannot be bent.
- Remove the sensor label from the probe.
- Place the sensor at the desired location.

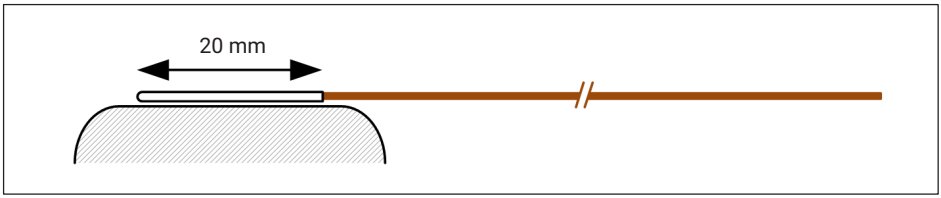

Fig. 2.4 Install the sensor on a flat surface

2.2.3 Fixing the sensor

To fix the sensor in place HBK recommends the use of polyimide tape (order number 1-KLEBAND).

- Apply a small piece of tape (~4 cm long) to secure the sensor head in place.

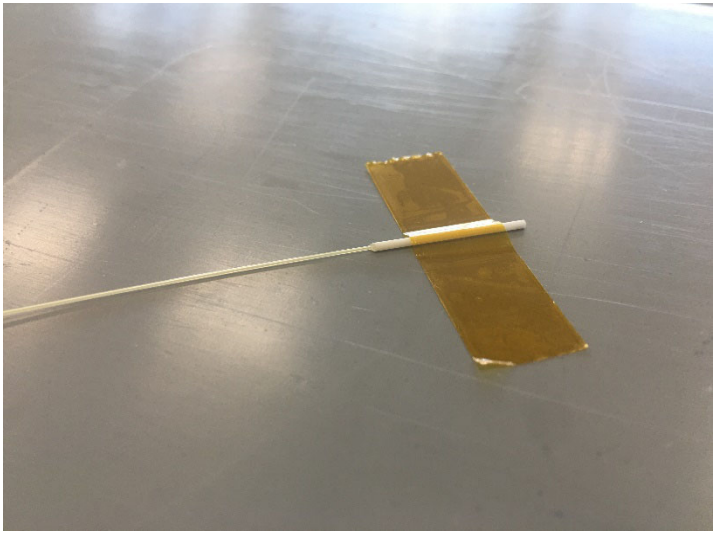

Fig. 2.5 Sensor fixed with Polyimide tape

2.3 Cable routing

The FS63DTP probe is a terminal sensor, meaning that there is only one cable exiting the sensor. The optical fiber is protected with submilimetric peek tube that, despite delivering a higher resistance to the fiber, has to be handled with care so that is is not damaged.

Cable routing must be chosen considering that curvatures are kept within the specified limits for the used cable and that sharp edges and kinks should be avoided.

Each FS73DTP (bundle of FS63DTP probes) can be delivered with a wrapping spiral that helps securing the cables together. The length of the spiral is customer-defined. It is a loose wrap, so that during installation its position can be adjusted.

Each probe's individual cable from the probe head to the spiral wrap should be fixed. The same tape type can be used. Probe lengths on the same bundle are the same. This means that, depending on the measurement position, differences can be accommodated on each side of the wrap (*Fig. 2.6*).

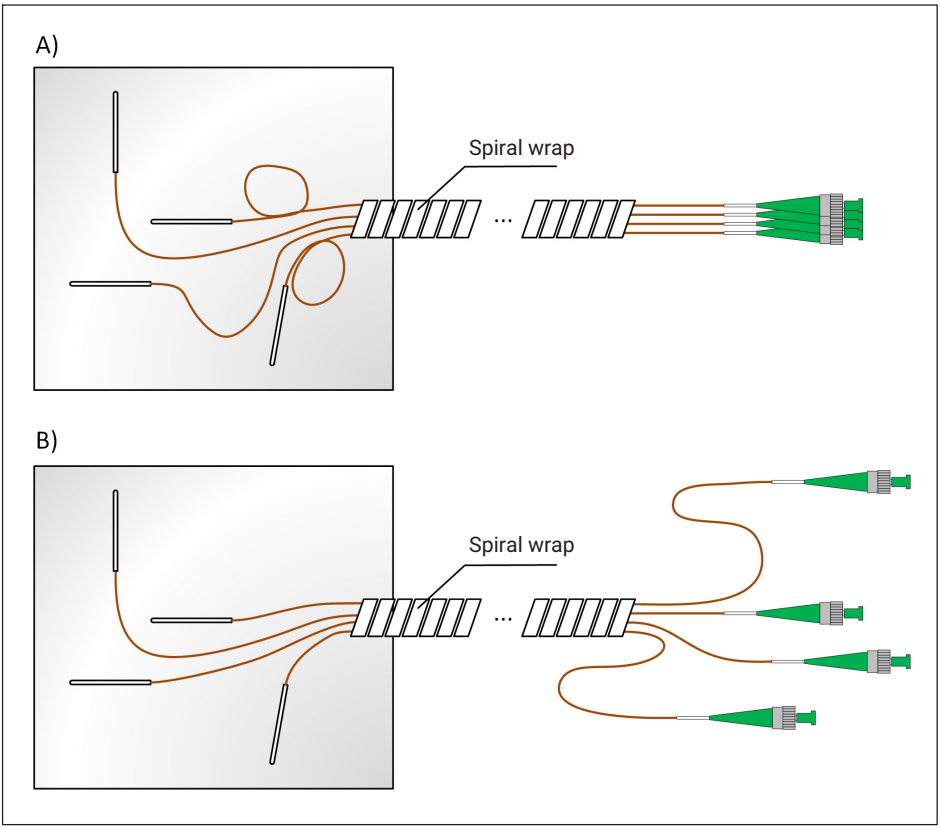

Fig. 2.6 Cable routing and excess cable accommodation options.

Important

In case the sensor and the cable are to be pressured (for example between battery cells), always consider routing the cables as presented in the option B above. Coiled cable will always have fiber crossing over one another that can create signal losses when compressed.

3 SENSOR CONFIGURATION

3.1 Sensor documentation

Calibrated HBK FiberSensing Sensors are delivered with a Calibration Sheet. The K-FS73DTP is a bundle of several FS63DTP Dielectric temperature probes, each with its individual characterization. The calibration sheet is, therefore, a table with with the relevant calibration information of each probe, identified by their individual Serial Number.

3.1.1 Measurement Computation

For enhanced accuracy FS63DTP dielectric temperature probes have a 3rd order polinomial calibration formula.

The calculations that should be performed for converting a wavelength measurement into temperature are the shown generally in *Fig. 3.1*. The temperature variation of each measurement point is given by a third order polynomial equation with coefficients obtained from the sensor calibration.

$$T = S_3 (\lambda - \lambda_0)^3 + S_2 (\lambda - \lambda_0)^2 + S_1 (\lambda - \lambda_0) + S_0$$

Fig. 3.1 Temperature computation formula.

Where

- λ is the measured Bragg wavelength of each measurement point in nm
- λ_0 is the Bragg wavelength of the temperature at reference temperature in nm
- S_0 is the zero order sensitivity (reference temperature) in ºC
- S_1 is the first order sensitivity in ºC/nm
- S_2 is the second order sensitivity in ºC/nm^2
- S_3 is the third order sensitivity in ºC/nm^3

When operating with catman® each measuring point of the probe should be created as a new computation channel and the algebraic expression typed in by hand.

Information

Temperature and Generic Polynomial sensors for MXFS are being prepared to soon accept the 3rd order coefficient. While this enhancement is not completed, follow as described above for sensor configuration.

4 TYPICAL CONFIGURATION

Each FS63DTP probe can be connected directly to a single connector of an optical interrogator. However, as these are terminal sensors, they cannot be linked in series taking advantage of the intrinsic multiplexing capability of the technology. To overcome this situation optical splitters can be used. Splitters (as seen in *Fig. 4.2*) combine connected sensors signals into a single optical line. This way we can take advantage of the device full capabilities and measure several sensors on each optical connector of the device.

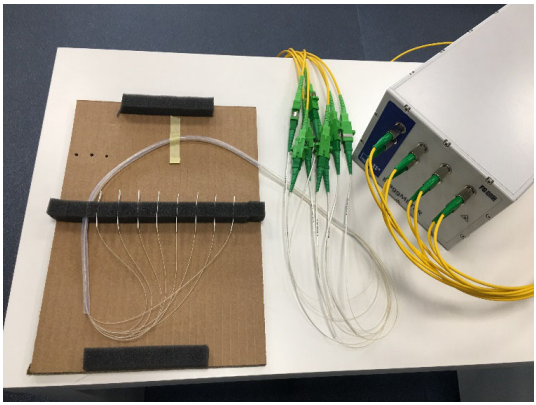

Fig. 4.1 8 Sensors connected directly to 8 connectors of the interrogator.

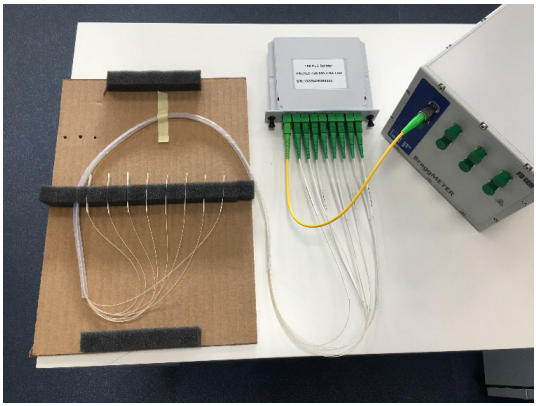

Fig. 4.2 8 Sensors combined through a splitter to a single connector of the interrogator.

16 FS63DTP Probes can be combined in a single optical connector of the device, which means that with a single instrument 128 temperature signals can be acquired simultaneously.

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