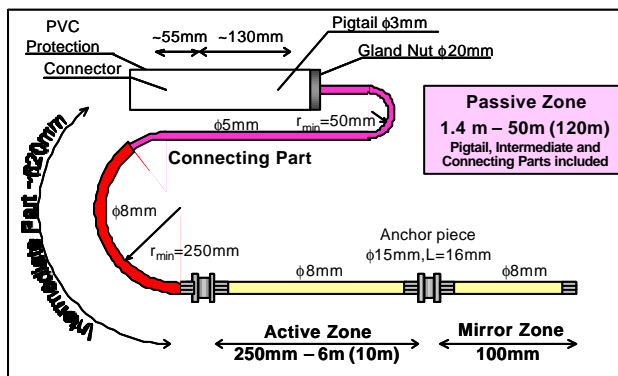


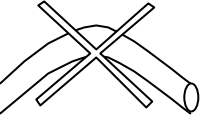
HOW TO INSTALL YOUR SOFO® SENSORS

Thank you for purchasing SOFO® deformation sensors. This brochure gives you basic information on how the SOFO® sensors should be installed in the most common types of applications. If this brochure does not cover your type of installation please contact SMARTEC SA or your local SOFO® Certified Solution Provider to obtain additional information. Non-specified uses are prohibited.

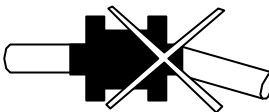
SOFO® sensors are composed of two parts called the active zone (LA and passive zone (LP). The active zone is the part of the sensor that measures deformations and is delimited by the two anchor pieces (AP). The passive zone consists of intermediate part (IR) and connecting part (CP). The intermediate part contains the optical coupler and connects the active length to the connecting part. The connecting part is used to optically connect the active zone with the SOFO® reading unit or a connection box. A single or two connectors are installed at the end of the passive zone and protected with a semitransparent tube. The metallic piece holding the protective tube (gland nut) is also used to couple the sensor to a connection box.



CAUTION

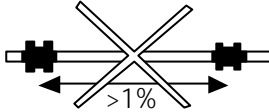


Do not excessively bend any part of the sensor

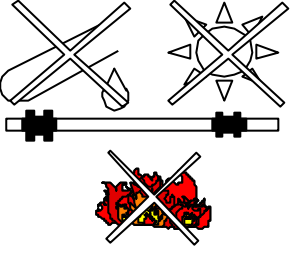


Anchor pieces and tubes must be aligned.

NB: Anchor piece may turn, Avoid turning more than 180°



Do not strain the sensor to more than 1%



Do not expose the sensor to acids, fire or permanent sunshine



Standard SOFO® Deformation Sensor

Installation and Handling Instructions

Read Carefully Before Using this Sensor



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GENERAL RECOMMENDATIONS

SOFO® sensors are built to withstand rough handling in typical building site conditions. There are however a few precautions that must be followed to avoid damage and ensuring good measurements.

During handling, the active, intermediate and connecting parts must not be excessively bent to prevent buckling. A sensor with a buckled zone does not work properly. In most cases, restoring the straightness of the sensor also restores its functionality. A buckling in the intermediate part can cause a permanent damage to the sensor.

Once the sensor is installed, its active zone must be relatively straight or present a smooth bending (e. g. along a vault). The anchor pieces must not form an angle to the active zone and the intermediate part.

The intermediate part must not be bent with radii below 250 mm. The connecting part must not be bent with radii below 50 mm.

The measurement fiber is pretensioned during fabrication to about 0.5% of the active length. In most cases it is therefore not necessary to further stress the sensor. On the SOFO® Sensors Test Report you will find the [DL stress] values that were measured during manufacturing. Once installed and measured, the sensors should present a value close to this one (a deviation of 1-2 mm per meter of active zone is acceptable).

The connectors should remain in the protective pipe until installation in the connection box or patch panel.

CONCRETE EMBEDDING

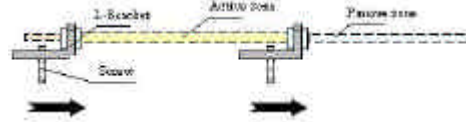
The SOFO® sensors can be embedded into newly poured reinforced concrete. If the sensor is installed according to the following recommendations, you can usually pour, vibrate and finish concrete without additional precautions for the sensors and obtain a survival rate of 95% or above. A failure of up to 5% of the sensors while embedding in concrete is considered as normal and does not indicate an error in the installation nor a defect of the sensors.

The active and intermediate parts must follow a rebar or another rigid element along their whole length and must be secured to that element every 30 cm (or less if necessary). The sensor can be attached to the rebar with plastic rings or other fixation methods. The two anchor pieces are attached by letting the plastic ring pass in their central groove. The intermediate part should be attached at its end (connection to the passive zone) and at its centre (coupler). The sensor must be installed in a way to avoid excessive bending and contact with the formwork.

Installing the sensors under the rebars is recommended since this will protect them from the pouring concrete and from workers walking in the formwork.

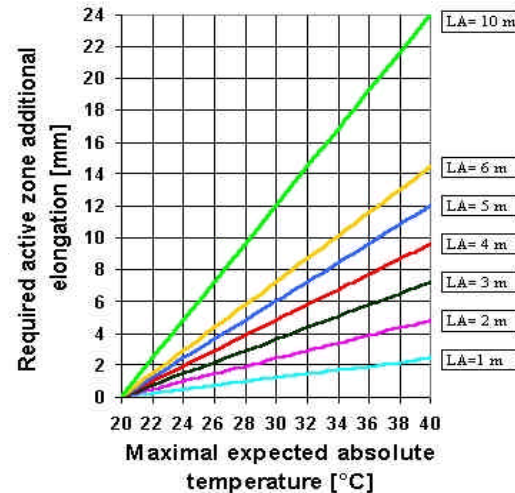
SURFACE INSTALLATION

To install the sensors on the surface of existing structures, use the appropriate L-bracket adaptors. These adaptors can be screwed, glued or welded (for the steel version) to the structure to be monitored. Remember to maintain the same L-bracket orientation as shown in the following picture.



The active and intermediate parts must follow a rigid cable or another rigid support along their whole length. The sensor must be attached to the support using plastic or metallic rings or other fixation methods.

Do to thermal expansion of the active part tube we suggest to add a small pretension following the diagram below. **Remember that this pretension is additional to DL value.** The active part must be connected to the structure over its whole length using U-shaped ties. The intermediate part should be secured to the rebar each 20 cm (or less if necessary). The sensor is not designed to remain under permanent exposure to the sun nor is resistant to rodents, birds and vandalism. In case of outdoor installation we recommend to protect the sensors and cabling inside plastic or metallic ducts.



BOREHOLE INSTALLATION

In the case of borehole installation, the sensors can be attached to a (semi) rigid element to allow their insertion in the borehole. The injection pipe is often a good candidate as support and the sensor can be connected to it with adhesive bands.

If the sensors are installed one after the other, the anchor pieces of two successive sensors should be interlaced (the anchor piece of each sensor is slightly inside the active zone of the other). Then two anchor pieces can be connected using metallic rings. The whole multipoint sensor can be pre-assembled and delivered to the construction site coiled.

CONNECTOR CLEANING

If the connectors are not handled properly or are directly exposed to a dusty environment, they might become dirty and need cleaning. It is a good practice to clean the connectors when permanent connections are made (sensor to connection box or to extension cable) or after a long time without using the sensors.

A sign that the connectors need cleaning are small or disappearing peaks in the measurements or the apparition of parasite peaks. A high LED intensity during the scans is also an indication of a poor optical connection between the unit and the sensors.

To clean a connector proceed like this:

- Open the connector protective lid by flipping it backwards.
- Gently rub the connector front surface on a clean tissue impregnated with alcohol + water. The tissue should not release fibers of particles.
- Gently rub the connector front surface on a dry clean tissue.
- Close the protective lid.

Another way of cleaning dusty connectors is the following:

- Open the connector protective lid by flipping it backwards.
- Stick and remove repetitively the connector front surface to a clean piece of 3M™ invisible tape or similar.
- Close the protective lid.

Both techniques can be used in sequence to obtain the best results. The connector surface can be examined with an adequate microscope (available through SMARTEC SA).