



PE SMARTprofile installatin procedure

HANDLING AND INSTALLATION

INSTRUCTION FOR

DiTeSt SMARTprofile

How to install DiTeSt PE SMARTprofile

Thank you for purchasing PE SMARTprofile - distributed deformation and temperature sensor. This brochure gives you basic information on how the PE SMARTprofile should be installed in the most common types of applications. If this brochure does not cover your type of installation please contact SMARTEC SA to obtain additional information. Non-specified uses are prohibited.

PE SMARTprofile is composed of two parts called the active zone (LA) and passive zones (LP).

The active zone is the part of the sensor that measures deformations and temperature, and it is to be in mechanical contact with the structure. It is built of polyethylene (PE) and contains 1 or 2 deformation measurement optical fibers, and 1 or 2 temperature measurement optical fibers.

The passive zones are found at both extremities of the active zone and consist of the connecting part (patch cords) and connectors. The passive zones are used to optically connect the active zone with the reading unit or a connection box. The passive zone is delivered with plastic protection that is supposed to be kept until the sensor is installed and put in service.

Remark: In most of figures in this document, except the figure below and the second figure on the backside, for reasons of simplicity of presentation the PE SMARTprofile is represented as a rose rectangular body.

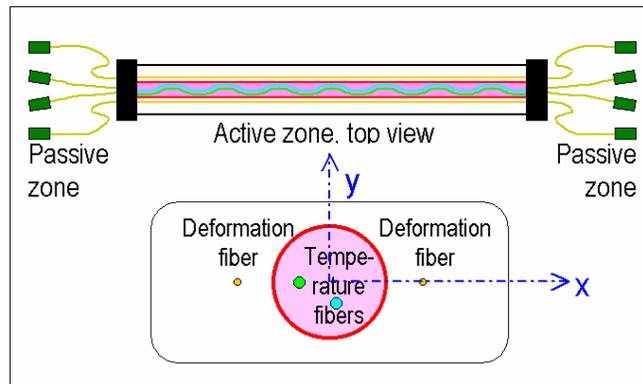


Figure: schematic representation of DiTeSt PE SMARTprofile

PE SMARTprofile – distributed deformation and temperature sensor

General recommendations

PE SMARTprofile is built to withstand rough handling in typical building site conditions. However, presented precautions must be followed to avoid damage and ensure correct long-term functioning.

During handling, installation and in service, the active zone must not be excessively bent, twisted, tensioned or squeezed. These operations can cause permanent damage to the sensor. Allowed thresholds are given in the table below.

Min. bending radius	Vertical (x-axis): 50 mm Horizontal (y-axis): 1'000 mm
Maximal torsion	$2 \cdot \pi / m$ (360°/m)
Max. tension	During installation*: 2mm/m In service*: 1.5% (15 mm/m)
Shear and/or squeezing force	Not allowed

*pre-stressing of sensor during installation will shorten its strain range

The passive zone (patch-cords and connectors) is not to be exposed to any mechanical action, and must be protected from dust, water and chemical agents. Hence, the plastic protection is to be kept during the installation, but also afterwards if the patch cords are not connected in connection boxes.

The manner of sensor installation depends on monitored structure construction material, allowed procedures and available resources. Installed PE SMARTprofile is either in continuous contact with monitored structure (gluing or welding) or in discrete points in contact with the structure (clamping with gluing). The next table summarises the possible installation manners.

Installation manner	Construction material	Contact with structure	Pre-stressing
Gluing	Steel, concrete, composites	Continuous	Not necessary
Welding	PE and PE composites	Continuous	Not necessary
Clamping with gluing	Steel, concrete, composites	Discrete, in clamping points	Necessary

The distributed sensor by its nature measures average value of measurand (strain or temperature) over certain length (spatial resolution).

Since the length of the passive zone (usually 0.5 m) can be shorter than the spatial resolution (usually ≤ 2 m), an alteration of measurement can be introduced at extremities of the PE SMARTprofile and confusion concerning the start and end point of the sensor can be created. In order to avoid these effects, it is recommended to leave the extremities of the SMARTprofile free (unattached to the monitored structure) in a length that is slightly longer than the spatial resolution of the system (usually ≤ 2 m), as shown in the next figure.

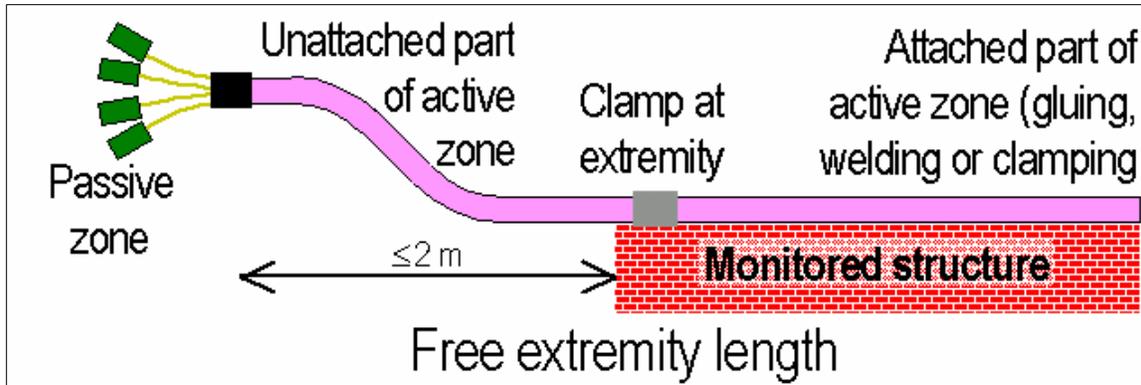


Figure: installation detail

Installation by gluing or welding

Installation by gluing or welding does not require pre-stressing of the sensor, since the sensor is in continuous contact with the structure (except small tension to maintain the sensor straight shape). Unless differently specified, the sensor is installed with its x-axis parallel to monitored structure (see figure below).

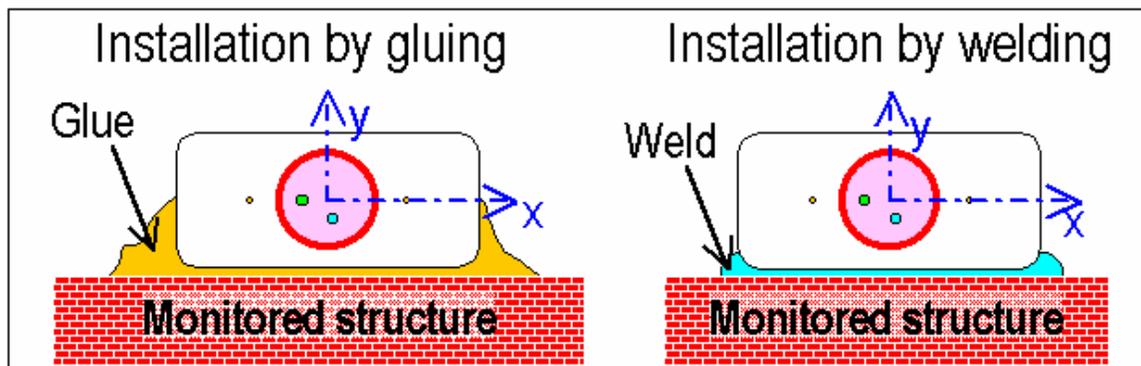


Figure: installation detail

The gluing is a delicate operation and must be performed carefully, fully respecting the gluing procedures. The glue to be used in gluing is to be compatible with both, PE SMARTprofile and the construction material on which the tape is to be installed (steel, concrete, composite etc.).

The following accessory material may be required for gluing: glue, scotch tape, isopropyl alcohol, metallic clamps and depending on the construction material steel brush, sandpaper, compressed air and three-chlore-ethylene alcohol.

The previously marked surface on which the sensor is to be installed must be clean from any kind of dirtiness including dust, grease, corrosion, paint, etc. and irregularity such as degraded layers of material, sharp points, etc. The cleaning can be performed mechanically (using brush, sandpaper, compressed air, etc.) and / or chemically (using alcohols). It is recommended to glue on slightly rough and not fully smooth surfaces in order to increase the adhesion of the glue.

In case of gluing to steel structure it is recommended to make last cleaning (after mechanical cleaning) with three-chlore-ethylene alcohol. In case of concrete, since porous, the last cleaning is to be performed with compressed air. In case of composite material the last cleaning is to be performed using isopropyl alcohol. Before gluing, also the sensor is to be cleaned using isopropyl.

The glue can be applied on sensing tape, structure or both sensing tape and the structure depending on type of the glue (read instructions delivered with the glue). Since the glue is commonly very liquid before setting, it is necessary to prevent sliding of the sensor during the setting period using the scotch-tape.

In case of welding, the installation can only be performed using special equipment operated by competent staff. In order not to damage the PE SMARTprofile during the welding, the temperature of 160°C can be achieved for not longer than 5 seconds. Higher temperature will melt the sensor and longer exposure to 160°C will damage the temperature fibers.

The glue / welding guarantees good shear bonding between the PE SMARTprofile and the monitored structure. However, the peeling is often not prevented. That is why it is recommended to ensure the extremities of the sensor with small metallic clamps as shown in previous figure.

Once the sensor is installed, it must smoothly follow the surface of monitored structure. If some obstacles are present it is recommended:

- If necessary to monitor the obstacle, to build an accessory structure that will guarantee smooth passage (see figure below);
- If not necessary to monitor the obstacle, to simply detour the obstacle (see figure below).

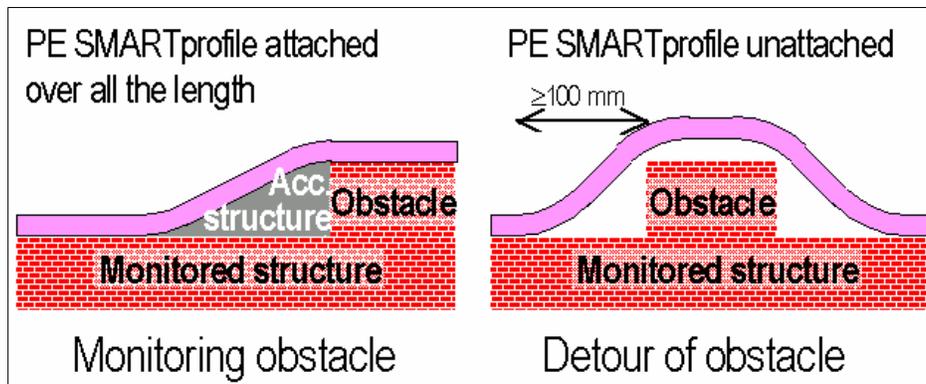


Figure: installation detail



After the installation, the PE SMARTprofile must be protected from all physical (high temperature, UV rays and sunshine, etc.), mechanical (shocks, squeezing, etc.) and chemical (exposure to acids etc.) actions that can damage the sensor. The protection is to be selected accordingly to the conditions found on-site.

Connector cleaning

If the connectors are not handled properly or are directly exposed to a dusty and humid environment, they might become dirty and need cleaning. Dirty connectors introduce high attenuation of optical signal and as a consequence the noise of the reading will increase and accuracy and completeness of measurement will decrease.

It is a good practice to clean the connectors before any connection, i.e. before connection with the reading unit in case of manual readings and before connection in a connection box for permanent installation. The cleaning can be performed using isopropyl alcohol and cleaning paper sheets. The recommended manner to clean and inspect connectors is to use the SMARTEC's maintenance kit.

IMPORTANT: Unless specified differently, the connectors of the PE SMARTprofile are angled for 8° (APC), and are conventionally marked with green colour. Mating with non-angled connector (conventionally marked with blue or black colour) can damage the connector and is therefore strictly forbidden.