

## SWS-02 Installation procedure

### Introduction

This document aims to describe the installation procedures applicable to the installation of the SWS-02 strain sensor on the surface of a monitored object. The document focuses on different installation methods, including spot-welding, which is the primary focus of this document. The aim is to achieve a long-term stable bond between the monitored structure and the SWS-02 sensor.

*Note: Other installation possibilities are mentioned in the last chapter.*

### Installation requirements

#### Instruments & Tools

- Cleaning supplies, and solvents (cleaning cloth, brush, ...)
- Standard spot-welding (SPW-01) machine for 0.2mm stainless steel plates. Typically, this works well with regular spot welders used for electrical gauges.
- FBG interrogator
- PST-02 Pre-strain set up tool for SWS-02 sensor
- Personal Protective Equipment (latex gloves, eye protection, respirator, ...)

#### Installation time

Typical spot-welded installation time of SWS-02 sensor: **between 10-15min** (basic surface preparation considered).

### Installation sequence

This sequence is described in the next chapters in more detail. Time indicates the estimated time for efforts.

- (1) Removing transportation protection from the sensor [1 minute]
- (2) Mounting of PST-02 and setting up the desired pre-strain [2 minutes] <sup>1</sup>
- (3) Surface preparation for spot welding [5 minutes] <sup>2</sup>
- (4) Spot welding of the sensor to the surface [5 minutes]
- (5) Removing PST-02 from the sensor [2 minutes]

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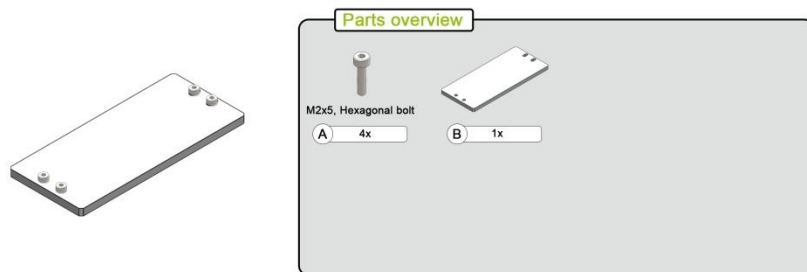
<sup>1</sup> It requires the sensor to be connected to the interrogator.

<sup>2</sup> Time for completing highly depends on the surface of the monitored object.

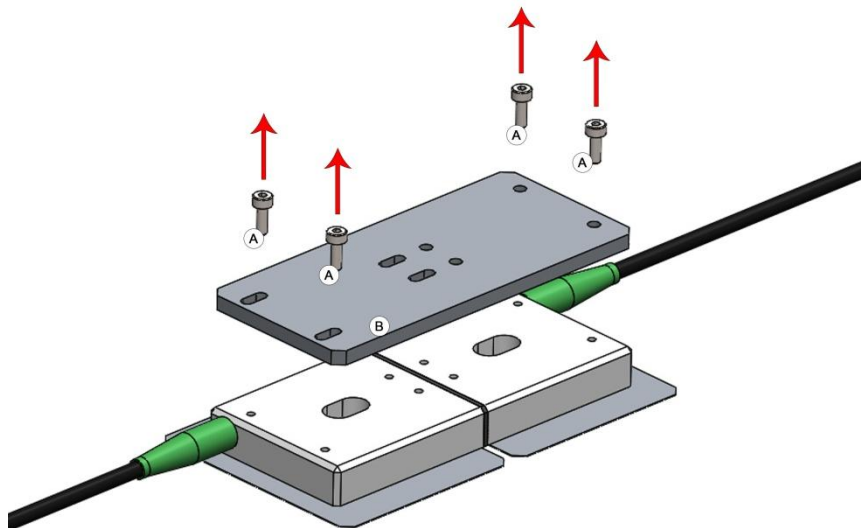
**(1) Removal of the transportation protection from the sensor**

SWS-02 comes with a preinstalled Transportation fixture – this is to protect the sensor during transportation and initial manipulation. This transportation fixture needs to be removed from the sensor before installation.

Remove the screws and top plate from SWS-02 as shown in **Figure 2** – follow the alphabetical order of all parts as listed in **Figure 1**. All tools are included in the PST-02 package.



**Figure 1:** Parts overview of the Transportation fixture.



**Figure 2:** Removing the Transportation fixture.

If you are not installing the sensor, it is recommended to mount the transportation fixture back on the sensor.

## (2) Mounting of PST-02 and setting up the desired pre-strain

SWS-02 comes with a very small pre-strain, therefore, it is necessary to adjust the pre-strain on the SWS-02 during installation, allowing the sensor to measure compression. For this purpose, the PST-02 pre-strain setup tool is used. It allows adjusting the pre-strain level of the sensor just before the installation of the sensor on the surface. It also keeps the defined pre-strain during installation. After installation, the PST-02 is removed from the sensor and can be used for another SWS-02 installation.

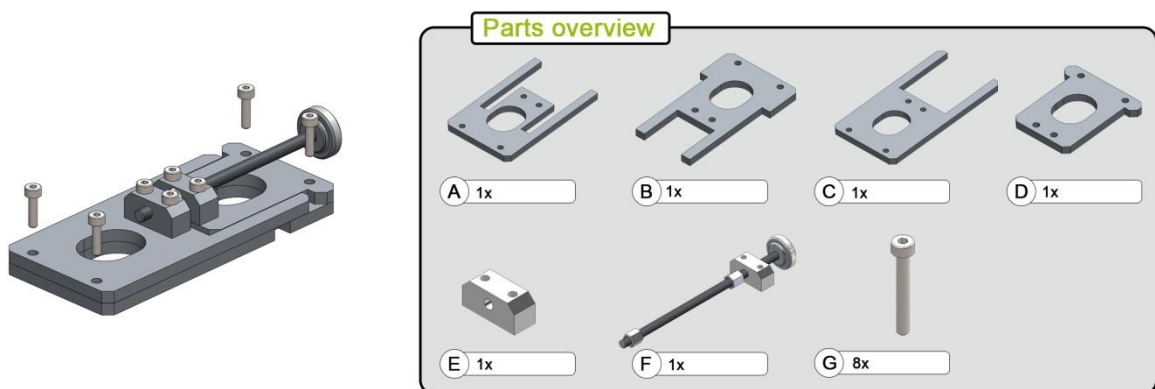
- ▲ PST-02 provides a safe pre-straining option for the SWS-02 sensor
- ▲ Easy to assemble or disassemble

### Mounting the PST-02 to the SWS-02 sensor

Mount the PST-02 on the SWS-02 sensor as shown in Figure 4 – follow the alphabetical order of all parts listed in “Parts overview” (Figure 3).

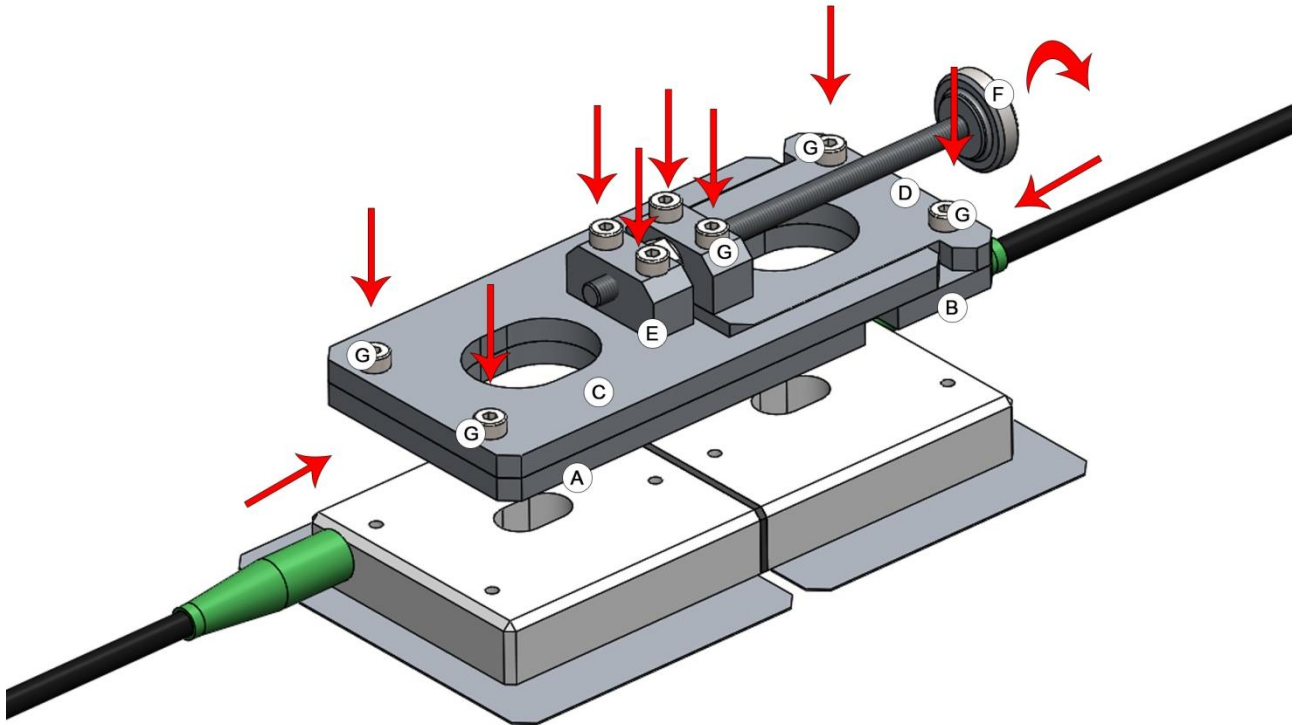
### Applying pre-strain to the SWS-02

To apply pre-strain, connect the sensor to an interrogation unit and focus on the higher wavelength. In a standard case, the higher wavelength the for strain measurement and the lower for temperature compensation. Use the knob on the top of the PST-02 (Figure 4) and rotate it clockwise to increase the pre-strain<sup>13</sup> and anti-clockwise to reduce it.



**Figure 3:** Parts overview of the PST-02.

<sup>3</sup> It can take several rotations before the sensor will react to the pre-strain tool.



**Figure 4:** Assembling/Disassembling of the PST-02.

### (3) Surface preparation for spot welding

It is necessary to properly treat the surface of the SWS-02 and the surface to which the sensor should be applied. This process includes mechanical cleaning of the surface using abrasive materials and the removal of any protective layers, rust, debris, or similar imperfections from the surface.

Chemical treatment of the surface is advised 20 minutes before the installation to avoid the creation of oxide layers on the treated surface.

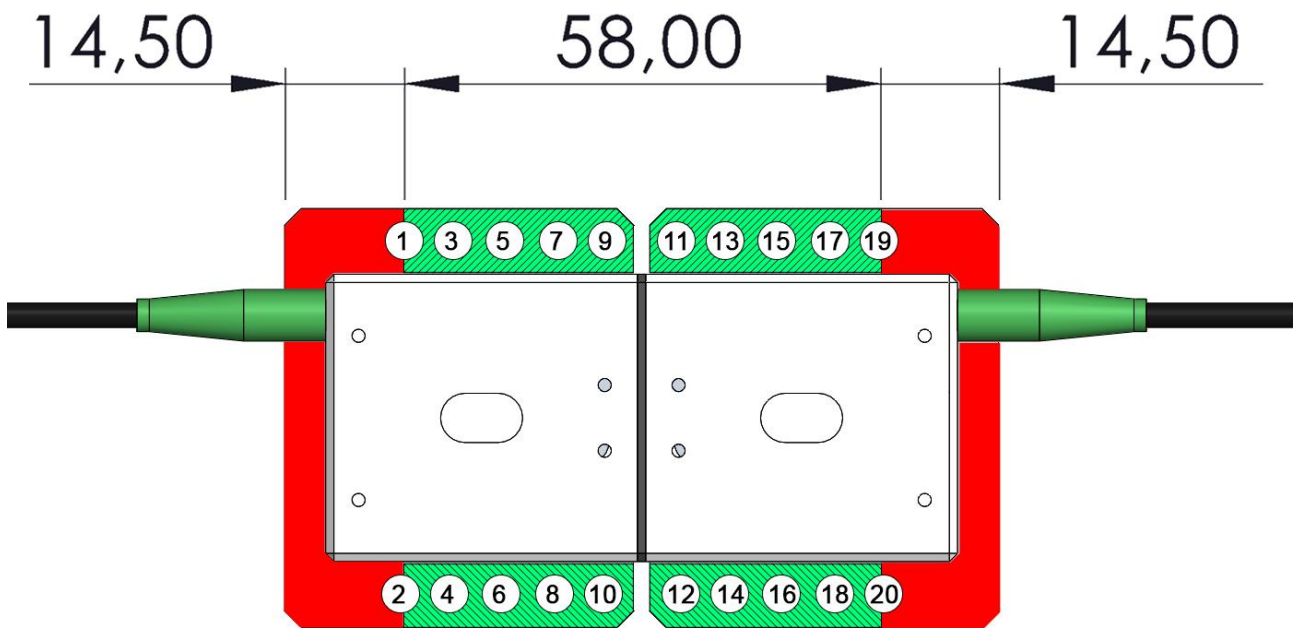
Recommended cleaning solvents (not included inside the packaging):

- ▲ Loctite 7061
- ▲ Loctite 7063
- ▲ Acetone, Isopropyl alcohol

**(4) Spot welding of the sensor to the surface**

The SWS-02 is surrounded by a 0.2mm metal sheet (base), allowing for spot-welding the sensor to a metal structure. The base is made from a 0.2mm thick SS304 material and allows the usage of common spot-welding tools. The recommended energy while using the SPW-01 spot-welding tool is around 30J.

The area mandatory to spot-weld is shown in **Figure 5** in green. It is necessary to follow the number order of spot-welds as shown in **Figure 5**. The number of spot-welds can exceed the ones shown in **Figure 5**.



**Figure 5:** Spot-welding area.

### (5) Removal of the PST-02 from the sensor

Dismount the PST-02 from the SWS-02 sensor as shown in **Figure 4** – follow the reversed alphabetical order of all parts listed in “Parts overview” (**Figure 3**).

After installation, it is recommended to verify the actual WL of the sensor with the interrogator. Small wavelength shifts that can occur during spot welding and PST-02 removal processes shouldn't exceed  $\pm 250\text{pm}$ .

### Other possible installation methods

Apart from spot-welding, other methods can be applied to secure the sensor on the surface of the measured object.

### Mechanical installation (screwing)

Mechanical installation includes the usage of two standard M6 metric screws (one at each side of the sensor). These screws are not supplied with the sensor. This method could apply to concrete, walls, or even metal structures if spot-welding or gluing is not applicable.

The anchoring distance is  $39 \pm 4\text{mm}$ . This has to be respected during the drilling of the holes for the screws. Follow the chapters (1) and (2) of this document to have the sensor ready and pre-strained before fastening it to the surface. Screws are then fastened on both sides of the SWS-02 sensor.<sup>4</sup> After securing the screws, the PST-02 can be removed as described in Chapter (5) of this document.

After the installation, it is recommended to verify the actual WL of the sensor with the interrogator. Small wavelength shifts that can occur during screwing and PST-02 removal processes shouldn't exceed  $\pm 250\text{pm}$ .

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<sup>4</sup> Suitable thread adhesive or secure washers can always improve the stability of this installation method.

**Chemical installation (glue bonding)**

Chemical installation is based on using an adhesive that bonds the sensor to the measured surface. The glue is not supplied with the sensor. The selection of the right glue highly depends on the material of the surface and the environmental conditions. Special curing procedures such as elevated temperature, pressure or air humidity can be required by using such adhesives.

Follow the chapters (1) and (2) of this document to have the sensor ready and pre-strained before bonding it to the surface. The glue can only be applied to the metal areas of the SWS-02.

After the adhesive is cured, the PST-02 can be removed as described in Chapter (5) of this document. After the installation, it is recommended to verify the actual WL of the sensor with the interrogator. Small wavelength shifts that can occur during screwing and PST-02 removal processes shouldn't exceed  $\pm 250\text{pm}$ .

**For more information, contact our sales team at [sales@sylex.sk](mailto:sales@sylex.sk)**

\* Specifications are subject to change without notice