

SWS-03 Installation procedure

Introduction

This document aims to describe recommended installation procedures applicable to the installation of the SWS-03 strain sensor. The document covers a spot-welding method of installation, however, other installation possibilities,¹ such as bonding using a two-compound epoxy, are possible as well.

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-03 Pre-strain setup tool for SWS-03 sensor
- Personal Protective Equipment (latex gloves, eye protection, respirator, ...)

Installation time

Typical spot-welded installation time of SWS-03 sensor: **between 10 and 15 minutes** (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-03 and setting up the desired pre-strain [2 minutes]²
- (3) Surface preparation for spot welding [5 minutes]³
- (4) Spot welding of the sensor to the surface [5 minutes]
- (5) Removing PST-03 from the sensor [2 minutes]

¹ Other installation possibilities are mentioned in the fifth chapter.

² It requires the sensor to be connected to the interrogator.

³ The time for completing highly depends on the state of the surface of the monitored object.

(1) Removal of the transportation protection from the sensor

SWS-03 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-03 as shown in **Figure 2** – follow the alphabetical order of all parts as listed in **Figure 1**. All tools are included in the PST-03 package.

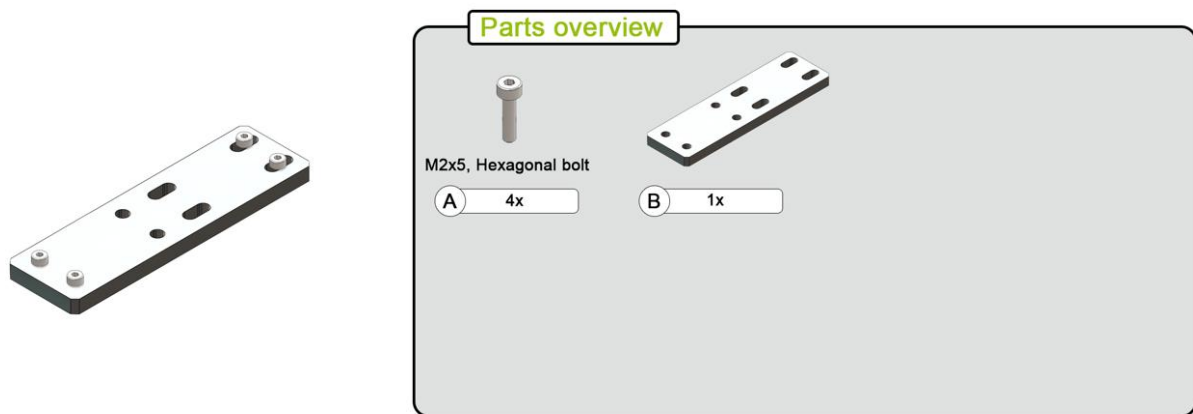


Figure 1: Parts overview of the Transportation fixture.

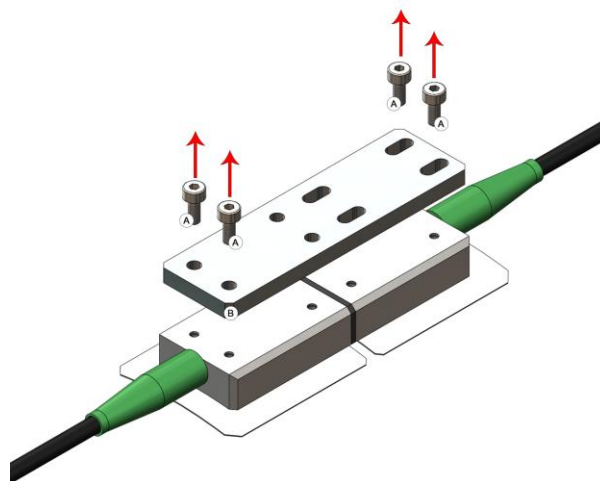


Figure 2: Removing the Transportation fixture.

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

(2) Mounting of PST-03 and setting up the desired pre-strain

SWS-03 comes with very small pre-strain, not applicable for compression measurement, therefore it is necessary to adjust the pre-strain on the SWS-03 before installation. For this purpose, the PST-03 pre-strain setup tool is used. It allows setting the desired pre-strain level to the sensor just before the direct installation of the sensor to the surface, and it also keeps the defined pre-strain during installation. After installation, the PST-03 is removed from the sensor and can be used for another SWS-03 installation.

- ▲ PST-03 provides safely pre-straining the SWS-03 sensor up to 4000 $\mu\epsilon$.
- ▲ Easy to assemble or disassemble within a fragment of time.

Mounting the PST-03 to the SWS-03 sensor

Mount the PST-03 on the SWS-03 sensor as shown in **Figure 4** – follow the alphabetical order of all parts listed in “Parts overview” (**Figure 3**). All tools are included in the PST-03 package.

Applying pre-strain to the SWS-03

To apply pre-strain, connect the sensor to an interrogation unit and focus on the higher wavelength. In a standard case, the higher wavelength is used for strain measurement and the lower for temperature compensation. Use the knob on the top of the PST-03 (**Figure 4**) and rotate it clockwise to increase the pre-strain⁴ and anti-clockwise to reduce it.

⁴ It can take several rotations before the sensor will react to the pre-strain tool.

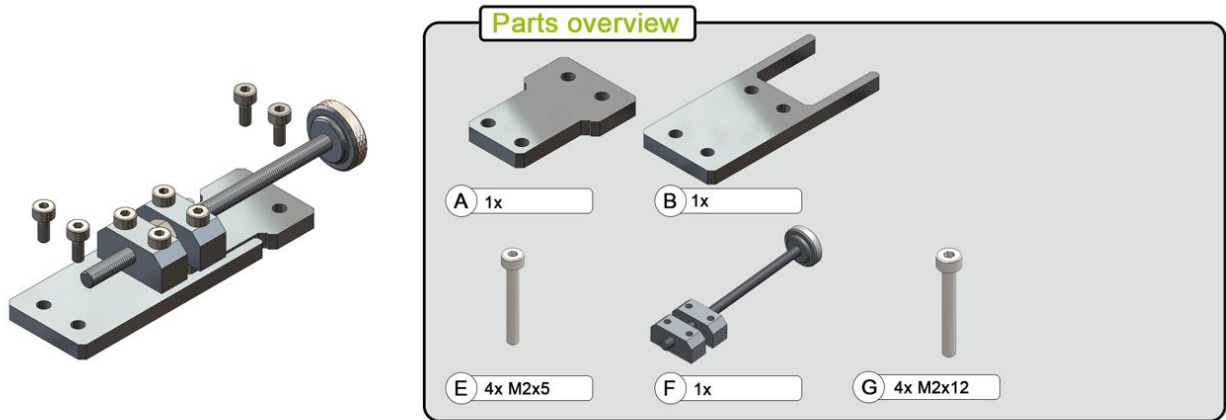


Figure 3: Parts overview of the PST-03.

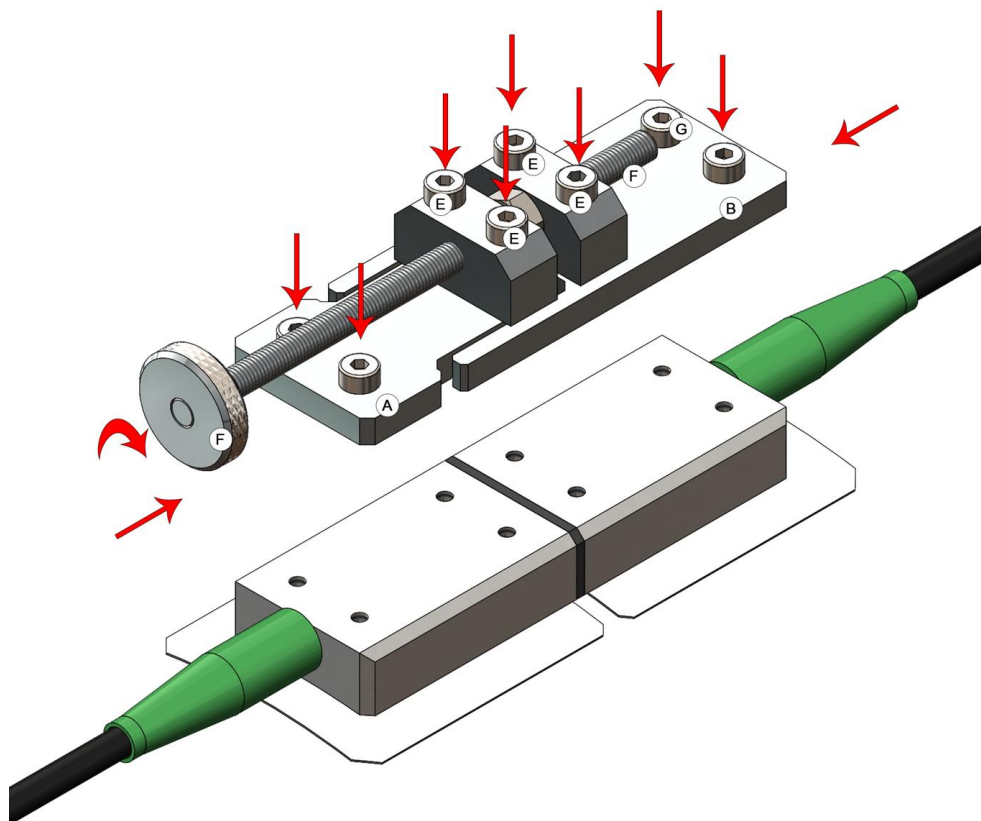


Figure 4: Assembling/Disassembling of the PST-03.

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(3) Surface preparation for spot welding

It is necessary to properly treat the surface of the SWS-03 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-03 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 304 – 1.4301 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**. The time between the spot-welds should be at least 5-10 seconds to allow the material to cool down.

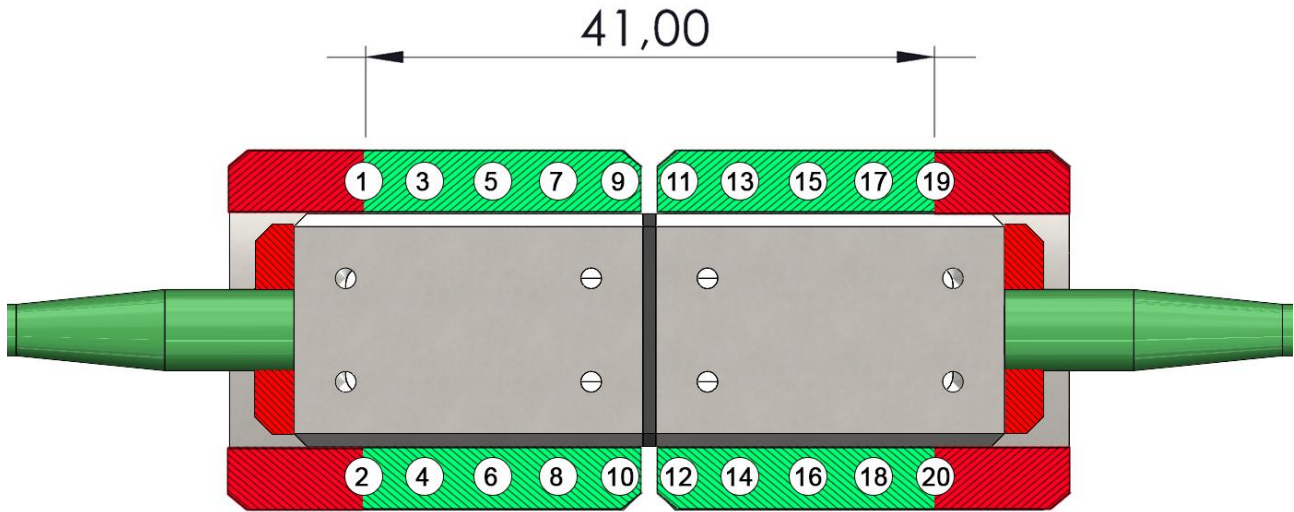


Figure 5: Recommended area of spot-weld.

Note: Not following the above-mentioned procedure can result in a different strain gauge factor.

(5) Removal of the PST-03 from the sensor

Dismount the PST-03 from the SWS-03 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-03 removal processes shouldn't exceed $\pm 250\text{pm}$.

Other possible installation methods

While spot welding is the recommended installation method, other methods can be applied to secure the sensor on the surface of the measured object.

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-03.

After the adhesive is cured, the PST-03 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-03 removal processes shouldn't exceed $\pm 500\text{pm}$.

(6) Installation of the cover

The SWS-03 can be additionally protected by a cover (**Figure 6**) that provides basic mechanical and thermal protection for the sensor. The cover is altered to copy the installation curvature and made from high-quality Polyamide material, highly resistant to environmental and chemical conditions.

The installation of the cover is performed after the installation of the sensor is finished. Basic surface preparation, such as cleaning, is recommended before the cover is installed. The cover is installed by using a silicone sealant that is applied at the bottom of the cover⁵ in a thin layer. The cover is afterward positioned above the sensor with applied pressure for the time of curing⁶.

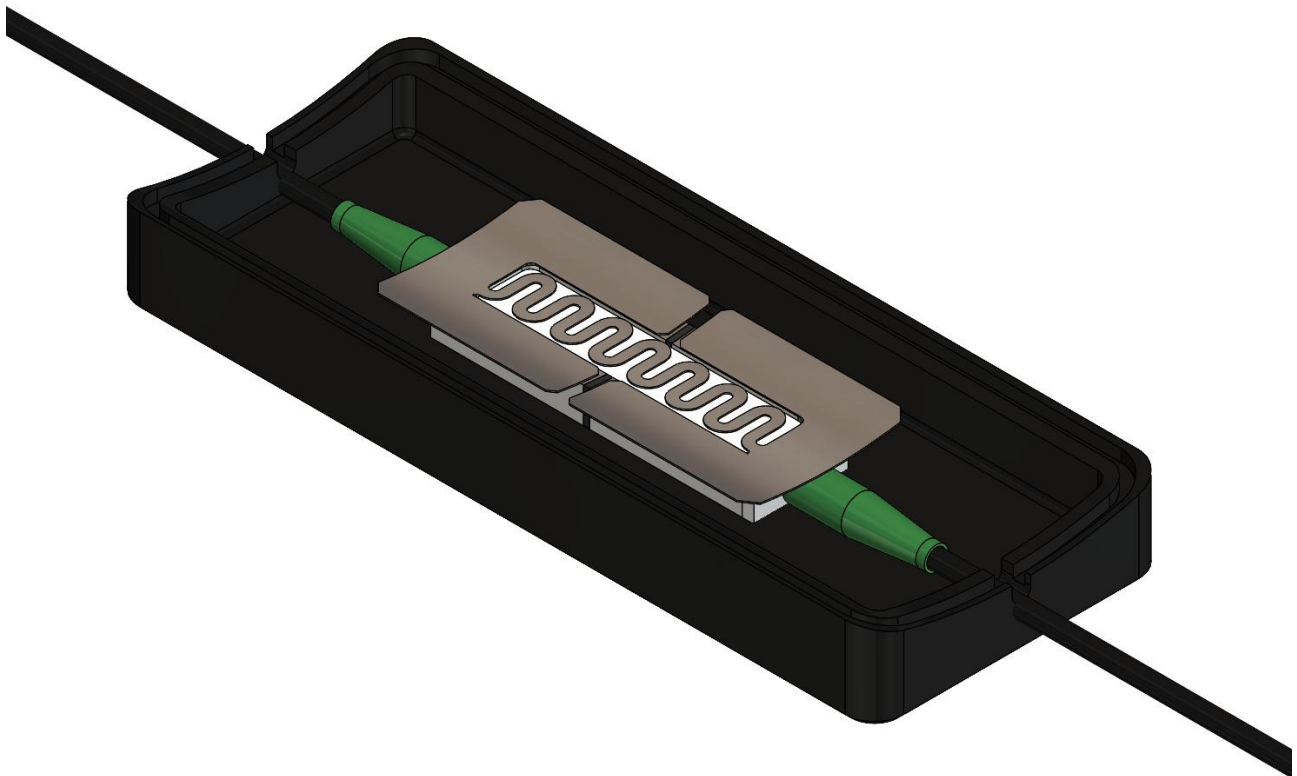


Figure 6: SWS-03 cover installation.

For more information, contact our sales team at sales@sylex.sk

* Specifications are subject to change without notice

⁵ General purpose silicone sealant is enough for the installation.

⁶ Please note, certain environmental conditions are necessary to be followed by the supplier of the sealant.