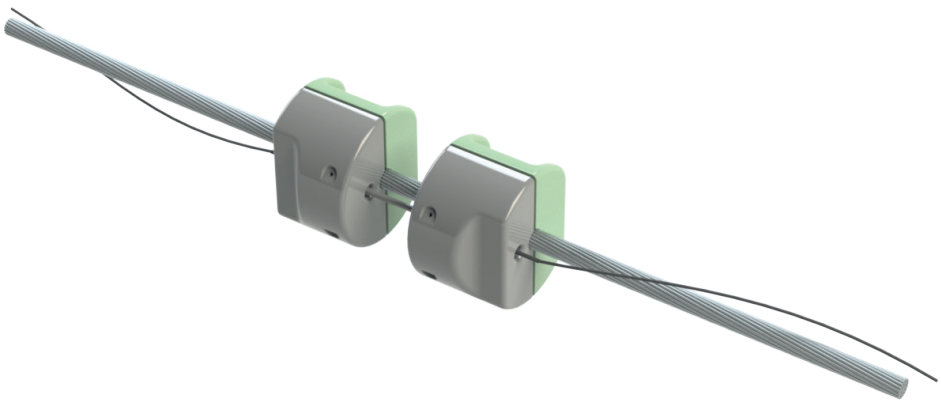
synaptec
powered by Megger

Installation manual

Overhead Line Sensor (OHLS)



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Contents

1. Introduction

1.1 Chapter overview

This chapter provides some general information about the technical manual and an introduction to the device(s) described in this manual.

This chapter contains the following sections:

- Chapter overview
- Foreword

1.2 Foreword

This technical manual provides a functional and technical description of Synaptec's Overhead Line Sensor (OHLS), as well as a comprehensive set of instructions for installation and use of the device. The level at which this manual is written assumes that you are already familiar with power systems instrumentation and have experience in this discipline. The description of principles and theory is limited to that which is necessary to understand the product.

The technical content presented in this document is based on an actual case or as-designed parameters, and therefore should not be relied upon for any specific application and does not constitute a performance guarantee for any projects. Actual results are dependent on variable conditions. Accordingly, Synaptec does not make representations, warranties, or assurances as to the accuracy, currency or completeness of the content contained herein. If requested, we will provide specific technical data or specifications with respect to any customer's particular applications. Our company is constantly involved in engineering and development. For that reason, we reserve the right to modify, at any time, the technology and product specifications contained herein.

We would therefore be very pleased to hear from you if you discover any errors or opportunities for improvement. Our policy is to provide the information necessary to help you safely specify, engineer, install, commission, maintain and eventually dispose of this product. We consider that this manual provides the necessary information, but if you consider that more details are needed, please contact us.

All feedback should be sent to us via info@synapt.ec.

1.2.1 Target audience

This manual is aimed towards all professionals charged with installing, commissioning, maintaining, troubleshooting or operating any of the products within the specified product range. This includes installation and commissioning personnel as well as engineers who will be responsible for operating the product.

The level at which this manual is written assumes that installation and commissioning engineers have knowledge of handling electronic equipment and fibre optics.

1.2.2 Nomenclature

Due to the technical nature of this manual, many special terms, abbreviations and acronyms are used throughout. Some of these terms are well-known industry-specific terms, while others may be special product-specific terms used by Synaptec. The first instance of any acronym or term used in a particular chapter is explained. In addition, a glossary is included in Section 1.2.3.

British English is used throughout this manual.

1.2.3 Glossary

For the purposes of this document, the following definitions apply:

- OHLS – Overhead Line Sensor

2. Product scope

2.1 Chapter overview

This chapter provides information on the product and its use.

This chapter contains the following sections:

- Product overview
- Features and functions
- Optical fibre routing

2.2 Product overview

The OHLS accurately measures vertical ground clearance for immediate warning when clearance thresholds are breached. The OHLS is designed for direct installation on an overhead line, and can provide measurements of line sag, strain, vibration and temperature. The OHLS is completely passive and seamlessly compatible with Synaptec's electrical current and voltage sensors and central Interrogators, adding valuable mechanical and environmental insights to any Synaptec condition monitoring system.

By combining OHLS with Synaptec's passive current sensors, precise ampacity information is published in one synchronous and permanent data stream from any number of individual locations in circuits of any length, traversing multiple climate zones.

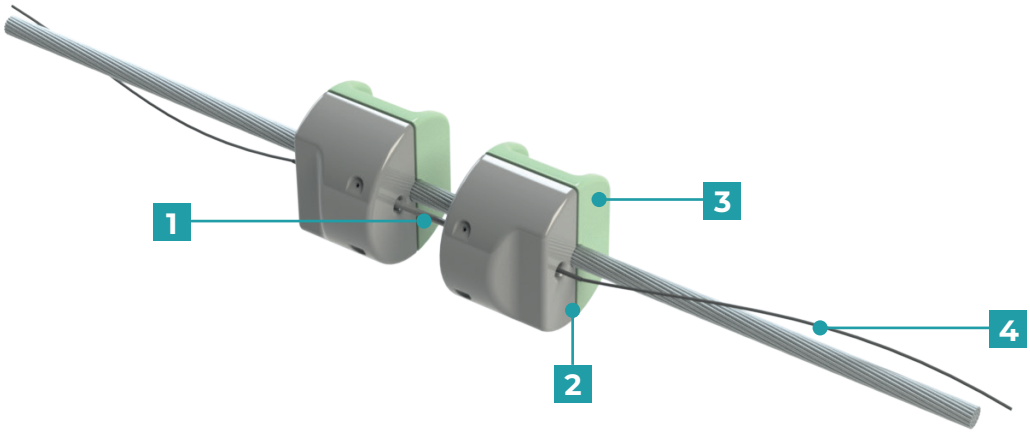
2.3 Features and functions

The OHLS is shown in Figure 2.1, with numbered items described in Table 2.1.

Table 2.1: Key components of the OHLS, with reference to the numbering in Figure 2.1.

Item	Designation	Description	Qty
1	Optical sensor	Fibre optic strain and temperature sensor	1
2	Upper clamp	Upper side of mechanical clamp to conductor	2
3	Lower clamp	Lower side of mechanical clamp to conductor	2
4	Optical fibre	Optical fibre connection to sensor	1

Figure 2.1: OHLS design. Numbered items are identified in Table 2.1.



Various clamp options are available, depending on the diameter of the cable to which the OHLS is to be mounted.

2.4 Optical fibre routing

The OHLS is designed to be monitored by Synaptec's Interrogator, utilising existing or new single-mode fibre to make series or parallel connection to each Synaptec sensor in the fibre network. Additional components are required to safely route the optical fibre from the OHLS on the phase conductor to a local splice box at a nearby location (e.g. on the tower). A conductor mounted joint case and phase-to-ground (PTG) insulator are required to make this connection. If no splice box is present on the tower, a tower mounted joint enclosure may also be added. A general approach to fibre routing and connection is shown in Figure 2.2. Final fibre routing shall be agreed with the customer at the design stage of each project, but will follow this same general principle. Examples of the additional routing components are shown in Figure 2.3.

Figure 2.2: Example fibre routing between OHLS and central Interrogator.

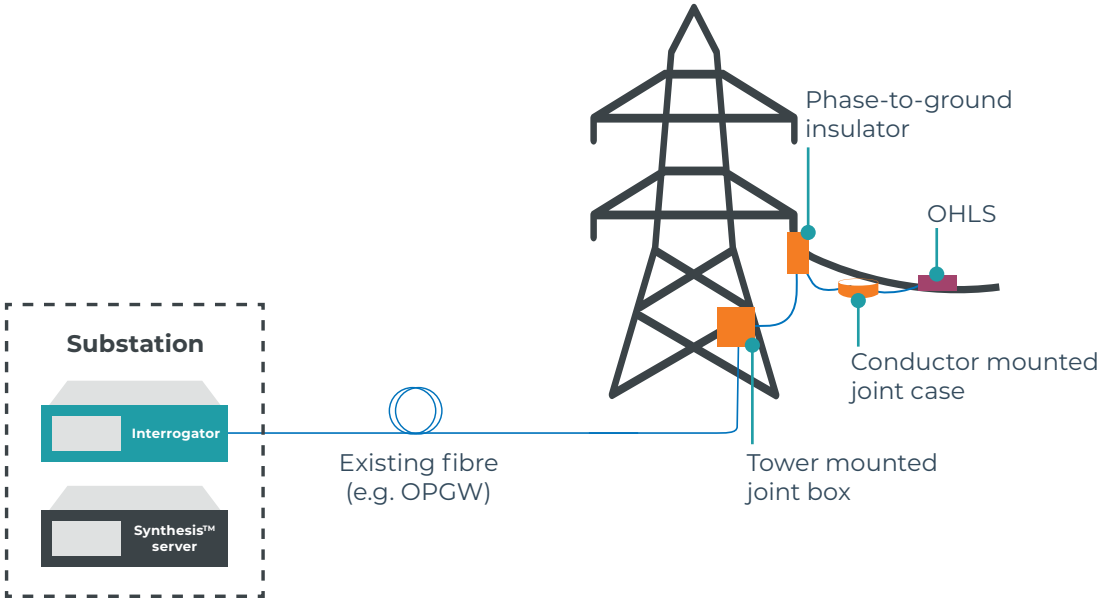
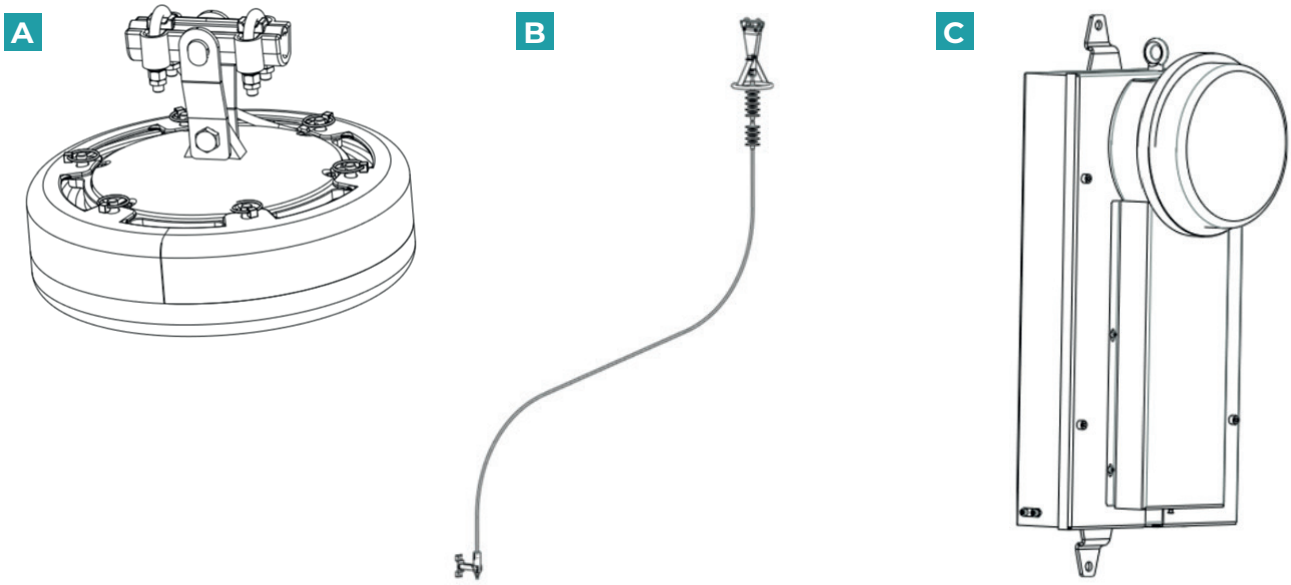


Figure 2.3: Example fibre routing components: (a) Conductor mounted joint case; (b) Phase-to-ground insulator; (c) Tower-mounted joint enclosure.



Further options exist to wrap fibre about the phase conductor to the next OHLS or other Synaptec sensor in the measurement chain. For further instructions for fibre wrapping and routing, please contact Synaptec.

3. Installation

3.1 Chapter overview

This chapter describes the process of installation of the OHLS.

This chapter contains the following sections:

- Tools
- Preparing for installation
- Installation
- Commissioning

3.2 Tools

For the purposes of installation the following tools are required and may be provided by Synaptec upon request.

- Setting bar
- Torque wrench with T40 Torx bit
- 3mm Hex bit
- Spirit level
- Cable ties
- Fusion splicer and associated accessories

3.3 Preparing for installation

For the purposes of this guide it is presumed that fibre routing infrastructure is installed to route optical fibre from the tower to the phase, and that fibre is routed back from the tower to the Synaptec Interrogator. The target location on the phase conductor should be cleared of dirt and debris and free from deformation.

Standard electrical safety protocols should be observed when working with overhead conductors. It is the responsibility of the installer to ensure that a suitable Risk Assessment and Method Statement (RAMS) is produced for the installation and approved by responsible persons.

3.4 Installation

3.4.1 Fibre optic connection

The OHLS fibre should be spliced into the fibre routed to the conductor mounted joint case. The OHLS employs standard polyimide-coated single-mode fibre. Fibre optic splices should be performed by trained individuals using a suitable fusion splicer. For optimal operation, it is recommended that splice loss not exceed 0.05 dB.

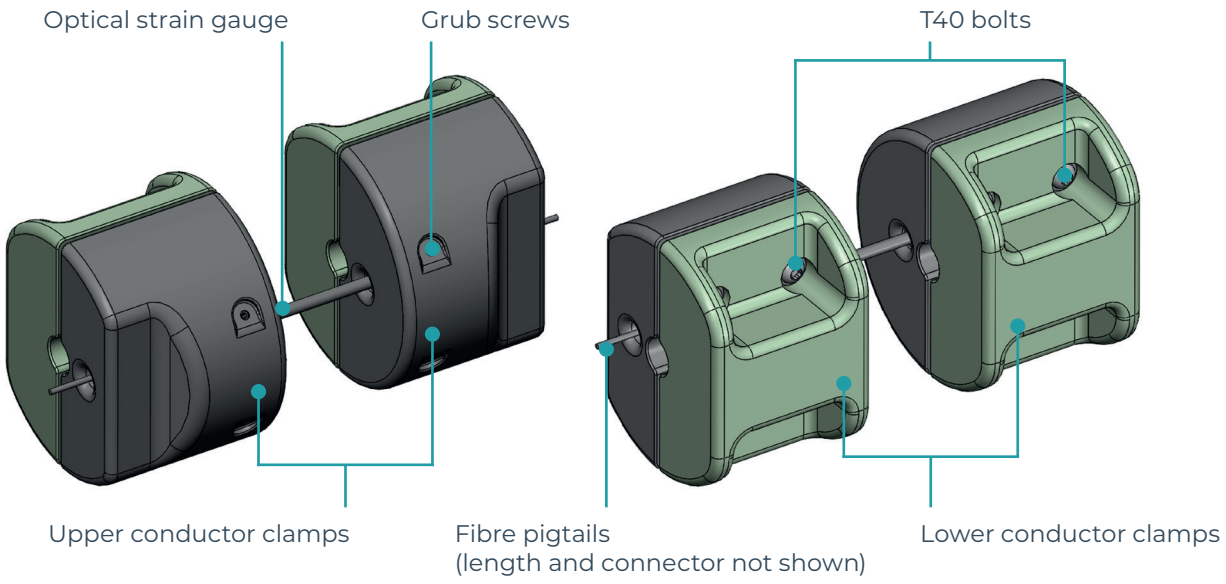
If the OHLS being installed is the last in the chain, the fibre on the far end of the sensor should be routed back to the conductor mounted joint case and terminated appropriately inside. Note that this final stage should be performed after mechanical mounting of the device (see Section 3.4.2), as the fibre must be threaded through the clamp.

Any fibre lengths between the OHLS and conductor mounted joint case should be wrapped securely about the conductor and secured in place where appropriate.

3.4.2 Mechanical installation

A detailed image of the OHLS orientated as per installation and with fixings applied is provided in Figure 3.1. For clarity, the conductor and fibre optic cables are not shown.

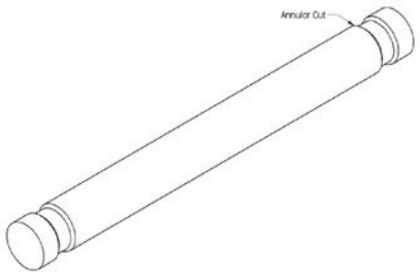
Figure 3.1: OHLS as assembled and orientated following installation. Conductor and fibre cable not shown for clarity.



Step 1 – Setting Bar and Upper Clamps

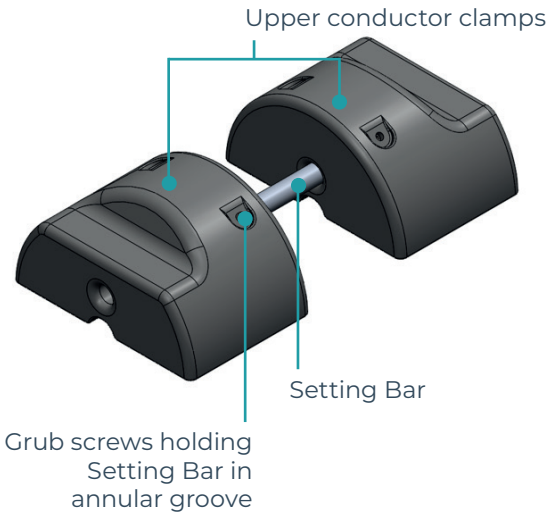
It is important that the mounting clamps are correctly spaced and axially aligned to avoid applying torque to the optical sensor after installation. The Setting Bar shown in Figure 3.2 is used to set the initial alignment and spacing of the clamps during installation. The Setting Bar has annular grooves cut into each end that are used to properly position the Upper Clamps.

Figure 3.2: Setting bar



Prior to mounting any components on the conductor, the Setting Bar should be inserted into both Upper Clamps and held in place with the provided 3mm grub screws as shown in Figure 3.3. The grub screws should be positioned in the annular grooves to maintain the proper spacing between the mounting clamps. The flat surfaces of the two Upper Clamps should be parallel after fixation of the Setting Bar.

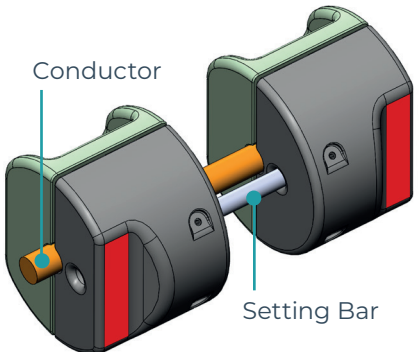
Figure 3.3: Setting Bar used to set separation and orientation of Upper Clamps.



Step 2 – Mounting Clamps to conductor

With the Setting Bar still in place, attach the clamp assembly to the conductor at the desired location by loosely screwing the Lower Clamps to each Upper Clamp using the T40 bolts provided. A spirit level should be used on the flat edges of the Upper Clamps to ensure the assembly is aligned vertically as shown in Figure 3.4. Once the assembly is confirmed to be vertically aligned as shown in Figure 3.4, tighten the T40 bolts on each clamp pair to a torque of 32 Nm in a cross formation (e.g., top-left, bottom-right, bottom-left, top-right).

Figure 3.4: Clamps mounted to conductor with the Setting Bar still in place.

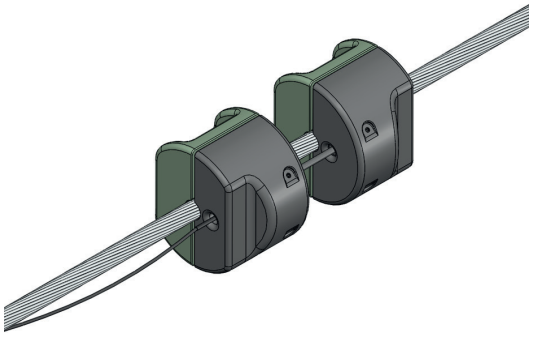


Step 3 – Optical sensor installation

After the clamps are affixed to the conductor as shown in Figure 3.4, loosen the grub screws and remove the Setting Bar. Thread the optical fibre through the same holes in the Upper Clamps, until the optical sensor is positioned in the same location as the Setting bar in Steps 1 and 2. Iteratively tighten the grub screws loosely using a cross formation (e.g., top-left, bottom-right, bottom-left, top-right), then repeat, tightening to full torque of 8 Nm, again in a cross formation, to avoid twisting of the sensor during installation.

After the sensor is fixed in place by the grub screws, ensure one fibre cable has been routed to the conductor mounted joint box and spliced into the fibre network. At this point, the installed device should resemble the image in Figure 3.5.

Figure 3.5: Clamps mounted to conductor, optical sensor secured in place and fibre routed to joint box and spliced.



Step 4 – Fine adjustment

After the optical sensor is secured in place and one fibre end spliced into the optical network, it is necessary to examine the measurement from the sensor and make fine adjustments to the mechanical installation. The Interrogator should be powered on and connection made into the sensor fibre as detailed in the DES Interrogator Installation Manual. A means of contact (e.g., telephone or radio) should be available between the engineers working on the Interrogator and OHLS. The engineer working on the Interrogator should have been qualified in its use by Synaptec.

The engineer working with the Interrogator will be able to view measurement data from the OHLS to evaluate the strain applied to the device following installation per Steps 1–3. Should this nominal strain be different to the design specification, the Engineer working with the OHLS may be required to gently loosen the T40 bolts between the clamp pairs and make small adjustments to the separation of the two clamp pairs on the conductor. This process should be iterated until the Interrogator engineer advises that the nominal strain setting of the OHLS is within the design parameters.

Once the nominal strain is set to within the design parameters, the OHLS installation engineer should ensure that all T40 bolts have been tightened again in a cross formation per Step 2, and nominal strain confirmed with the Interrogator engineer one final time before mechanical installation is complete.

3.4.3 Commissioning

To enable accurate calculation of line sag, the following parameters should be made available to Synaptec:

- Reference measurement of absolute line sag during installation or after re-energisation
- Absolute height of conductor suspension point
- Reference measurement of absolute ambient temperature
- Nominal conductor length
- Span length

With these parameters available, the Interrogator engineer will configure the line sag calculation and confirm that measurements are generated by the Interrogator and interpreted successfully by the receiving software (e.g. Synthesis™).