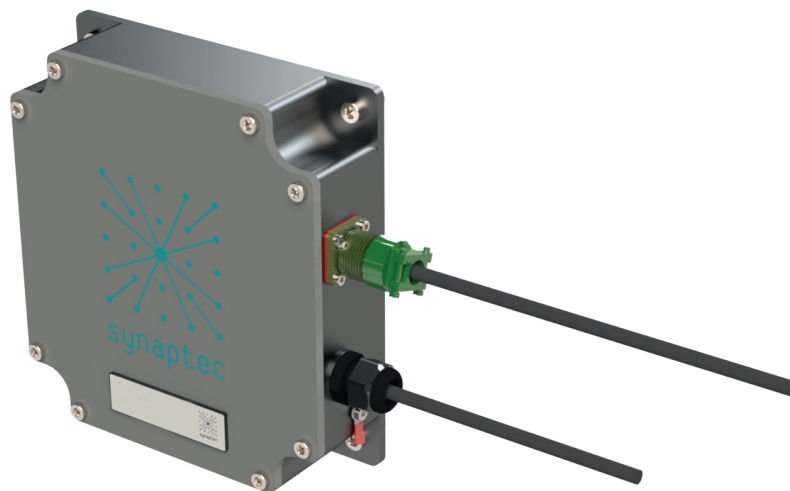




Installation manual

Passive Secondary Converter Single-Phase (PSC-1)



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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 single-phase Passive Secondary Converter (PSC-1), 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:

- CT – Current Transformer
- VT – Voltage Transformer
- PSC – Passive Secondary Converter
- PSC-1 – Passive Secondary Converter – Single-Phase
- PSC-1-C – Passive Secondary Converter – Single-Phase – Current
- PSC-1-V – Passive Secondary Converter – Single-Phase – Voltage

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
- Compliance
- Functional overview

2.2 Product overview

The PSC retrofits Synaptec's passive photonic sensing technology to the secondary circuits of existing CTs or VTs to deliver reliable, centralised power system instrumentation. The PSC-1 is a single-phase measurement device.

The PSC, in combination with Synaptec's unique optical sensing architecture, allows standard instrument transformers in the substation to be digitized without recourse to multiple powered Merging Units and digital telecoms.

The PSC also allows new instrument transformers to be installed beyond the substation fence and monitored passively via the same optical fibre network. The PSC may be configured as an IEC 60044- or IEC 61869-compliant protection class device.

Synaptec's photonic sensing technology allows the PSC-1 to be completely optically isolated: no electronics, batteries, data communications, power supplies or time synchronisation is required at the measurement location.

Each PSC-1 is installed in combination with Synaptec's Interrogator measurement device. Up to 30 single-phase PSC-1 units may be installed in series on a single optical fibre, connected to the Interrogator at a single end (typically in a substation environment). The PSC-

1 may also be interoperated with Synaptec's other electrical and mechanical sensors (PSC-3, PCT, PVT, PTT, PST, OHLS, etc.) to provide comprehensive local and remote infrastructure monitoring, protection, and metering. The distance from the Interrogator to the final PSC-1 in the chain may be as much as 60 km (with larger distances possible on request).

2.3 Features and functions

The PSC-1 is shown in Figure 2.1, with numbered items described in Table 2.1.

Table 2.1: Key components of the PSC-1, with reference to the numbering in Figure 2.1.

Item	Designation	Description	Qty
1	Housing	Weatherproof enclosure for passive secondary converter	1
2	Transformer secondary connection	Electrical connection to transformer secondary circuit	1
3	Fibre optic cable	Duplex cable for connection of optical sensor into the wider sensor network	1
4	Earth bonding point	For earthing of the enclosure	1
5	Mounting points	Mounting points for M6 bolts	4

Figure 2.1: PSC-1 design. Numbered items are identified in Table 2.1.

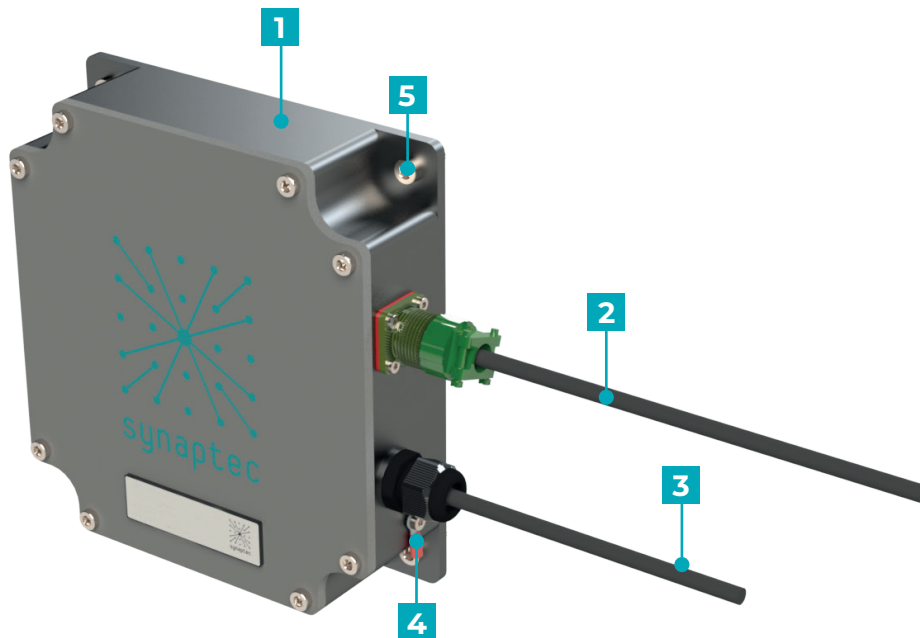
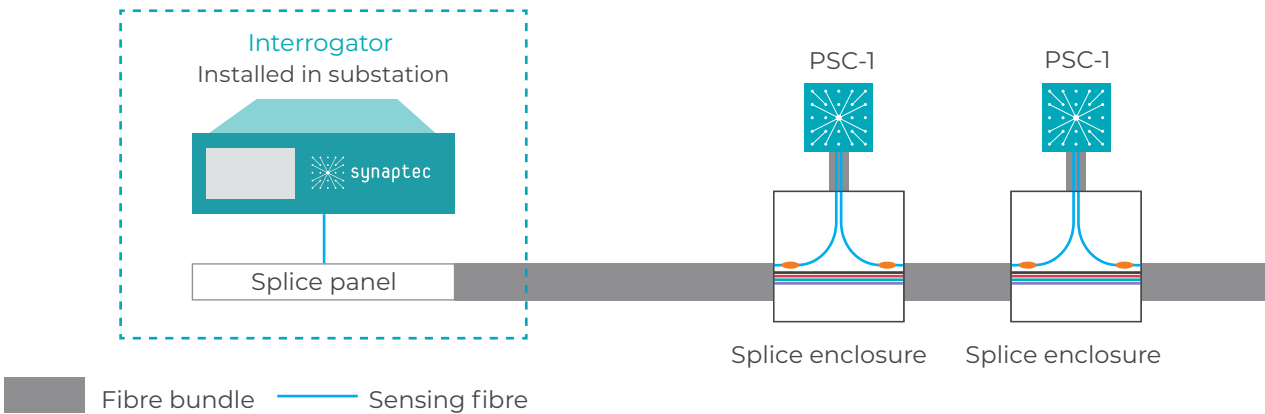


Figure 2.2: Example fibre routing between PSC-1 units and central DES Interrogator.



2.4 Optical fibre routing

The PSC-1 is designed to be monitored by Synaptec's DES Interrogator, utilising existing or new single-mode fibre to make series or parallel connection to each PSC-1 in the fibre network. Each PSC-1 is connected into the optical fibre network via a local fibre splice enclosure. 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.

3. Installation

3.1 Chapter overview

This chapter describes the process of installation of the PSC-1.

This chapter contains the following sections:

- Tools
- Preparing for installation
- Mechanical mounting
- Secondary connection
- Fibre optic connection

3.2 Tools

For the purposes of installation it is presumed that the installer has access to the following tools:

- Flat-head screwdriver
- Adjustable spanner
- M6 bolts and appropriate hex key or screwdriver
- Fusion splicer

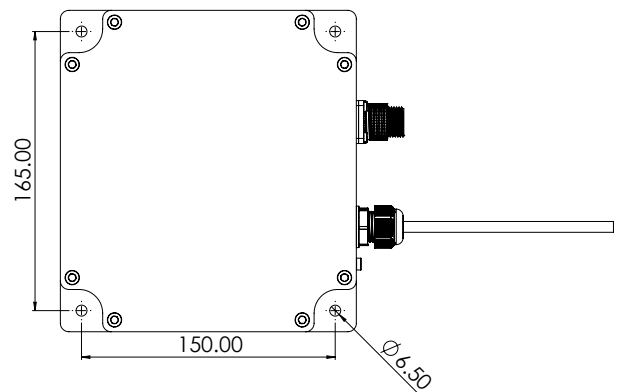
3.3 Preparing for installation

If the PSC-1 is to interface with the secondary wiring of an existing instrument transformer, it should be ensured that a suitable mounting location is available for the PSC-1 with suitable access to the secondary wiring. If the PSC-1 is supplied with a new CT or VT, the PSC-1 should be installed at a suitable location adjacent to that new instrument transformer location within distance of the secondary wiring. The arrangement of mounting holes on the PSC-1 base is shown in Figure 3.1.

In advance of the installation, the installation location should be cleared of mess and debris. Any mounting adaptors required for interfacing with the device as shown in Figure 3.1 should be installed before the PSC-1 itself.

It is at the customer's discretion whether an electrical outage should be arranged for installation of this equipment, since this depends on the complete scope of work and the electrical safety protocols under which the work will be taking place.

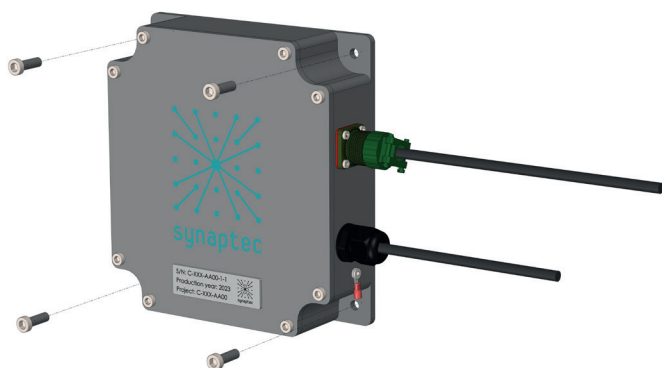
Figure 3.1: Arrangement of mounting holes on the PSC-1 base.



3.4 Mechanical mounting

The PSC-1 should be mounted to a suitable surface or any required adaptor using M6 bolts, per the diagram in Figure 3.2. M6 bolts of appropriate length for interface with any adaptor elements should be inserted into the enclosure mounting holes and secured to the mounting surface.

Figure 3.2: PSC-1 mounting arrangement.



After mounting and before the equipment is energised, the enclosure should be earthed to a local common earthing point by connection to the earth bonding point on the housing.

The CT element is industry-standard, and so should be familiar to any qualified installer of CTs in the power sector. The CT may be supplied in solid- or split- core format depending on the customer preference.

For installation of solid-core devices, typically employed for new-build circuits, the cable to be monitored should be passed through the ring core before termination

For split-core devices, typically retrofitted to existing circuits, the core may be split at the midpoint and passed around the cable to be monitored. The securing ring should then be used to fix the two CT halves together.

The CT should be oriented such that current flows in the direction P1 to P2 as labelled on the CT exterior.

For outdoor installations of split-core CTs, a suitable putty is supplied for sealing the exposed sections of the iron core. In this case, manufacturer instructions for the putty are supplied separately.

3.5 Secondary connection

Connection to the secondary circuit is achieved via a mil. spec. weatherproof electrical connector. If Synaptec is not providing the primary transformer, connectors will be supplied for connection of existing devices.

3.6 Fibre optic connection

Unless otherwise agreed with the customer, the PSC-1 is supplied with 25 m of unterminated fibre optic cable for connection into the sensor network. The fibre cable typically contains 4 or 8 fibres. The fibres typically coloured red and yellow should be used to connect into the sensor network, and other fibres should be left unterminated. The red and yellow fibres should be spliced into the agreed optical fibre network at a local splice box location, providing uninterrupted line-of-sight through the fibre to the other sensors in the network and the Interrogator.

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.

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