synaptec
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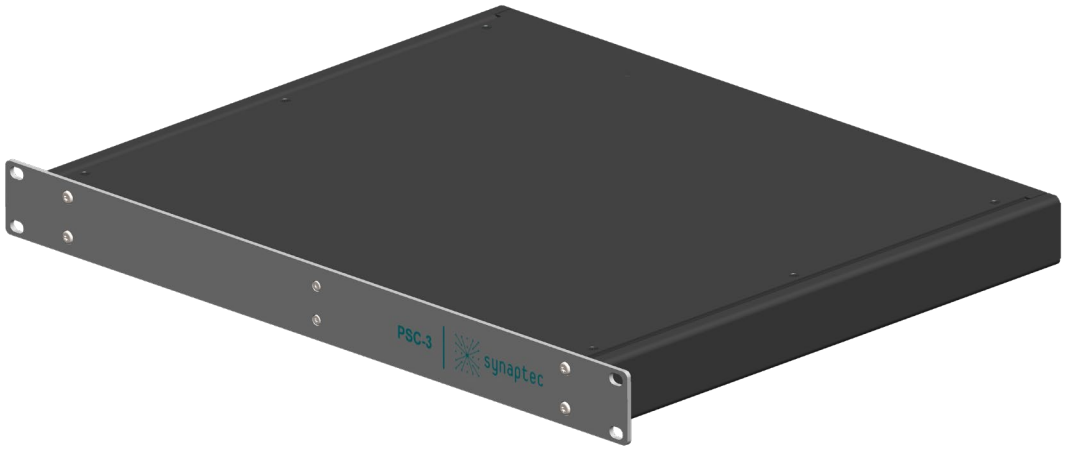
Product manual

Passive Secondary Converter for Current – Three-Phase (PSC-3-C) Gen2

(003-02-A001-1) & (003-02-A001-2)



Contents

1. Introduction

1.1 Scope

This document is valid for the following products:

Passive Secondary Converter for Current – Three-Phase (PSC-3-C Gen2):

- **Enclosed Terminal (003-02-A001-1)**
- **Barrier Terminal (003-02-A001-2)**

This technical manual provides an overview of the Synaptec Passive Secondary Converter for Current – Three-Phase (PSC-3-C Gen2) and the information necessary for installation, use, and end-of-life treatment of the device.

1.2 Limitations

The technical content presented in this document aims to provide general guidance suitable for most users in typical installations. Specific use cases and applications may vary from the content of this document - please contact Synaptec to discuss your application-specific requirements.

1.3 Revision and feedback

While Synaptec has made reasonable efforts to ensure the accuracy of the information stated herein at the time of publication, it is presented without any guarantee or warranty other than as explicitly stated in a valid contract. Synaptec may change this document at any time without notice.

Please report any errors or opportunities for improvement to Synaptec. Our policy is to provide the information necessary to help you safely specify, engineer, install, commission, maintain and end-of-life treatment of this product. If you require further guidance, please contact us.

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

1.4 Target audience

This manual is aimed towards all professionals involved in:

- Product installation
- Commissioning
- Use and operation
- End of life treatment

For each section, the reader is assumed to be a competent person who possesses the necessary technical knowledge.

1.5 Glossary

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

- PSC-3-C – Passive Secondary Converter for Current – Three-Phase. Sometimes referred to as “the product” or “the sensor”
- CT – Current Transformer
- DES – Distributed Electrical Sensing
- OTDR – Optical Time-Domain Reflectometry
- Earth/earthing/earthed – according to the definition in IEC 61936-1
- Three phase notation: “Red, Yellow, Blue” is used throughout the document. Phase A, B, C or L1, L2, L3 can be substituted accordingly
- Throughout the document “screen” is used to refer to the earth screen around power cables. Other equivalent terminology such as “sheath” can be substituted accordingly

2. Product overview

2.1 Introduction to the PSC-3-C

The PSC-3-C applies Synaptec's passive photonic sensing technology to the secondary circuits of new or existing current transformers (CTs) to deliver reliable, centralised power system instrumentation. The PSC-3-C is a three-phase measurement device used to collect high-accuracy and high-frequency measurements of current waveforms on power cables or screen bonding cables of Transmission, Distribution or other electrical assets.

The PSC-3-C allows new and existing current transformers to be digitised and monitored passively via the same optical fibre network. In combination with an appropriate interrogation system, the PSC-3-C may be configured as an IEC 60044 or IEC 61869 compliant protection class device or merging unit.

Synaptec's photonic sensing technology allows the PSC-3-C to operate without auxiliary power or communications networks and does not use active electronics, batteries, data communications, power supplies or time synchronisation at the measurement location.

Each PSC-3-C is used in combination with Synaptec's Distributed Electrical Sensing (DES) Interrogator measurement device. Multiple PSC-3-C sensors and single-phase PSC-1-C sensors may be installed in series on a single optical fibre, connected to the Interrogator at a single end (typically in a substation environment). The standard maximum distance from the Interrogator to the final sensor is 60 km. Longer distances can be achieved using an optical amplifier in the case of specific application requirements.

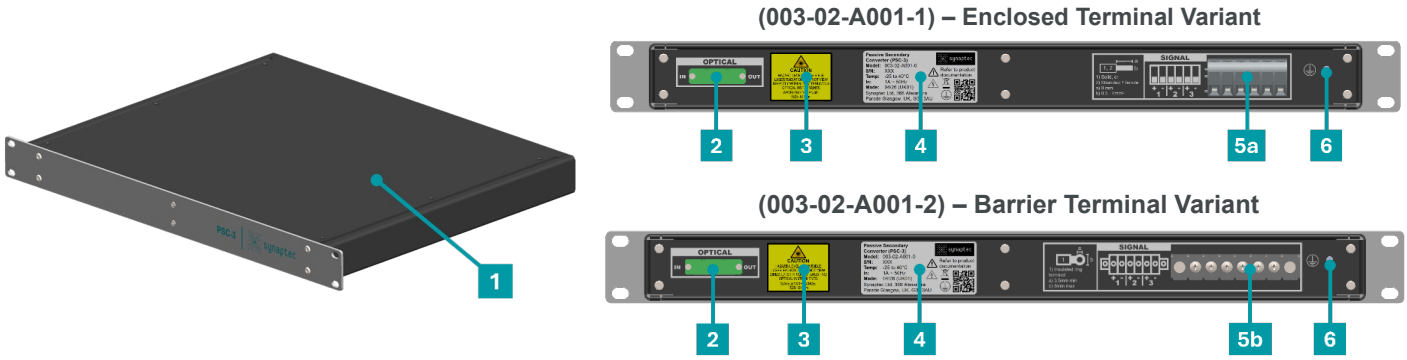
The PSC-3-C may also be interoperated with Synaptec's other electrical and mechanical sensors to provide comprehensive local and remote infrastructure monitoring and protection.

2.2 Features and functions

Table 2.1: Key components of the PSC-3-C.

Item	Designation	Description
1	Unit enclosure	19" x 1U Rack-mounted Aluminium Enclosure
2	Fibre optic connector	Shuttered Duplex SC-APC Connector *OPTICAL IN:* Connects to the upstream fibre (Interrogator or preceding sensors) *OPTICAL OUT:* Connects to the downstream fibre (following sensors)
3	Laser Safety Label	Per IEC 60825-2
4	Rating Plate	Information including sensor unique identifier / serial number
5a	CT Terminal Block - Enclosed Terminal	IP20 – Considering recommended usage and conductor preparation *SIGNAL:* 6-pole terminal block for connection of CT secondaries
5b	CT Terminal Block - Barrier Terminal	IP10 – Considering recommended usage and conductor preparation *SIGNAL:* 6-pole terminal block for connection of CT secondaries
6	M4 Earth Stud	For use with M4 ring terminal for earthing unit enclosure

Figure 2.1: PSC-3-C design. Numbered items are identified in Table 2.1



2.3 Overview of optical fibre routing

The PSC-3-C can be connected in series into an optical network of sensors. The sensor network is monitored at a single end, at a substation installation, by Synaptec's DES Interrogator.

Optical fibre may be existing or new single-mode fibre.

Each PSC-3-C is connected into the optical fibre network via SC/APC terminated patch cables, not provided by Synaptec.

A general approach to fibre routing and connection is shown below. Refer to Section 3 for detailed installation instructions.

Figure 2.2: Example fibre routing between PSC-3-C units and DES Interrogator (Single unit).

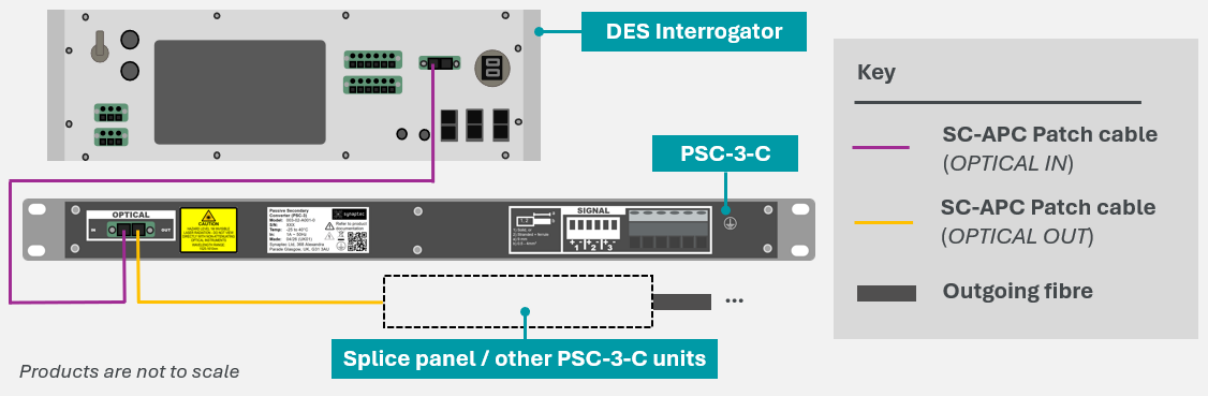
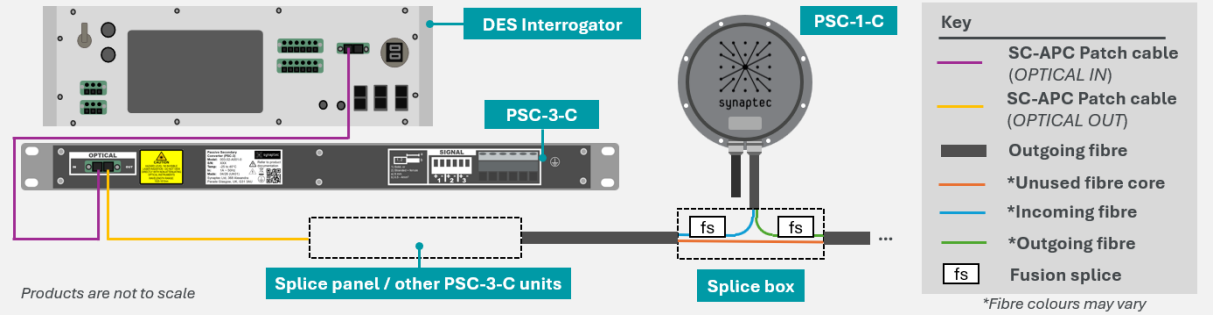


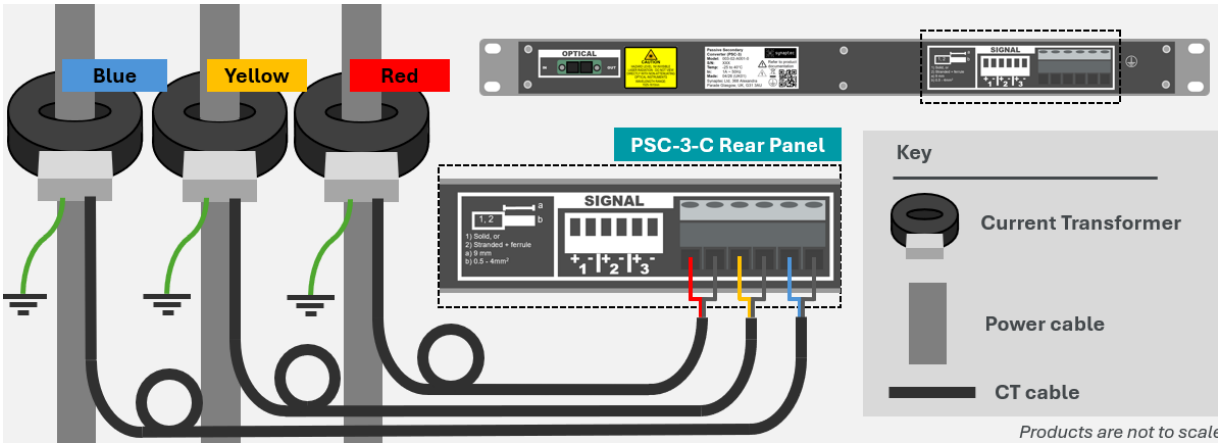
Figure 2.3: Example fibre routing between a PSC-3-C, PSC-3-C units and DES Interrogator (Multiple units)



2.4 Overview of secondary electrical connection

The PSC-3-C electrical cables are connected to new or existing current transformers. Each PSC-3-C phase is connected to a separate CT. Refer to Section 3 for detailed installation instructions.

Figure 2.4: Example electrical secondary connection. Note that transformer core colours may differ



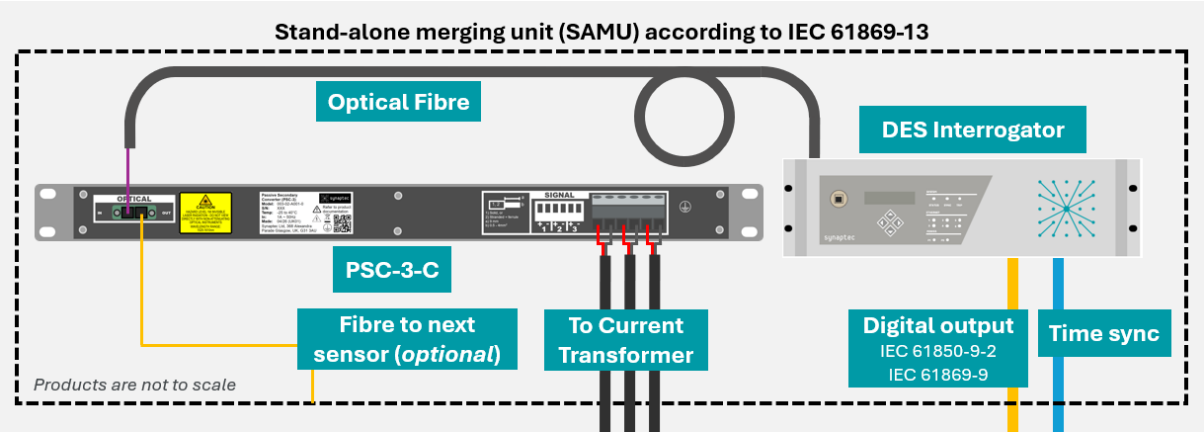
2.5 Stand-alone merging unit (SAMU) classification according to IEC 61869-13

For application of the IEC 61869-13 definition for a stand-alone merging unit (SAMU), the following scope applies.

A system of one or more PSC-3-C (or PSC-3-C) products connected by optical fibre to a DES Interrogator product may act as a SAMU under the IEC 61869-13 definition. Each PSC-3-C (which may be installed in a substation or at an external location) instruments the CT secondaries as defined per IEC 61869. The DES Interrogator (typically installed in a substation) receives a local auxiliary power supply and time synchronisation signal and outputs digital measurements of the instrumented CTs per IEC 61850-9-2 and IEC 61869-9. The SAMU digital output may be accessed by other devices to enable various protection, control and condition monitoring applications.

The PSC-3-C is therefore a component of a SAMU when used in conjunction with the DES Interrogator.

Figure 2.5: Classification of PSC-3-C and DES Interrogator according to IEC 61869-13



3. Product Installation

3.1 Installation order

The order of system installation steps depends on application requirements and operator considerations and procedures.

3.2 Prerequisites

3.2.1 Further references

- DES System Manual (TD-014)
- PSC-3-C Gen2 Installation checklist (TA-048)

Figure 3.1: Installation Checklist Indicator

When this icon appears, it means the section includes information that is required for completing the installation checklist or contains steps directly linked to it.

3.2.2 Associated documents

Documentation related to the PSC-3-C and supplied to the installer prior to installation shall include:

- PSC-3-C Product Manual (this document)
- Detailed system design pack for the full delivered system, signed by Synaptec and the end-user/client

The detailed system design pack includes:

- System specifications
- Topology and fibre routing diagrams
- Bill of materials
- Any exceptions to the standard product installation guides
- Laser safety assessment

This information will indicate the installation location of each PSC-3-C sensor, indexed by serial number, and other relevant information related to its installation and operation. Particular attention should be given to the location of each sensor (PSC-3-C and PSC-3-C units) by serial number, as any deviations from this design during installation will impact system performance. Where no exceptions are listed to the installation information provided in this manual, that information should be followed.

3.2.3 Competencies

Installation of the PSC-3-C requires no specialist competencies that are unfamiliar to the installation of measurement or telecoms hardware in the power sector.

All mechanical and electrical installation works should be carried out by qualified installers. Typical skills required for mechanical and electrical installation works will include:

- Mechanical mounting of components in a standard 19” rack, including installation of additional support where this is required for structural security of the hardware
- Wiring of CT secondary terminals

All fibre optic work should be carried out by qualified fibre optic engineers. Synaptec systems use only single-mode fibre. Typical skills required for fibre optic works during PSC-3-C installation will include:

- Use of single-mode, SC-APC (angle-polished) fibre connectors
- Fibre optic routing and the use of splice boxes and patch panels
- Optical time-domain reflectometry (OTDR) and splice loss measurement

Depending on the optical system, the following may be required:

- Fibre end cleaving, cleaning and inspection
- Single-mode fibre splicing

For additional competencies related to the wider DES system installation, refer to TD-014 DES System Manual.

3.2.4 Tools

Tools for mechanical installation, for example:

- Tools and accessories for mounting the PSC-3-C in a standard 19” rack (See Section 3.4)

Tools for electrical installation, for example:

- Stripping, crimping, and connecting wires of up to 4 mm2 cross-section, for connection between the PSC-3-C and the current transformers, including recommended consumables (see Section 3.6)

Tools for fibre optic inspection, splicing (if applicable) and protection, for example:

- Fibre optic inspection equipment
- Fibre optic stripping, cleaving, cleaning and fusion splicing tools and accessories (See Section 3.7)

3.3 Receipt of products and documentation

This section discusses requirements for receiving and unpacking the goods, as well as associated considerations regarding product care and user safety.

3.3.1 Handling and product care

Handle the product carefully at all times during installation to avoid damage. Special care should be taken to avoid damage to the terminal block and the optical connector. They should not be subject to stress, crushing, or significant tensile force. The dust cap must not be removed from the optical connector until connection to optical network.

After initial unboxing to confirm receipt, products should be carefully re-packed in the original packaging for storage and onward transport to final installation locations. Products should not be removed again from packaging until the time of installation.

Ensure that loose components are retained with the product, in the packaging. These should accompany the product to its installation destination and afterwards be stored in a dedicated safe location. Digital copies of all documentation are available from the Synaptec website.

The site environment should be appropriate for the product installation to be carried out properly. This includes consideration of lighting, cleanliness, and vibration. This particularly applies where installation is being carried out at the same time as construction work.

3.3.2 Receipt

Open the product packaging on receipt to confirm the products and accessories are correct and there has been no external damage in transit. Do not remove the product from packaging unless required.

Re-seal the product in its original delivery packaging for storage and onward transport.

Refer to TD-14 DES System Manual for further information related to receipt of DES system hardware.

3.3.3 Storage

If the product is not intended for immediate installation, store in a place free from dust, moisture and high humidity, between -25 to 50°C in the original packaging. Products should be stored in a way that avoids crushing the packaging.

On subsequent unpacking, make sure that any dust on the carton does not fall inside.

3.4 Preparing for installation

3.4.1 Installation method

A plan for the installation should be developed in advance of works. This should establish a safe and practical method for the work and consider factors such as access, lighting, environmental factors, cleaning or

preparation of the site for the work. Safety is always a priority when conducting installations or maintenance and the method of work should be consistent with the asset owner's policies, as well as regional best practices and regulatory requirements.

3.4.2 Sensor location

The PSC-3-C requires electrical cables to interface with the current transformers placed around the power cable being instrumented, and SC/APC terminated patch cables for the optical connections: *OPTICAL IN* and *OPTICAL OUT* (if needed).

The location of the sensor should be appropriate to support connection to the CTs and optical fibre network, with acceptable arrangements for cable lengths, restraints, minimum bend radii and paths.

The PSC-3-C occupies 1U of rack space but must be supported using a standard 1U or 2U, 19" rack-mount shelf. As a result, the installation requires a minimum of 2U or 3U of rack space, depending on the shelf used.

Access to the sensor should be restricted or controlled, in accordance with laser safety requirements in IEC 60825-2. Refer to section 3.7.3.

3.5 Mechanical mounting

The PSC-3-C should be securely attached to the rack. The exact method of installation will depend on the specific rack. The following general instructions apply:

- A standard 19" rack-mount shelf must be installed to support the PSC-3-C. The PSC-3-C has mounting holes only on the front panel and must never be cantilevered. The support shelf shall be suitable for the application, providing adequate load capacity and compatibility with the rack depth
- Use standard mounting fasteners to attach the PSC-3-C to the rack (not provided by Synaptec)
- If mounted on the same rack as the DES Interrogator, the Interrogator requires at least a free 1U above for air flow, see Figure 3.3 as an example.
- The PSC-3-C is suitable for installation directly above or below other rack-mountable devices without an air gap, subject to the installation guidelines for those devices
- The PSC-3-C must not be subjected to movement, mechanical loads, excessive vibrations, ingress of water, chemicals or contaminants

Figure 3.2: Overall dimensions of the PSC-3-C

Mounting:

19in Rack x 1U

For use with M6 screws

Support:

Requires Installation on a rack shelf

Ventilation:

No clearance required above or below the unit

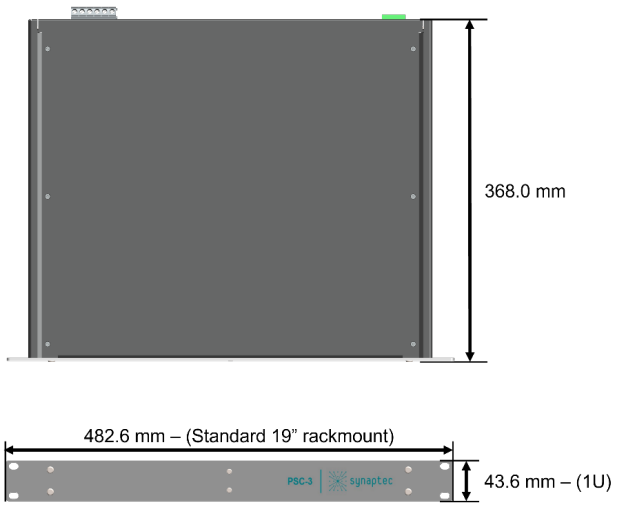
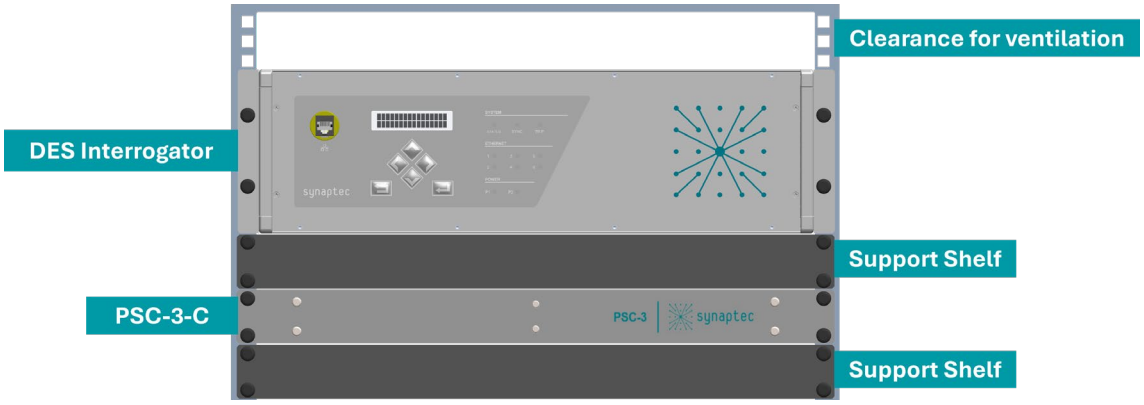


Figure 3.3: Suggested mounting arrangement of the PSC-3-C



INSTALLATION CHECKLIST

After completing the mechanical mounting, take a clear photo of each PSC-3-C, showing the mechanical mounting, including the support shelf.

3.6 Earthing the metal enclosure

After the product is mechanically mounted, and before the equipment is energised, the enclosure earth stud on the rear panel (M4x0.7, 10mm long) should be reliably connected to earth using a ring terminal and a locking nut.

The earthing arrangement should be in accordance with the asset operator's policies and appropriate standards for the specific application and region of use. The PSC-3-C enclosure is constructed from powder-coated aluminium, and the product surface is therefore non-conductive. The PSC-3-C is not suitable for earthing by contact with the rack alone.

Synaptec recommends that the earthing conductor should have a cross-sectional area no smaller than 3.3 mm^2 and be constructed from stranded copper. The earthing strap should be restrained to the PSC-3-C earthing point using an M4 stainless steel (A2) locking nut. A tightening torque of 2 Nm should be used as a reference, but may differ depending on the specific approach used.

INSTALLATION CHECKLIST

After completing the PSC-3-C earthing, take a clear photo of each PSC-3-C, showing the earthing conductor and bonding point.

3.7 Secondary electrical connection

Caution: Connection to the current transformer and cable routing should be performed according to an approved method of work which meets the asset operator's requirements, regional best practices and safety protocols.

Electrical cables for connection between CTs and PSC-3-C are not provided by Synaptec. Ensure cable specifications are appropriate for the application. It is recommended to take appropriate steps to mitigate the effect of EMC on the cables, such as through using EMC screened cables.

3.7.1 Placing the Current Transformers

In all cases, refer to the project specific detailed design documentation, which takes precedence over this general guidance.

Phase current CTs should be installed with the screen conductor routed back through the CT in the opposite direction (for example, see below, left). This is to subtract the screen current from the total currents flowing through all conductors in the cable, providing a measure of the load current.

Screen current CTs should be installed on the screen conductor directly (for example, see below, right).

Figure 3.4: CT installation

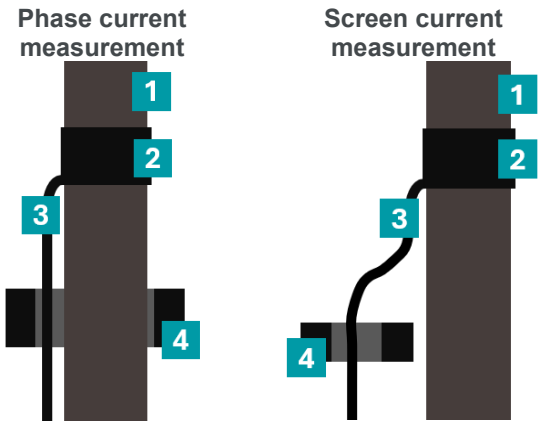


Diagram legend

Item	Description
1	Power cable
2	Electrical connection to screen
3	Screen conductor
4	Current transformer

The polarity of the CT must be consistent with the application requirements and detailed design instructions.

- The general convention is that the CT should be positioned such that current in the power cable flows from P1 to P2
- For MCP applications, Synaptec's convention is to install CTs with P1 facing the termination/busbar and P2 facing the cable (into the differential protection zone)
- Screen current CTs should be positioned such that P1 faces the joint/termination and P2 faces the connection to earth

3.7.2 Using Open Circuit Protection

The Synaptec PSC-3-C features integrated Open Circuit Protection (OCP). For the best protection across a wide range of scenarios, it is recommended to also install an additional OCP device directly at the CT electrical terminals, at the discretion of the end user and installer, and taking into account the asset operator's requirements, regional best practices and safety protocols.

3.7.3 Earthing the current transformer secondary

Note: Current transformer earthing is the responsibility of the asset operator and installer and the following provides general guidance only.

Current transformer secondary circuits are not connected to ground within or at the PSC-3-C. Current transformer secondary circuits should be reliably connected to earth in one location only, for example, at one of the secondary terminals in the electrical enclosure, as illustrated in section 3.6.7 below. It is recommended that the earthing conductor has a cross-sectional area of at least 3.3 mm^2.

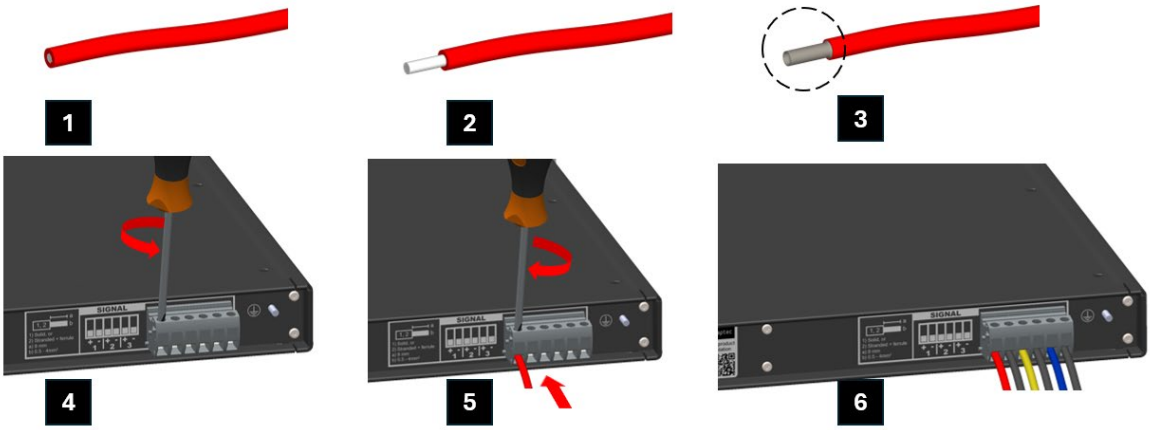
3.7.4 Connection to PSC-3-C (003-02-A001-1) – Enclosed Terminal Variant

Connection should be made according to the following steps, as represented in Figure 3.5 below:

1. Measure and cut the electrical cable to length. It should not be under strain at the terminal blocks
2. Strip the insulation, **9mm**
1. Apply a **9mm uninsulated copper ferrule** and crimp to provide a secure finish
3. Loosen the screw connection, using a **4mm slotted screwdriver**
4. Insert the conductor fully into the terminal and tighten the screw (recommended torque: **0.6 – 0.8 Nm**)

5. Repeat for the remaining cables and gently pull each cable to ensure it is correctly restrained
6. Apply cable identification

Figure 3.5: PSC-3-C Enclosed Terminal Secondary Electrical Connection

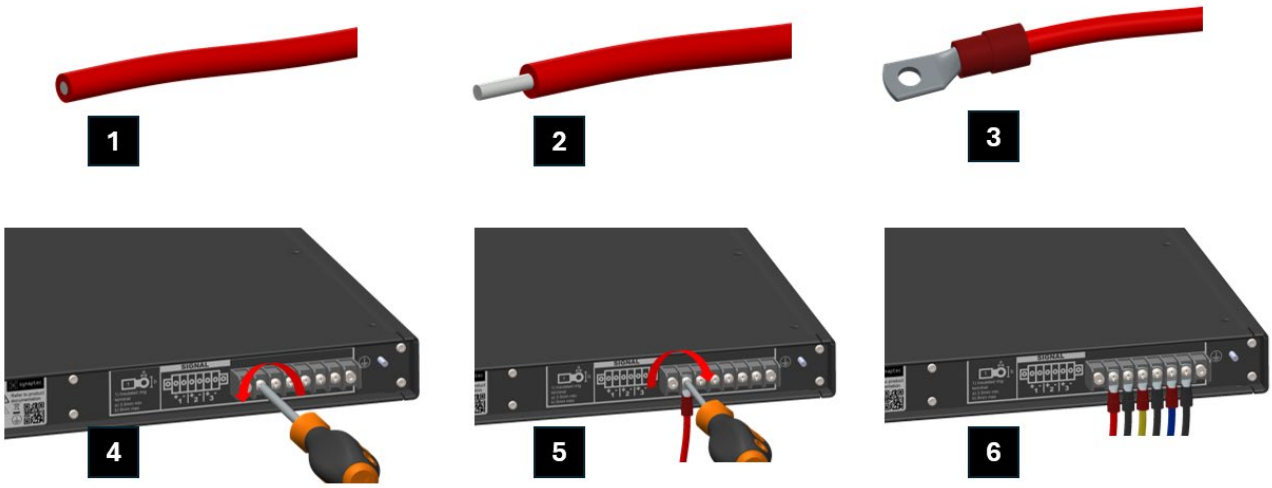


3.7.5 Connection to PSC-3 (003-02-A001-2) – Barrier Terminal Variant

Connection should be made according to the following steps, as represented in Figure 6 below:

1. Measure and cut the electrical cable to length. It should not be under strain at the terminal blocks
2. Strip the insulation according to the insulated ring terminal datasheet
3. Fit and crimp the selected **M4 insulated ring terminal** to ensure a secure connection
4. Remove the screw using a **Phillips screwdriver**
5. Insert the ring terminal onto the screw and tighten (recommended torque: **0.6–0.8 Nm**).
6. Repeat for the remaining cables and gently pull each cable to ensure it is correctly restrained
7. Apply cable identification

Figure 3.6: PSC-3-C Barrier Terminal Secondary Electrical Connection



3.7.6 Sensor polarity

Unless specified otherwise in the detailed design documentation, secondary electrical cables should be connected to the PSC-3-C electrical terminals as shown in Table 3.1. This applies to both terminal block variants.

Table 3.1: Secondary electrical connections to PSC-3-C terminal block

Secondary Wiring Connection	Terminal Block Identification
Red – S1	1+
Red – S2	1-
Yellow – S1	2+
Yellow – S2	2-
Blue – S1	3+
Blue – S2	3-

INSTALLATION CHECKLIST

After connecting the secondary electrical wires to the PSC-3-C terminal block, take a clear photo showing the connection, including identification if present

3.8 Fibre optic connection

Caution: Working with optical fibres should be performed according to an approved method of work which meets the asset operator's safety protocols.

Warning: The optical splice box must not be opened when the DES Interrogator is turned on. The Synaptec DES Interrogator must only be operated when the optical system is fully installed and tested.

Caution: Use of controls or adjustments or performance of procedures other than those specified herein might result in exposure to hazardous invisible laser radiation in the range 1525-1600 nm.

3.8.1 Installing the fibre optic cable

A simplex, single-mode SC/APC fibre optic patch cable should be used to connect the PSC-3-C to the preceding device in the sensor network (if the PSC-3-C is the first sensor in the network, the preceding device is the DES Interrogator) and to the following device, providing uninterrupted line-of-sight through the fibre to the other sensors in the network and the Interrogator.

Ensure that fibre routing is tidy, appropriately protected, free from excessive axial twist, free from bend radius below the applicable rating, and free from mechanical strain.

The PSC-3-C is connected to the optical network via the connector on the rear panel, according to:

- OPTICAL IN (input) port - connected into the fibre network in the direction of the previous sensor in the chain, in the direction of the Interrogator.
- OPTICAL OUT (output) port - connected into the fibre network in the direction of the next sensor in the chain, away from the Interrogator.

Ensure that SC/APC connectors are properly mated in the PSC-3-C. It is recommended that the optical fibres should be tagged next to the connectors to facilitate inspection of correct polarity.

3.8.2 *Fusion splicing and dB loss measurement*

Warning: Fusion splicing must not be attempted while the DES Interrogator is powered on. This could cause exposure to potentially harmful invisible laser radiation, and damage the system.

Should fibre optic splices be required, these should be performed by trained individuals using a suitable fusion splicer. Fibre optic cabling should be routed and protected per the installer and operator's best practices and the manufacturer's guidance.

The dB loss of each splice should be below -0.1dB, and the dB loss of each splice or connector should be confirmed using calibrated equipment and reported in the Document reference TBC PSC-3-C Gen2 Installation Checklist. Loss measurement is generally made using a handheld light source and power meter.

For typical optical loss guidelines, and instructions on verification of the complete sensor fibre network following installation of a DES system, refer to TD-014 DES System Manual.

3.8.3 *Laser safety risk assessment and mitigation*

The Synaptec PSC-3-C is a passive optical device intended only for use as part of an Optical Fibre Communication System (OFCS) per IEC 60825-2 in conjunction with the Synaptec DES Interrogator, which contains an invisible laser light source emitting in the invisible wavelength region between 1525-1600 nm. It is important that, according to IEC 60825-2, appropriate measures are taken to prevent users of the system from being exposed to potentially harmful laser radiation.

Synaptec provides details of the optical safety features incorporated into the DES Interrogator, and of the intensity of laser radiation at each connector or splice location to support the asset operator and installer in conducting a risk assessment and developing safe methods of installation and use for the system.

The asset operator and installer ("the user") takes responsibility for the safe installation and maintenance of the optical system.

The user should identify whether each splice box in the optical system is a ***restricted*** or ***controlled*** location. It is not recommended to locate splice boxes in *unrestricted* locations, i.e. those where members of the public have free access.

- Restricted: locations are inaccessible, except to authorised personnel who might not have appropriate laser safety training
- Controlled: locations are inaccessible, except to authorised personnel who do have appropriate laser safety training.

Synaptec will affix the appropriate laser safety labels on the rear panel of the PSC-3-C according to the hazard level applicable to the specific application. It is the user's responsibility to ensure continuous compliance with IEC 60825-2 and applicable local regulations, for example by ensuring access to locations is addressed.

Figure 3.7: Example laser safety warning labels according to hazard level and location category

	Restricted locations	**Controlled locations**
Hazard level 1M	 Label mandatory	 Label optional
Hazard level 3B	*Not permitted*	 Label mandatory

INSTALLATION CHECKLIST

After completing the optical installation, take a photo showing each connector / splice, with ID tags visible. Also take clear photos which show the fibre cable routing. For each fusion splice or connector, record the optical loss (dB) and loss measurement method in the installation checklist.

3.9 Completing the installation checklist

After the product installation is completed, ensure that:

- The provided installation checklist has been completed and signed off by the installer(s) and approver(s)
- All the required evidence and photos have been taken and provided to Synaptec

4. Use of the product

4.1 Condition inspection

Note: In ordinary use, the Synaptec PSC-3-C requires no maintenance. Correct functionality can be verified by analysis of the optical spectrum and electrical measurements at the DES Interrogator.

Caution: The user is recommended to assess application-specific health and safety considerations before conducting condition inspection or maintenance on the equipment. Risks include electric shock and exposure to harmful invisible laser radiation.

To maximise the product lifespan, it is recommended to conduct condition inspections of the system when access is available:

Item	Suggested inspection
Sensor enclosure	Visual inspection to identify corrosion or contamination. Confirm that the sensor mechanical mounting is acceptable. **Do not** use cleaning products, water, oils or spray jets on the enclosure.
Current transformer electrical enclosure	Visual inspection to identify ageing or damage. Confirm that the cable glands are in an acceptable condition.
Fibre optic cable	Visual inspection to identify ageing or damage (for example, brittleness or discolouration of the cable), confirm correct cable restraint and that there has been no movement which could introduce strain or insufficient bend radius.
CT Cable	Visual inspection to identify ageing or damage (for example, brittleness or discolouration of the cable), confirm correct cable restraint and that there has been no movement which could introduce strain or insufficient bend radius.
Earth bonding point	Visual inspection to identify corrosion or contamination.
Fibre optic splice box	Visual inspection to identify ageing or damage.

If maintenance is required, contact Synaptec for application-specific support before carrying out work.

4.2 In-use notices

Synaptec draws the user's attention to the following notices:

- Do not open any optical splice box or cut any optical fibre or cable when the DES Interrogator is powered on. This could cause exposure to potentially harmful invisible laser radiation
- Do not open the PSC-3-C enclosure at any time. Opening the PSC-3-C enclosure voids the product warranty, may damage the product and poses a risk of electric shock and/or exposure to potentially harmful invisible laser radiation

- If any splice box in the optical system is opened or moved, the optical splices can be disturbed, and dB attenuation can change. If this is the case, check at the Synaptec Interrogator that the sensor system is valid
- In the case of a fault on the power cable, or an elevated current below fault classification, the PSC-3-C enclosure can become hot to touch, even when de-energised
- If any changes may alter the environmental conditions, such as the exposure of the PSC-3-C to elevated or reduced temperatures, or vibrations, it is recommended to re-assess the installation and if necessary, discuss the changes with Synaptec
- If any changes may alter access restrictions to any of the splice boxes, it is important to re-assess the laser safety classification of the location and take appropriate actions

5. End of life treatment

Note: If PSC-3-C sensors are no longer required, please **contact Synaptec to discuss end-of-life options**, such as collection of sensors. When possible, returning equipment to Synaptec provides the best opportunity for equipment to be recycled or reused in a safe and environmentally sustainable way.

5.1 Why recycle?

Synaptec PSC-3-C contains valuable materials which place a burden on the environment to extract and process. Recycling these materials returns these materials to the manufacturing value chain and avoids the need for virgin materials to be extracted. This reduces the use of energy and resources such as water, in turn reducing the emission of greenhouse gases like Carbon Dioxide (CO_2).

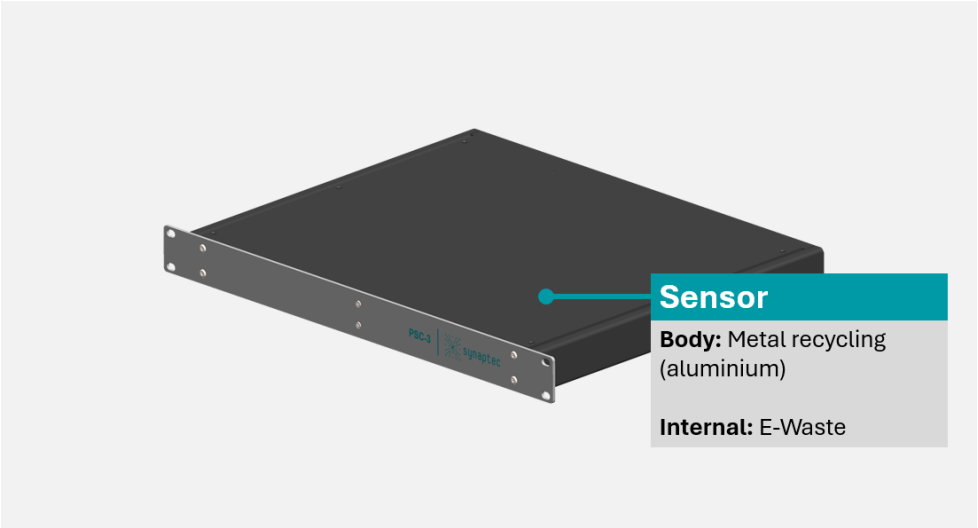
5.2 Follow local guidance

Recycling services differ between regions and countries. Always seek up-to-date guidance for your region. Treatment should only be conducted by an appropriately registered and qualified recycling operator in accordance with regional best practice. In the EU and UK, Synaptec PSC-3-C is considered "Electronic and Electrical Equipment" according to the Waste Electronic and Electrical Equipment Directive (“WEEE Directive”).

5.3 Summary product breakdown

Synaptec strives to make our products suitable for disassembly to assist recycling, however the PSC-3-C is a complex and highly integrated product with an internal silicone encapsulation. It is therefore recommended to treat the product as e-waste:

Figure 5.1: PSC-3-C Recommended breakdown for recycling



5.4 Material breakdown

Synaptec's PSC-3-C is built using valuable and high-quality materials - with your help, they can be recycled to reduce environmental impact.

Excluding the external electrical cable and fibre cable, which depend on the specific project, the PSC-3-C material breakdown is given by the table below.

Table 5.1: PSC-3-C Material Breakdown by material category (excluding fibre cable and electrical cable)

Material category	% Content
Aluminium	69%
Mixed electrical	16%
Silicone	4%
Plastic (general)	5%
Optical Mixed Assembly	4%
Stainless steel	2%
Other	<1%

5.5 Hazards and waste classification

Synaptec is committed to minimising harm to people and the environment as far as reasonably possible. The following aims to support operators in identifying and addressing risks associated with treatment:

- Product contains optical fibres and other parts which can be sharp and irritant to the skin
- Product contains max 0.2%wt (<10.5g) lead compounds. If the gold-coloured sensor is removed from the product, it should be classified as hazardous waste with the waste code 06 04 05 (“wastes containing other heavy metals”)
- Product contains small quantities (<3g) of epoxies, which can be harmful to humans and the environment if inhaled

For technical support, please visit https://synapt.ec/technical-support/, call +44 (0)141 488 3664, or email support@synapt.ec

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