

# Installation of PLC Cores



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This document refers to the following part numbers:

- PLC-CORE-57-1
- PLC-CORE-75-1

Each part number contains quantity 1 PLC Core. These items are supplied as an ordering convenience, and are also available directly from the manufacturer:

<http://www.coolblue-mhw.com>



## Purpose

Occasionally PV installs using TrueString inverters experience issues with the Power Line Communication (PLC) used to communicate between the inverters and the HiQ communication gateway. One reason for this can be that the nearby grid is sufficiently low impedance that the PLC signal 'leaks away' and has insufficient strength remaining for proper communication to occur. In this instance the PLC Cores provide a means of increasing grid impedance in the frequency band used by the HiQ system to ensure sufficient signal remains. External noise can be another source of issues.

## Sizing

Two sizes are offered, as shown in the photographs. US Quarter coins (which are around 1" across) are included for scale. The size required will depend upon the size of the install/thickness of wires being accommodated. The inner diameters are as follows:

- PLC-CORE-57-1: 57mm (2.25")
- PLC-CORE-75-1: 75mm (3")

Physical wire diameter and internal diameter of the core are the overriding criteria. Note that core saturation is not an issue, due to the fact that all three power phases are passed through

the core, resulting in a net zero flux when all three phase currents are equal. In a balanced system, the cores only see flux from the communication signal, which is very small.

Chapter 9, Table 5 of the National Electrical Code<sup>1</sup> gives information on wire characteristics including wire diameter with different insulation types. Similar information is also available elsewhere<sup>2 3</sup>.

Each core will have three wires running through it. A translation from wire diameter to the diameter of a bundle may be calculated using the k factor<sup>4</sup>. For 3 wires,  $k = 2.16$ . It is also useful to leave a 10% margin to ensure the fit is sure to work.

- As an example, the outer diameter of THHN wire 4/0 is 16.3mm. 3 wires in a bundle will have  $16.3 \times 2.16 = 35.2\text{mm}$ ; adding 10% margin gives 39mm. This fits comfortably inside the smaller (57mm inner diameter) Core.
- Similarly, a 750MCM THHN wire has an outer diameter of 30mm.  $30\text{mm} \times k \text{ of } 2.16 \times 110\% = 71\text{mm}$ , which will fit inside the larger (75mm) Core.

## Installation

The end objective is to achieve an impedance barrier with the inverters and Gateway on one side, and the grid on the other, with the PLC Cores between. An example is shown in the line diagram below where the Cores are installed next to the load center. If there is a main PV disconnect, this can also be a convenient place to situate the Cores.

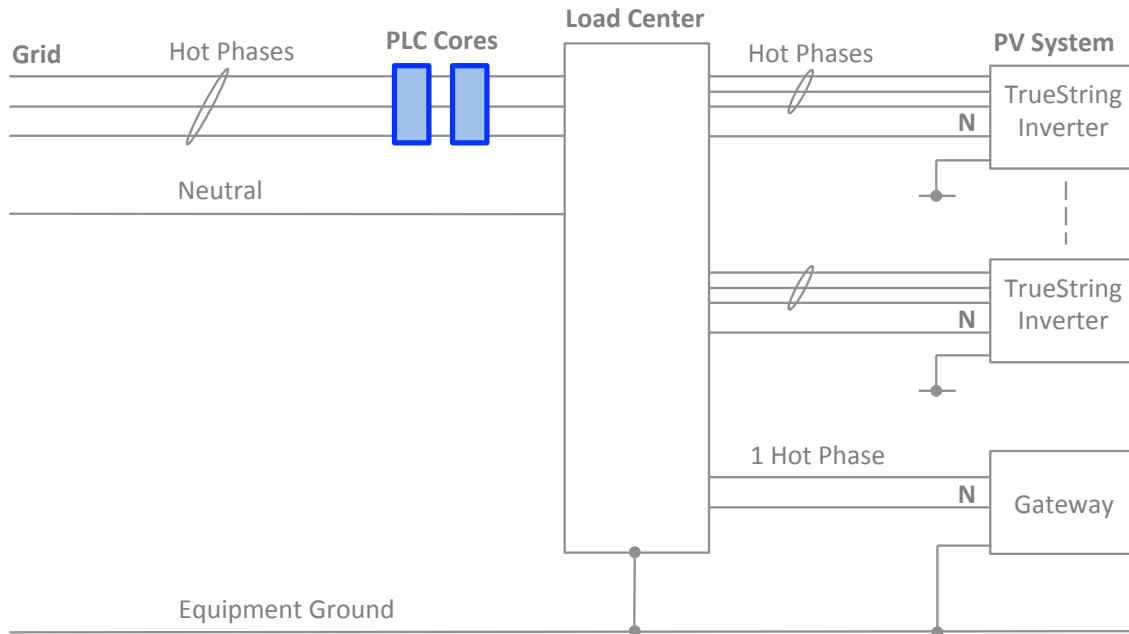
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<sup>1</sup> <http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards?mode=code&code=70>

<sup>2</sup> [http://www.buildmyowncabin.com/nec/nec2011\\_chap9\\_table5.html](http://www.buildmyowncabin.com/nec/nec2011_chap9_table5.html)

<sup>3</sup> <https://www.encorewire.com/wp-content/uploads/EncoreWire-THHN-SSE.pdf>

<sup>4</sup> [http://www.nationalwire.com/pdf/cat07\\_design\\_guideV10.pdf](http://www.nationalwire.com/pdf/cat07_design_guideV10.pdf), bottom of page 7-1



Note that for the Cores to achieve the desired affect, all three hot phases must pass through the same core(s), and the Neutral and Ground MUST NOT. We recommend a minimum of two cores be used, although more may be added if desired and there is sufficient physical space.

These items must be used within their ratings:

- <http://www.coolblue-mhw.com/wp-content/uploads/2016/11/M-113-Rev-02-03.pdf>
- <http://www.coolblue-mhw.com/wp-content/uploads/2016/11/M-114-Rev-03-03.pdf>

A design guide is available from the manufacturer:

- <http://www.coolblue-mhw.com/wp-content/uploads/2014/09/CoolBLUE-Installation-Guide.pdf>

