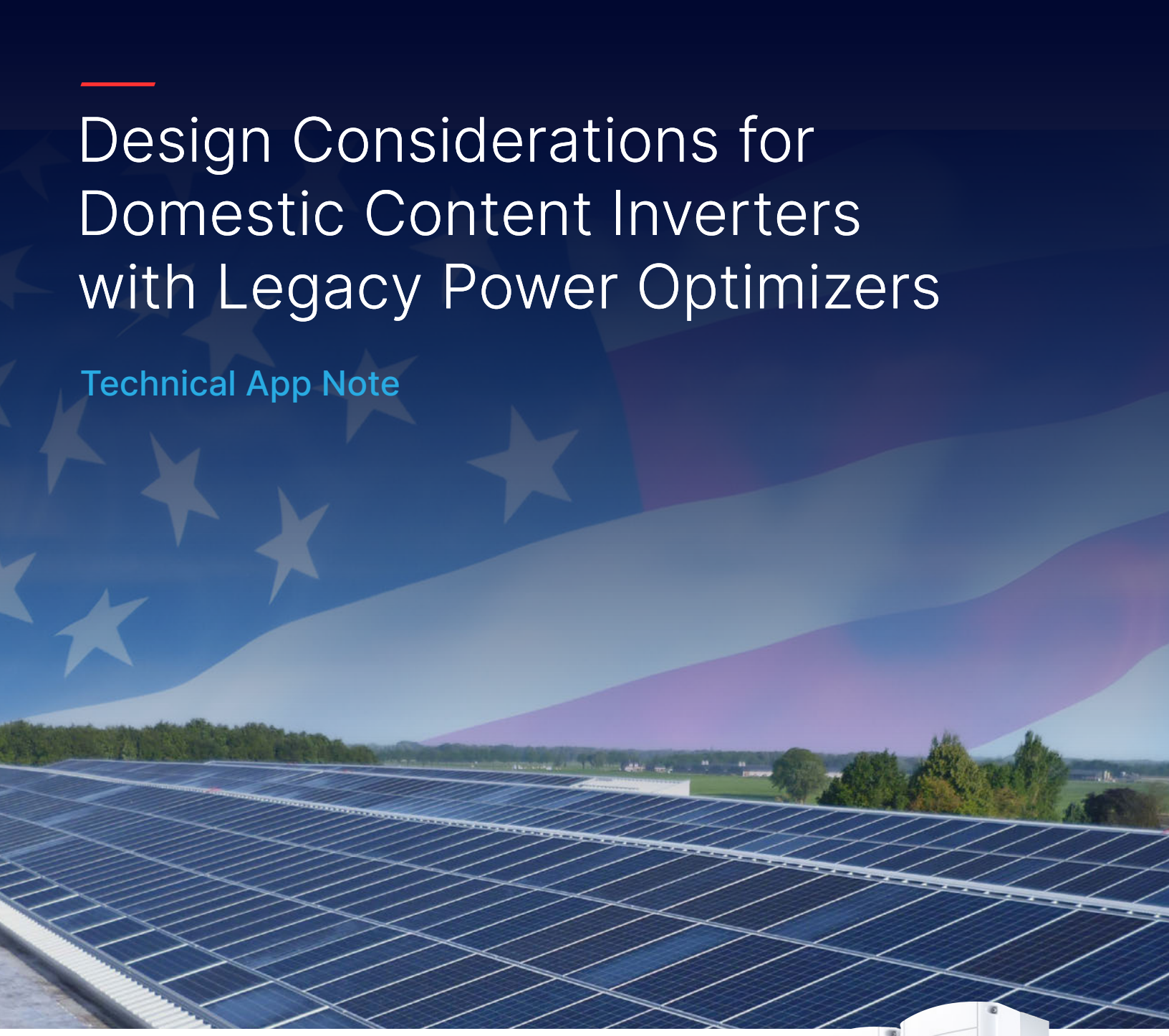
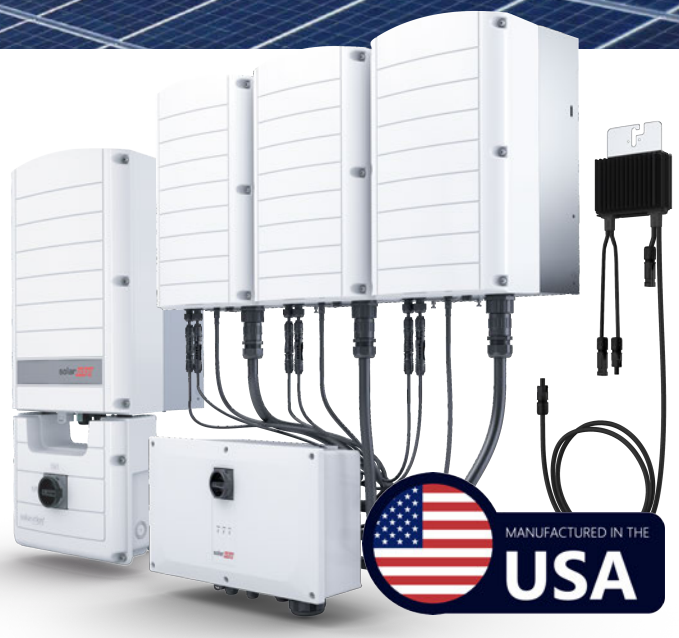
Design Considerations for Domestic Content Inverters with Legacy Power Optimizers

Technical App Note





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Introduction: Designs with Three Strings When Using SolarEdge C&I Domestic Content Inverters

This document explains the design considerations when using 18A Power Optimizers such as P1100, P1101, S1200 and S1201 with C&I Domestic Content inverters (USE-SIN, SE-DBL and SE-TRI). In this scenario, three strings per 40kW inverter may be needed. The Domestic Content inverters (USE-SIN, SE-DBL and SE-TRI) **do not include DC fuses**, therefore designers must take a few extra steps for NEC and local codes compliance. This guide provides a quick reference on the design considerations for this scenario.

Fusing and Cable Sizing – Key Assumptions Based on NEC 690, Using 2023 Version

690.8 Circuit Sizing and Current

Calculating Maximum Circuit Current

690.8 (A)(1) (c): P110x and S120x Power Optimizers are a DC-DC converter with maximum current of **18A**. There is one parallel circuit as optimizers are connected in series.

Calculating Conductor Ampacity

Conductor ampacity to be the larger of 690.8 (B)(1) and 690.8 (B)(2)

- 690.8 (B)(1): 18 × 1.25 = 22.5A
- 690.8 (B)(2):
  - 18A ÷ 0.91 (Temperature de-rating according to NEC) ÷ 0.8 (4-6 conductors per conduit) = **24.7A**
  - 18A ÷ 0.91 ÷ 0.7 (7-9 conductors per conduit) = **28.3A**
  - 18A ÷ 0.91 (cable trays) = 19.8A
- Therefore, the numbers achieved in 690.8 (B)(2) are to be used when choosing the correct conductor, except for when using cable trays (22.5A).

690.9 Overcurrent Protection

690.9 (A)(1): A fault scenario must be considered. In a fault condition, the maximum current that could feed into the fault is n-1 (where n is the number of strings) multiplied by the maximum circuit current. So, in a three-string scenario, the maximum current per conductor can be 18A x 2 = **36A, where n-1=2**. 36A is to be used to determine the wiring size if no Overcurrent Protection Device (OCPD) is used.

Conductor Ampacity

According to NEC table 310.15(C)(1) for copper wire rated 90°C at ambient temperatures of 40°C or less:

	#10 AWG Ampacity	#8 AWG Ampacity
4-6 Conductors per Conduit	40A x 0.91 × 0.8 = **29.12A**	55A x 0.91 × 0.8 = **40.04A**
7-9 Conductors per Conduit	40A x 0.91 × 0.7 = **25.48A**	55A x 0.91 × 0.7 = **35.04A**
Cable Tray (free-air)	40A x 0.91 = **36.4A**	55A x 0.91 = **50.05A**

Three Wiring Options for Three-String Systems

There are a few practical solutions to design systems with legacy Power Optimizers and Domestic Content inverters which are un-fused (assuming ambient temperatures of 40°C or less).

For three strings per 40kW inverter, the worst-case scenario for current carrying is 36A upon a fault scenario (see above for key assumptions). So, the following options are available:

	#10 AWG Ampacity	#8 AWG Ampacity
4-6 Conductors per Conduit	Include 25A Inline Fuse per String	✓
7-9 Conductors per Conduit		Include 25A Inline Fuse per String
Cable Tray (free-air)	✓	✓

Staubli manufactures inline fuses that are MC4 compatible and will integrate with SolarEdge Power Optimizers:
https://www.staubli.com/global/en/electrical-connectors/products/renewable-energy-solutions/in-line-fuse.html

Centralized Configurations with SolarEdge Single DC Input Synergy Inverter (for Rooftop or Carport Applications)

For systems where inverters are centralized, SolarEdge's Single DC input option offers another solution. By using an external combiner box with integrated fusing, OCPD requirements are accounted for and therefore there will not be a need for inclusion of inline, extra fuses.