Application Note: PARSOLU
Revision: 083018

CPS 3Phs TL String Inverter Parallel Solutions

This inverter application guide addresses various key points which must be taken into account in the planning and implementation of a decentralized large-scale plant. This guide has recommendations solely limited to inverter performance and inverter operation when multiple inverters are installed in parallel. The guidance provided in this document by CPS is in no way comprehensive and does not consider other system level design or reliability requirements. It is the responsibility of the system designer and engineer of record to consider any other relevant factors, including but not limited to the reliability of other system components.

CPS 3Phs TL String Inverters (models CPS SCA23KTL-DO/US-480, CPS SCA28KTL-DO/US-480, CPS CSA 36KTL-DO/US, CPS SCA50KTL-DO/US-480, CPS SCA60KTL-DO/US-480, CPS SCH100KTL-DO/US-600, and CPS SCH125KTL-DO/US-600) may be installed in a parallel AC electrical scheme at a single point of connection to construct a low voltage building block. Such low voltage blocks can then be connected directly to the utility grid with or without a step-up transformer. When constructing a low voltage building block CPS allows a maximum number of inverters paralleled into a single step-up transformer. See Table below.

CPS 3Phs TL String Inverter model	Maximum number of inverters in parallel
SCA23KTL, SCA28KTL, SCA36KTL, SCA50KTL, and SCA60KTL	70 units
SCH100KTL	40 units
SCH125KTL	32 units

The requirements for this building blocks must be of the following:

1. Utility Grid Voltage
The 480V or 600V, 60Hz voltage performance and range for the utility grid must follow the **ANSI C84.1-1995 (R2005)** standard.

2. System Voltage Drop
System voltage drop between the inverter output terminals and the utility grid connection point should be considered and must not affect the grid voltage at Point of Common Coupling (PCC). If the system voltage drop is too high, the inverter may disconnect from the utility grid due to excessive voltage. In cases where the grid voltage at the POI is normally higher than nominal (480V, or 600V) and voltage drop on the inverter output conductors is high, impedance in the output conductors will cause an increase in the voltage at the POI terminals. By creating higher than nominal voltage, the output is closer to the mandatory trip voltage limits required by the utility. For example, if the grid voltage is 105% nominal and 3% voltage drop exists, any fluctuation in grid voltage could trigger the 110% over-voltage trip point causing the inverter to stop producing power until grid voltage returns to within acceptable limits.

The voltage drop should be limited to minimize the power loss in the conductors.

CPS recommends the **voltage drop is < 2% of Vnom** (nominal AC voltage) at maximum power production. Voltage drop greater than 2% may require changing the transformer tap or as a last resort adjusting the GridMaxVolt trip point settings.

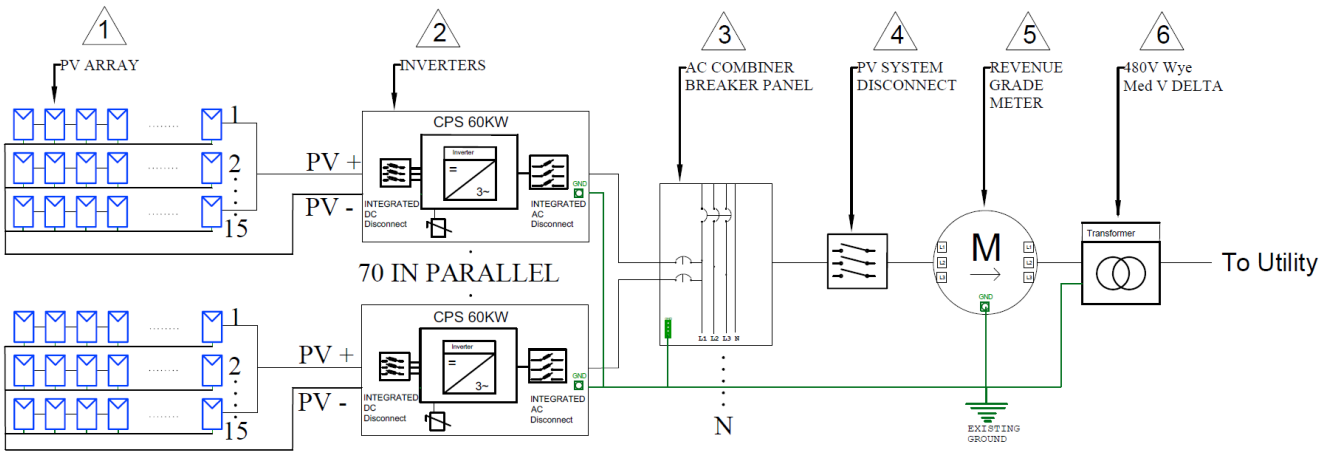
Temperature rise in the conductors and the ambient temperature should be considered for the voltage drop calculation.

When the connection to the utility grid uses a step-up transformer, then additional requirements include:

3. Transformer Short-circuit Impedance
The short-circuit impedance (Z%) of each transformer is recommended to be **no greater than 6%.**

4. Transformer VA Rating
CPS recommends the **transformer VA rating be selected** based on IEEE C57.159-2016 *Guide on Transformers for application in Distributed Photovoltaic (DPV) Power Generation Systems*. Another source is IEEE C57.91-1995 *Guide for Loading Mineral Oil Immersed Transformers*. It is the responsibility of the system designer to determine and take in account the reliability of the transformer or other system parameters.

CPS 3Phs TL String Inverters can be paralleled and connected to one common point of connection in a single building block up to 4.2MWac (60KW Inverter) or 4.0MWac with either the 100kW or 125KW Inverter. An example is shown below:



Example: 4.2MW building block with 60kW inverters

A transformer with a **minimum** rating of 4.5MVA should be used with (70) CPS60kW inverters connected in parallel to the secondary winding or low voltage side of this transformer. This transformer rating would need to be adjusted for safety margin according to the operating environment as stated in point 3 & 4 above.
System designs that follow the above rules can utilize many string inverters in parallel. CPS recommends its customers contact CPS Application Engineering to review any projects with complex AC system design or with multiple inverters designed in parallel.

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