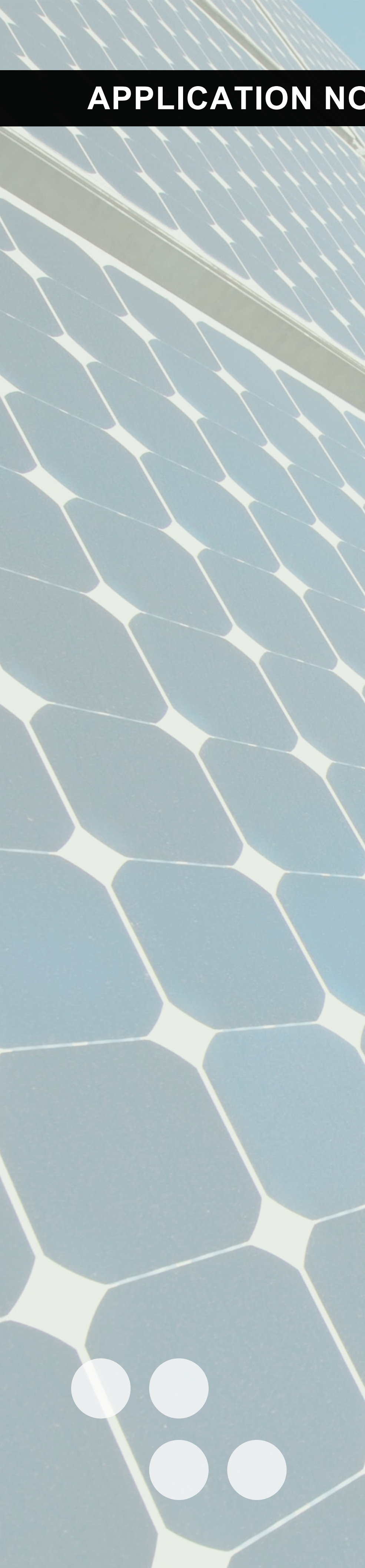


APPLICATION NOTE

Sensata Technologies

ELECTRICAL PROTECTION AND SWITCHING IN SOLAR POWER/ESS APPLICATIONS

Challenge

From 2012 to 2022, solar power capacity has averaged an annual growth rate of 24 percent, accounting for more than 40 percent of new capacity added to the U.S. energy grid each year from 2020-2022.

A greater percentage of installations now also feature a supplemental battery or energy storage system (ESS), with the industry projecting that nearly 30 percent of new solar systems will feature a battery system by 2027.

Many of the constraints and demands of a solar power system are driven by the need to manage both alternating current (AC) and direct current (DC) electricity.

The solar panels mounted on the roof convert the sun's energy into DC electricity. This flows into a hybrid inverter, which can convert the DC current into AC for use within the home itself, or transmission back to the electrical grid for use elsewhere.

At the same time, the inverter also leverages the energy which passes through it to charge the ESS on-site. This energy can be utilized at night when solar power is not available, during power outages, or other occasions.

A standard residential solar installation with an ESS might include a 3-10KW inverter with a 48V DC low voltage battery, creating a need for both DC and AC current circuit breakers in the overall system design. High-isolation switching – generally leveraging a Reed Relay – is also needed within the inverter itself to manage the flow of current.

Solution

Breakers selected for solar installations must be well suited for extreme reliability – with components exposed to the elements for decades and a wide variety of temperature extremes, and notable performance of trip accuracy under overload condition, making hydraulic magnetic circuit breaker designs more beneficial than a magnetic circuit breaker alone. This also allows for a smaller size in what is often limited assembly space.

Within the installation itself, the AC circuit breaker must be designed to function between the inverter and the rest of the household power system to ensure it is discharging appropriately. In the U.S., the AC Breaker is often used for the inverter integrated with distribution box.

On the DC current side, a second circuit breaker is needed to protect the current flowing between the inverter and the ESS.

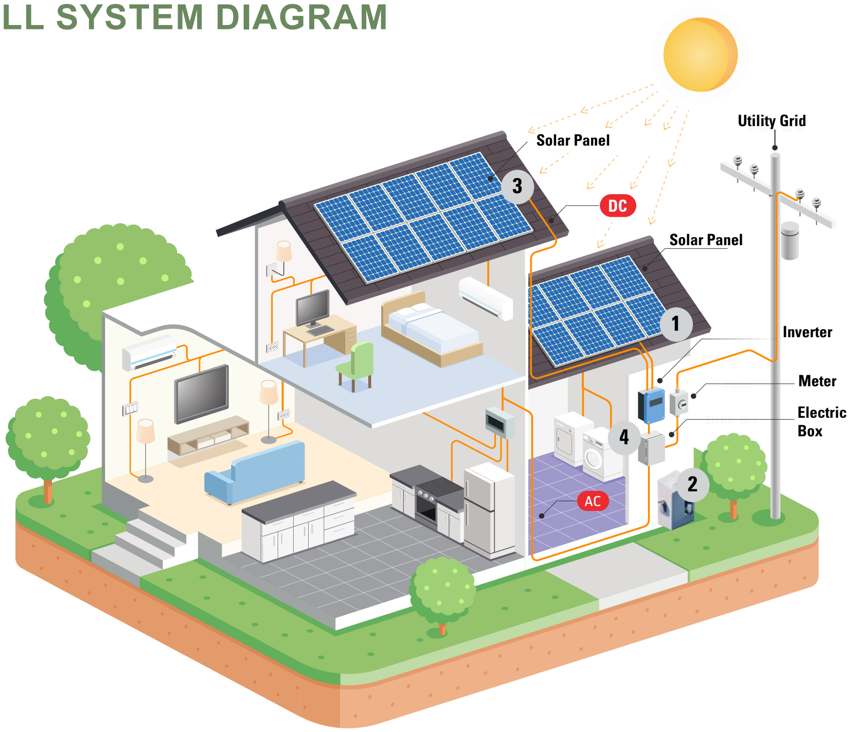
Both the DC Breaker and AC Breaker are selected based on inverter power, with amperage ratings increasing as the capacity of the inverter increases.

RECOMMENDED PRODUCTS

Reference on Diagram	Product		Features	Function
1		CEL Circuit Breaker (214 Series)	• Configurations to support 80-300A of 80V DC current (1-3 poles) • Bidirectional protection (DC dual polarities) available • UL 489A[1] /EN 60947-2	DC Circuit Breaker for Inverter (Inverter outlets to ESS)
2		LEL Circuit Breaker (214 Series)	• Configurations to support 20-60A of 120/240V AC Current (1-2 Pole Units) • UL 489[1] /EN 60947-2	AC Circuit Breaker for Inverter (Inverter outlets to AC loads)
3		108/109 PV Switch	• Ratings for 20A at 700V DC and 35A at 500V DC • Certification EN/IEC 60947-3	Switch off the circuit of solar panel to inverter
4		DBR71210 Reed Relay	• 12kV Isolation • Rhodium Contacts • 1000VDC/AC peak switching voltage	High voltage switching within inverter

[1]Additional system-wide UL certification may be required.

SOLAR CELL SYSTEM DIAGRAM



CONTACT US

Regional head offices:
United States of America
Sensata Technologies
Attleboro, MA
Phone: 508-236-3800
E-mail: support@sensata.com
Netherlands
Sensata Technologies Holland B.V.
Hengelo
Phone: +31 74 357 8000
E-mail: support@sensata.com
China
Sensata Technologies China Co., Ltd.
Shanghai
Phone: +8621 2306 1500
E-mail:support@sensata.com