



Sensata
Technologies

INDUSTRIAL SOLUTIONS FOR CLEAN ENERGY



Our solutions help make clean energy systems safer, cleaner, more efficient and connected

For more than 100 years, we have provided a wide range of customized, sensor-rich solutions that address complex engineering requirements to help customers solve difficult challenges in many industries. Our solutions help to make systems safer, cleaner, more efficient and connected.

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We want to preserve the planet for future generations

Electrification is playing a key role in the global transition from high polluting technologies to a cleaner energy. As energy storage systems and clean energy generation rise in popularity and demand, they require sensors to monitor and optimize the energy generation and storage process from the beginning all the way up to the end consumer.

There is an ever-increasing demand for improved stored energy systems, as well as fast and precise technologies for protecting batteries and the systems connected to them. Advanced circuit protection solutions improve the battery safety and performance and encourage the market acceptance of electrified solutions.

Sensata is a key player in electrification and our solutions help improve the efficiency, performance, and safety of your electrified systems and equipment. The flexibility, responsiveness and the exceptional level of support and advice offered by our team along the design process, as well as our customization capabilities in order to meet your specific requirements is what makes us truly a partner of choice.

SAFE | CLEAN | EFFICIENT

Why Sensata

We have a deep knowledge and understanding of a broad range of industrial applications and we offer advice and support to help you select the right product for your application. All our products are of exceptional quality. We take pride on the flexibility we drive in our operations to customize products at a global scale.



Industry-specific knowledge and proprietary technology in mission critical and hard-to-do applications



Partnership mindset of our team and flexible technology building blocks configured for customized solutions



Low cost manufacturing model with concentrated manufacturing operations across the globe



Strong teamwork to deliver fast responses to our customers, with deep understanding of product design cycles and launch execution

What Our Customers Say

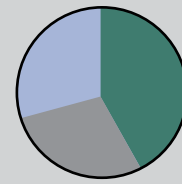
Global Manufacturer of Recreational Electric

Vehicles: *We've been working with Sensata's GIGAVAC team for many years and their staff consists of true relay and power switching experts, who were there for us even in critical situations when our production line was down.*

We have always appreciated the fast response time and the availability of the engineering team to deeply look into the problem and find the best solution together with us. This team and partnership spirit of Sensata's team, as well as their deep engineering know-how and the high quality of their products is what has made us work with them for several years now.

Fast Facts

2020 Net Revenues: \$3B



Americas 42%

Europe 28%

Asia 30%

47,000+

different products
manufactured

1.1B

devices shipped each year,
each highly engineered

19,000

employees worldwide

11

countries with business centers
and manufacturing sites

Solution Overview

	High Power Contactors	Thermal and Mechanical Fuses	Modular Battery Management Systems	Modular Power Distribution Units	Pressure and Temperature Sensors	Position Sensors and Encoders	High Voltage Relays	Solid State Relays	Hydraulic Magnetic Circuit Breakers
Energy Storage Systems for Residential, Commercial, Industrial and Utility	•	•	•	•					
Charging Stations	•	•							•
Battery Packs	•	•	•	•	•				
Power Distribution Units	•	•		•	•				
Hydrogen Fuel Cells	•	•			•				
Solar & Wind Systems	•	•			•	•	•	•	

Functional Solutions

High Power Contactors

GIGAVAC's EPIC® sealing technologies provide the ultimate in power switching contactors and relays. From high power DC contactors that can withstand environmental extremes, to competitive PCB mount contactors, we offer competitive sealed solutions to fill your power switching needs.

Thermal and Mechanical Fuses

Sensata has a broad portfolio of fuses, including DC Fuses for EV, energy storage & charger, high speed fuses for Industrial Power Supply, SMD fuses for electronic device & battery and high power applications, cartridge fuses for DMI, cartridge fuses for industrial power applications, air conditioner & household appliances, photovoltaic and telecom protection, as well as many accessories.

Modular Battery Management Systems

Lithium Balance battery management systems are designed to be a long-term solution for our customers with the highest level of safety in mind. Advanced algorithms and electronics ensure high precision measurements. These systems are functionally safe and provide a fast and efficient balancing, shortened charging time, improved range per charge, as well as maximum battery life.

High Voltage Relays

GIGAVAC is an industry expert in the design and manufacture of relays offering high performance, quality and value to our customers. Compact high voltage relays, using either a vacuum or gas dielectric, are suitable for applications up to 70kVdc. This is the largest high voltage relays offering in the world and GIGAVAC can provide modifications to meet your application requirements.

Position Sensors and Encoders

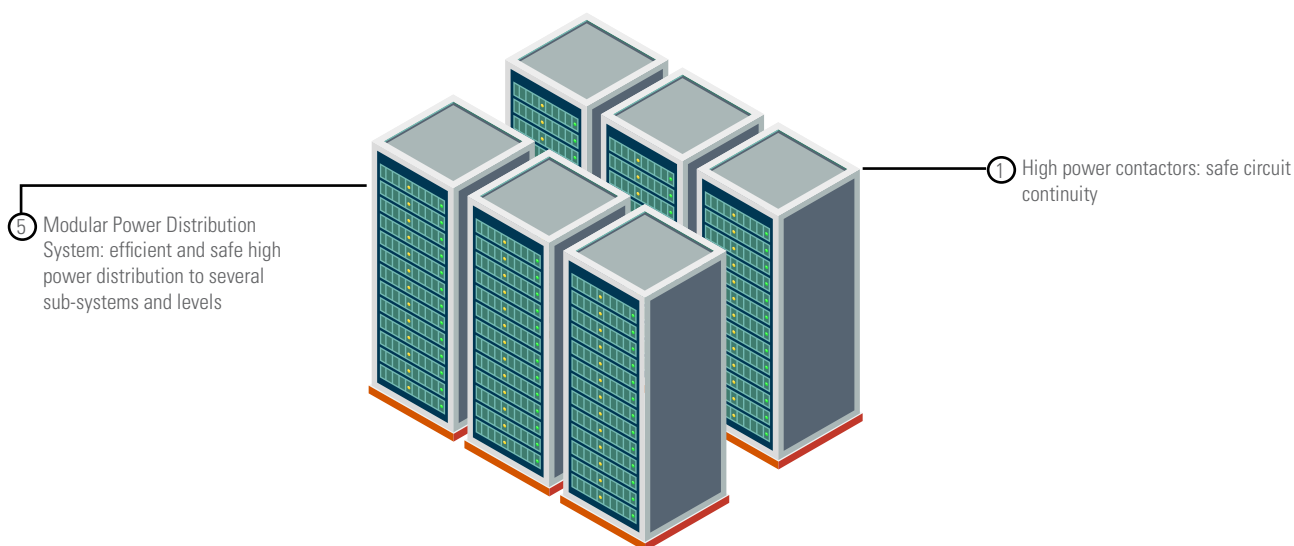
Our comprehensive Encoders and Position Sensors line includes incremental and absolute encoders, hall effect sensors, rotary and linear potentiometers as well as inclinometers and draw wire solutions. Reliable and rugged products that are designed for use in standard industrial to heavy duty and hazardous area applications.

Energy Storage Systems

High power DC contactors from Sensata can withstand any environmental extremes without compromising on the reliability and safety of your power switching needs.

Energy storage systems are essential to the operation of power systems, as they ensure continuity of energy supply and improve the reliability of a system. They can be in many forms and sizes, depending on the end application they can be used for residential, commercial and utilities applications, for small or large scale storage systems.

What all these storage systems have in common is that they need to be safe when these huge amounts of energy are stored. Sensata Technologies has a broad portfolio of products that will keep your energy storage system safe and under control. The high voltage thermal fuses and mechanical magnetic GIGAVAC fuses enable high level of protection for any storage systems. Our sealed EPIC contactors provide the ultimate in power switching.



①



High Power Contactors

- Hermetic sealed SPST contactors (Epoxy seal/EPIC seal)
- Up to 1500Vdc/1000A operating voltage and continuous current carry
- Normally open or normally closed; auxiliary contact options available

Safe circuit continuity. Rapid and secure connection and disconnection of the circuit managing arcing and inrush situations.

②



Thermal and Mechanical / Magnetic Fuses

- Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A
- Mechanical / magnetic fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current

Fast acting protection of the power circuit against high interrupt currents.

③

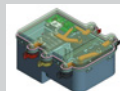


Modular Battery Management Systems

- Customized and off the shelf battery management systems
- Low voltage up to 100Vdc and high voltage up to 1000Vdc BMS
- Easy programmable

Modular battery management system keep the battery pack in optimal condition and protects it from overload and thermal damage

④



Modular Power Distribution Units

- Designed as a modular box to adapt to customer needs
- Different contactors can be mounted and additional contactors can be added, as well as GigaFuse or passive/active PyroFuse
- Sealed box to be less environment dependent

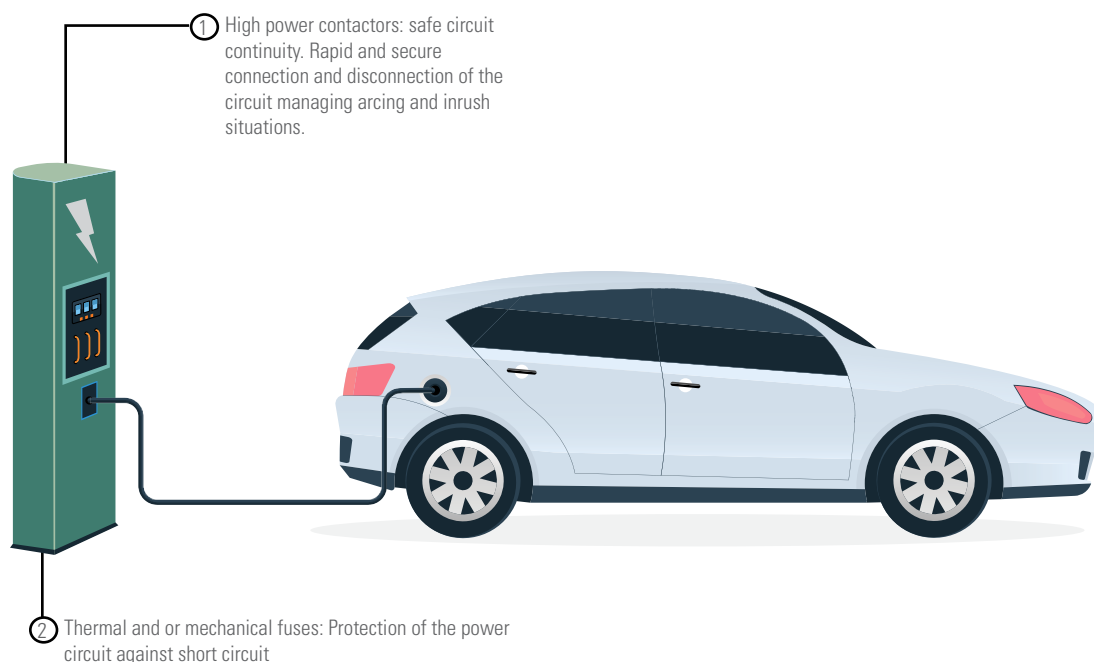
Efficient and safe distribution of high power to several sub-systems and levels

Charging Stations

As the number of electric vehicles and industrial equipment and devices is rapidly growing, the demand for charging points will increase as well. In order to ensure a smooth and easy driving of these electric vehicles, the charging time needs the number of charging stations need to increase as well reducing the charging time.. Reducing charging time is only possible by increasing the charging power of the charging stations.

Sensata Technologies has a broad portfolio of products that are required in a charging station to make it safe and efficient both for small and for high power DC fast charging.

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①		High Power Contactors • Hermetic sealed SPST contactors (Epoxy seal/EPIC seal) • Up to 1500Vdc/1000A operating voltage and continuous current carry • Normally open or normally closed; auxiliary contact options available	Safe circuit continuity. Rapid and secure connection and disconnection of the circuit managing arcing and inrush situations.
②		Thermal and Mechanical / Magnetic Fuses • Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A • Mechanical / magnetic fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current	Protection of the power circuit against short circuit
③		PyroTactor™ High voltage DC Thermal Fuse • The world's first contactor with integrated pyro fuse, designed for high voltage and high power fuse application requirements • It combines the function of HV fuses and contactors in a single device, thereby eliminating the need to size each component separately	Used in the power circuit to have safe circuit continuity and additionally a build-in protection against short circuit
④		High Voltage Relays • Very high isolation voltages, up to 15kV, are achieved through the use of high vacuum reed switches with either rhodium or tungsten contacts and make these relays suitable for high reliability applications • The rhodium contact relays have low contact resistance, while the tungsten contact relays can switch higher voltages	Safely discharge the output of electric vehicle battery chargers after the vehicle battery has been charged to allow safe disconnection
⑤		Hydraulic Magnetic Circuit Breakers • Up to 300Vdc or 660Vac with rated current up to 1200A • Temperature independent (no derating) • EN60947-2, UL recognized or listed, CSA approved versions available	Power circuit protection against overload and short circuit, with usage in the smaller home or work charging stations

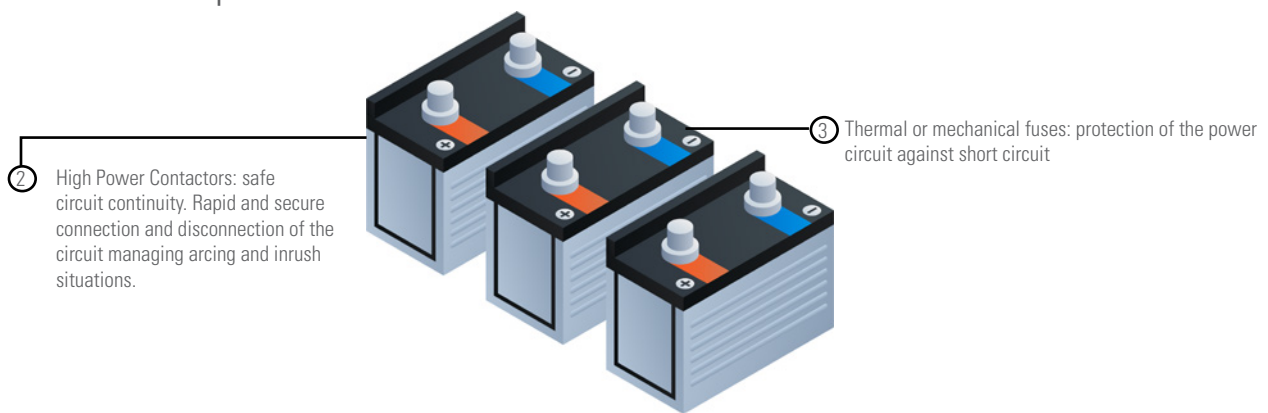
Battery Packs and Power Distribution Units

The GigaFuse from Sensata significantly reduces resistance, eliminates thermal aging, and increases system efficiency of the battery pack.

Battery packs and their related power distribution units are usually used in a variety of electric vehicles: forklifts, autonomously guided vehicles, light electric vehicles such as scooters or motorbikes, utility vehicles, niche heavy vehicle & off-road, rail vehicles, and also non-professional and recreational vehicles such as supercars, campers, and maritime vehicles.

In advanced battery systems, the quality of the power electronics helps determine the quality of the final product, its level of functionality, and its reliability. There is a lot of energy in a modern battery, and catastrophic failure can certainly involve thermal runaway (fire). The increasing level of publicity being given to EV fires has brought more attention to this danger, which is why safety concerns must be addressed in order to avoid adversely impacting public EV adoption.

Solutions from Sensata enable design engineers to provide the levels of protection that are required for the advanced battery systems of today and the future.



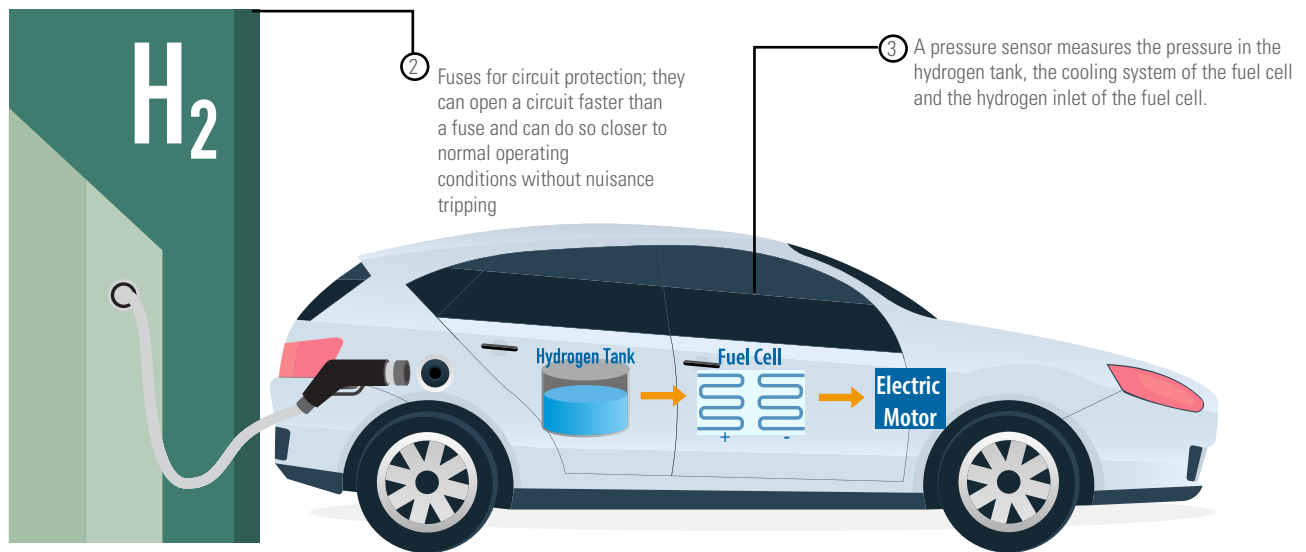
①	 Contactor for Precharge Circuit	• Small, compact size, hermetic sealed contactors • Up to 1200Vdc operating voltage and up to 150A continuous carry current	Precharge circuit is required to power up the capacitors during start and avoid that main circuit will get a peak current. A precharge circuit consist of a resistor in combination with a small contactor
②	 High Power Contactors	• Hermetic sealed contactors (Epoxy seal/EPIC seal) • Up to 1500Vdc/1000A operating voltage and continuous current carry • Normally open or normally closed; auxiliary contact options available	Safe circuit continuity. Rapid and secure connection and disconnection of the circuit managing arcing and inrush situations.
③	 Thermal and Mechanical / Magnetic Fuses	• Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A • Magnetic / mechanical fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current	Protection of the battery power circuit and sub-circuits against short circuit
④	 Modular Battery Management Systems	• Customized and off the shelf battery management systems • Low voltage up to 100Vdc and high voltage up to 1000Vdc BMS • Easy programmable	Modular battery management systems keep the battery pack in optimal condition and protect it from overload and thermal damage
⑤	 Modular Power Distribution Units	• Designed as a modular box to adapt to customer needs • Different contactors can be mounted and additional contactors can be added, as well as GigaFuse or passive/active PyroFuse • Sealed box to be less environment dependent	Efficient power distribution
⑥	 Pressure and Temperature Sensors	• Three advanced pressure sensing technologies available for low pressure (2mbar) up to high pressure sensing (>50bar) • Temperature sensing from -40°C up to 1200°C • Combined Pressure and temperature sensor products available • Both analog and digital output option available	Protection against thermal runaway by measuring pressure increase in battery packs

Hydrogen Fuel Cells

As much as electrification will help to reach clean energy systems in the future, the world's environmental challenges can not be solved only with electric and/or battery powered applications. Fortunately there are alternative techniques and hydrogen fuel cell systems are starting to be more accepted. Fuel cells are used in hydrogen vehicles, as a back up power system for companies, and for supplying heating and electricity to residential homes.

Also for these type of application Sensata Technologies has a broad range of safe and efficient solutions available.

Sensata's solutions for hydrogen fuel cells provide excellent circuit protection and accurate measurement of the hydrogen pressure in the high pressure tank.



High Power Contactors

- Hermetic sealed SPST contactors (Epoxy seal/EPIC seal)
- Up to 1500Vdc/1000A operating voltage and continuous current carry
- Normally open or normally closed; auxiliary contact options available

Provides safe circuit continuity between fuel cell, battery pack and electric motor



Thermal and Mechanical / Magnetic Fuses

- Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A
- Mechanical / magnetic fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current

Fuses for circuit protection; they can open a circuit faster than a fuse and can do so closer to normal operating conditions without nuisance tripping



Pressure and Temperature Sensors

- High accuracy with measuring range from 0-50 bar to 0-900 bar
- Wide range of ports, connectors, and electrical outputs
- Storage and operating media temperature -40-125°C; Operating ambient temperature range -40-100°C

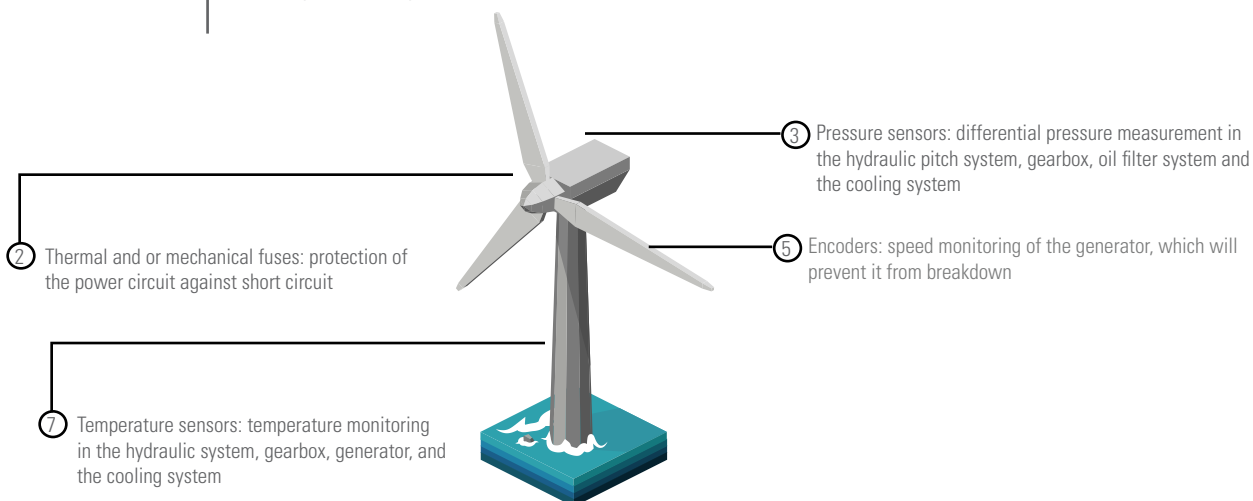
Measurement of the pressure in the hydrogen tank, the cooling system of the fuel cell and the hydrogen inlet of the fuel cell

Wind Turbines

Multi-turn absolute encoders are ideal for controlling the pitch position or for tracking and controlling the Yaw position.

Wind turbines have gotten larger and more powerful, making them competitive with convention fuel-fired power plants. Since they rely on wind, there are a lot of control surfaces that need to be instrumented and adjusted for optimum performance.

In order to meet the increasing demand of wind energy, wind turbines manufacturer are producing bigger wind turbines in remote areas. In order to maximize the energy efficiency of the wind turbine, the machine has to incline the blades with accuracy in order to have a good hold in the wind. Manufacturers need robust and accurate sensors in order to avoid downtime and costly maintenance operation on those critical components of the wind. Sensata Technologies has a broad portfolio of sensing solutions to help wind turbines operate efficiently and safely.



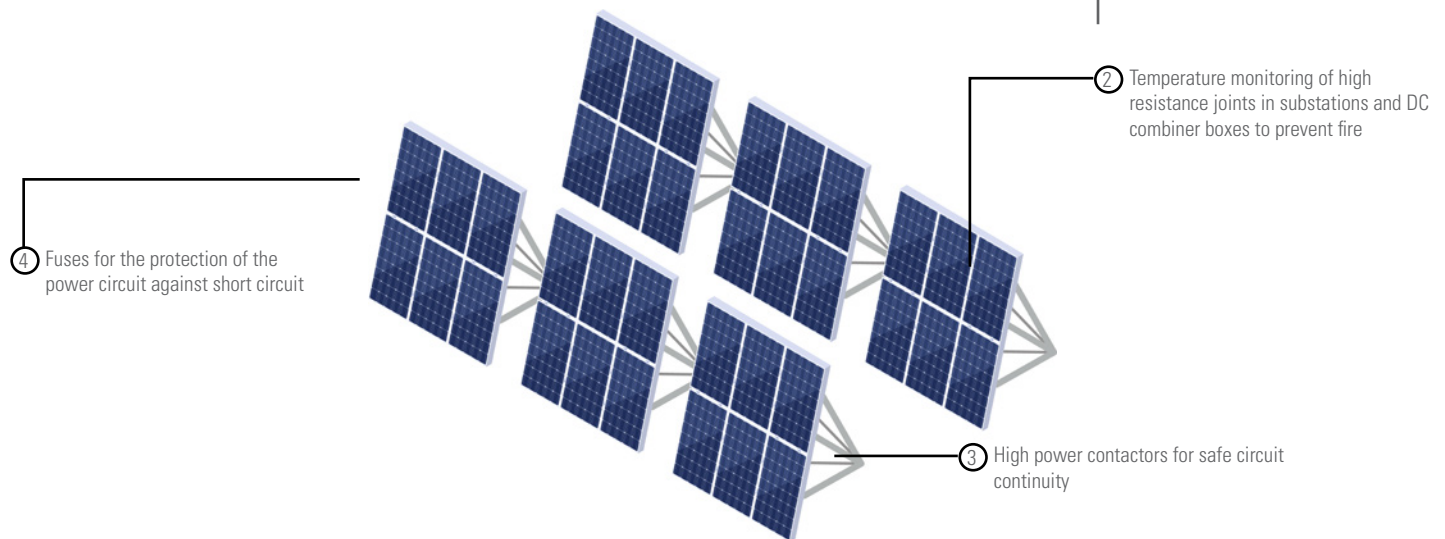
①		High Power Contactors	• Hermetic sealed contactors (Epoxy seal/EPIC seal) • Up to 1500Vdc/1000A operating voltage and continuous current carry • Normally open or normally closed; auxiliary contact options available	Rapid and secure connection and disconnection of the circuit managing arcing and inrush situations.
②		Thermal and Mechanical / Magnetic Fuses	• Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A • Mechanical / magnetic fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current	Protection of the power circuit against short circuit
③		Pressure Sensors	• Three advanced pressure sensing technologies available for low pressure (2mbar) up to high pressure sensing (>50bar) • Both analog and digital output option available	Differential pressure in the hydraulic pitch system, gearbox, oil filter system and the cooling system
④		Shaft Encoders	• Shafted and hollow shaft absolute multiturn encoders with resolution up to 13x16 bits • To fit with the remote environment, an advanced electronic system will protect the encoder against over voltage and polarity inversion, and will allow a reliable signal through long cable.	Monitors speed and position of the blade, allowing an accurate and efficient positioning of the nacelle in front of the wind direction
⑤		Incremental Encoders	• These heavy duty encoders are isolated from the generator thanks to an insulated reduction sleeve, protecting it from current leak • Anodized housing to protect the encoder from corrosion in case of offshore installation of turbines	Speed monitoring of the generator, which will prevent it from breakdown
⑥		Solid State Relays	• Due to the not moving parts and complete electronic system, solid state relays have a nearly unlimited switching life • AC and DC versions; single channel, dual channel and three phase options; many different package styles • Instantaneous switching in less than 100 microseconds	Safety cutoff of the circuit to prevent abnormal currents
⑦		Temperature Sensors	• Versatile temperature sensor meeting the harshest environmental conditions • Compact and economical, with a performance range up to 300°C, fast response time, O-ring sealed hex port and an integrated electrical connector	Temperature monitoring in the hydraulic system, gearbox, generator, and the cooling system
⑧		High Voltage Relays	• Voltage ratings up to 70kV and current carry up to 150A • Different configuration option available (SPST, SPDT, DPDT, latching bi-stable)	Safe circuit continuity

Solar Parks

Large solar panel installation is becoming more economical as a viable alternative to coal, oil or gas-fired power plants. With tens of thousands solar farms installed worldwide with a capacity higher than 200MW, tracking and protection of the system is crucial in order to ensure a safe and efficient operation. Fires for instance are mainly attributed to high resistance joints resulted from loose or corroded electrical connections and the damage can be very severe. The wireless temperature solutions from Sensata provide monitoring of termination temperature considering ambient conditions, programming of real time alarms, and maintenance forecast to prevent actual fires.

In addition to that, Sensata Technologies has a broad range of sensing and control solutions, like encoders to ensure a precise movement of a geared motor, or to track the exact position of the panel, as well as solutions to control and safely protect the electricity generated by the panels, like for instance contactors, fuses, and circuit breakers.

As the panels themselves are large and subject to hot, dusty conditions, they typically need a geared motor for precise movement, which in turn requires a multiturn absolute encoder for tracking.



1		Position Sensors and Encoders • Robustness and excellent resistance to shocks / vibrations, high protection level IP65, IP67 option with a sealing flange • High resolutions available, universal electronic circuits, high performances in temperature -30°C to 100°C (option -40°C) • Entire range of position sensors, linear and rotary encoders, potentiometers, draw wires and inclinometers	Position monitoring of the azimuth and the elevation of the panel
2		Temperature Sensors • 5 years battery life and up to 750m line of sight range • Wired or wireless temperature transducer options available, with same level of reliability and precision measurement	Temperature monitoring of high resistance joints in substations and DC combiner boxes to prevent fire
3		High Power Contactors • Hermetic sealed SPST contactors (Epoxy seal/EPIC seal) • Up to 1500Vdc/1000A operating voltage and continuous current carry • Normally open or normally closed; auxiliary contact options available	Rapid and secure connection and disconnection of the circuit managing arcing and inrush situations.
4		Thermal and Mechanical / Magnetic Fuses • Thermal fuses up to 1500Vdc/300A or 1000Vdc/500A • Mechanical / magnetic fuses with passive or passive/active triggering (Pyro), up to 2500A breaking current and 400A continuous current	Protection of the power circuit against short circuit
6		Solid State Relays • Due to the not moving parts and complete electronic system, solid state relays have a nearly unlimited switching life • AC and DC versions; single channel, dual channel and three phase options; many different package styles • Instantaneous switching in less than 100 microseconds	Safety cutoff of the circuit to prevent abnormal currents
7		High Voltage Relays • Voltage ratings up to 70kV and current carry up to 150A • Different configuration option available (SPST, SPDT, DPDT, latching bi-stable)	Safe circuit continuity

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