

**Panasonic**  
ideas for life



***Solar Technology: Applications  
and Solutions from  
Panasonic Electric Works***



# ***Solutions and technology***

**Sustainability**

**Renewable energy**

**Responsible handling of resources**

Meet the challenges of the **FUTURE** – with solutions and technology from Panasonic.



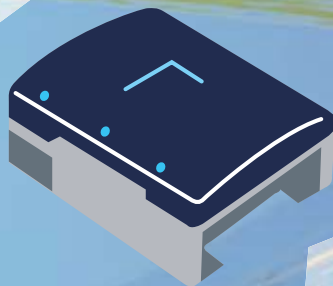
**Green Automation**  
by Panasonic Electric Works



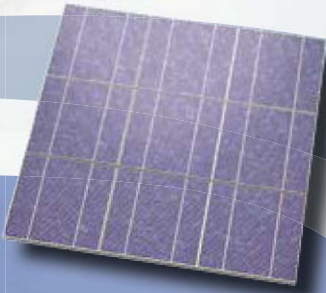
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monocrystalline no micro cracks  
 traceability track'n trace  
 unique, permanent  
**Solar module production**  
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 laser marking **pages 6-9**  
 high quality glass marking  
 high contrast



concentrated solar systems  
 remote control, monitor, maintenance high accuracy  
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# ***One-stop shopping***

Choose the best. Choose products made by Panasonic  
Panasonic offers 25 years of experience and high quality.

## **From the industry – for the industry**

We use Panasonic products extensively in our own manufacturing plants. Our systems are therefore developed and based on actual industrial requirements and applications. Our customers can be certain that our products have thoroughly proved their quality and performance on the factory floor.

## **Quality matters**

In order to guarantee superior quality we have our own quality technology center which utilizes the world's most advanced equipment. Our products, their usability and their safety are evaluated using a common technology employed throughout the company.

## **One-stop shopping for the entire automation product range**

Panasonic offers a comprehensive automation product range: sensors, PLCs, human machine interfaces, machine vision systems, inverters, FA components, relays, connectors, and much more.

## **Global support and services network**

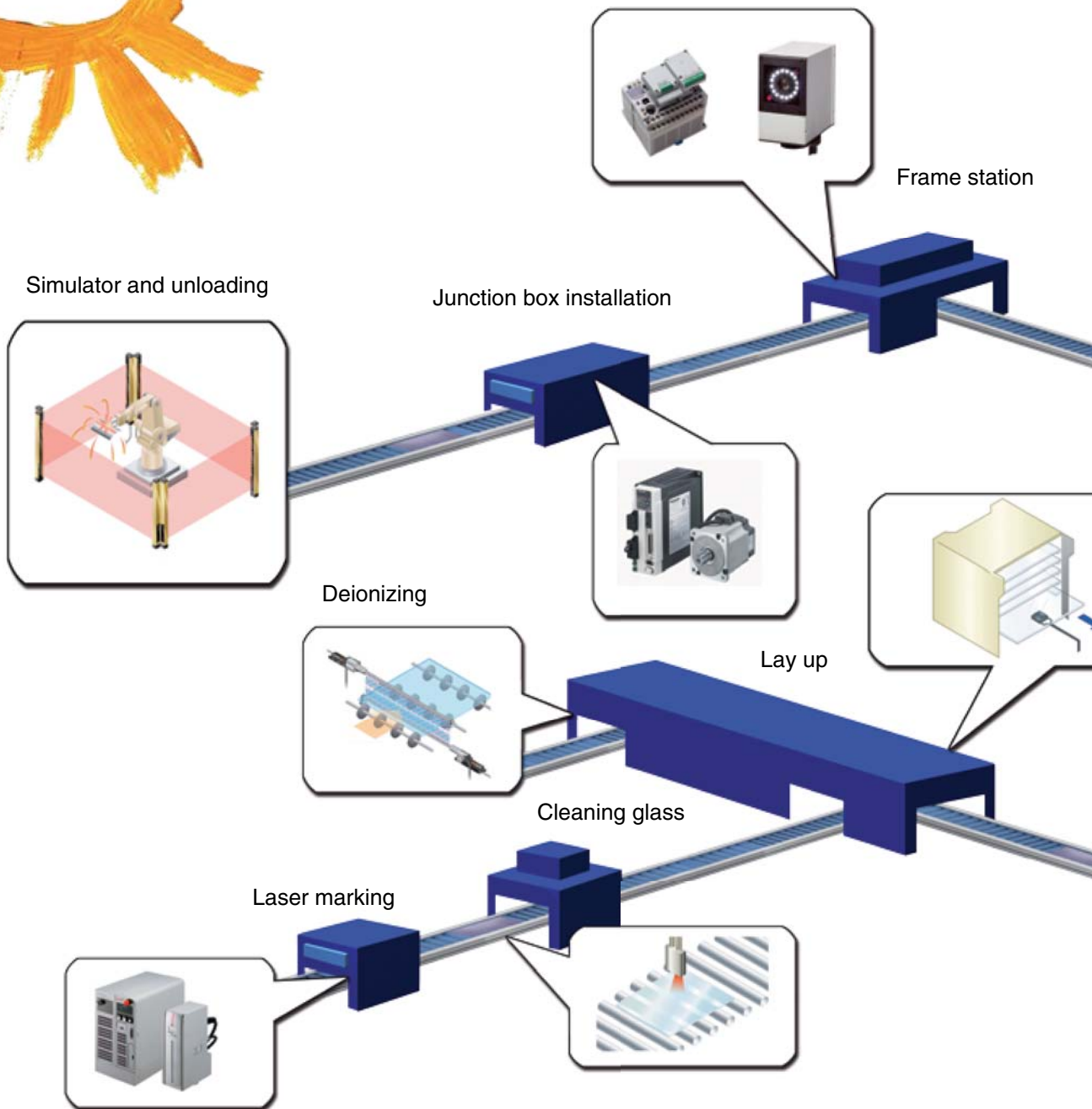
Panasonic Electric Works has 123 operation sites and more than 70 sales companies or offices located throughout the world. Each of our European headquarters has its own product development center. Each European branch has its own laboratory with experienced application engineers.

## **A powerful and long-term partner**

The Panasonic Group is one of the largest electrical engineering companies in the world. In the more than 80 years since our company's founding, we have developed some 220,000 products ranging from high-quality lighting and information systems to consumer electronics, household appliances and factory automation systems. The products are marketed under diverse brands such as Panasonic and SUNX.

Smart solutions – from us for you





**SUNX Sensors**



have been developed to solve a wide variety of complex tasks during the automation process. Miniaturization, extremely high accuracy, high speed, ability to function in adverse environments, e.g. in a vacuum and/or at high temperatures, are features provided by our products which are essential for companies involved in the manufacture of solar cells, glass and semiconductors.

**SUNX Safety**



from the Japanese market leader for safety light curtains. With a wide-ranging product portfolio for optical safety sensors, Panasonic provides state-of-the-art devices to satisfy the demands of your safety applications.

**SUNX Ionizers**



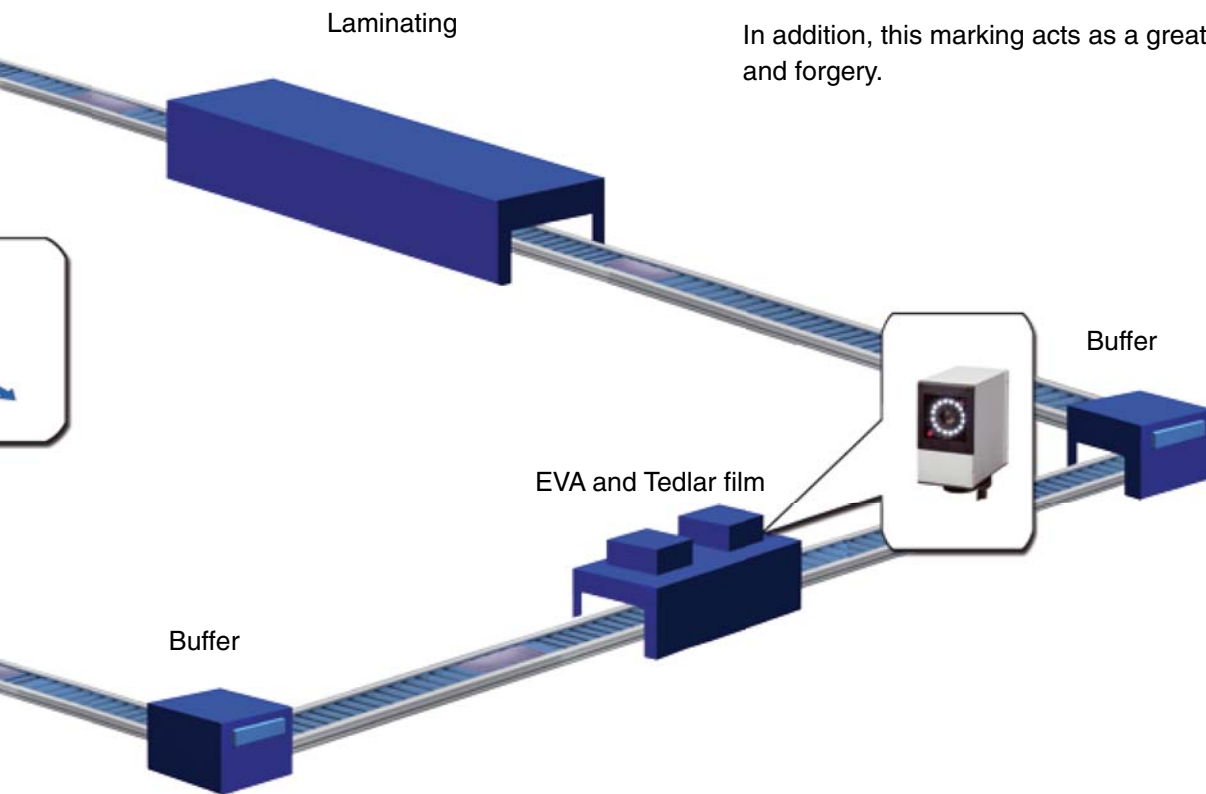
are made to balance electrostatic discharge, one of the main problems in semiconductor and solar module production processes. SUNX ionizers are compact, flexible and easy to use.



# Solar module production

In solar module production, the first processing step requires a unique, permanent marking of the panel in order to ensure that product data is recorded precisely, and to guarantee traceability thereafter during production. With the help of this state-of-the-art identification technology, the requirements of DIN EN 50380 can be met, e.g. traceability is granted for 25 years minimum.

In addition, this marking acts as a great safeguard against theft and forgery.



Sensors used during both production of wafers and production of substrate materials guarantee optimal process control. These sensors' tasks include helping to detect and position objects.

## Machine Vision Systems

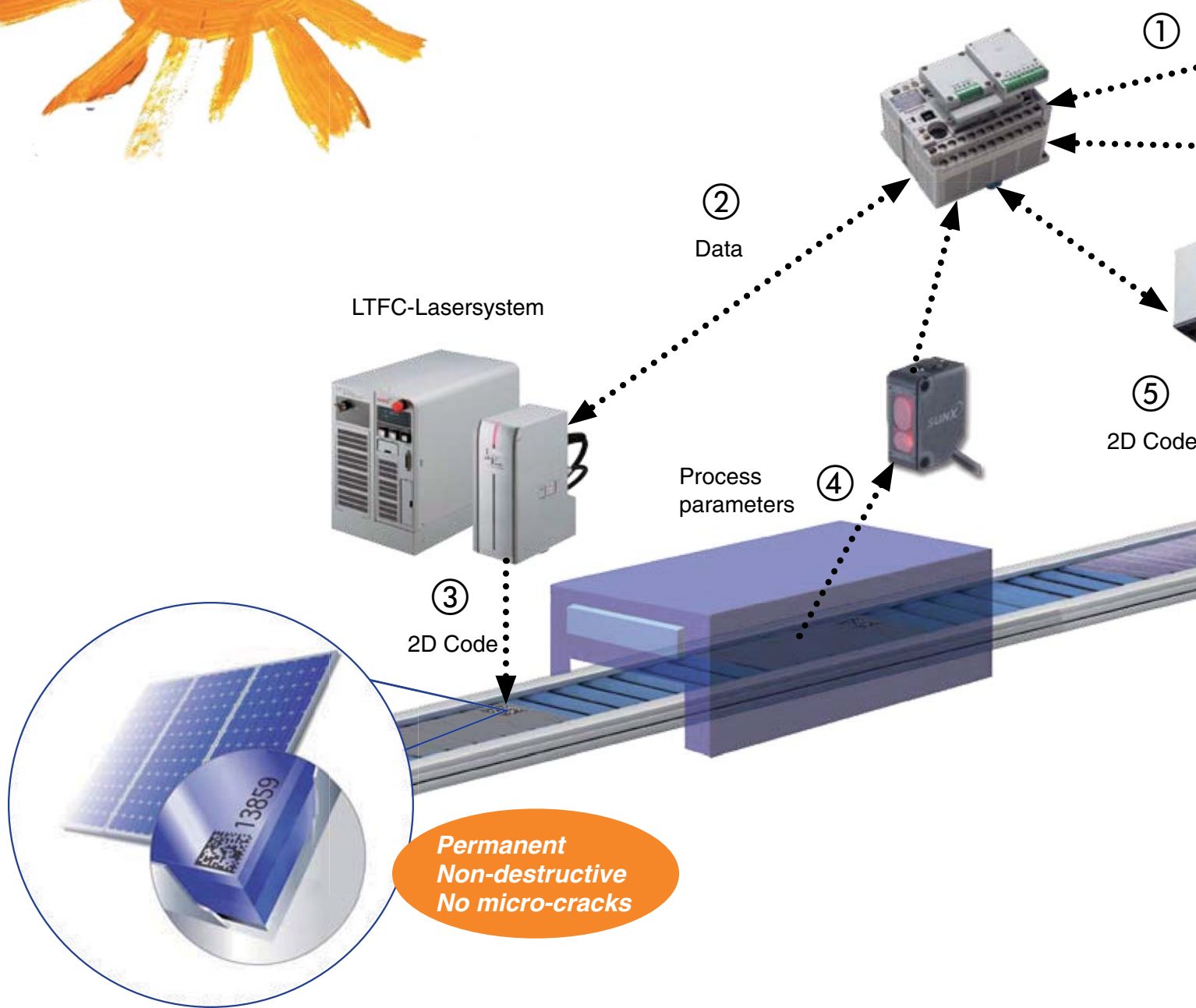


are an essential factor in quality assurance. By detecting flaws at an early stage, the number of rejects can be reduced significantly. Output quality and quantity can be improved by quick detection of minute deviations and failures. The systems are flexible and permit a quick changeover to new inspection tasks. These are features that will reduce the number of product returns and increase customer satisfaction.

## 2D Code Reading Sensors



The marked codes should be read and validated during every phase of the production process. Our 2D Code Reading sensors are especially suited for the very demanding conditions on glass, and impress with their advanced reading ability. The easy, sensor-like handling and architecture grant a low total cost of ownership.



**Permanent  
Non-destructive  
No micro-cracks**

### Laser Markers



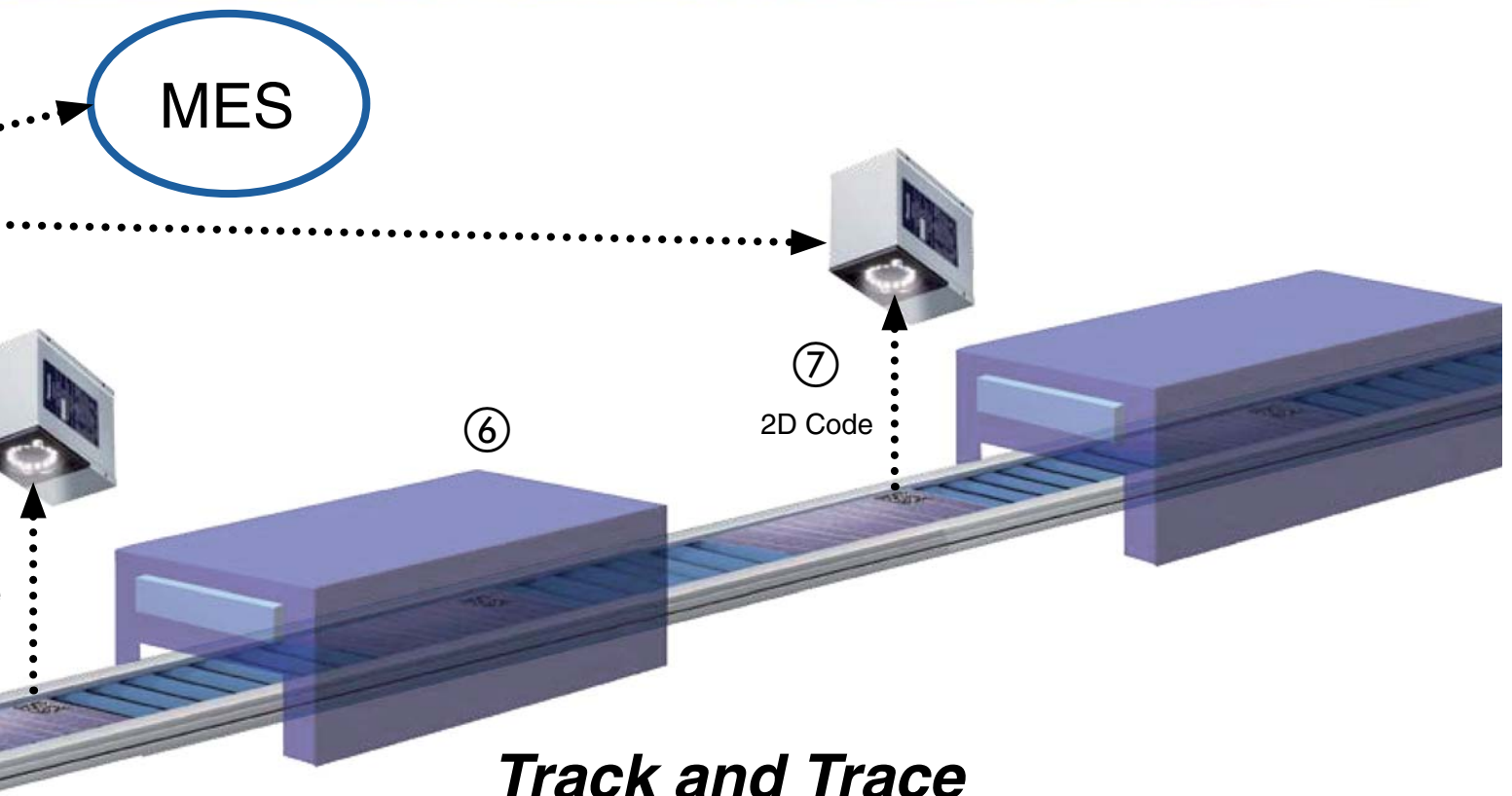
Panasonic is now able to offer complete solutions developed especially for solar module production which requires non-destructive, permanent marking (DIN50380). Thanks to their small laser head size, our Laser Markers can easily be integrated into existing production lines. The systems can mark strings of characters, 1D and 2D codes, logos and signs.

### Eco-POWER METERS



Our Eco-POWER METER series enables you to manage your energy needs professionally. Visualization and analysis of your consumption data helps you to find ways of saving energy. Eco-POWER METERS can easily be distributed throughout the factory and linked to a central PC or PLC for monitoring, logging and analyzing measured data.





## Track and Trace

In order to ensure traceability, Panasonic developed a dedicated laser system for marking photovoltaic solar cells and float glass. Thanks to our experience and expertise, we were able to develop a solution which permits glass to be marked without creating micro-cracks or damaging the TCO coating. The individual and machine-readable text and 2D-code withstand temperatures of up to 1200°C as well as UV-resistance and are impervious to UV radiation. This kind of marking also protects against theft and forgery.

- ① The higher-level system (MES=Manufacturing Execution System) creates a Data Matrix code. This 2D code is transmitted to a PLC.
- ② The PLC transmits the 2D code to the Laser Marker.
- ③ The Laser Marker marks the product with the 2D code.
- ④ The product is detected by a laser sensor.
- ⑤ The 2D code reading sensor, e.g. a PD60, checks the product and the code prior to the next production step.
- ⑥ Production step.
- ⑦ The 2D Code Reading Sensor checks the product and the code after the production step, collects the machine parameters and stores them in the higher-level system.

### Research and development

Panasonic Electric Works is perfecting a new procedure for permanent marking of glass. The success of this revolutionary technology is based on the combination of the Panasonic laser marker and the Laser-Transfer-Film-Contrast which yields an indestructible, tamper-proof and high contrast marking.

### Complete solution

The machine building department of Panasonic Electric Works in Germany offers complete marking systems and integration of laser marking stations (stand-alone or integrated into an existing transport system). Complete track and trace solutions, which include additional equipment such as 2D code readers, network communication and data storage, are integrated into applications such as remote maintenance via networks or web pages.



# Solar tracking systems

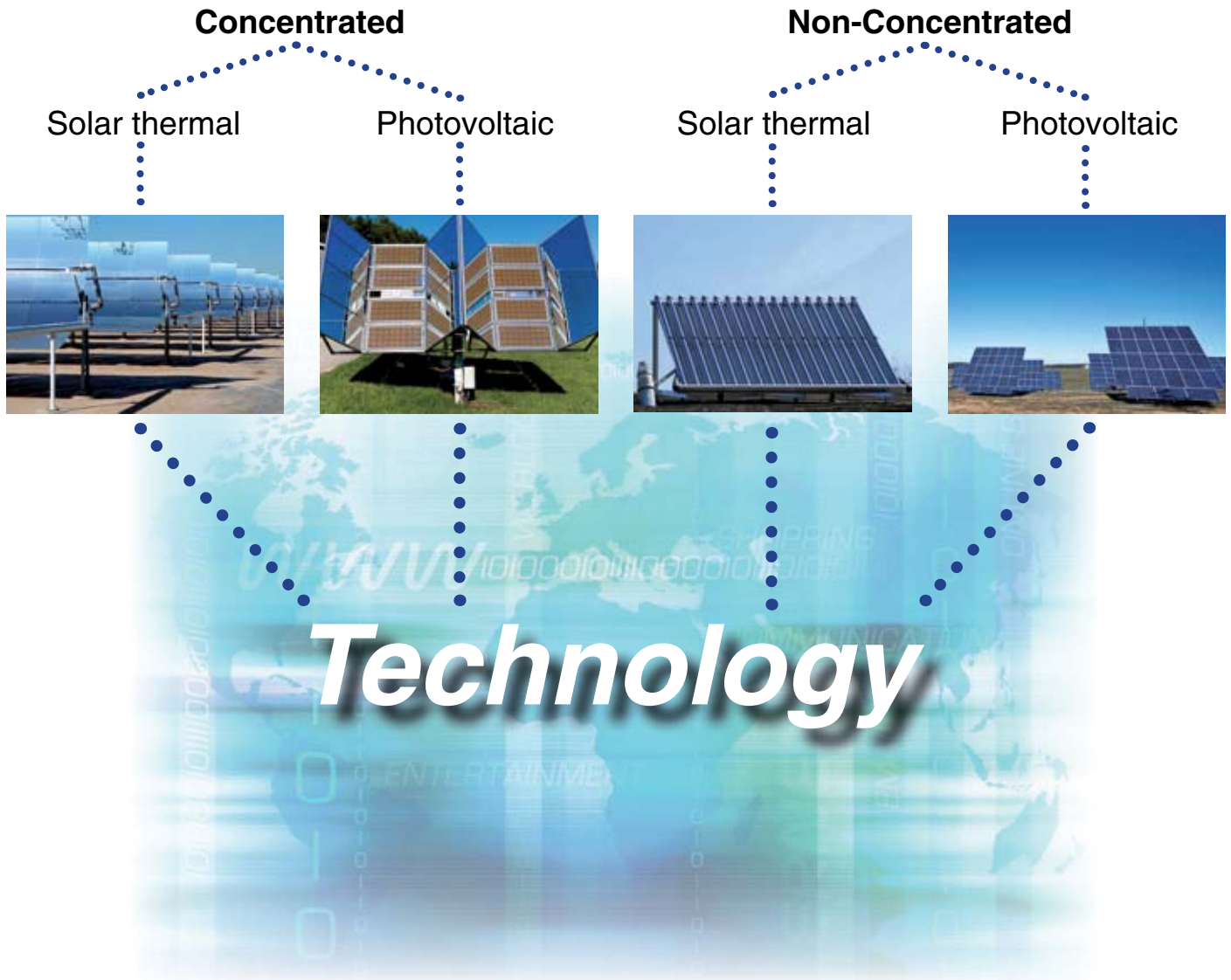
Technologies which are able to generate energy from sunlight can be divided into two main categories:

- Energy generation through solar thermal systems
- Energy generation through photovoltaic systems

In turn, each of these can again be divided into

- Concentrator technology
- Non-concentrator technology.

True to our eco ideas campaign, we have developed sustainable solutions to preserve our environment.





# Solutions for solar tracking systems

As a result of our longtime experience in the area of solar tracking systems, Panasonic is able to offer comprehensive solutions for solar photovoltaic tracking and solar concentrated systems, not only in respect to control equipment, but also in the area of programming, thereby solving the application requirements with great reliability.

In order to fulfill the special requirements for high accuracy, orientation to the sun, and safe operation, Panasonic designed a concept which has proved to be very successful in numerous projects throughout southern Europe. Our solution provides reliable and fully automated operation for 1-axis and 2-axis solar trackers.



## Tracking algorithm:

An astronomical calculation of the sun's position enables precise solar tracking. The algorithm uses longitude, latitude and the real time clock from the GPS system to synchronize the real-time clock of our PLC.

## Analysis and remote control, alarms:

Networking allows the solar plant to be monitored and prevents high voltage peaks while the tracker is moving. Remote monitoring and maintenance can be performed via the mobile data service GPRS, a network, e.g. Ethernet, wireless network, or via the KR20 Wireless Unit. An SMS alarm notification system is included for alarms and emergencies.



## Position control:

The position of the solar tracker and the actual alignment of the solar panels is checked by different functions, depending on the feedback sensor (encoder, inductive sensor, analog sensor). The position control functions allow the tracker to follow the sun or to move to a specific position (wind security position, snow position or maintenance position) in one or two axes. Panasonic limit switches are used as safety devices to ensure safe and reliable operation.

## Coping with bad weather:

To ensure that the solar tracker is not damaged by bad weather, special control functions have been integrated. These include, among others, a snow shedding function and a safety function for strong winds.



# Solutions for solar tracking systems



A special library for FPWIN Pro, the IEC-61131-3 compliant programming software for Panasonic PLCs, makes starting up your solar tracking systems very easy. The **system is easy to configure** even, **without programming skills**.

Each user can customize and configure the library according to his own needs. **Initiation takes only a few minutes**, thanks to the **ready-to-use program**. The library was designed to use a single program for all PLCs in the solar tracking field.

## FP Series Programmable Controllers



With its FP series, Panasonic provides the solar industry with compact yet powerful programmable controllers that provide reliable and fully automated operation of 1-axis and 2-axis solar trackers. The PLC is capable of performing important tasks such as positioning control, monitoring safety devices and generating tracking algorithms.

## Inverters



Various movement patterns for the solar trackers are possible with our compact, PLC-controlled inverters, e.g. they can move quickly to a safe position in the event of danger, or move slowly for continuous tracking.

## Limit Switches



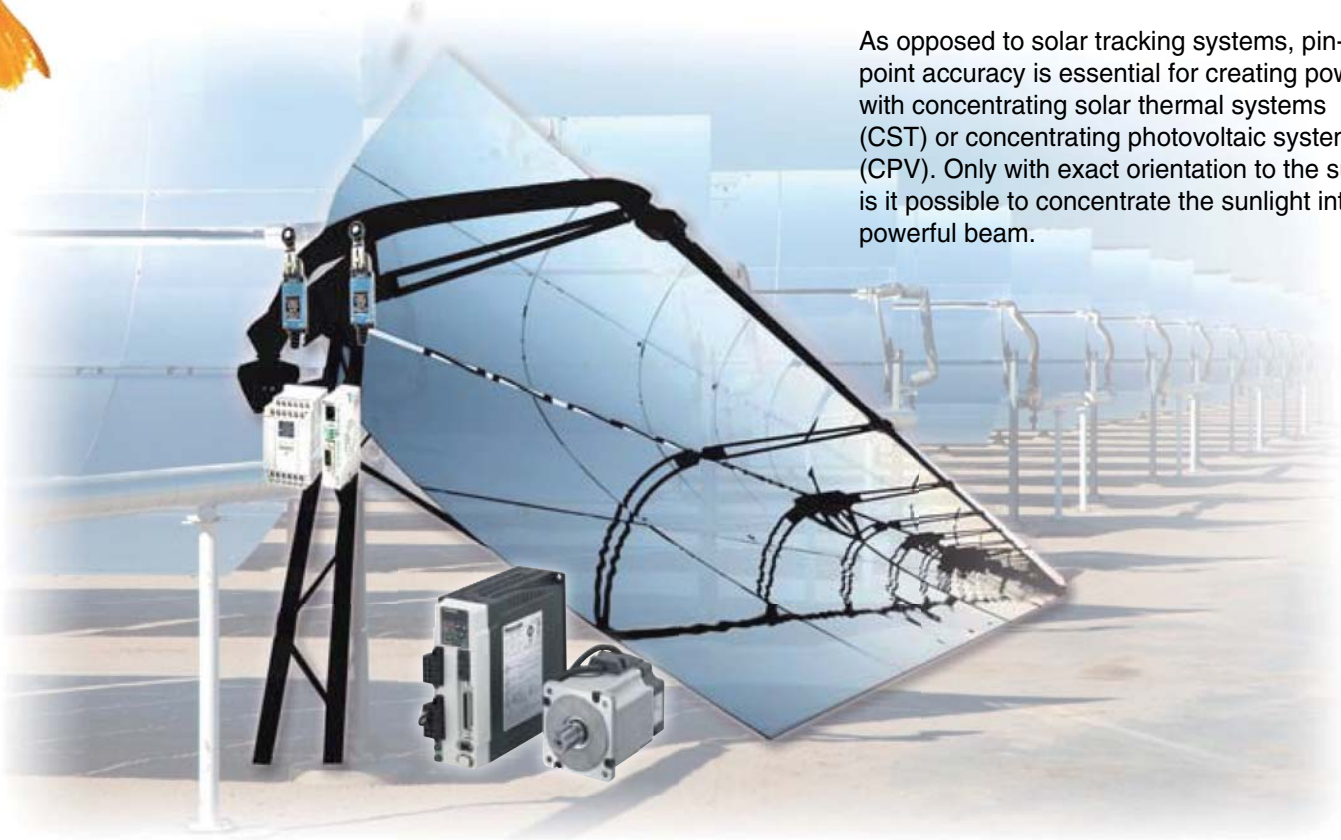
are equipped with electronic responsiveness, contact reliability and sensitivity, thereby allowing safe movement of solar tracking systems with one or two axes.





# Concentrating solar systems

As opposed to solar tracking systems, pinpoint accuracy is essential for creating power with concentrating solar thermal systems (CST) or concentrating photovoltaic systems (CPV). Only with exact orientation to the sun is it possible to concentrate the sunlight into a powerful beam.



The orientation of your systems can, however, be affected by shocks triggered by strong winds, earthquakes, maintenance work or other factors. Consequently, your system may suffer a deviation in its orientation and would then no longer be able to concentrate the sunlight. To prevent such deviation, Panasonic developed a high accuracy sensor (tilt) module. As soon as a tilt angle is detected, the system reacts quickly and corrects the deviation.

Panasonic is able to offer you a complete system which ensures high performance, high quality and cost effectiveness. Our solutions include control units to ensure safe operation. Motors, limit switches and our sensor (tilt)-modules are available for positioning functions.

In addition, telecontrol units permit easy monitoring and maintenance via SMS messaging, e-mail or GPRS secured by a VPN.



### Tilt modules

This technology was specifically developed for concentrated solar systems and is capable of detecting tilt angles (triggered by external instances) with an extremely high accuracy of 0.1 degrees. In addition, it allows reliable operation of your system.



### Minas A4 servo drives

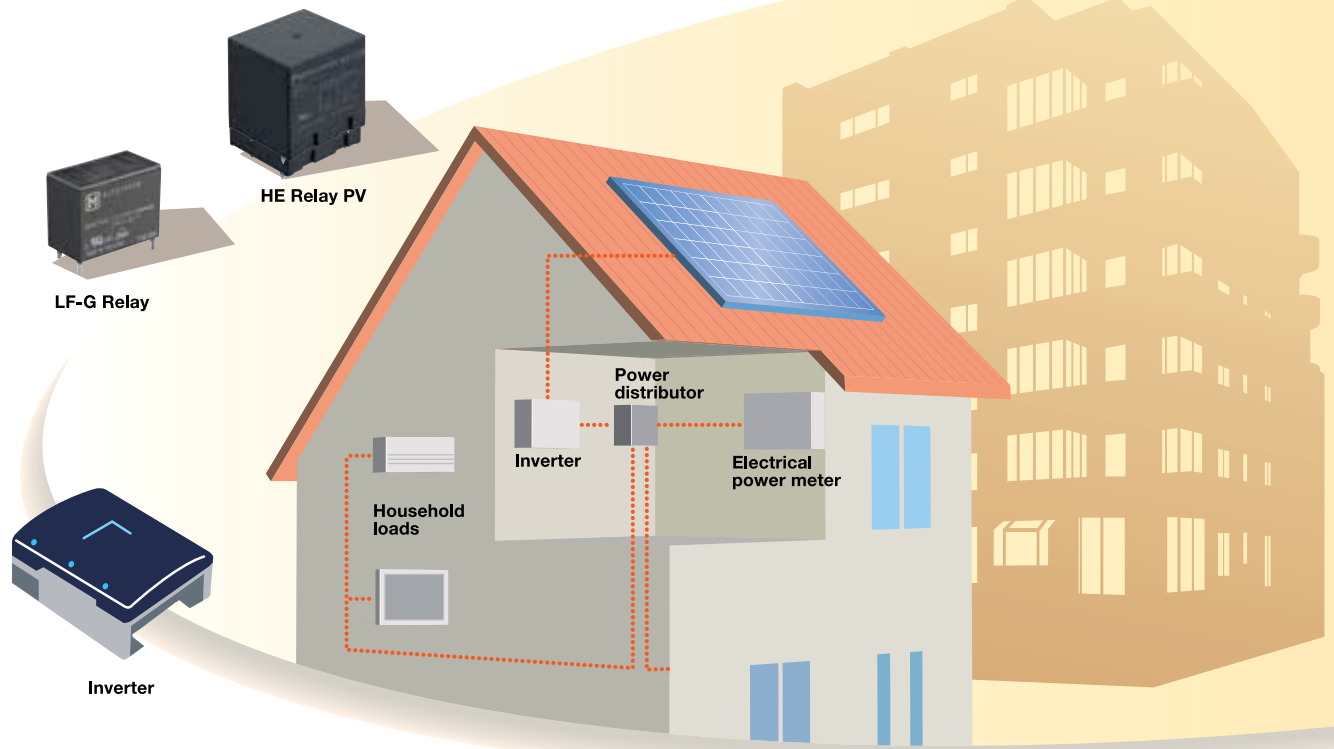
The Minas A4 series is perfectly suited for centrally controlled 1- or 2-axis positioning with small servo motors, thanks to networking technology such as RTEX.



### Telecontrol

Whether you want to monitor, control or maintain your solar plant, our safe, easy and cost-effective M2M communication gives you remote access via Ethernet, GPRS, etc., world-wide. Numerous functions such as alarm notification via e-mail, Fax or SMS messaging are available.

# Solar power

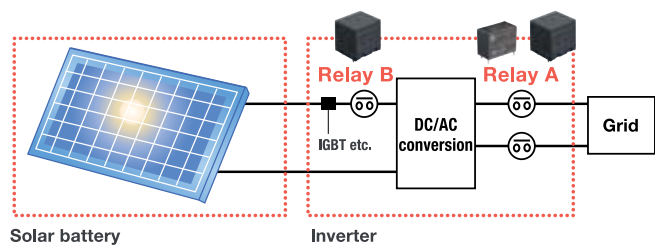


## Safety shutoff on the AC side (LF-G, HE-relay)

Relays are used on the commercial power supply line (grid) to shut off the circuit to prevent abnormal currents from affecting the commercial power supply. Power relays are required as a safety measure to protect the power supply system.

## Safety shutoff on the DC side (HE-relay)

By combining relay B and the IGBT you can incorporate the high-voltage DC breaker function into an inverter, thereby saving labor costs and downsizing the system.



## Households/ Buildings/ Factories

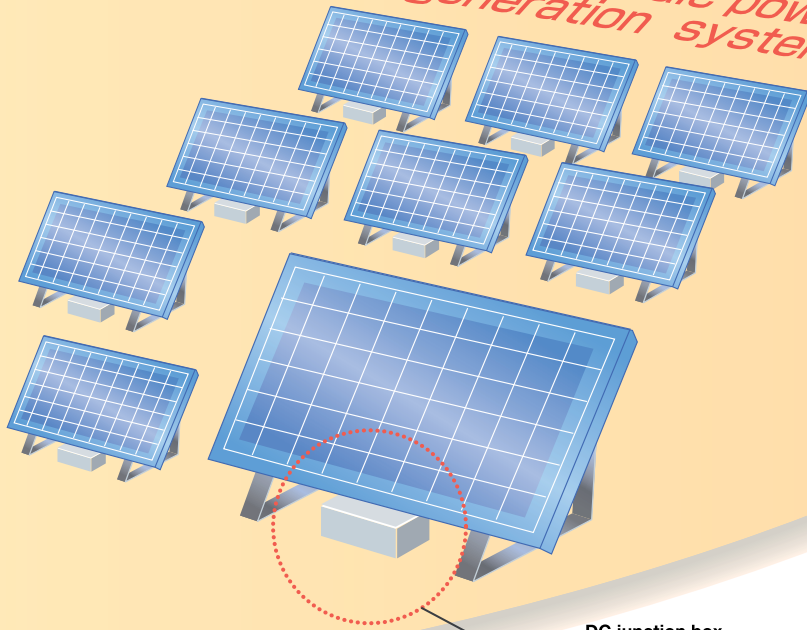
Application	Relay		Figure
Inverter (safety shutoff on the AC side)	LF-G	HE PV	Relay A
Inverter (safety shutoff on the DC side)	HE PV		Relay B

The A,B relay is used only for conduction.





## Photovoltaic power generation system



EP Relay

### SOL-Series

RZM-connectors for photovoltaic modules and solar junction boxes.

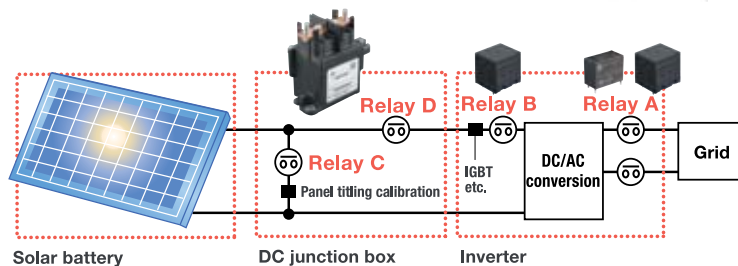


### Detection of the solar positions

With calibrating the inclination, relay C is turned on and relay D is turned off. The current generated is detected by a current sensor and the inclination of the solar panels is calculated and optimized.

### Safety shutoff on the DC side (EP-relay)

Many such relays, not manual breakers, are used in various fields. They must be able to control high voltages remotely.



## Electrical power plants

### Solar tracking system

Solar tracking systems periodically track and adjust the position of solar collection panels in order to efficiently generate electric power.

Application	Relay	Figure
Inverter (safety shutoff on the AC side)	LF-G   HE PV	Relay A
Inverter (safety shutoff on the DC side)	HE PV	Relay B
DC junction box (calibration unit)	EP	Relay C
DC junction box (safety shutoff on the DC side)	EP	Relay D



# Green Automation **eco ideas** by Panasonic Electric Works

Our solutions for the solar industry were developed in order to achieve the following goals:



- Protect the environment by providing sustainable solutions
- Reduce CO<sub>2</sub> output according to the Kyoto protocol
- Force renewable energy to be used
- Use energy in a more efficient way

As a global manufacturer of automation products, we have a huge responsibility toward our environment. It is up to us to build products that help control climate change.



Green automation:



Solutions for solar industry



Solutions for water/waste water



Solutions for energy management





## **Panasonic eco ideas**

Assume responsibility

Care about the environment and about society

The extent of human activities may have exceeded the earth's capacity.

Coexistence with the global environment is an urgent – and shared – task for mankind.

Contribute to mankind's quality of life

Realize a ubiquitous network society

Panasonic has signed as one of the first corporate sponsors of the WWF's work on the Arctic. The WWF International Arctic Program's goal is to initiate a new approach to understanding and managing the Arctic via a four-pronged approach:

Communication of the global implications of Arctic climate change

Ensuring the Arctic biosphere does not become a new source of atmospheric carbon

Eliminating the additional pressures on the environment caused by unsustainable exploitative activities

Establishing governance regimes that conserve the ecosystems and species of the Arctic for future generations

Panasonic's support will enable the WWF to increase their Arctic activities at a time when the Arctic faces unprecedented changes. These activities will include devising and promoting governance and management regimes to help protect Arctic ecosystems, eliminating illegal fishing activities, and researching, monitoring, and supporting the continued well-being of key Arctic species such as polar bears.

For Panasonic, this initiative is an important part of its global 'eco ideas' strategy, which strives to improve the efficiency of products, increase environmental performance at manufacturing sites and encourage people such as consumers and employees to take their own actions on the environment by proactively engaging with local communities across the continent.

**Panasonic**  
Project Supporter



**„eco ideas“  
for products**

**„eco ideas“ for  
manufacturing**

**„eco ideas“ for  
everybody, everywhere**

Panasonic's 'eco ideas' program has three key aims:

To deliver more environmentally-friendly products

To reduce the environmental impact of manufacturing

To promote environmentally-conscious activities within communities for everybody, everywhere

## North America

## Europe

## Asia Pacific

## China

## Japan

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