



Solar energy

Solutions for photovoltaics

In dialog with customers and partners worldwide

Phoenix Contact is a worldwide market leader in the field of electrical engineering and automation. Founded almost 90 years ago, this family company now employs around 12,800 people worldwide. A sales network with over 46 subsidiaries and more than 30 additional sales partners guarantees customer proximity directly on site, anywhere in the world.

Our range of services consists of products surrounding various different electrotechnical applications. This includes numerous connection technologies for device and machine manufacturers, components for modern control cabinets, and tailor-made solutions for many applications and industries, such as automobile production, wind energy, photovoltaics, the process industry or applications in the field of water supply, power distribution, and transportation infrastructure.



Global player with personal customer contact

Company independence is an integral part of our corporate policy. Phoenix Contact therefore relies on in-house competence and expertise in a range of contexts: the design and development departments constantly come up with innovative product ideas, developing special solutions to meet customer requirements. Numerous patents emphasize the fact that many products have been developed exclusively by Phoenix Contact.



Photovoltaics – safe energy for the future

Worldwide energy requirements are on the increase and renewable energies will play a major role in future from both an ecological and economic standpoint. Leading institutes are assuming annual growth of between eight and twelve percent by 2020. Consequently, in the energy mix of the future, solar current, including solar current generated by solar thermal power stations, will meet up to thirty percent of total energy requirements. Around two thirds of this power will be generated via roof surfaces with solar panels installed. Vacant areas, facades, and traffic routes offer additional development potential for photovoltaics.

Design an environmentally-friendly and economic power supply with Phoenix Contact. For years now, we have been a reliable and an expert partner in the PV sector. Our product solutions and services enable you to operate your systems even more safely and efficiently.



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“With the power of the sun and technology from Phoenix Contact, you can design inspirational solutions for a sustainable power supply.”

Solutions for photovoltaics

Whether small rooftop systems on detached houses, tracking systems or free-standing systems in the megawatt range: for reliable and, in particular, efficient operation, the market requires easy connection technology solutions featuring long-term stability, complete monitoring and management systems, and comprehensive protection against surge voltages. The development of intelligent power supply systems also shapes the electrotechnical equipment for all aspects of photovoltaics: network and system operators must communicate on a consistent and uniform basis and reliable remote control concepts are indispensable.



Free-standing systems

Intelligent connection technology reveals its strengths in the installation of free-standing PV systems. For efficient operation, Phoenix Contact offers all string combiner box components as well as solutions for park management.

More information from page 6 onwards



Tracking systems

Tracking systems aim to deliver maximum energy yields. With durable and reliable technology from Phoenix Contact, you can rest assured that the additional financial expenditure that these systems involve will be worthwhile.

More information from page 24 onwards



Rooftop systems

Obviously, rooftop PV systems are susceptible to damage from lightning strikes. Protect your systems and connected systems reliably and permanently – with powerful surge protection.

More information from page 28 onwards



Building integration

Building-integrated photovoltaics offer huge potential for environmentally-friendly urban energy generation. However, the prevailing structural conditions pose special cabling challenges. The solution: plug-in connectors from Phoenix Contact.

More information from page 32 onwards



Autonomous power supply

For independent power supply in the field or wherever you need energy, Phoenix Contact offers intelligent solutions for autonomous photovoltaic systems.

More information from page 36 onwards

Solutions for free-standing systems

Photovoltaics make a major contribution toward meeting the continually rising energy requirements. Interest in building increasingly larger and more powerful free-standing PV systems is on the increase worldwide. Networking, monitoring, and communication are indispensable in this regard, particularly in relation to constant network quality and maintenance in line with requirements. At the same time, in the case of larger systems, the aim is easy and fast connection technology. Discover the advantages of Phoenix Contact solutions for yourself.

“Intelligent technology is impressive if it is simple to use – irrespective of whether it's connection technology or remote control software.”



Park management

Sensor/actuator cabling for extreme weather conditions, park networking, energy data acquisition and diagnostics, and visualization.

Control room

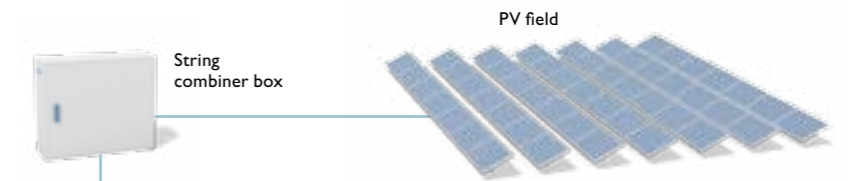


Protection for the AC current

Surge protection for inverters and supply.

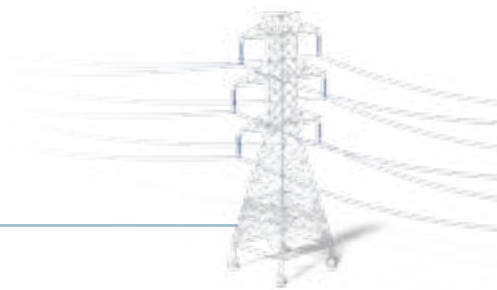
String combiner technology

String combiner technology for collecting, forwarding and monitoring currents. In addition: protection against surge voltages.



Connection technology

With plug-in connector and cables featuring long-term stability, a PV park can be cabled and connected quickly and easily.



Connection technology: connecting and wiring

From the PV module and the string combiner box to the inverter – Phoenix Contact offers numerous cabling solutions that are perfectly tailored to the requirements of free-standing PV systems. These were designed with durability and quick and easy installation in mind. The DC plug-in connectors for field assembly can be mounted within approximately 10 to 15 seconds without special tools. This ensures long-term system availability even under extreme atmospheric influences.



Plug-in connectors for assembly

The innovative spring connection of the DC plug-in connectors enables cables from 2.5 to 16 mm² to be connected reliably and safely without special tools. This facilitates particularly fast on-site assembly.



Assembled PV cables: Y-distributors

Even more flexibility in PV cabling: Using Y-distributors, you can easily and inexpensively route adjacent strings to the inverter with just one string cable. They can also be equipped with plug-in connectors.

Customer-specific cable lengths are available on request.



Photovoltaic cables: By the meter

With our cable rings, you are supplied with high-quality TÜV-certified cables by the meter for securely wiring your PV system.



DC device plug-in connector

The DC device plug-in connector is available pre-assembled on a customer-specific basis or as an assembly set for user assembly. It is suitable for voltages of up to 1500 V and features integrated anti-rotation protection.



Intelligent connection technology: compact and user-friendly

Your advantages

- Variety and flexibility, thanks to various conductor cross sections from 2.5 to 16 mm²
- UV, temperature, and weather-resistant
- Future-oriented for voltages of up to 1500 V
- Innovative spring connection for durable, reliable, and safe connections without special tools

Easy and reliable mounting



Insert the stripped PV conductor



Press down on the spring and snap in

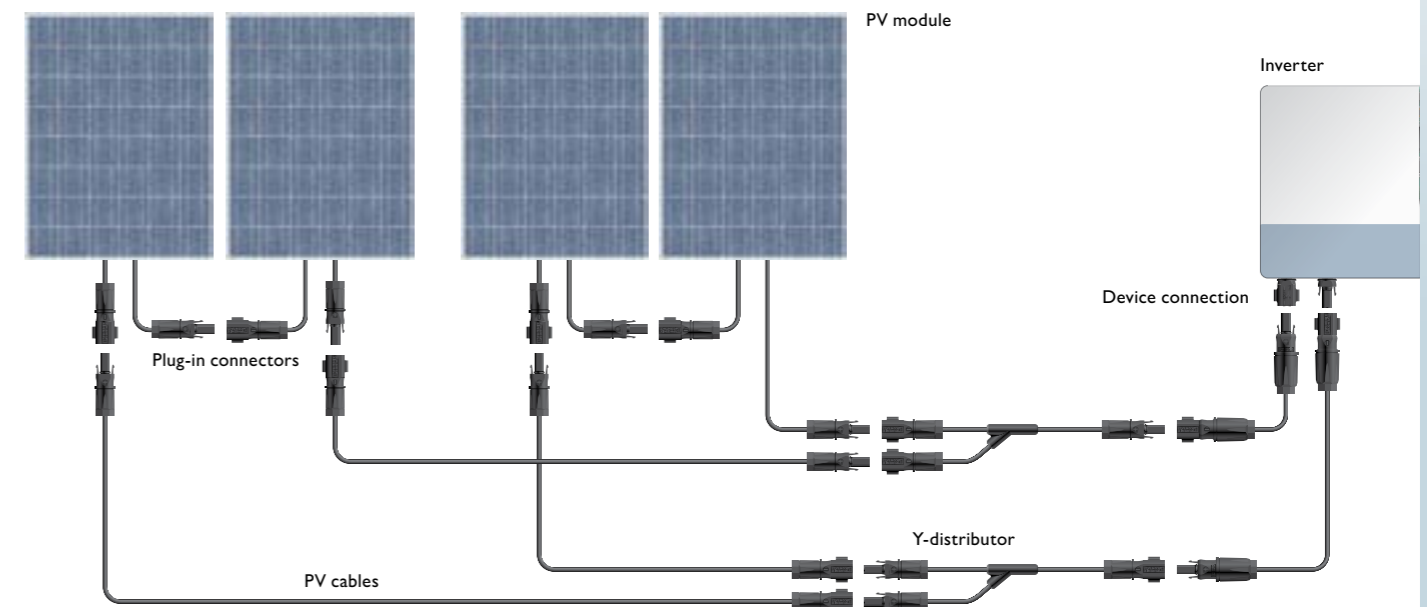


Tighten screw connection



Connection can only be released using a screwdriver

Consistent connection technology from the PV module to the supply



Plug-in connectors and cables facilitate fixed or flexible installation and are suitable for a temperature range of -40°C to 85°C.

Detailed product information on connection technology can be found from page 42

String combiner box: collection and distribution

String combiner boxes collect and distribute string currents, protect the PV modules against surge voltages, and monitor the performance of the free-standing systems. In this regard, string combiner boxes combine numerous electrical and electronic devices in compact, space-saving housing. Depending on voltage and strength, the fuse, hybrid, and connection terminal blocks that are used are also available for large conductor cross sections.



Fuse terminal blocks

Terminal blocks for protecting individual strings against reverse currents. The optional LED signals a blown fuse. By using appropriate jumpers, the string currents can be connected and accumulated.



Hybrid terminal blocks

Potential collective terminal blocks are available for a quick and space-saving interconnection of individual strings. As such, four strings are combined without additional cabling effort. The output side accommodates up to 35 mm² of conductor in a screw terminal block unit.



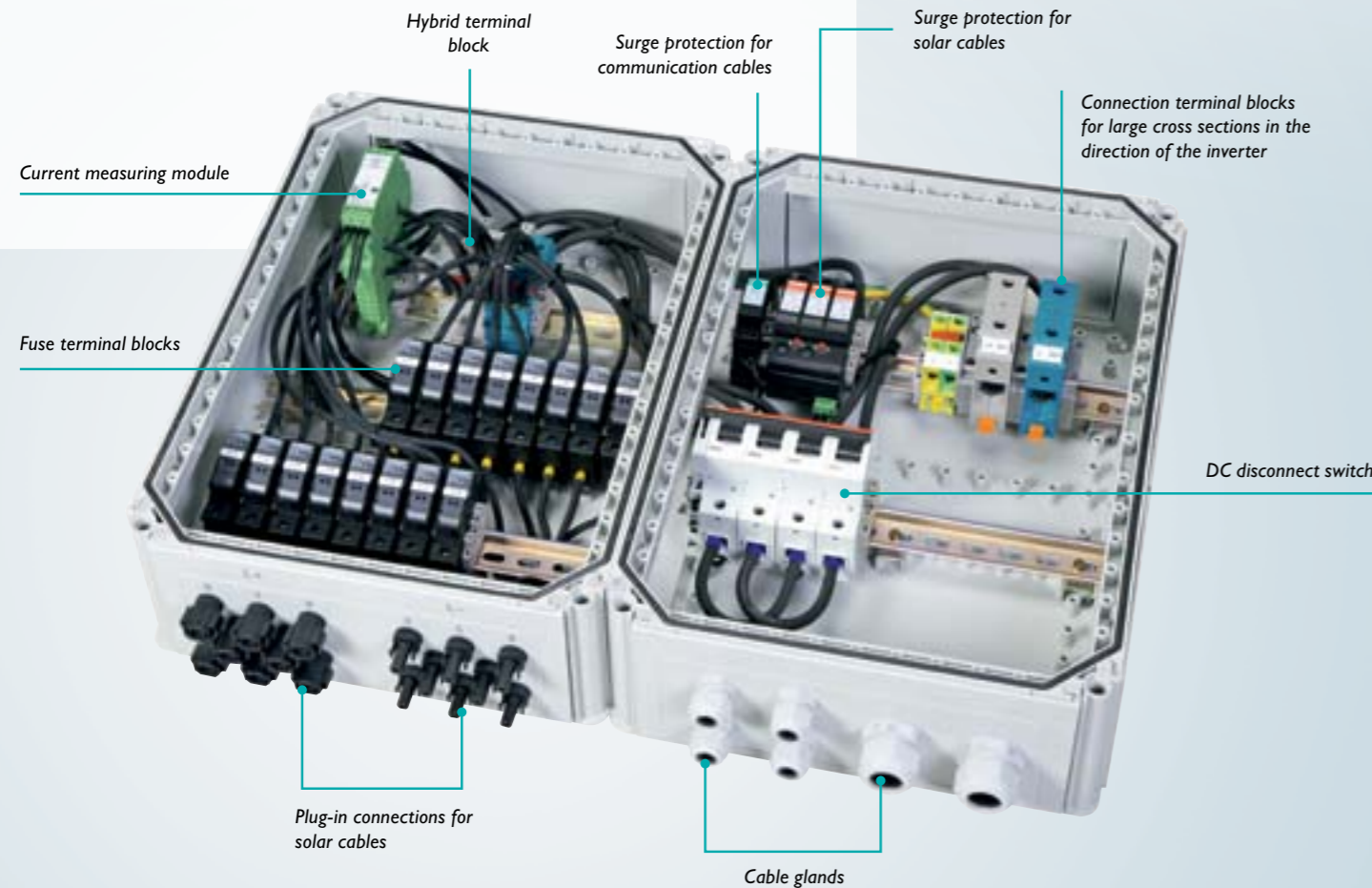
Diode terminal blocks

Diode terminal blocks serve as string diodes and are used in thin-film photovoltaic systems to prevent reverse currents. This means that the often sensitive thin-film modules are ideally protected to provide long-term stability.

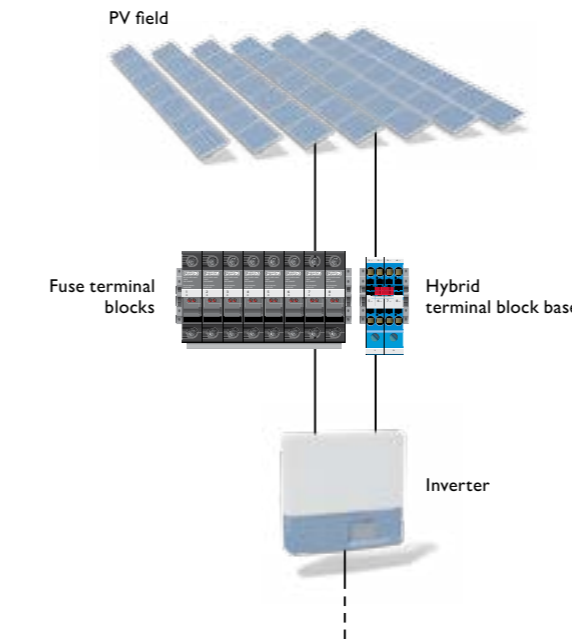


Disconnect terminal blocks

Disconnect terminal blocks provide a disconnection option for maintenance and repair work. Once a photovoltaic system has been switched off, a single string can be disconnected via the disconnect terminal block.

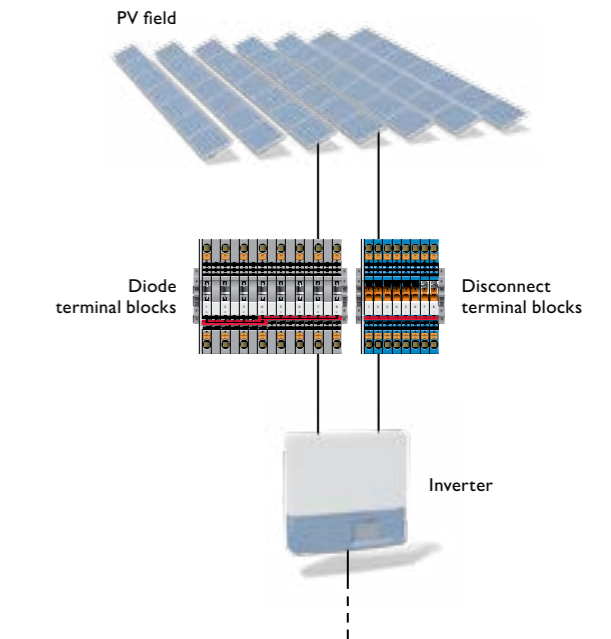


Crystalline PV modules



Crystalline modules are characterized by a very high level of efficiency in good light conditions. They offer significantly higher string currents in comparison to the thin-film modules. The compact fuse terminal blocks from Phoenix Contact protect PV cables against dangerous reverse currents.

Thin-film PV modules



In comparison with crystalline modules, thin-film modules perform more favorably in weak light and are more sensitive to reverse currents. Block diodes connected in series are often used for fast and reliable protection in the case of reverse currents.

Detailed product information on terminal blocks and fuses can be found from page 44

String combiner box: protection

Due to their size and exposed location, free-standing PV systems are particularly at risk from lightning currents and surge voltages. Take preventive action and significantly increase the availability of your system with lightning current and surge arresters from Phoenix Contact. These arresters fulfill EN 50539-11 and UL 1449, 3rd edition standards for surge protection in photovoltaic installations and are KEMA-certified.



Type 1/type 2 DC lightning and surge protection

Specially developed for photovoltaics, this lightning and surge arrester provides the PV modules and inverters with the best possible protection against lightning currents and surge voltages on the DC voltage side.



Type 2 DC surge protection

The type 2 PV surge arrester reliably protects PV modules and inverters on the DC voltage side against surge voltages.



Type 1/type 2 AC lightning and surge protection

The combination of type 1 lightning arresters and type 2 surge protection provides comprehensive protection. The inverter is protected against harmful surge couplings from the power supply network.



Surge protection for data and communication systems

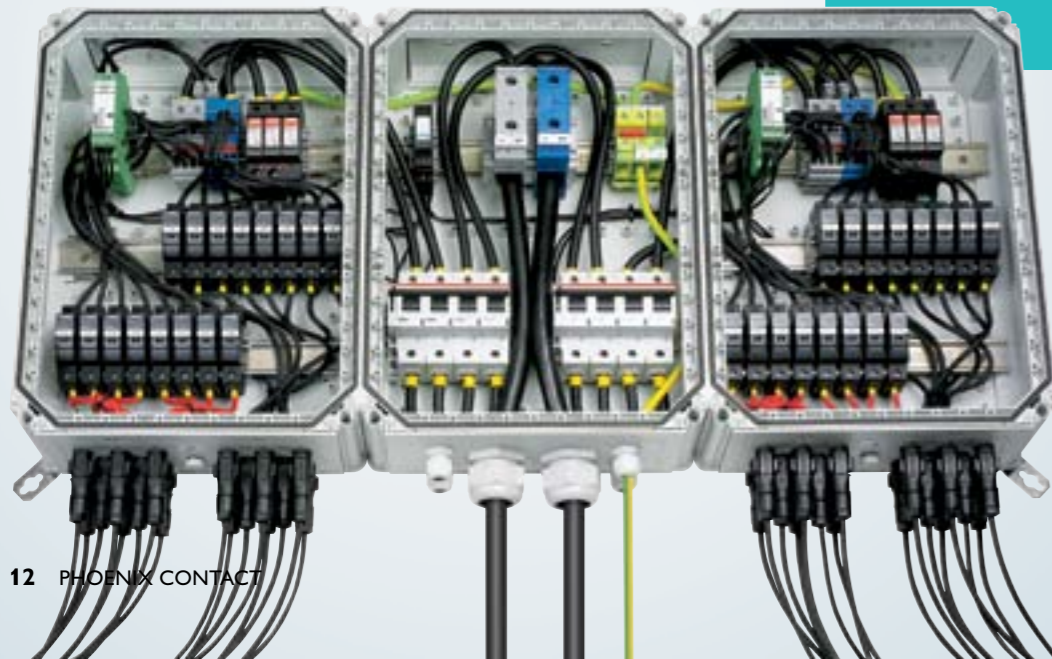
Surge protective devices for data cables in extensive free-standing installations protect, for example, connected tracking or monitoring systems.



Increased risk due to lightning strikes: protect your PV systems reliably – with Phoenix Contact technology.

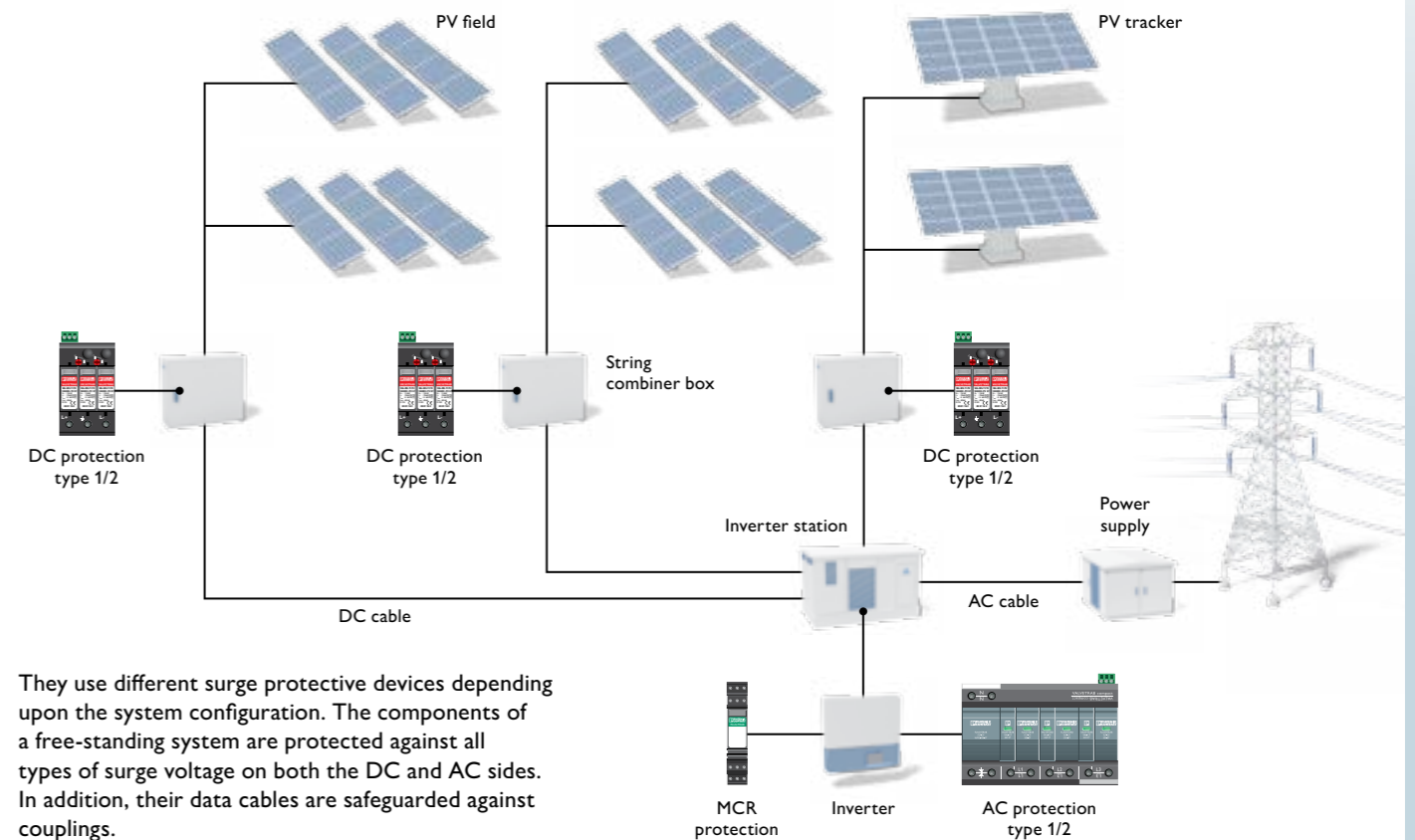
Your advantages

- Reliable protection for the inverter
- Optical status indicator on each plug
- High level of safety, thanks to EN 50539-11 and UL 1449, 3rd edition
- Efficient maintenance planning, thanks to remote signaling
- Protection against incorrect connection
- Always the right arrester, thanks to universal protective components



Comprehensive security: string combiner boxes with surge protective devices

Surge protection for large free-standing PV systems



Detailed product information on surge and lightning protection can be found from page 46

String combiner box: monitoring

Photovoltaic systems should achieve maximum energy yield from solar power in the shortest possible time. It is therefore essential to respond immediately to the failure of individual strings.

The PV string current monitoring system from Phoenix Contact, which consists of a communication module and various measuring modules, enables you to react immediately to malfunctions and power losses.



Current measuring modules

In a measuring module just 22.5 mm wide, the characteristics of your PV systems are determined on a contact-free basis with the aid of Hall sensors and forwarded to the communication module. 4 and 8-channel versions are available.



Communication modules

The communication module collects the values from the measuring modules and, as a Modbus slave, forwards them to your central higher-level control system. It is also used to supply the measuring modules in the field. The communication module is simply integrated into an existing network as a Modbus RTU device.



Voltage modules

With the voltage module you can measure DC voltages of up to 1500 V. The module is suitable for both measurements in grounded and insulated PV systems. It is also possible to use the voltage measurement flexibly outside the monitoring system as a simple analog device.



Current transducers

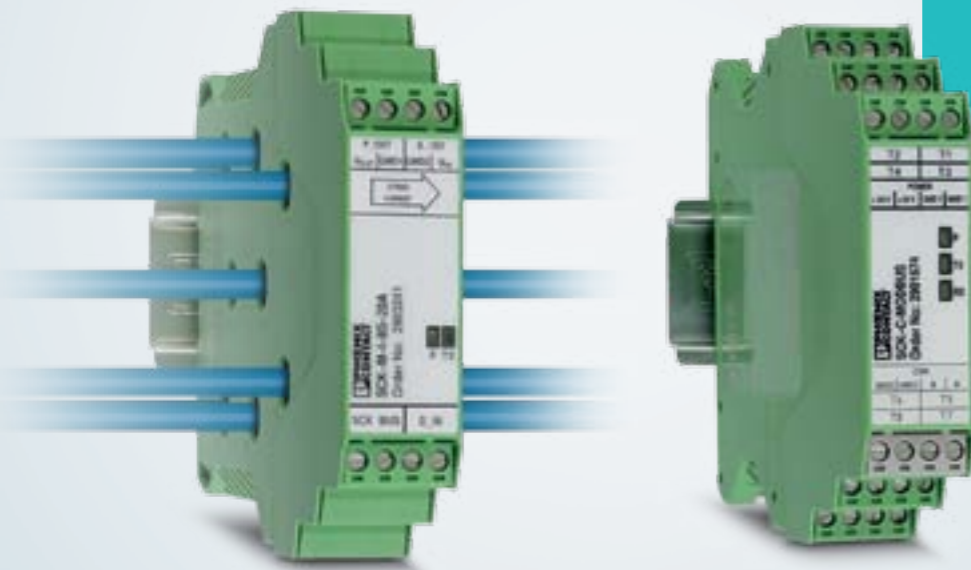
With the universal AC/DC current transformers, DC bus cables of up to 600 A are monitored. This means that the conductor that is to be monitored does not have to be interrupted.



String current monitoring increases efficiency in larger photovoltaic systems

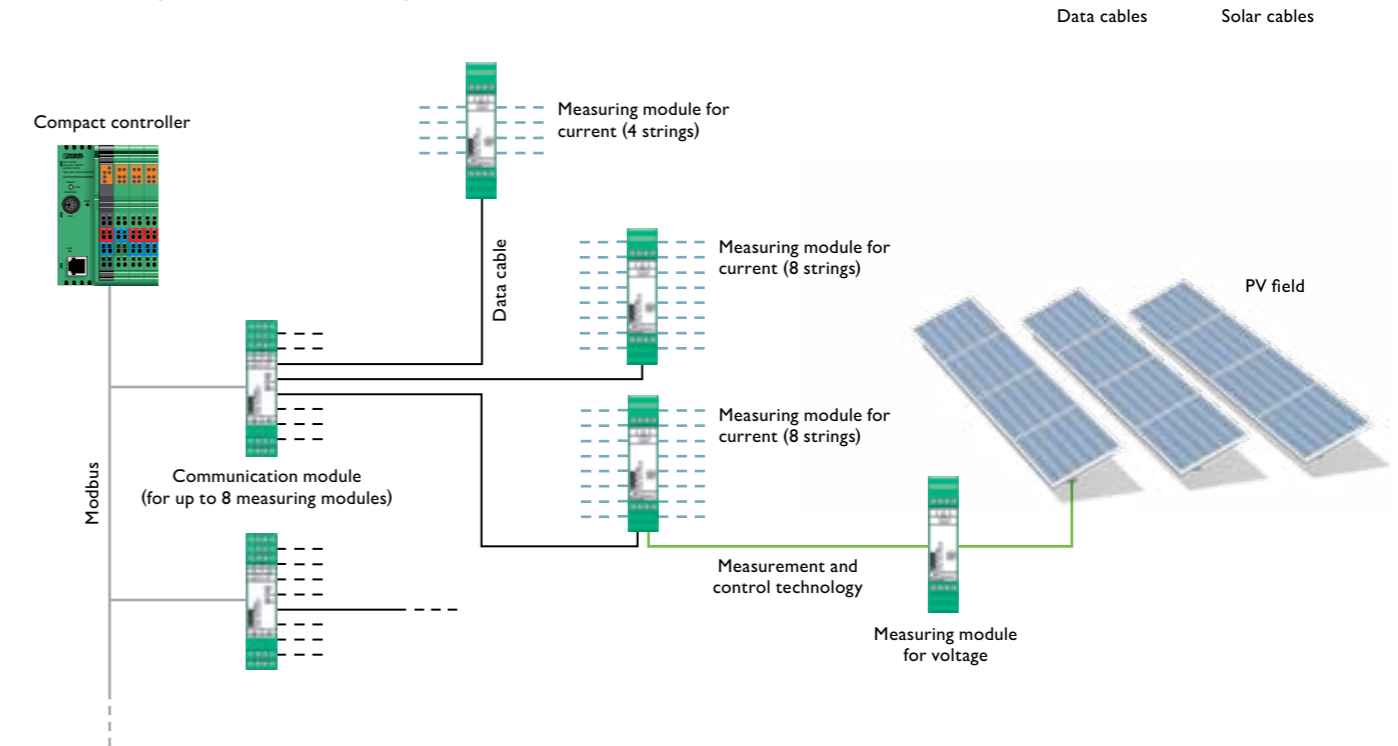
Your advantages

- Reduced costs and wiring effort
- A separate power supply unit in the field is not necessary
- Design flexibility for string boxes, thanks to 4 and 8-channel versions
- Space-saving installation, thanks to the compact design
- It is possible to monitor remote indication contacts
- Can be expanded with voltage measurement of up to 1500 V DC



The modular monitoring system consists of various measuring modules for current and voltage measurement and an associated communication module.

Monitoring photovoltaic strings



The measuring module can be used to measure up to eight direct currents and one DC voltage value at the same time. The complete system enables you to operate eight measuring modules on one communication module. The 2-wire communication cable is used to supply the measuring modules with power. This means that you can supply up to eight measuring modules without an additional power supply unit.

Detailed product information on string current monitoring systems can be found from page 48

Park management: sensor connection for extreme weather conditions

Outdoor PV cabling is constantly exposed to particular conditions: UV radiation, ozone pollution, extreme heat, extreme cold, and sudden changes in temperature. In addition, the cabling frequently needs to withstand vibrations, and shocks. For these extreme conditions, Phoenix Contact offers suitable plug-in connectors, cables, and distributor boxes.



Cables for outdoor applications

The halogen-free control cable is installed outdoors in direct sunlight. The insulation and sheath materials offer excellent resistance to weather, UV, and wear. Thanks to its outstanding resistance to oil, high degree of flexibility, and low smoke gas density, it is also suitable for automation technology, machine building and systems manufacturing – anywhere and everywhere plagued by particularly harsh ambient conditions.



Plug-in connectors for assembly

The plug-in connector knurls are made from stainless steel and the plastics are resistant to atmospheric influences. For reliable contacting, choose particularly fast insulation displacement or screw connections. Plug-in connections made of metal or plastic with corresponding outdoor properties facilitate the individual adaptation of cable lengths in the field at any point in time.



Assembled cables

In addition to 4, 5, and 8-pos. shielded and unshielded versions, PROFINET and Ethernet cables are available for data applications. The materials used in our products, such as cables with a cross-linked special polymer outer sheath and a special extrusion coating of polypropylene, guarantee a safe plug-in connection outdoors. In addition, all the metal parts are manufactured from V4A to withstand corrosive atmospheric influences.



Distributor boxes

Robust, fully molded sensor/actuator distributor boxes with 8 slots are available with fixed master cable or plug-in screw connection. The distributor boxes have corrosion-resistant metal knurls made from tin-plated zinc die casting and are produced from UV-resistant plastic.



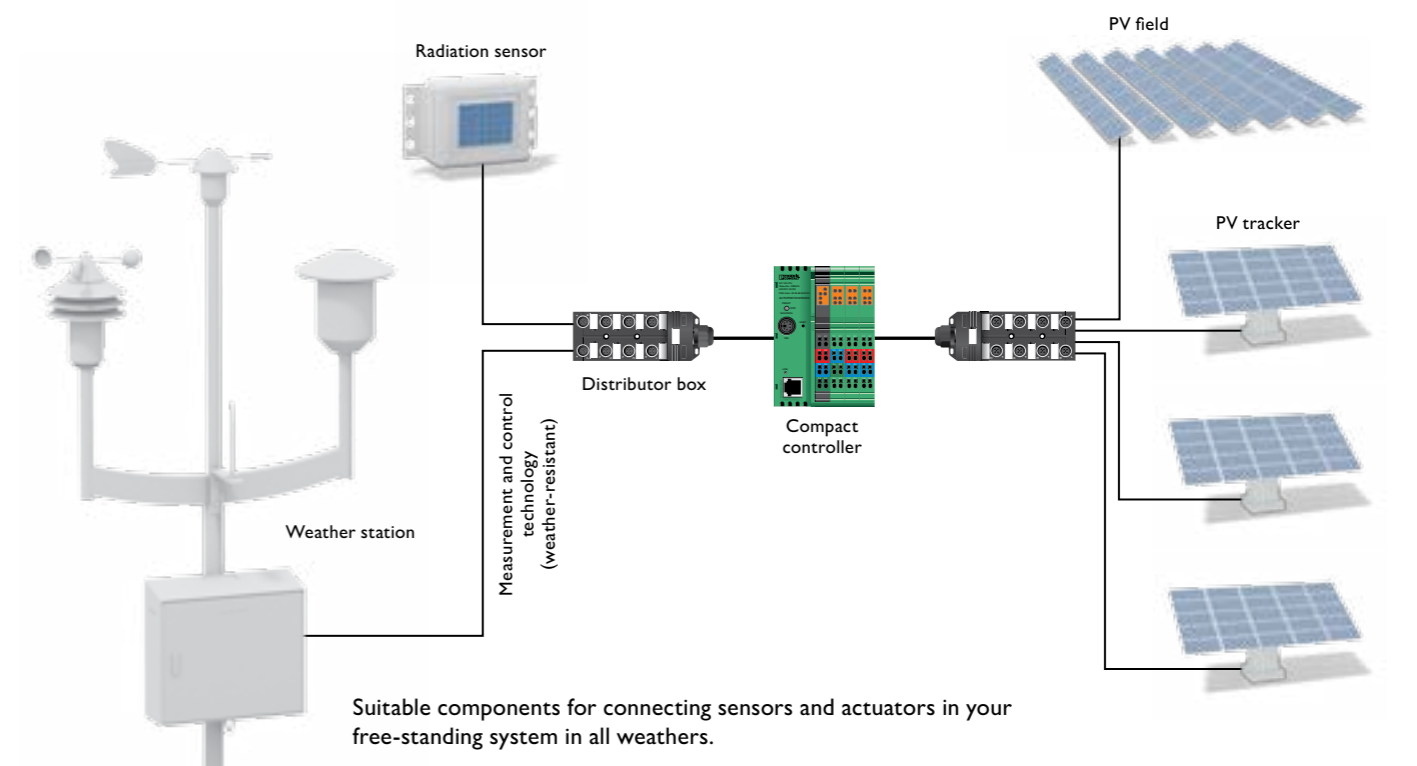
Extreme atmospheric influences – no problem for M12 cabling



The right materials for harsh conditions

Through the selection of special materials, the components are designed for use outdoors. They are resistant to UV, ozone, corrosion, and temperature. Intensive test methods such as air storage ensure that the plug-in connectors and cables are suitable for controlling solar plants in the long term without any restrictions.

M12 cabling for outdoor use



Suitable components for connecting sensors and actuators in your free-standing system in all weathers.

Detailed product information on sensor/actuator cabling can be found from page 50

Park management: networking

The network infrastructure components from Phoenix Contact allow you to safely and reliably network your free-standing PV system. Redundant fiber optic cables ensure permanent communication of the individual network devices.

It is also possible to perform maintenance operations on the free-standing system remotely via public networks while preventing unwelcome third party network access.



WLAN access point

With the industrial WLAN access point, Phoenix Contact offers a device for wireless communication according to the IEEE 802.11n WLAN standard. The integrated cluster management function enables your WLAN network to be easily and centrally configured and monitored.



Router with firewall

This router with integrated firewall encrypts all the data according to the secure standard IPsec. This facilitates the secure remote maintenance of free-standing systems via public networks. In addition, this router is alternatively available with a VPN tunnel.



Managed switches

Managed switches are the perfect solution for manageable Ethernet networks. They support non-proprietary redundant network structures using RSTP, as well as full network management using SNMP.



Ethernet port adapter

Ethernet port adapters facilitate the easy and cost-effective integration of automation devices and controllers with serial or Ethernet connection into a WLAN network, including under harsh conditions.



Network your free-standing system quickly and easily with components from Phoenix Contact and create redundant and firewall-protected networks.

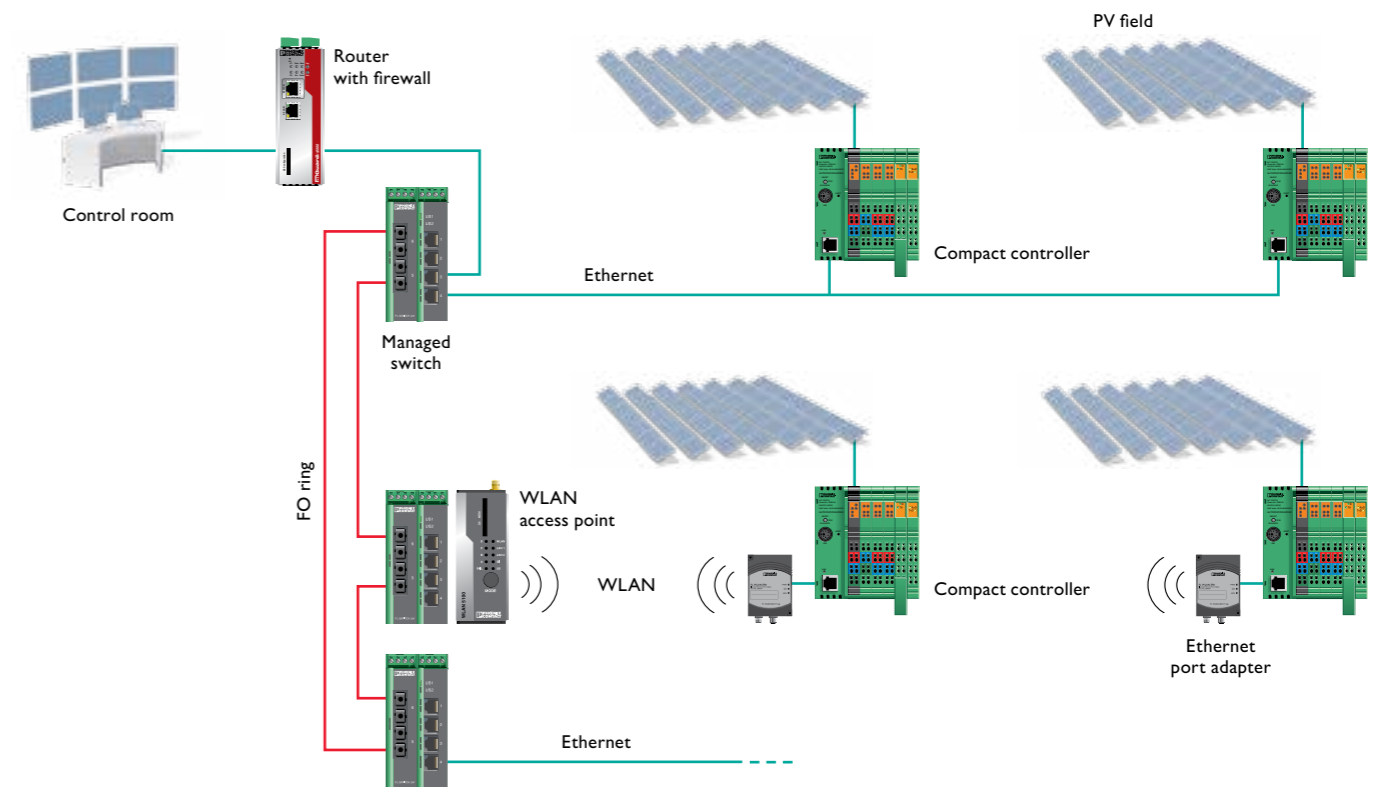
Your advantages

- Redundant and thus failsafe networks
- Wireless communication possible
- Comprehensive protection, thanks to firewalls
- Communication via standards such as TCP/IP
- Customer-specific network structures which can be expanded



Optimum connection technology for fiber optics

Networking a free-standing PV system



Scalable network infrastructure featuring a high degree of data security.

Detailed product information on network components can be found from page 52

Park management: acquiring and monitoring energy data

Continual control is the key to efficient PV park management. Phoenix Contact offers standard and customer-specific solutions for controlling, processing, and visualizing all aspects of photovoltaics. Innovative software products such as libraries for functional blocks according to IEC 61131 and drivers for data loggers and interfaces also facilitate adaptation to the increasingly important power supply rules.



Compact controllers

The class 100 controllers not only allow you to control the complete system, but also to implement continuous monitoring. They enable the integration of I/O signals from Modbus devices into the control program via Modbus/TCP. Additional controllers and systems can be connected via the Ethernet interface.



I/O systems

A wide range of I/O modules and various function terminals suitable for all applications are available. For example, you can acquire temperatures and positions with one module each, which can be flexibly mounted on the PLC.



Operator panels and observation devices

In conjunction with class 100 compact controllers, HMI devices from Phoenix Contact are the cost-effective option for basic operating and observation tasks in a free-standing system. Various web panels also facilitate the individual implementation of user interfaces for your park visualization.



Energy meters

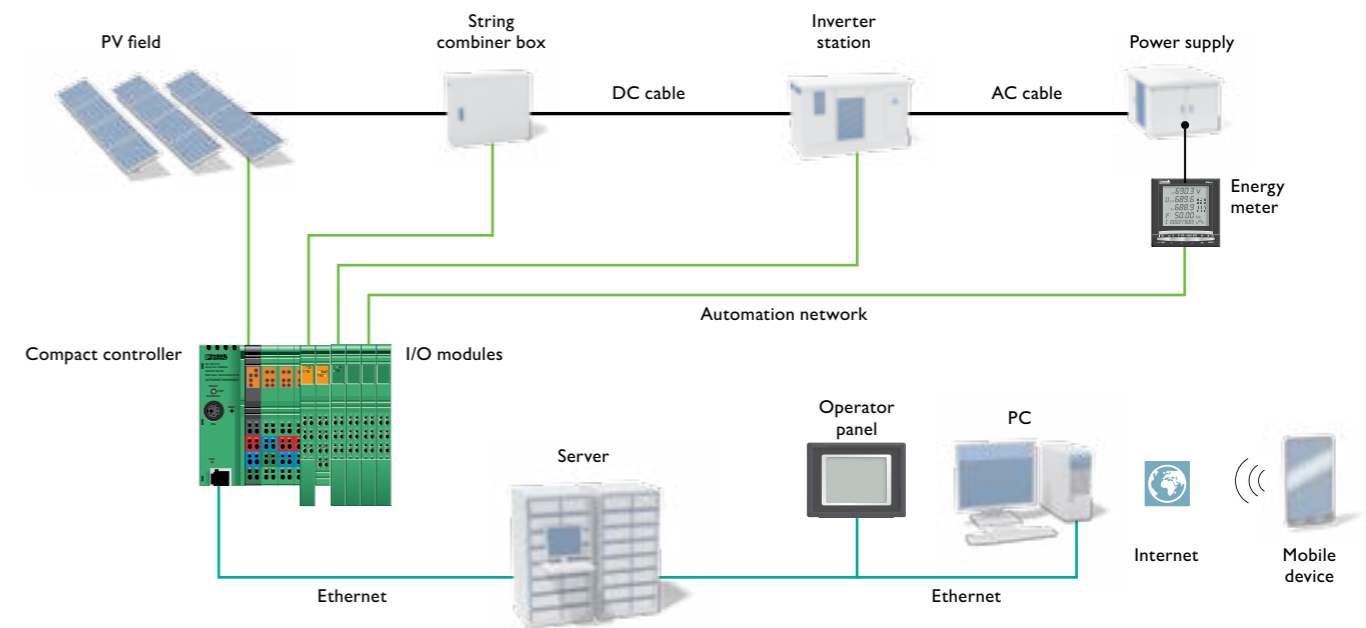
With the network-capable energy meters, you can monitor characteristic electrical data both centrally and on site. You can therefore gather all characteristic data relevant to production via a compact controller and log it in an SQL database.

Your advantages

- Enhanced efficiency of your PV system, thanks to monitoring and acquiring energy and performance data
- Highly flexible, thanks to modular expansions for the compact controllers and the wide range of functions of the I/O systems.
- Analog signal acquisition for ambient and module temperature as well as global radiation
- Serial protocols for communicating with inverters



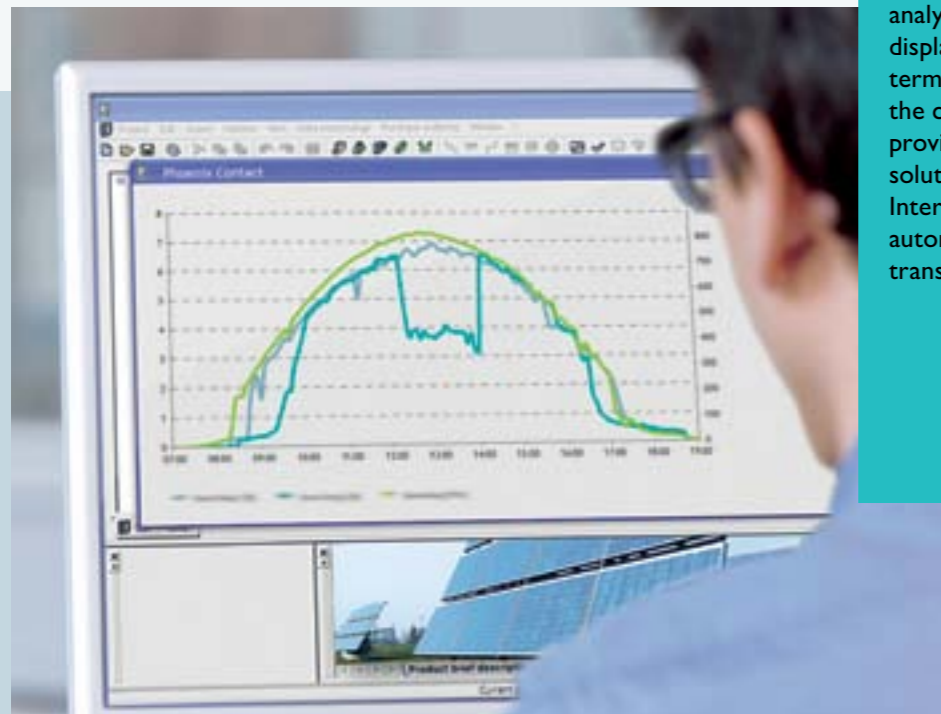
Monitoring and diagnostics for free-standing systems



Easy programming and control, thanks to standard functional blocks. The status and performance data can be requested via web panels or web browser.

Park management: automation and visualization

Use continuous production data acquisition and data management to enhance the efficiency and yield of your PV system. To this end, Phoenix Contact enables free-standing systems to be networked worldwide with automation and visualization tools. This enables you to acquire and evaluate data at all times. Redundant systems ensure the availability of the PV systems.



Automation and visualization solutions

In solar park management systems, data must be transmitted from local on-site stations to a central computer system, where it is saved, analyzed, and displayed. Do you want to display and edit this data at the distributed terminals that use web browsers as well as the control center? If so, Phoenix Contact provides the perfect solution. This system solution is achieved easily with the AXweb+ Internet application and PC WORX automation software. All data can be transmitted via Ethernet or GPRS/EDGE.



PLC programming

All Phoenix Contact controllers can be programmed consistently with PC WORX software. It combines programming according to IEC 61131, fieldbus configuration, and system diagnostics.

The free PC WORX EXPRESS software is suitable for cost-sensitive PV systems with straightforward requirements. It is reduced to the most important basic functions.



Web visualization

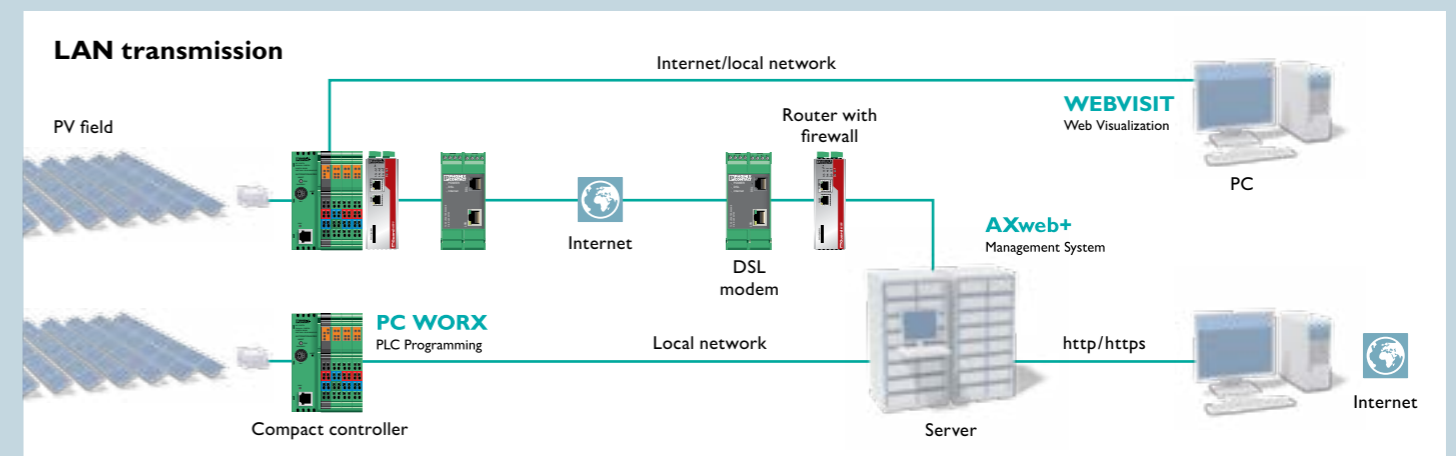
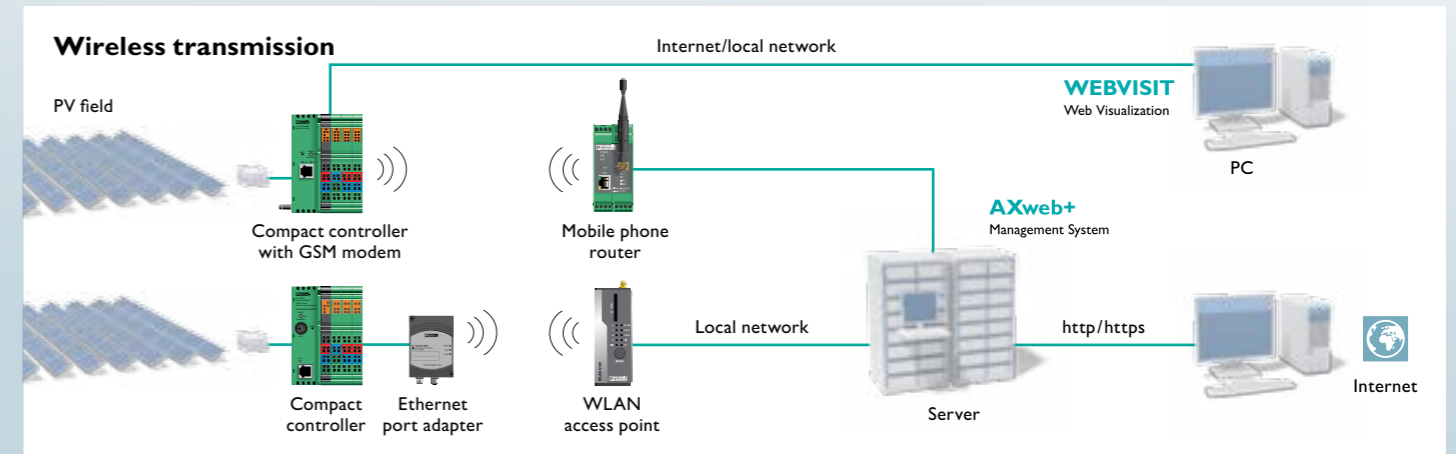
WebVisit enables you to easily create user interfaces for the visualization of a PV system. WebVisit facilitates quick and user-friendly representation of your control variables.

Monitor your PV system via a PC using a standard browser or via a web panel. Remote control is also possible with WebVisit.



Web-based management system

AXweb+ is a management system that depicts performance data of one or more PV systems. You retrieve data from the SQL server via freely configurable web pages: locally or via the Internet. The integrated assignment of permissions authorizes access to sensitive data.



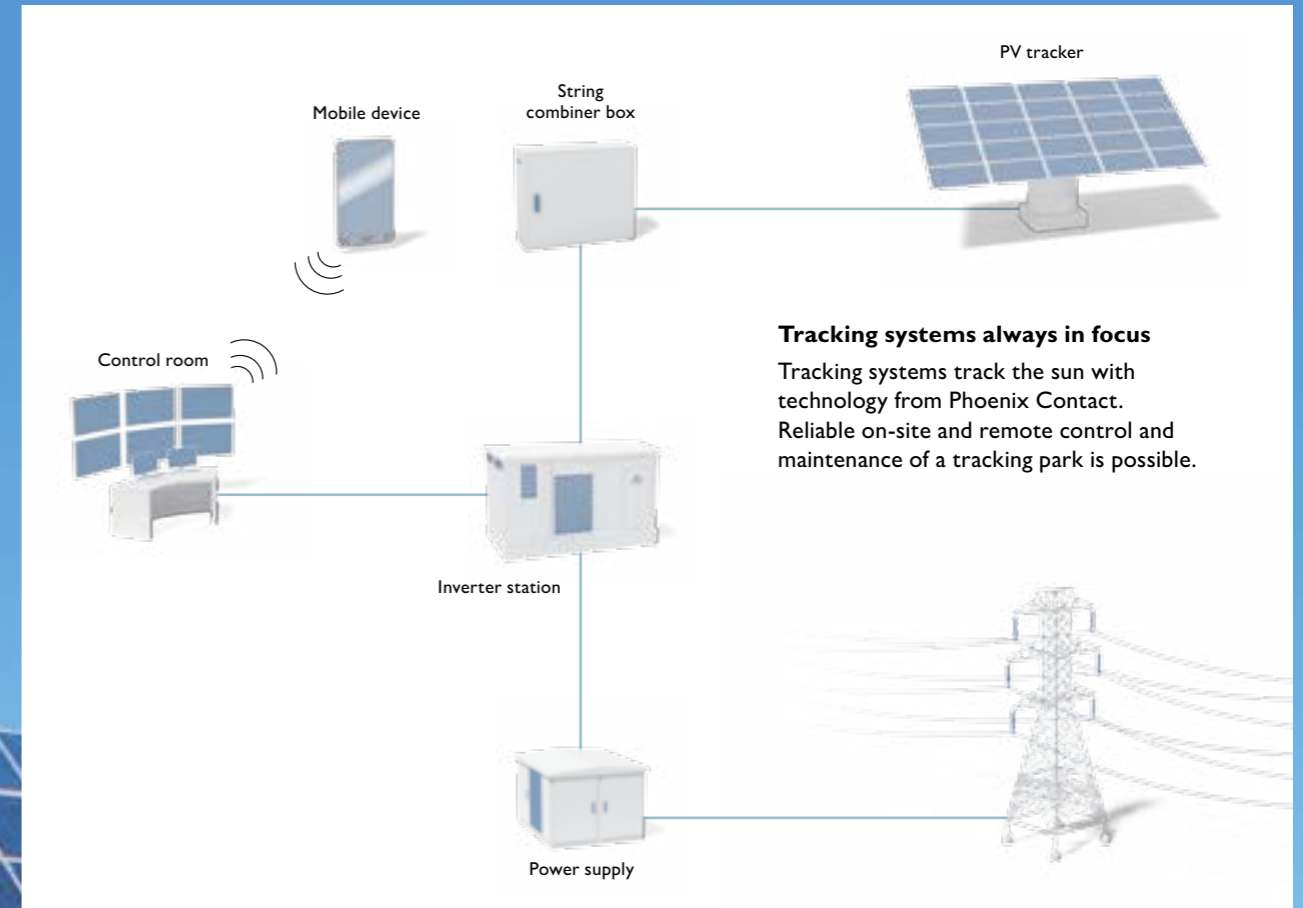
Detailed product information on software can be found on page 60

Solutions for tracking systems

Taking the sunflower as an example, photovoltaic tracking systems likewise track the course of the sun. In comparison with permanently installed PV systems, tracking systems therefore generate far higher yields.

With the compact hybrid motor starters from Phoenix Contact, you can switch and reverse tracking systems safely and reliably. In addition, Phoenix Contact offers a comprehensive range of automation components for controlling a tracking park.

“Tracking systems generate a large amount of energy in a small amount of space – with the right technology, they function even more efficiently”.



Tracking systems always in focus

Tracking systems track the sun with technology from Phoenix Contact. Reliable on-site and remote control and maintenance of a tracking park is possible.

Tracking systems: tracking

The yield from solar panels can be optimized with the help of a single or double-axis tracking system. Exact tracking aligns the solar cells to the sun so that sunlight falls perpendicular to the solar modules. This guarantees optimum energy generation.

Continually monitoring the system status is of major importance in this regard. With software and hardware from Phoenix Contact, you can implement an efficient and reliable monitoring system for your tracking park.



Compact controllers for drive control

Compact controllers with an integrated Modbus interface are ideal for controlling tracking systems. Step motor drivers and frequency inverters can be connected directly without any additional modules. Analog or incremental input channels are available for position detection.



Compact controllers with modem

Thanks to an integrated GSM/GPRS modem, these compact controllers are the perfect solution for remotely controlling and maintaining your PV tracking systems. The PLC acquires operating data and sends error messages and system information.



Hybrid motor starter

To track PV modules, the hybrid motor starter offers four functions: forward running, reverse running, motor protection, and emergency stop. This motor starter has significantly longer service life than mechanical contactors, saves space, and can be quickly wired.



Mobile phone router

The industrial 3G mobile phone router enables you to access your systems worldwide via high-speed connections. The router supports UMTS/HSPA in the 3G network and features GPRS/EDGE fallback. Firewall and VPN provide reliable protection for your tracking system.



Switch and reverse motors quickly and reliably with compact hybrid motor starters.

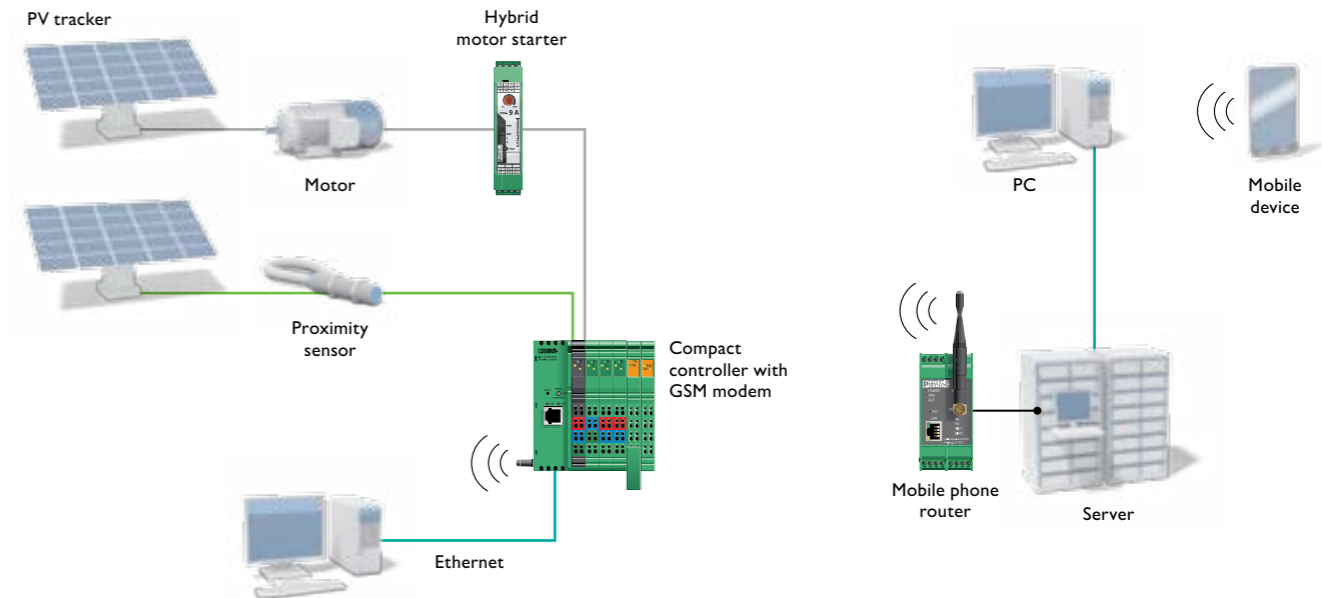
Your advantages

- Fast startup - via a web browser and functional block libraries
- Remote access to your tracking park via Ethernet or a mobile phone network
- Ideal motor-driven alignment of your PV modules by means of solar altitude calculations



Reliable technology from Phoenix Contact: ideal for durable application in tracking systems.

Control and regulate tracking systems efficiently



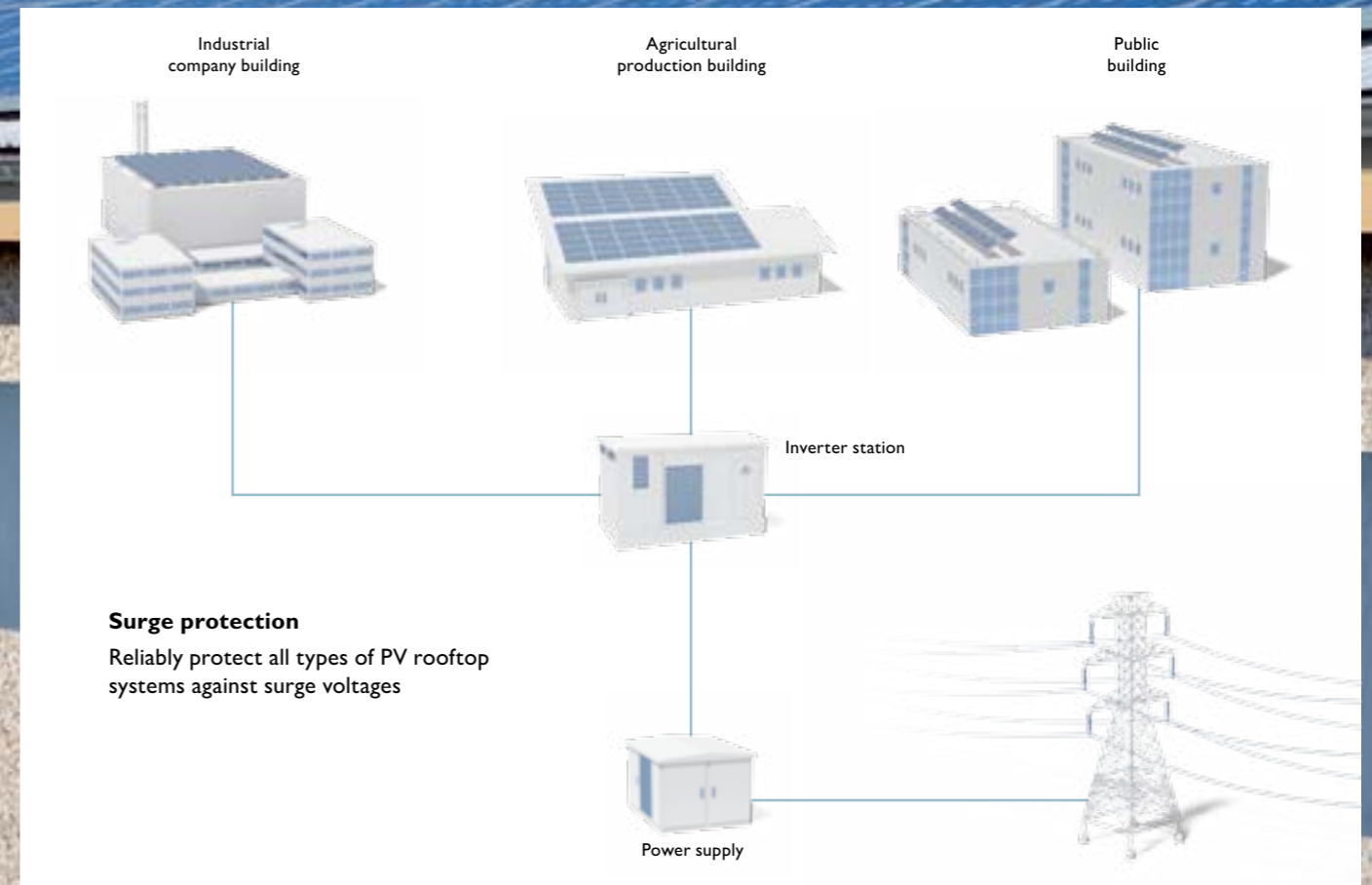
Increase the yield from your PV system by systematically tracking PV modules.

Detailed product information on hybrid motor starters can be found on page 60

Solutions for rooftop systems

Large, slightly slanted roof surface areas provide ideal conditions for the profitable deployment of photovoltaics. As a result of declining module prices and increasing energy costs, PV systems on private, commercial, and public buildings are becoming increasingly attractive, even without state subsidies. For the purpose of providing comprehensive and permanent protection against all manner of lightning currents and surge voltages, Phoenix Contact offers a wide range of surge protection products.

“PV rooftop systems use available spaces – why shouldn't the technology for these systems be equally as space saving?”



PV rooftop systems: surge protection

It is not always a direct lightning strike in the PV module that causes surge voltage damage. Surge voltages can also be coupled over module surfaces and DC voltage cables. With PV sets, Phoenix Contact offers reliable system solutions that protect the inverter directly before the DC and AC voltage inputs. The surge couplings are thereby diverted straight to the ground potential, protecting the inverters and other sensitive devices against surge voltage.



DC type 1/2 lightning/surge protection

The PV-SET 1000 DC protects the single-phase inverter in your single-string system on the DC voltage side. One or two PV sets are necessary, depending on cable lengths.



DC lightning/surge protection for type 1/2 multi-string systems

With the PV sets for multi-string PV systems, each individual MPP tracker of an inverter is protected against surge voltage damage. Versions are available for inverters with two or three MPP trackers.



Surge protection Type 2 DC/AC

Inverters should be protected against surge voltages on both the DC and AC voltage side. The PV-SET 1000 DC/AC combines both DC and AC side inverter protection.



DC surge protection for 5 type 2 strings

The prewired PV-SET 5ST/600 DC accommodates up to five PV strings with a string voltage of 600 V DC. A generator disconnect provides additional safety.



Protect your PV rooftop systems against surge voltages triggered by lightning strikes

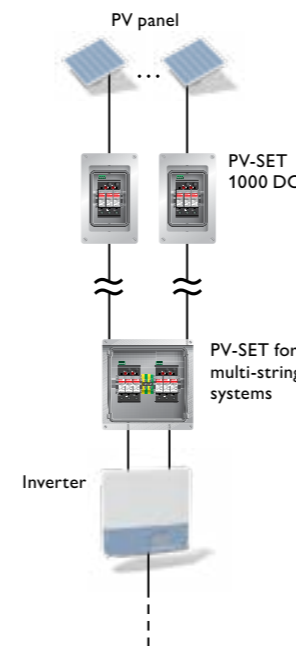
Your advantages

- Robust and durable components: all sets are installed in housing which is protected against dust and jet water (IP65)
- Fast installation, thanks to the pre-assembly of the PV sets
- Easy connection with the PV plug-in connector system
- Customer-specific PV set solutions on request



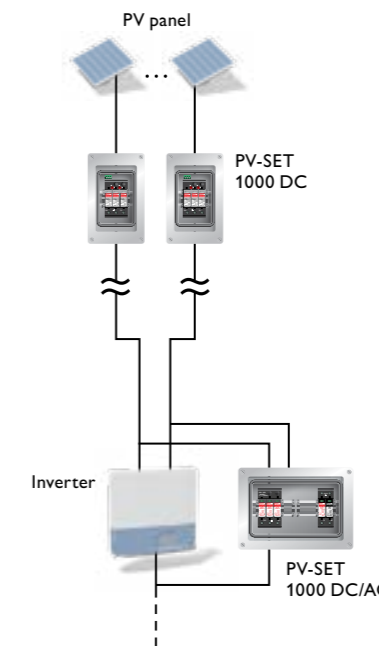
Compact and fully pre-assembled: reliable surge protection for your PV system

Multi-string system



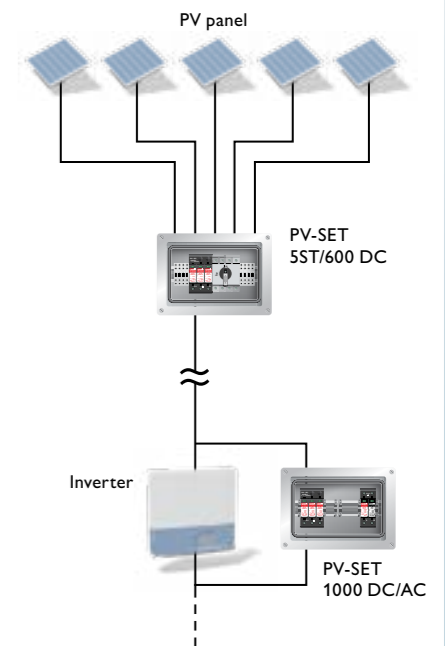
Surge protection for 1 to 4 strings. Alternatively available with protection for inverters with up to 3 MPP trackers.

Combined DC/AC protection



Combined DC/AC protection for inverters.

5-string system



Surge protection for 5 strings. Alternatively available with combined AC/DC protection.

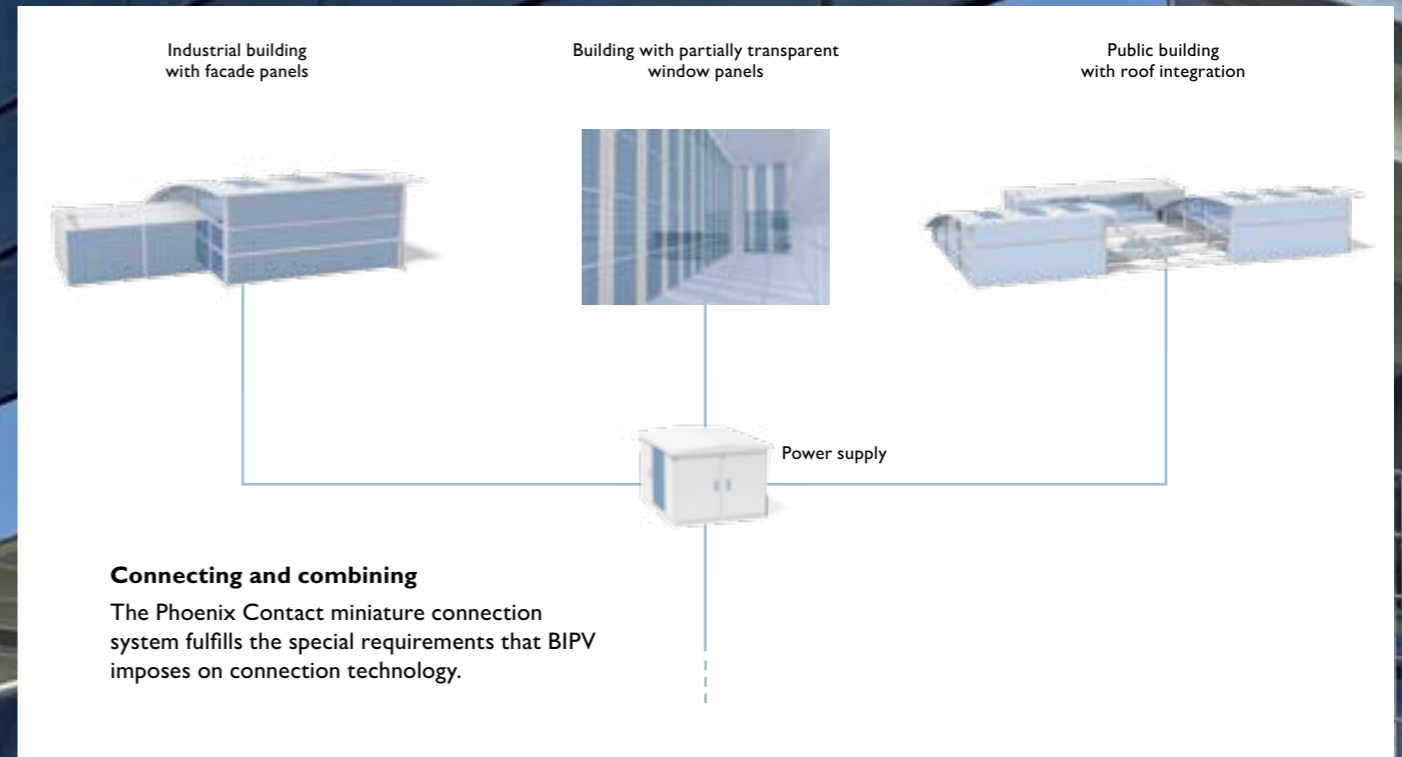
If the cables between solar panel and inverter are longer than 10 m, a PV set should be installed directly at the solar panel.

Detailed product information on surge protection sets can be found on page 61

Solutions for building integration

An increasing number of building contractors, architects, engineers, and specialist planners are opting for building-integrated photovoltaics (BIPV). It is the combination of aesthetics, CO²-free power generation, and weather protection that renders solar modules on facades and roofs such an attractive proposition. They also enable the available space on the building to be used more efficiently.

“Set not only power supply but also building design trends.”



Building integration: connecting and combining

Absorb solar energy not only from the roof of a building, but from its entire surface. Phoenix Contact has developed a new DC connection system in miniature format for this trend in energy generation using photovoltaics. This allows you to efficiently use the facade of a building to generate energy. The prevailing, usually tight, spaces impose special connection technology requirements for building-integrated PV modules. The Phoenix Contact miniature connection system meets these requirements perfectly.



The miniature DC plug-in connectors have a diameter of just 11 mm and can be connected without a special tool

Your advantages:

- Ultra-narrow design – just 11 mm in diameter
- Suitable for conductor cross sections of 2.5 mm²
- Fast connection, thanks to pierce connection technology
- Designed for currents up to 15 A and voltages up to 1000 V
- Meet the requirements of IP68 protection
- VDE-certified

Module junction box: quick and easy mounting



1. Position the module junction box above the ribbon.

2. Remove the adhesive strip and position the module junction boxes on the edge of the glass.

3. Insert the ribbon in the spring case, snap in the spring, and close the connection area with the cover.

4. Fill each of the module junction boxes in turn with sealant using the special opening.



Single-position module junction boxes

One module junction box is used per position. Both module junction boxes are integrated into the facade module and subsequently potted. Their adaptable width enables module junction boxes to be integrated very easily.



Miniature DC plug-in connectors for assembly

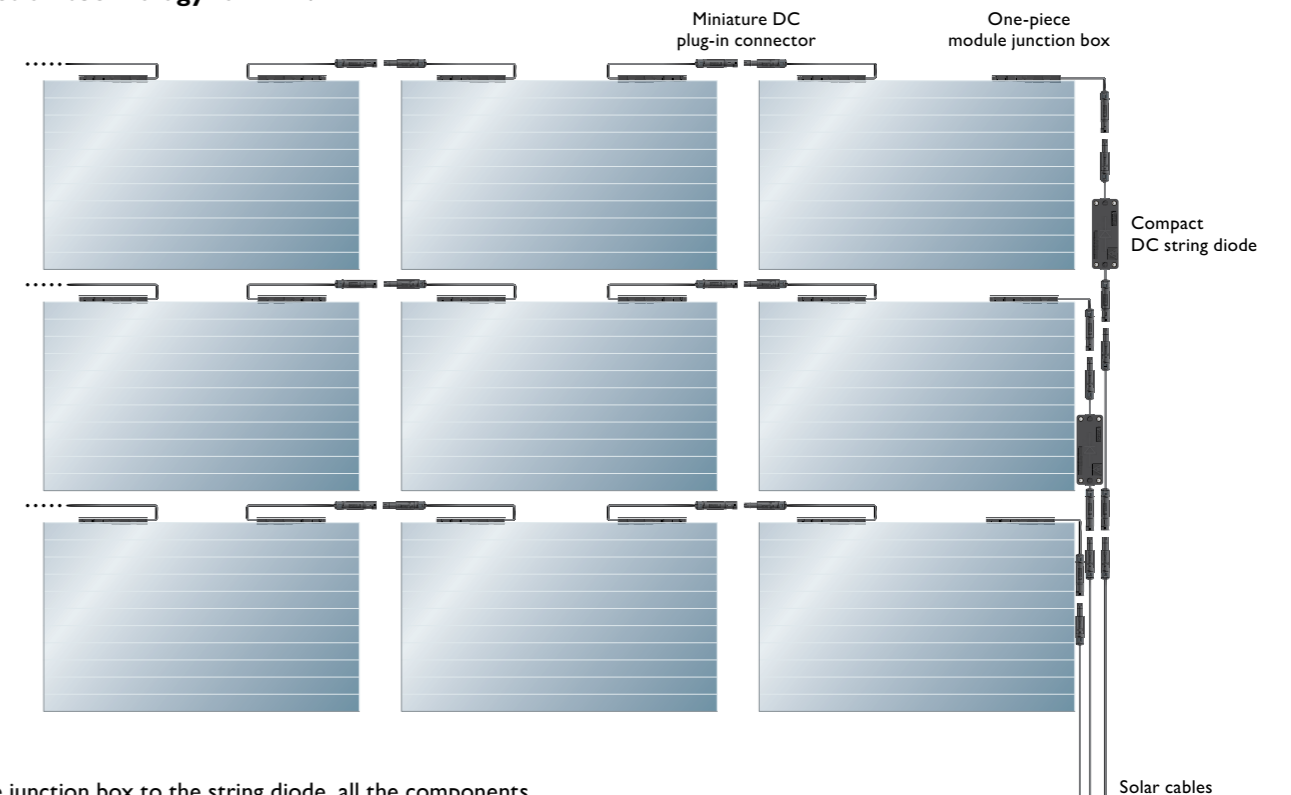
The compact design of the plug-in connectors enables concealed installation behind the PV modules or direct installation within the facade profile. Assembly is quick and easy and requires no additional special tools.



Compact DC string diodes

Return currents can occur in PV modules as a result of shading. The stable housing and flat design of the DC string diode ensure the safe flow of current between the facade modules. It protects the modules against reverse currents of up to 5 A at 1000 V according to IEC. The maximum reverse voltage is 2200 V.

Connection technology for BIPV



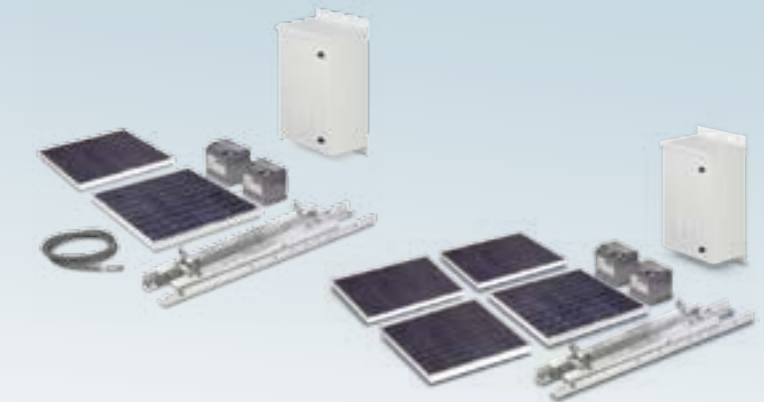
From the junction box to the string diode, all the components are hidden from view in the building facade.

Detailed product information on BIPV connection technology can be found on page 62

Solutions for autonomous power supply

Phoenix Contact solar systems supply your external stations independently of the power grid – even on short, dark winter days. The systems are ideal for supplying weather stations or parking meters with power. Combined with wireless technology, they open up new possibilities for covering remote and poorly accessible system parts.

“Autonomous power supply is opening up new possibilities for your distributed automation solutions.”



Solar systems

Complete solar systems with 100 and 200 Wp are available for worldwide operation. When exposed to sunlight, the battery is charged via the solar panel and charge controller. The charge controller is responsible for battery charge management and protects the battery against total discharge. Connected loads – such as wireless modules – are supplied with the relevant system voltage from the solar system.

Your advantages:

- Ideal for all distributed applications with low energy consumption
- Easy startup: the control cabinet is prewired
- Worldwide use, thanks to the universal module mounting bracket with a tilt angle that can be adjusted in increments

Autonomous power supply in the field



Possible areas of application:

- **Water and waste management**
 - Monitoring drinking water pipes for leaks
 - Level monitoring for rainwater reservoirs
 - Level measurement for rivers and reservoirs
- **Supply systems**
 - Oil and gas pipeline monitoring
 - Level monitoring for tanks
 - Repeater applications, e.g., bypassing obstacles and covering long distances
 - Monitoring weather data
 - Supplying power for communications technology

Detailed product information on autonomous power supply can be found on page 63

Accessories

Phoenix Contact offers you a wide range of products for all your PV system operations: e.g., marking systems and materials enabling your PV system wiring to be marked transparently and efficiently. In addition, high-quality and sophisticated tools are available for fast and safe installation.



Crimping tool



Cutting tool



Stripping tool



Solar tool kit

The right tool for the installation of PV systems

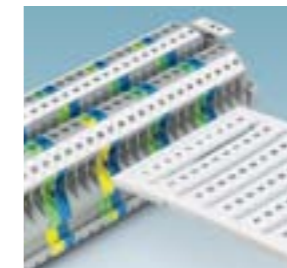
Cutting, stripping, crimping, and screwing – Phoenix Contact offers a high-quality hand tool for every application.

Avoid unnecessary searching by storing your tools in a clear way: with the Solar toolset, the right tools are clearly arranged and always to hand, particularly for on-site operations.

Easy and professional marking

Ensure fast startups and short downtimes in the event of maintenance operations by clearly and permanently marking all the elements of your electrical photovoltaic installation.

Phoenix Contact offers a tailor-made marking system: mark terminal blocks, cables, devices, and equipment with weather and UV-resistant marking materials.



Terminal marking



Cable and conductor marking



Device marking

Thermal transfer printer for material off the roll



Thermal transfer printer for cards



Service and support

Our specialists are always on hand to help you plan, configure, and implement your photovoltaic solution. Invariably boasting vast technical expertise, they bear in mind your specific requirements.

Together with our specialists, you will always find the ideal solution to meet your requirements.



Engineering

Do you need a customized solution? We can offer you the necessary technological expertise, combined with vast experience in many industries. Our expert project management team will guide you through all the important phases of your project. Together with you, we will arrange the necessary services and handle the subtasks during the implementation phase.

We provide support for the following:

- PROFINET
- Industrial Ethernet
- Ethernet security
- Wireless LAN
- Bluetooth
- PLC programming, PC WORX
- SQL database communication
- Web visualization with WEBVISIT

Service

Our service teams stand out thanks to their focused expertise, years of practical experience, and maximum degree of flexibility. Our service network is on hand to assist you during installation, startup, and operation, even in the most remote corners of the world.

To learn more about our training courses and workshops and for direct assistance with your photovoltaic-specific issues, please feel free to approach your local contact person.

Training and workshops

Thanks to intensive contact with our customers and years of on-site experience, we have developed a qualification concept whereby we can specify employee qualifications so as to meet your individual requirements. We will offer you the appropriate service depending on the project phase, target group, and prior knowledge.

We offer seminars and workshops on various topics:


- Energy data acquisition
- Ethernet networks
- Remote access to machines and systems
- Fiber optic cabling
- PROFINET
- Controllers
- Surge protection
- Wireless data communication

Your personal contact person will provide telephone support and, in the event of a malfunction, organize immediate delivery of replacement parts or on-site service.

Selection tables and technical data

DC connection technology for devices

SUNCLIX DC device plug-in connectors			
With 130 mm litz wire; other lengths are available on request			
			
Type	Order No.	Pin(-) Socket (+)	Pin(-) Socket (+)
		1805148 1805135	1805164 1805151
Cross section		2.5 mm ²	4 mm ²
Rated voltage		1500 V	1500 V
Nominal current		Maximum 27.5 A	Maximum 40 A
Degree of protection		IP65/IP66/IP68 (24 h/2 m)	IP65/IP66/ IP68 (24 h/2 m)
Properties	Temperature range: -40°C to +85°C, VDE-certified according to DIN EN 50521		

SUNCLIX DC device plug-in connectors			
For user assembly			
			
Description	Plastic housing	Contacts for crimp connection, 1500 V/2.5 – 4 mm ²	Contacts for crimp connection, 1500 V/6 mm ²
Type	Order No.	Pin (-) Socket (+)	Pin (-) Socket (+)
		1704925 1704926	1704927 1704930
Cross section		–	2.5 – 4 mm ²
Rated voltage		–	1500 V
Nominal current		–	Maximum 40 A
Properties	Temperature range: -40°C to +85°C, VDE-certification according to DIN EN 50521 in progress		

Accessories			
			
Type	Order No.	Fastening nut	1775880








DC connection technology for PV modules and field cabling

SUNCLIX DC plug-in connectors			
Can be assembled			
			
Type	Order No.	Pin (-) Socket (+)	Pin (-) Socket (+)
		1774687 1774674	1789834 1789821
Cross section		2.5 – 6 mm ²	6 – 16 mm ²
Rated voltage		1100 V	1500 V
Nominal current		Maximum 40 A	Maximum 65 A
Degree of protection		IP66/IP68 (24 h/2 m)	IP66/IP68 (24 h/2 m)
Ambient temperature (operation)		-40°C to +85°C	-40°C to +85°C
Properties	VDE-certified according to DIN EN 50521, class II protection		

SUNCLIX DC accessories																							
																							
Description	Y-distributor Connection set with branch line for fast parallel interconnection of photovoltaic modules. Cable length: 120 mm	DC test plug Test plug with tool-free release for test applications with high insertion/withdrawal cycles Cable length: 1500 mm	Solar cable Tin-plated single litz wires, suitable for permanent and flexible installation; insulating and sheath material offers excellent resistance to weather, UV, and wear; TÜV and VDE-certified PV1-F cable																				
			<table border="1"> <thead> <tr> <th>Cross section</th> <th>100 m ring</th> <th>500 m drum</th> <th>1000 m drum</th> </tr> </thead> <tbody> <tr> <td>2.5 mm²</td> <td>1459509</td> <td>1459540</td> <td>1459566</td> </tr> <tr> <td>4 mm²</td> <td>1459511</td> <td>1787700</td> <td>1459579</td> </tr> <tr> <td>6 mm²</td> <td>1459524</td> <td>1787713</td> <td>1459582</td> </tr> <tr> <td>10 mm²</td> <td>1459537</td> <td>1459553</td> <td>1459595</td> </tr> </tbody> </table>	Cross section	100 m ring	500 m drum	1000 m drum	2.5 mm ²	1459509	1459540	1459566	4 mm ²	1459511	1787700	1459579	6 mm ²	1459524	1787713	1459582	10 mm ²	1459537	1459553	1459595
Cross section	100 m ring	500 m drum	1000 m drum																				
2.5 mm ²	1459509	1459540	1459566																				
4 mm ²	1459511	1787700	1459579																				
6 mm ²	1459524	1787713	1459582																				
10 mm ²	1459537	1459553	1459595																				
Type	Order No.	Pin (-) Socket (+)																					
		1795019 1795022 1787726 1787739	1780464 1780451																				
Cross section		4 – 6 mm ²	10 mm ²																				
Rated voltage		1100 V	1100 V																				
Nominal current		Maximum 40 A	Maximum 40 A																				
Degree of protection		IP66/IP68 (24 h/2 m)	IP20																				
Ambient temperature (operation)		-40°C to +85°C	-20°C to +55°C																				

Accessories			
			
Type	Order No.	Protective cap	1785430
		Filler plug	1775631

Terminal blocks – fuses – accessories

Type	Order No.	Type/blue	Order No.	Conductor connection [mm ² /AWG]	Voltage [V]	Current [A]	Cover	Jumpers 2-pos.	3-pos.	4-pos.	5-pos.	10-pos.	Marking center groove	Lateral and center groove				
Push-in connection terminal blocks																		
Feed-through terminal blocks with two connections																		
	PT 6	3211813	PT 6 BU	3211819	0.5 - 10/20 - 8	1000/600	41	3212011	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	PT 10	3212120	PT 10 BU	3212123	0.5 - 16/20 - 6	1000/600	57	3212047	3005947	3030297	3030307	3030310	3030323	0829142	0829204			
	PT 16 N	3212138	PT 16 N BU	3212142	0.5 - 25/20 - 4	1000/-	76	3212060	3005950	3030886	-	-	-	0829144	0829214			
	PTPOWER 95	3260100	PTPOWER 95 BU	3260103	25 - 95/4 - 3/0	1500/-	232	-	3260157	3260160	-	-	-	0829146	-			
Modular terminal blocks (feed-through terminal blocks) with three connections																		
	PT 6-TWIN	3211929	PT 6-TWIN BU	3211985	0.5 - 10/20 - 8	1000/600	41	3211508	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	PT 10-TWIN	3208746	PT 10-TWIN BU	3208747	0.5 - 16/20 - 6	1000/600	57	3208748	3005947	3030297	3030307	3030310	3030323	0829142	0829204			
	PT 16 TWIN N	3208760	PT 16 TWIN BU	3208773	0.5 - 25/20 - 4	1000/-	76	-	3005950	3030886	-	-	-	0829144	0829214			
Modular terminal blocks (feed-through terminal blocks) with four connections																		
	PT 6-QUATTRO	3212934	PT 6-QUATTRO BU	3212937	0.5 - 10/20 - 8	1000/600	41	3212963	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
Disconnect terminal block																		
	PTME 6 HV	3035696	PTME 6 HV BU	3035695	0.5 - 10/20 - 8	1000/-	30	3034426	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
Diode terminal block																		
	PTME 6-DIO/L-R HV	3035697	-	-	0.5 - 10/20 - 8	1000*/-	5	3034426	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	PTME 6-DIO/R-L HV	3035698	-	-	0.5 - 10/20 - 8	1000*/-	5	3034426	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	DP-STMED6	3036590	A spacer plate of similar shape ensures sufficient spacing between two neighboring diode terminal blocks															
Spring-cage connection terminal blocks																		
Feed-through terminal blocks with two connections																		
	ST 6	3031487	ST 6 BU	3031490	0.2 - 10/24 - 8	1000/600	52	3030433	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	ST 10	3036110	ST 10 BU	3036123	0.2 - 16/24 - 6	1000/600	65	3036644	3005947	-	-	-	-	0829142	0829204			
	ST 16	3036149	ST 16 BU	3036149	0.2 - 25/24 - 4	1000/600	90	3036657	3005950	-	-	-	-	0829144	0829214			
	ST 35	3036178	ST 35 BU	3036181	2.5 - 35/14 - 2	1000/600	125	-	3005963	-	-	-	-	0829146	0829218			
Modular terminal blocks (feed-through terminal blocks) with three connections																		
	ST 6-TWIN	3036466	ST 6-TWIN BU	3036479	0.2 - 10/24 - 8	1000/600	52	3036767	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
	ST 10-TWIN	3035288	ST 10-TWIN BU	3035292	0.2 - 16/24 - 6	1000/600	70	3035288	3005947	-	-	-	-	0829142	0829204			
	ST 16-TWIN	3035328	ST 16-TWIN BU	3035331	0.2 - 25/24 - 4	1000/600	90	3035357	3005950	-	-	-	-	0829144	0829214			
Potential terminal blocks with one screw connection and four spring-cage connections																		
	STU 35/ 4X10	3033126	STU 35/ 4X10 BU	3033210	1 x 0.2 - 50/24 - 1/0 4 x 0.2 - 10/24 - 8	1000/600	125	-	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
Disconnect terminal block																		
	STME 6 HV	3035693	STME 6 HV BU	3035694	0.2 - 10/24 - 8	1000/-	30	3034426	3030284	3030297	3030307	3030310	3030323	0828740	0828748			
Diode terminal block																		
	STME 6-DIO/L-R HV	3035691	-	-	0.2 - 10/24 - 8	1000*/-	5	3034426	3030284	3030297	3030307	3030310	3030323	0828740	828748			
	STME 6-DIO/R-L HV	3035692	-	-	0.2 - 10/24 - 8	1000*/-	5	3034426	3030284	3030297	3030307	3030310	3030323	0828740	828748			
	DP-STMED6	3035690	A spacer plate of similar shape ensures sufficient spacing between two neighboring diode terminal blocks															
Screw connection terminal blocks																		
Feed-through terminal blocks with two connections																		
	UT 2.5	3044076	UT 2.5 BU	3044089	0.14 - 4/26 - 12	1000/600	32	3047028	3030161	3030174	3030187	3030190	3030213	-	0828734			
	UT 4	3044102	UT 4 BU	3044115	0.14 - 6/26 - 10	1000/600	41	3047028	3030336	3030242	3030255	3030349	3030271	-	0828736			
	UT 6	3044131	UT 6 BU	3044144	0.2 - 10/24 - 8	1000/600	57	3047028	3030284	3030297	3030307	3030310	3030323	-	0828740			
	UT 10	3044160	UT 10 BU	3044188	0.5 - 16/20 - 6	1000/600	76	3047028	3005947	-	-	-	-	-	0829142			
	UT 16	3044199	UT 16 BU	3044209	1.5 - 25/16 - 4	1000/600	101	3047026	3005950	-	-	-	-	-	0829144			
	UT 35	3044225	UT 35 BU	3044238	1.5 - 50/16 - 1/0	1000/600	150	-	3005963	-	-	-	-	-	0829146			
	UKH 50	3009118	UKH 50 BU	3009105	16 - 70/6 - 2/0	1000/600	150	-	0201346	0201317	-	-	-	-	0829142			
	UKH 70	3213140	UKH 70 BU	3244601	16-95/4-3/0	1000/1000	192	-	3213195	3213205	-	-	-	-	0829142			
	UKH 95	3010013	UKH 95 BU	3010136	25 - 95/4 - 3/0	1000/600	232	-	0201362	0201375	-	-	-	-	0829142			
	UKH 150	3010110	UKH 150 BU	3010123	35 - 150/2 - 300	1000/600	309	-	0201388	0201391	-	-	-	-	0829142			
	UKH 240	3010217	UKH 240 BU	0711852	70 - 240/2/0 - 500	1000/600	415	-	0201401	0201414	-	-	-	-	0829142			
	UHSK/S 2000	0704076	-	-	0.5 - 10/20 - 8	2000/1000	41	0704021	-	-	-	-	203276	-	0829142			
Disconnect terminal block																		
	UT 6-T-HV	3070134	-	-	0.2 - 10/24 - 8	1000/-	57	3070147	3030284	3030297	3030307	3030310	3030323	-	0828740			
	UT 6-T-HV P/P	3070121	-	-	0.2 - 10/24 - 8	1000/-	57	3070147	3030284	3030297	3030307	3030310	3030323	-	0828740			
Fuse terminal blocks																		
	UK 10,3-HESI 1000 V	3211236	-	-	1.5 - 25/16 - 4	1000/600		Fuse insert 2 A	3061295	3061305	3061318	3061321	3061334	3061347	3061350	3061363	3009299	0829204
	UK 10,3-HESI 1500 V	3062760	-	-	1.5 - 25/16 - 4	1500/-		4 A	3062766	3062767	3062768	3062769	3062770	3062771	3062772	3062773	3062775	-
								6 A										
								8 A										
								10 A										
								12 A										
								16 A										
								20 A										
								Jumpers 56-pos.										
								Marking center groove										

* 1000 V reverse voltage

Surge protection for DC and AC voltages

Surge protection for the DC side up to 1000 V DC					
Standards/regulations: DIN EN 61643-11, IEC 61643-1, IEC 60364-7-712, EN 50539-11, UL 1449, 3 rd edition, and KEMA-KEUR					
Type	Order No.	VAL-MS-T1/T2 1000DC-PV/2+V-FM 2801161	VAL-MS-T1/T2 1000DC-PV/2+V 2801160	VAL-MS-T1/T2 600DC-PV/2+V-FM 2801164	VAL-MS-T1/T2 600DC-PV/2+V 2801163
Number of positions		3	3	3	3
Status message		Optical, remote indication contact	Optical	Optical, remote indication contact	Optical
Maximum continuous voltage U_{CPV}		1050 V DC	1050 V DC	720 V DC	720 V DC
I_{SCPV} short circuit stability		300 A	300 A	300 A	300 A
Protection level U_p (L+) - (L-)		≤ 3.5 kV	≤ 3.5 kV	≤ 2.6 kV	≤ 2.6 kV
Protection level U_p (L+/L-) - PE		≤ 3.5 kV	≤ 3.5 kV	≤ 2.6 kV	≤ 2.6 kV
Residual voltage (L+) - (L-)		≤ 2.9 kV (at 5 kA)	≤ 2.9 kV (at 5 kA)	≤ 2 kV (at 5 kA)	≤ 2 kV (at 5 kA)
Residual voltage (L+/L-) - PE		≤ 2.9 kV (at 5 kA)	≤ 2.9 kV (at 5 kA)	≤ 2 kV (at 5 kA)	≤ 2 kV (at 5 kA)

Surge protection for the DC side up to 1000 V DC					
Standards/regulations: DIN EN 61643-11, IEC 61643-1, IEC 60364-7-712, EN 50539-11, UL 1449, 3 rd edition, and KEMA-KEUR					
Type	Order No.	VAL-MS 1000DC-PV/2+V-FM 2800627	VAL-MS 1000DC-PV/2+V 2800628	VAL-MS 600DC-PV/2+V-FM 2800641	VAL-MS 600DC-PV/2+V 2800642
Number of positions		3	3	3	3
Status message		Optical, remote indication contact	Optical	Optical, remote indication contact	Optical
Maximum continuous voltage U_{CPV}		1170 V DC	1170 V DC	800 V DC	800 V DC
I_{SCPV} short circuit stability		300 A	300 A	300 A	300 A
Protection level U_p (L+) - (L-)		≤ 3.7 kV	≤ 3.7 kV	≤ 2.7 kV	≤ 2.7 kV
Protection level U_p (L+/L-) - PE		≤ 3.7 kV	≤ 3.7 kV	≤ 2.7 kV	≤ 2.7 kV
Residual voltage (L+) - (L-)		≤ 3.1 kV (at 5 kA)	≤ 3.1 kV (at 5 kA)	≤ 2.2 kV (at 5 kA)	≤ 2.2 kV (at 5 kA)
Residual voltage (L+/L-) - PE		≤ 3.1 kV (at 5 kA)	≤ 3.1 kV (at 5 kA)	≤ 2.2 kV (at 5 kA)	≤ 2.2 kV (at 5 kA)

Surge protection for the AC side					
Type 1 lightning arrester Type 2 surge arrester VALVETRAB compact					
Type	Order No.	FLT-CP-PLUS-3S-350 2882640	FLT-CP-3S-350 2859712	FLT-CP-1S-350 2859738	VAL-3S-350 2859521
IEC-category/EN type		I/T1	I+II/T1+T2	I+II/T1+T2	II/T2
Lightning Protection Level		I/T1	I	III - IV	-
Nominal voltage U_N		240/415 V AC (50/60 Hz)	240/415 V AC (50/60 Hz)	240/415 V AC (50/60 Hz)	240/415 V AC (50/60 Hz)
Maximum continuous voltage U_c (L-N)		350 V AC (50/60 Hz)	350 V AC (50/60 Hz)	350 V AC (50/60 Hz)	350 V AC (50/60 Hz)
Lightning test current I_{imp} (10/350) μ s		100 kA	100 kA	50 kA	-
Nominal discharge surge current		25 kA (per channel)	25 kA (per channel)	25 kA	20 kA (per channel)
Protection level U_p		≤ 1.5 kV	≤ 1.5 kV	1.5 kV	≤ 1.4 kV
Maximum backup fuse according to IEC 61643-1		315 A gL/gG	315 A gL/gG	315 A gL/gG	125 A gL/gG




Surge protection for AC voltages, information technology, and telecommunications

BLOCKTRAB		DATATRAB		DT-LAN-CAT.6+		DT-UFB-485/BS		DT-TELE-RJ45	
For devices with optical or acoustic signaling.		For effective surge protection at network speeds of up to 10 Gbps.		ETHERNET (incl. PoE) - 100Base-T - 1000Base-T - 10GBase-T		RS-485 DT-UFB-V24/S-9-SB 2803069		DSL Analog telephony ISDN U_{KO}	
Type	Order No.	BT-1S-230AC/A BT-1S-230AC/O	2803409 2800625	DT-LAN-CAT.6+	2881007	DT-UFB-485/BS	2920612	DT-TELE-RJ45	2882925
IEC category/EN type		III/T3		• ATM • ISDN S_0 • ISDN S_{2H}		RS-232 C/V.24 with D-SUB 9 connection			
Nominal voltage U_N /protection level U_p		230 V AC/ ≤ 1.2 kV (L-N)		DT-UFB-V24/S-SB-SET 2803072		RS-232C/V.24, with adapter cable from D-SUB 9 to D-SUB 25			
Maximum continuous voltage U_c		275 V AC							
Nominal discharge surge current (8/20) μ s	I_n	3 kA							
Maximum backup fuse according to IEC 61643-1		16 A (gL/C)							


PLUGTRAB					
Two-part surge protection designed with plug-in arresters for protecting signal interfaces of actuators and sensors					
Plug	Order No.	PT 5-HF-3DC-ST 2838775	PT 5-HF-12DC-ST 2858043	PT 2X2-24DC-ST 2838228	PT 1X2-24DC/FM-ST 2920078
+ Base element, indirect grounding		PT 2X2+F-BE 2839224	PT 1X2+F-BE 2856126	PT 2X2+F-BE 2839224	PT 1X2+F-BE/FM 2920023
+ Base element, direct grounding		-	-	PT 2X2-BE 2839208	PT 1X2-BE/FM 2920010
Description		Data systems: RS-485, RS-422A	Data systems: RS-232C	0(4) - 20 mA current loop	0(4) - 20 mA current loop





COAXTRAB		Accessories		CN-UB-280DC-SB		CN-UB-280DC-BB		CN-UB/MP		CN-UB/MP-90DEG-50	
Arresters for transceiver systems		Mounting bracket for COAXTRAB arrester		GPS or GSM (900, 1800 MHz), UMTS, with N connector		GPS or GSM (900, 1800 MHz), UMTS, with N connector		Mounting plate for individual CN-UB180DC attachment		Mounting plate, 90° angled, for individual CN-UB180DC attachment	
Type	Order No.	CN-UB-280DC-SB	2818148	CN-UB-280DC-BB	2818150	CN-UB/MP	2818135	CN-UB/MP-90DEG-50	2803137		
Description											

Current transducer

Current transformers up to 300 A							
Type	Order No.	MCR-SL-CUC-100-U	2308108	MCR-SL-CUC-200-U	2308205	MCR-SL-CUC-300-U	2308302
Current measurement [A]		0 ... 100		0 ... 200		0 ... 300	
Frequency ranges [HZ]		DC; 20 ... 6000		DC; 20 ... 6000		DC; 20 ... 6000	
Connection method		Through connection 32 mm Ø		Through connection 32 mm Ø		Through connection 32 mm Ø	
Output signal		0 ... 10 V		0 ... 10 V		0 ... 10 V	
Load		< 300 Ω		< 300 Ω		< 300 Ω	
Supply voltage		20 ... 30 V DC		20 ... 30 V DC		20 ... 30 V DC	
Test voltage: input/output		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Test voltage: input/supply		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Ambient temperature [°C]		-40 to +65		-40 to +65		-40 to +65	

Current transformers up to 600 A							
Type	Order No.	MCR-SL-CUC-100-I	2308027	MCR-SL-CUC-200-I	2308030	MCR-SL-CUC-300-I	2308043
Current measurement [A]		0 ... 100		0 ... 200		0 ... 300	
Frequency ranges [HZ]		DC; 20 ... 6000		DC; 20 ... 6000		DC; 20 ... 6000	
Connection method		Through connection 32 mm Ø		Through connection 32 mm Ø		Through connection 32 mm Ø	
Output signal		4...20 mA		4...20 mA		4...20 mA	
Load		< 300 Ω		< 300 Ω		< 300 Ω	
Supply voltage		20 ... 30 V DC		20 ... 30 V DC		20 ... 30 V DC	
Test voltage: input/output		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Test voltage: input/supply		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Ambient temperature [°C]		-40 to +65		-40 to +65		-40 to +65	



Current transformers up to 600 A							
Type	Order No.	MCR-SL-CUC-400-I	2308072	MCR-SL-CUC-500-I	2308085	MCR-SL-CUC-600-I	2308098
Current measurement [A]		0 ... 400		0 ... 500		0 ... 600	
Frequency ranges [HZ]		DC; 20 ... 6000		DC; 20 ... 6000		DC; 20 ... 6000	
Connection method		Through connection 32 mm Ø		Through connection 32 mm Ø		Through connection 32 mm Ø	
Output signal		4...20 mA		4...20 mA		4...20 mA	
Load		< 300 Ω		< 300 Ω		< 300 Ω	
Supply voltage		20 ... 30 V DC		20 ... 30 V DC		20 ... 30 V DC	
Test voltage: input/output		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Test voltage: input/supply		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.		3.5 kV, 50 Hz, 1 min.	
Ambient temperature [°C]		-40 to +65		-40 to +65		-40 to +65	

SOLARCHECK string monitoring									
Type	Order No.	SCK-C-MODBUS*	2901674	SCK-M-I-8S-20A*	2903241	SCK-M-I-4S-20A*	2903242	SCK-M-U-1500V*	2903591
Current measurement [A]		–		0 ... 20		0 ... 20		–	
Reverse current detection		–		- 1 A		- 1 A		–	
Voltage measurement [V DC]		–		–		–		0 ... 1500	
Interfaces		RS-485 Modbus RTU		–		–		Output signal 2 ... 10 V	
Serial transmission speed		9.6 kbps		–		–		–	
Supply voltage U _B		24 V DC (-10% ... +25%)		Via SCK-C-MODBUS		Via SCK-C-MODBUS		Via SCK-M-I module or separate	
Own current consumption [mA]		12		45		45		35	
Temperature coefficient		–		0.02%/K (from T > 25°C)		0.02%/K (from T > 25°C)		< 0.03%/K (from T > 25°C)	
Transmission error, maximum		–		< 1%		< 1%		< 1% (following additional adjustment)	
Degree of protection		IP20		IP20		IP20		IP20	
Ambient temperature [°C]		-20 to +70		-20 to +70		-20 to +70		-20 to +70	

* new as of Intersolar 2013

M12 cabling for sensors and devices in outdoor use

Plug-in connector, for assembly Material for screw connection, stainless steel 1.4404					
Description		Plug-in connector, with stainless steel knurl, insulation displacement connection, unshielded, 4-pos.		Plug-in connector, with M16 screw connection, screw connection, shielded, 5-pos.	
Type	Order No.	Socket, straight Pin, straight	1440766 1440753	Socket, straight Pin, straight	1440782 1440779
		Socket, straight Pin, straight	1440038 1440012	Socket, straight Pin, straight	1440041 1440025
Cross section	0.14 mm ² – 0.34 mm ²		0.34 mm ² – 0.75 mm ²		0.25 mm ² – 0.75 mm ²
Cable diameter	3.5 mm ... 6 mm		4 mm ... 8 mm		3 mm ... 5.5 mm
Rated voltage	125 V		250 V		60 V
Rated current	4 A		4 A		4 A
Degree of protection	IP65/IP67		IP67/IP69K		IP67/IP69K
Properties	Temperature range: -25°C to +80°C, M12 circular plug-in connector according to IEC 61076-2-101		Temperature range: -40°C to +85°C, M12 circular plug-in connector according to IEC 61076-2-101		Temperature range: -40°C to +85°C, M12 circular plug-in connector according to IEC 61076-2-101



M12 distributor with corrosion-resistant metal thread Sensor/actuator box, M12 socket, 8 slots, 5-pos., double occupancy, no status indicator					
Description		With master cable		Plug-in screw connection, horizontal	
Type	Order No.	5 m 10 m	1457364 1457377	5 m 10 m	1457380 1457380
Rated voltage	120 V		120 V		120 V
Rated current for each I/O signal	2 A		2 A		2 A
Rated current per slot	4 A		4 A		4 A
Total rated current	12 A		10 A		10 A
Degree of protection	IP65/IP67/IP69K		IP65/IP67		IP65/IP67
Properties	Distributor box: -30°C to +90°C, housing material: PBT		Distributor box: -30°C to +80°C, housing material: PBT		Distributor box: -30°C to +80°C, housing material: PBT



M12 SAC cable Stainless steel knurl									
Description		4-pos, cable type 28X		4-pos., cable type 28X, shielded		5-pos., cable type 28X		5-pos., cable type 28X, shielded	
M12 plug to open end, straight	2 m 5 m 10 m	1454040 1454053 1454066	2 m 5 m 10 m	1454121 1454134 1454147	2 m 5 m 10 m	1407255 1407256 1407257	2 m 5 m 10 m	1407263 1407264 1407265	
M12 plug to open end, angled	2 m 5 m 10 m	1407965 1407966 1407967	– – –	– – –	– – –	– – –	– – –	– – –	
M12 socket to open end, straight	2 m 5 m 10 m	1454079 1454082 1454095	2 m 5 m 10 m	1454150 1454163 1454176	2 m 5 m 10 m	1407258 1407259 1407260	2 m 5 m 10 m	1407266 1407267 1407268	
M12 socket to open end, angled	2 m 5 m 10 m	1407968 1407969 1407970	– – –	– – –	– – –	– – –	– – –	– – –	
M12 plug to M12 socket, straight	2 m 5 m	1454105 1454118	2 m 5 m	1454189 1454192	2 m 5 m	1407261 1407262	2 m 5 m	1407269 1407270	
Rated voltage	250 V		250 V		60 V		60 V		
Rated current	4 A		4 A		4 A		4 A		
Degree of protection	IP65/IP67/IP68/IP69K		IP65/IP67/IP68/IP69K		IP65/IP67/IP68/IP69K		IP65/IP67/IP68/ IP69K		
Temperature range:	-40°C to +105°C		-40°C to +105°C		-40°C to +105°C		-40°C to +105°C		

M12 SAC cable Stainless steel knurl							
Description		8-pos., cable type 28X		8-pos., cable type 28X, shielded		M12 Ethernet/PROFINET cable, 4-pos., cable type 93X	
M12 plug to open end, straight	2 m 5 m 10 m	1407271 1407272 1407273	2 m 5 m 10 m	1407279 1407280 1407281	2 m 5 m 10 m	1454202 1454215 1454228	
M12 socket to open end, straight	2 m 5 m 10 m	1407274 1407275 1407276	2 m 5 m 10 m	1407282 1407283 1407284	– – –	– – –	
M12 plug to M12 socket, straight	2 m 5 m	1407277 1407278	2 m 5 m	1407285 1407286	– –	– –	
M12 plug to M12 plug, straight	– –	– –	– –	– –	2 m 5 m	1454231 1454244	
Rated voltage	30 V		30 V		250 V		
Rated current	2 A		2 A		4 A		
Degree of protection	IP65/IP67/IP68/IP69K		IP65/IP67/IP68/IP69K		IP65/IP67/IP68/IP69K		
Temperature range:	-40°C to +105°C		-40°C to +105°C		-40°C to +105°C		

Industrial network technology: wireless and cable-based components




Wireless network components				
Type	Order No.	FL WLAN 5100 2700718	FL WLAN EPA 5N 2700488	FL Bluetooth EPA 2692788
Operating modes		Access point, client	Client, 5 GHz	Client
Antenna		3-pack, antennas not supplied as standard	Integrated, circular polarized special antenna	Integrated, circular polarized special antenna
Standard		IEEE 802.11 a/b/g/n	IEEE 802.11 a/n	Bluetooth, configurable up to 200 m (open field)
Special features		IP20, cluster management, 24 V DC	IP65/67, power consumption < 1.8 watt	IP65/67, power consumption < 1.1 watt


Cable-based network components			
Type	Order No.	FL Switch LM 4TX/2FX 2832658	FL NAT SMN 8 TX 2989365
Description		Managed switch with two fiberglass ports	NAT router
Special notes		RSTP support, Large Tree Support, fast ring detection, VLAN	Integrated managed switch

Cable-based network components			
Type	Order No.	FL MGuard RS2000 TX/TX VPN 2700642 FL MGuard RS4000 TX/TX VPN 2200515 FL MGuard RS2000 TX/TX 2700634	FL MGuard GT/GT 2700197
Description		Firewall router	Router with intelligent firewall
Special notes		With VPN functionality, SD card as storage medium, extended temperature range	Up to 200 Mbps of data throughput, gigabit connectivity, SFP slots, stateful inspection firewall for maximum security and extremely easy configuration, replaceable configuration memory

Industrial communication technology

Fiber optic media converters					
Type	Order No.	FL MC EF 1300 MM SC 2902853	FL MC EF 1300 MM ST 2902854	FL MC EF 1300 SM SC 2902856	FL MC EF WDM SET 2902660
Description		Fiber optic media converters, multi-mode fiberglass	Fiber optic media converters, multi-mode fiberglass	Fiber optic media converters, single-mode fiberglass	Fiber optic media converters, single-mode fiberglass, full duplex communication via a single fiber
Connection		SC duplex	B-FOC(ST)	SC duplex	SC simplex
Transmission length		Maximum 10 km	Maximum 10 km	Maximum 36 km	Maximum 38 km
Transmission speeds		10/100 Mbps	10/100 Mbps	10/100 Mbps	10/100 Mbps
Auto negotiation modes		Auto negotiation/ auto MDI (X)	Auto negotiation/ auto MDI (X)	Auto negotiation/ auto MDI (X)	Auto negotiation/ auto MDI (X)
MDI/MDI-X switchover		Auto MDI (X)	Auto MDI (X)	Auto MDI (X)	Auto MDI (X)

Isolators				
The isolators are used for electrical isolation in copper-based Ethernet networks.				
Type	Order No.	FL ISOLATOR 1000-RJ/RJ 2313915	FL ISOLATOR 100-RJ/RJ 2313931	FL ISOLATOR 100-RJ/SC 2313928
Description		Galvanic Ethernet isolators	Galvanic Ethernet isolators	Galvanic Ethernet isolators
Connection		RJ45 socket, shielded	RJ45 socket, shielded	RJ45 socket and COMBICON plug-in screw terminal block
Transmission speeds		10/100/1000 Mbps	10/100 Mbps	10/100 Mbps
Transmission lengths		≤ 100 m (depending on the data rate and cable used)	≤ 100 m (depending on the data rate and cable used)	≤ 100 m (depending on the data rate and cable used)
Electrical isolation		Ethernet // Ethernet	Ethernet // Ethernet	Ethernet // Ethernet
Test voltage		4 kV AC (50 Hz, 1 min.)	4 kV AC (50 Hz, 1 min.)	4 kV AC (50 Hz, 1 min.)

Copper-based data transmission		
Type	Order No.	PSI-REP-RS485W2 2313096
Description		Repeater for RS-485 2-wire systems
Connection		Plug-in screw connection
Transmission length		1200 m, Maximum
Transmission speeds		of 4.8 to 500 kbps
Electrical isolation		RS-485 (A) // RS-485 (B) // power supply // DIN rail connector





Industrial remote communication Global networking, alarm generation, remote maintenance, and continual data acquisition			
Type	Order No.	TC DSL ROUTER X400 A/B 2902709 TC DSL ROUTER X500 A/B 2902710	PSI-MODEM-3G/Router 2314008 PSI-MODEM-SHDSL/ETH 2313643
Description	Industrial ADSL broadband router, supports ADSL/ADSL2/ADSL2+ according to Annex A and B Industrial UMTS/HSPA mobile phone router with firewall and VPN for worldwide network access SHDSL Ethernet extender for point-to-point, line, and ring structure on in-house 2 and 4-wire cables		
Telecommunications interface	ADSL/ADSL2/ADSL2+ (Annex A and B), maximum 25 Mbps (downstream), 1 Mbps (upstream) 850/900/1800/1900 MHz GPRS/EDGE (maximum 210 kbps), 850/1900/2100 MHz UMTS/HSPA (maximum 7.2 Mbps) 2-wire operation: 32 kbps ... 15.3 Mbps 4-wire operation: 64 kbps ... 30 Mbps		
Connection	6P2C RJ11 socket, shielded SIM and backup SIM; SMA antenna connection COMBICON plug-in screw terminal block		
LAN transmission speeds	10/100 Mbps, auto negotiation 10/100 Mbps, auto negotiation 10/100 Mbps, auto negotiation		
Electrical isolation	VCC // ADSL // Ethernet // FE VCC // UMTS // Ethernet // PE VCC // Ethernet // DSL (A) // DSL (B)		
Ambient temperature range	-20°C ... 60°C -25°C ... 65°C -20°C ... 60°C		





FO converters The FO converters for serial data communication are perfect for deployment in free-standing systems. Long transmission lengths and a high level of EMI immunity guarantee interference-free data transmission.			
Type	Order No.	PSI-MOS-RS485W2/FO 660 E 2708313 PSI-MOS-RS485W2/FO 660 T 2708300	PSI-MOS-RS485W2/FO 850 E 2708339 PSI-MOS-RS485W2/FO 850 T 2708326 PSI-MOS-RS485W2/FO 1300 E 2708562
Connection/wavelength	FSMA/660 nm B-FOC (ST®)/850 nm SC DUPLEX/1300 nm		
Transmission length	70 m (with polymer fiber), 400 m (with HCS/PCF fiber) 2800 m (with HCS/PCF fiber), up to 4200 m (with multi-mode fiberglass) Up to 25 km (with multi-mode fiberglass), up to 45 km (with single-mode fiberglass)		
Ambient temperature range	-20°C ... 60°C -20°C ... 60°C -20°C ... 60°C		

Wireless-data communication Radioline is the new wireless system for extended systems and networks for up to 250 stations.					
Type	Order No.	RAD-2400-IFS 2901541	RAD-DI4-IFS 2901535 RAD-DOR4-IFS 2901536 RAD-DI8-IFS 2901539 RAD-DO8-IFS 2902811 RAD-DAIO6-IFS 2901533	RAD-AI4-IFS 2901537 RAD-PT100-4-IFS 2904035 RAD-AO4-IFS 2901538	RAD-CONF-RF3 2902814 RAD-CONF-RF5 2902815 RAD-CONF-RF7 2902816 RAD-MEMORY 2902828 RAD-CABLE-USB 2903447
Description	<ul style="list-style-type: none"> 2400 MHz wireless transceiver with RS-232, RS-485 2-wire interface, expandable with I/O extension modules Easy point-to-point or network connections (line, star, mesh) Transmission of I/O signals and serial data Trusted Wireless 2.0-technology Network applications I/O-to-I/O, I/O-to-serial, serial-to-serial <ul style="list-style-type: none"> Digital and combined I/O extension modules Digital wide-range inputs (0...250 V AC/DC) Digital pulse inputs 0 ... 100 Hz Relay or transistor outputs Easy I/O mapping via thumbwheel <ul style="list-style-type: none"> Analog I/O extension modules Analog inputs (0/4 ... 20 mA) Temperature inputs for Pt 100 sensors Analog outputs (0/4 ... 20 mA or 0 ... 10 V) Easy I/O mapping via thumbwheel <ul style="list-style-type: none"> Accessories Unique network addressing via plug-in configuration memory for secure, parallel operation of multiple networks Memory stick, for saving custom configuration data USB cable, for diagnostics and extended configuration A wide range of accessories (including antennas, connecting cables) can be found on the Internet 				




Fiber optic installation technique For industrial solutions which are easy to install and maintain.					
Type	Order No.	HCSO-1015 2901557	GDO-1017 2901559	PSM-SET-FSMA/4-HCS 2799487 PSM-SET-B-FOC/4-HCS 2708481 PSM-SET-SCRJ-DUP/2-HCS 2313070	PSM-HCS-KONFTOOL/SC-RJ 2708876
Description	HCS outdoor cables for assembly, lengths, and fiber optic plugs (IP20) that can be combined as required, cables can also be ordered by the meter without plugs Multi-mode fiberglass outdoor cables for assembly, lengths, and fiber optic plugs (IP20) that can be combined as required, cables can also be ordered by the meter without plugs Quick mounting plug for HCS/PCF cables Assembly kit for HCS fiber cables, all tools for simple and quick plug assembly				




Controllers and I/O systems

Compact controller and bus coupler					
Type	Order No.	ILC 131 ETH/XC 2701034 ILC 151 ETH/XC 2701141	ILC 151 GSM/GPRS - 2700977	ILC 171 ETH 2TX 2700975	ILC 191 ME/INC 2700075 ILC 191 ME/AN 2700074
Description		Compact controller with extended temperature range	Compact controller with modem	Compact controller with 2 Ethernet ports	Compact controller for drive control
Special feature		Suitable for increased temperature requirements	Integrated GSM/GPRS-modem, integrated Modbus/TCP client	Plug-in parameterization memory (SD Flash with 512 Mbytes or 2 Gbytes), integrated Modbus/TCP client	Analog or incremental input channels for position detection
Processing speed		90 µs per 1000 instructions (bit data system)	90 µs per 1000 instructions (bit data system)	90 µs per 1000 instructions (bit data system)	90 µs per 1000 instructions (bit data system)
Interfaces		1 x INTERBUS; 1 x Ethernet	1 x INTERBUS; 1 x Ethernet	1 x INTERBUS; 2 x Ethernet	1 x INTERBUS; 1 x Ethernet
Ambient temperature		-40°C to +60°C	-25°C to +55°C	-25°C to +55°C	-25°C to +55°C
Width		80 mm	85 mm	80 mm	164 mm

I/O systems in the control cabinet					
Type	Order No.	IB IL 24 DI 2-PAC 2861221 IB IL 24 DI 4-PAC 2861234 IB IL 24 DI 8-PAC 2861247 IB IL 24 DI 8/HD-PAC 2700173 IB IL 24 DI 16-PAC 2861250 IB IL 24 DI 32/HD-PAC 2862835	IB IL 24 DO 2-PAC 2861470 IB IL 24 DO 4-PAC 2861276 IB IL 24 DO 8-PAC 2861603 IB IL 24 DO 8/HD-PAC 2700173 IB IL 24 DO 16-PAC 2861292 IB IL 24 DO 32/HD-PAC 2862822	IB IL AI 2/SF-PAC 2861302 IB IL AI 4/I-PAC 2700458 IB IL AI 4/U-PAC 2700459 IB IL AI 4/EF-PAC 2878447 IB IL AI 8/SF-PAC 2861412 IB IL AI 8/IS-PAC 2861661	IB IL AO 1/U/SF-PAC 2861399 IB IL AO 1/SF-PAC 2861315 IB IL AO 2/UI-PAC 2700775 IB IL AO 2/SF-PAC 2863083 IB IL AO 2/U/BP-PAC 2861467 IB IL AO 4/8/U/BP-PAC 2878036
Description		Digital input terminal	Digital output terminal	Analog input terminal	Analog output terminal
Number of channels		2 – 32	2 – 32	2 – 8	1 – 8
Ambient temperature		-25°C to +55°C	-25°C to +55°C	-25°C to +55°C	-25°C to +55°C
Width		12 – 48 mm	12 – 48 mm	12 – 48 mm	12 – 48 mm

I/O systems in the field					
Type	Order No.	FLM DI 8 M8 2773348	FLM DIO 8/4 M8 2773351	FLM DO 4 M8-2A 2736932	FLM DIO 8 M8 2736893
Description		8 inputs	8 inputs	8 outputs	8 outputs
Number of channels		-25°C to +60°C	-25°C to +60°C	-25°C to +60°C	-25°C to +60°C
Ambient temperature		29.8 mm	29.8 mm	29.8 mm	29.8 mm
Width		IP65/67 (protected against dust and jet water)	IP65/67 (protected against dust and jet water)	IP65/67 (protected against dust and jet water)	IP65/67 (protected against dust and jet water)


Compact controller and bus coupler				
Type	Order No.	IL MOD BK DI8 DO4-PAC 2878696	IL ETH BK DI8 DO4 2TX-PAC 2703981	IL CAN BK-TC-PAC 2718701
Description		Bus coupler for Modbus/RTU (ASCII)	Bus coupler for Modbus/TCP (UDP)	Bus coupler for CANopen®
Special feature		–	–	–
Processing speed		–	–	–
Interfaces		1 x D-SUB-9 socket	2 x RJ45 socket	2 x 5-pos. TWIN-COMBICON plug
Ambient temperature		-25°C to +55°C	-25°C to +55°C	-25°C to +55°C
Width		80 mm	80 mm	85 mm

I/O systems in the control cabinet				
Type	Order No.	IB IL 24/230 DOR1/W-PAC 2861881 IB IL 24/230 DOR4/W-PAC 2861878 IB IL 24/230 DOR1/W-PAC 2862178 IB IL 24/230 DOR1/W-PC PAC 2862181	IB IL RS 232-PAC 2861357 IB IL RS 232-PRO-PAC 2878722 IB IL RS 485/422-PAC 2861933 IB IL RS 485/422-PRO-PAC 2863627 IB IL RS-UNI-PAC 2700893	IB IL CAN-MA-PAC 2700196 IB IL IFS-MA-PAC 2692720 IB IL PB-MA-PAC 2700631 IB IL FLM MULTI-PAC 2727009
Description		Digital relay output terminals	Communication terminals	Communication terminals
Number of channels		1 – 4	1	1
Ambient temperature		-25°C to +55°C	-25°C to +55°C	-25°C to +55°C
Width		12 – 48 mm	12 – 48 mm	12 – 48 mm

HMIs for basic applications

Web panel/ widescreen web panel				
Type	Order No.	WP 06T 2913645	WP 07T/WS 2700307	WP 09T/WS 2700309
Display		7.1 cm/2.8" TFT active	17.8 cm/7" TFT active	22.9 cm/9" TFT active
Resolution		320 x 240 pixels (QVGA)	800 x 480 pixels (WVGA)	800 x 480 pixels (WVGA)
Ambient temperature		0°C to +50°C	0°C to +50°C	0°C to +50°C

Outdoor web panel Versions with sunlight-readable displays, UV resistant, suitable for an extended temperature range			
Type	Order No.	WP 06T/XC 2701555	WP 07T/XC 2701556
Display		14.5 cm/5.7" TFT active	17.8 cm/7" TFT active
Resolution		320 x 240 pixels (QVGA)	800 x 480 pixels (WVGA)
Ambient temperature		-20°C to +70°C	-20°C to +70°C




Minitouch Inexpensive visualization unit, ideal for applications in which information needs to be displayed in alphanumeric format.		
Type	Order No.	TD 1030T 2701257
Display		7.1 cm/2.8" TFT active
Resolution		320 x 240 pixels (QVGA)
Ambient temperature		0°C to +50°C

Energy meters

EMpro				
Type	Order No.	EEM-MA600-24DC 2902352	EEM-MA600 2901366	EEM-MA400 2901364
Voltage measurement direct		Up to 700 V AC	Up to 700 V AC	Up to 500 V AC
Voltage measurement via voltage transducer		•	•	–
Current measurement		Direct up to 6 A/ via current transformer	Direct up to 6 A/ via current transformer	Via current transformer
Power		•	•	•
Active energy/reactive energy		kWh +/- / kvarh +/-	kWh +/- / kvarh +/-	kWh + / kvarh +
2-tariff meter		–	–	–
THD (Total Harmonic Distortion)		Up to 63rd harmonic	Up to 63rd harmonic	Up to 51st harmonic
Harmonics analysis		Up to 63rd harmonic	Up to 63rd harmonic	–
Outputs		Optionally with special function module	Optionally with special function module	Optionally with special function module
Communication		Optionally with communication module; RS-485 JBUS/MODBUS; PROFIBUS; Ethernet; RS-485/Ethernet Gateway	Optionally with communication module; RS-485 JBUS/MODBUS; PROFIBUS; Ethernet; RS-485/Ethernet Gateway	Optionally with communication module; RS-485 JBUS/MODBUS
UL-listed		–	According to 61010-1	According to 61010-1




EMpro			
Type	Order No.	EEM-MA250 2901363	EEM-MA200 2901362
Voltage measurement direct		Up to 500 V AC	Up to 500 V AC
Voltage measurement via voltage transducer		–	–
Current measurement		Via current transformer	Via current transformer
Power		•	•
Active energy/reactive energy		kWh + / kvarh +	kWh + / kvarh +
2-tariff meter		•	•
THD (Total Harmonic Distortion)		Up to 51st harmonic	Up to 51st harmonic
Harmonics analysis		–	–
Outputs		Pulse output or alarm, configurable	Pulse output or alarm, configurable
Communication		RS-485 interface integrated	–
UL listed		According to 61010-1	According to 61010-1

Software

Programming and visualization			
			
Type	Order No. PC WORX DEMO 2985725	WebVisit 6 EXPRESS 2700954	AXweb+
	Licenses available on request	Licenses available on request	Licenses available on request
Description	Software package for PC-based automation solutions	Development software for web-based visualizations	Web-based information and control system
System requirements	MS Windows XP SP3, MS Windows Vista Business SP2, MS Windows 7 Professional (32/64-bit) SP1	MS Windows XP SP3, MS Windows Vista Business, MS Windows 7 Professional (32/64-bit)	Client side: every operating system must have a current browser and JavaScript Server side: MS Windows 2008 R2 (64-bit), SQL Server 2008 R2




Hybrid motor starters

CONTACTRON			
For starting and reversing 3 AC motors up to 4 kW. Only 22.5 mm wide, they combine up to four functions: right-side protection, left-side protection, motor protection relay, and emergency stop up to category 3/PLe			
			
Type	Order No. ELR H5-IES-SC-24DC/500AC-2 2900414	ELR H5-I-SC-24DC/500AC-2 2900574	ELR H5-SC- 24DC/500AC-9 2900538
Input voltage	24 V DC	24 V DC	24 V DC
Output voltage	42 V AC ... 550 V AC	42 V AC ... 550 V AC	42 V AC ... 550 V AC
Load current	Maximum 2.4 A	Maximum 2.4 A	Maximum 9 A
Ambient temperature range	-25°C to +70°C	-25°C to +70°C	-25°C to +70°C

CONTACTRON			
For starting and reversing 3 AC motors up to 4 kW. Only 22.5 mm wide, they combine up to four functions: right-side protection, left-side protection, motor protection relay, and emergency stop up to category 3/PLe			
			
Type	Order No. ELR H5-IES-SC-230AC/500AC-2 2900420	ELR H5-I-SC-230AC/500AC-2 2900575	ELR H5-SC-230AC/500AC-9 2900539
Input voltage	120/230 V DC	120/230 V DC	120/230 V DC
Output voltage	42 V AC ... 550 V AC	42 V AC ... 550 V AC	42 V AC ... 550 V AC
Load current	Maximum 2.4 A	Maximum 2.4 A	Maximum 9 A
Ambient temperature range	-25°C to +70°C	-25°C to +70°C	-25°C to +70°C



Surge protection: set solutions

PV sets			
			
Type	Order No. PV-SET 1ST/1000DC/1MPP-SPD-SC 2801529	PV-SET 2ST/1000DC/2MPP-SPD-SC 2801317	PV-SET 3ST/1000DC/3MPP-SPD-SC 2801531
Description	Lightning current and surge arrester in IP65 housing for protecting single-string photovoltaic systems up to 1000 V DC, connection via SUNCLIX plug/socket.	Lightning current and surge arrester in IP65 housing for protecting the DC side of an inverter with two MPP trackers up to 1000 V DC, connection via SUNCLIX plug/socket, plug-in varistors with thermal disconnect device between L+, L-, and ground/PE.	Lightning current and surge arrester in IP65 housing for protecting the DC side of an inverter with three MPP trackers up to 1000 V DC, connection via SUNCLIX plug/socket, plug-in varistors with thermal disconnect device between L+, L-, and ground/PE.
Cross section [mm ²]	2.5 – 15	2.5 – 15	2.5 – 15
Maximum continuous voltage U _{CPV}	1000 V DC	1000 V DC	1000 V DC
Nominal load current I _L	≤ 80 A DC	≤ 80 A DC	≤ 80 A DC
Short-circuit current I _{SCSTC}	25 A DC	25 A DC (per MPP)	25 A DC (per MPP)

PV sets			
			
Type	Order No. PV-SET 1000 DC/AC 2804458	PV-SET 5ST/600DC 2920780	PV-SET-16ST-1000/F-M-SPD-SD-SC 2801203
Description	Surge protection in IP65 housing for the AC and DC sides of an inverter for single string photovoltaic systems up to 1000 V DC.	Surge protection in IP65 housing for the DC side of an inverter for five-string photovoltaic systems up to 600 V DC. Plug-in varistors with a thermal disconnect device between L+, L-, and ground/PE. With generator disconnect and modular terminal blocks.	Surge protection in IP65 housing for the DC side of an inverter For 16-string photovoltaic systems up to 1000 V DC and the MODBUS communication. With monitoring system (SCK-M), two DC switch disconnectors and fuse holders for L+ and L-
Cross section [mm ²]	1.5 – 35	0.2 – 16	2.5 – 15
Maximum continuous voltage U _{CPV}	1000 V DC/230 V AC	600 V DC	1000 V DC
Nominal load current I _L	≤ 80 A DC/AC	≤ 30 A DC	–
Short-circuit current I _{SCSTC}	–	–	8.5 A DC (per string)

Miniature connection system for building-integrated photovoltaics – BIPV

SUNCLIX mini				
				
Order No.	1795336	1795323	1463065	1811239
Description	Pin (-)	Socket (+)	DC string diode with SUNCLIX mini plug-in connector	DC string diode without plug-in connector, free cable ends
Cross section	2.5 mm ²	2.5 mm ²	2.5 mm ²	2.5 mm ²
Rated voltage	1000 V	1000 V	1000 V	1000 V
Nominal current	Maximum 15 A	Maximum 15 A	Maximum 5 A	Maximum 5 A
Reverse voltage	–	–	2200 V	2200 V
Cable length	–	–	800 mm	800 mm
Dimensions	Ø 11 mm	Ø 11 mm	100 x 38 x 11 mm	100 x 38 x 11 mm
Degree of protection	IP67	IP67	IP67	IP67
Properties	Temperature range: -40°C to +85°C, class II protection, VDE-certified according to DIN EN 50521		Temperature range: -40°C to +85°C, class II protection, VDE-certified according to DIN EN 50548	




SUNCLIX mini		
		
Order No.	1705132	1705131
Description	Left module junction box	Right module junction box
Cross section	2.5 mm ²	2.5 mm ²
Rated voltage	1000 V	1000 V
Nominal current	Maximum 15 A	Maximum 15 A
Reverse voltage	–	–
Cable length	500 mm	500 mm
Dimensions	92 x 40.4 x 9.5 mm	92 x 40.4 x 9.5 mm
Degree of protection	Process-dependent	Process-dependent
Properties	Temperature range: -40°C to +85°C, VDE certification according to DIN EN 50548 in progress	

Autonomous power supply

Solar systems			
Type	Order No.	RAD-SOL-SET-24-100 2885472	RAD-SOL-SET-24-200 2917722
Nominal voltage	[V]	24 DC	24 DC
Maximum power	[Wp]	100	200
Battery capacity	[Ah]	40	100
Maximum load	[W]	0 W ... 11 W (maximum connected load for year-round constant load in relation to power reserve and installation location)	0 W ... 23 W (maximum connected load for year-round constant load in relation to power reserve and installation location)

Accessories

Tool kit				
Type	Order No.	TOOL KIT SOLAR 1212071	SZF 1-0.6X3.5 1204517	WIREFOX-D SR 6-1 1212511
Description		Solar tool kit	Screwdriver	Stripping tools

MARKING system				
Type	Order No.	THERMOMARK CARD 5146464	THERMOMARK ROLL 5145477	MARKING BOX 5147100 MARKING BOX EN 5147101
Description		Thermal transfer printers for sheet materials and cards, including: <ul style="list-style-type: none"> • CLIP PROJECT advanced • Power cable, USB cable • Magazine for UCT-TM material • Magazine for US... material • A VPE UCT-TM 5 • A VPE US-EMP • User manual • 50 m of ink ribbon 	Thermal transfer printers for roll material, including: <ul style="list-style-type: none"> • CLIP PROJECT advanced • Power cable, USB cable • EML (20 x 8) 1000 labels • User manual • 50 m of ink ribbon 	Complete marking system consisting of: <ul style="list-style-type: none"> • THERMOMARK CARD (5146464) • THERMOMARK ROLL (5146477) • And a notebook with pre-installed CLIP PROJECT professional software for immediate startup, Plug'n'Print



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- Surge protection devices
- System cabling for DCS and PLC
- Tools
- Wireless data communication

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