3 | 15

Day by DIN

An ABB technical journal for
Low Voltage products
Installers, Consultants
and Panel Builders

News and know-how for informed professionals

Energy Storage Systems
Much more than a bunch of batteries!
Good morning DIN-Rail
Key 2014 NEC Code changes for PV installations
Doktor Wise. The expert answers
How to use monitoring in a PV plant

e-Design. Everyone has a project.
We have the solution to make it happen.

e-Design is the new integrated suite, designed and produced by ABB for all professionals working in the electrical sector: designers, panel builders, installers and wholesalers' technical offices. e-Design enables an electrical system to be designed optimizing processing times, thanks to simple and intuitive functionalities and management of a full product portfolio.

Download e-Design suite
www.abb.com/edesign-software

Power and productivity
for a better world™

A "technological house" for the company's premises (58)

Day by DIN 3|15

Valentina Surini
Product Marketing Manager
DIN-Rail Products

Dear readers,
Welcome to the third 2015 edition of Day by DIN.
Since people usually close the year with a good proposal for the next one, we wanted to focus this edition on renewable energies, with a desire to raise attention to environmental issues and sustainability. In fact, for the companies working in this field, this is also an opportunity to develop a good business that can lead to a win-win situation in terms of respecting the earth's resources and being profitable at the same time.
In this edition of Day by DIN you will discover key drivers for the Wind Industry, such as the importance of providing a protection against arc faults, the prominence of the electrical coordination systems and much more.

On the theme of renewables, Solar energy also plays a major role and for this reason, we wanted to update you on the next generation components up to 1,500 V DC and about the 2014 NEC Code changes for photovoltaic installations. This was one of the hundreds questions we received from you at mail.daybydin@abb.com: thanks a lot for giving us the opportunity to be your point of trust, we cannot wait to read your next e-mails!
In case you missed it, you can find more interesting content concerning renewable energy in our previous editions of Day by DIN, just point your smartphone or tablet to the QR codes on page 56 and browse it for free!
The entire Day by DIN Team and I wish you a great 2016,
Enjoy the reading!

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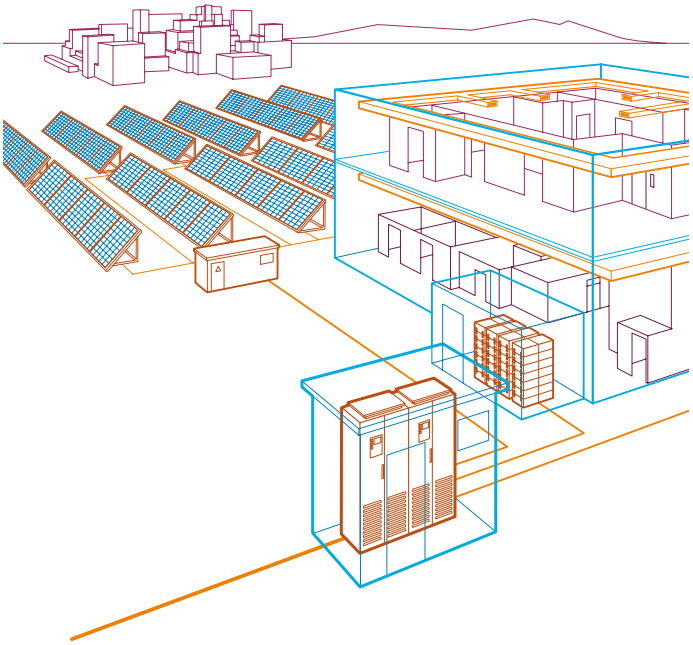

News and facts

The expert answers

Doktor Wise

Report

Curiosity

Technical

Time to relax

Jump in the box

Discover in this section brand new solutions offered by ABB for safe storage in Data centers, smart installations at home, solutions for protecting equipments and making your business grow at the same time.

Electrical distribution

ONE20 Enclosed Switches

The all-new ONE20 Enclosed Switches promise to be the only enclosed switches you will ever need

The ONE20 Enclosed switches are suitable for residential and commercial applications. They can be used as main switches or for local isolation in various applications, such as HVAC, residential water and heat pumps and for commercial lighting. ONE20 has an Ith=20 A and it is available in three colors: red-yellow, white and grey.

For more information: http://new.abb.com/low-voltage/launches/one20

Benefits

- Reliable performance in all indoor and outdoor environments, thanks to a durable and water-resistant (IP67) enclosure
- UV- and ageing-resistant material
- Safety lockout
- Quick and reliable installation – compression glands included in the delivery
- Factory tested and approved - each individual switch has been factory tested before shipping
- Built-in feature to stop mechanical breakage

Motor control

DRAF enclosed direct-on-line starters

Experience reliable and easy-to-install motor starting

The new DRAF enclosed starter embeds the well-estabilished AF technology. The electronically controlled coil of AF contactors offers multiple benefits over conventional alternatives. The DRAF is an enclosed direct-on-line starter, used for 3 phase motor control up to 7.5 kW (400 V) and 10 hp (440 V). The starter is available for both IEC and UL markets. Control of stand-alone motors like heat pumps, air conditioning units, small machine tools, irrigation, diary sheds are typical applications for DRAF.
This was a highly awaited product and it is a key addition to the AF portfolio. It provides a plug and play starting solution combined with AF contactor benefits, with product variants reduced to a few. It will allow our Customers to simplify their logistics and to cut administration costs.

For more information: http://new.abb.com/low-voltage/products/motor-protection/starting-solutions/draf

Benefits

- Improved installation efficiency: each starter is delivered with control circuit prewired. With easy to follow wiring instructions it is simple and quick to connect and operate the DRAF.
- Reliable in harsh conditions: with a double electrical insulation enclosure and an IP66 degree of protection (4X type for UL market), the DRAF is robust and reliable in all conditions. In addition, the high number of electrical and mechanical operations of the AF contactor extends your installation lifetime
- Continuous operation: the AF contactor can manage voltage fluctuation and chattering free. Voltage sags, dips and surges pose no threat. Motor protection is ensured via thermal overload relays and coordination between products is mandatory and guaranted by ABB

Connection

RGW ring lug terminal block

Fast and secure wiring for ring lugs

The RGW terminal blocks offer a combination of fast and secure wiring. Thanks to its exceptional design, the terminal block offers 100% captive wire connections with an optimal combination of stud, safety wings, captive nut and ring lug while being 45% faster to connect than open style terminal blocks. The range is qualified for worldwide markets, applications and for extreme environments. Thanks to the compliance to shock and vibration tests, it is particularly well suited to utility, HVAC, railway and industrial applications in general.

For more information: http://new.abb.com/low-voltage/products/connection-devices/solution-series/terminal-blocks/ring-lug-terminal-blocks

Benefits

- Improved wiring secureness thanks to “Pull-out proof" connection (stud+lug) and touch proof design
- Space saving compared to the open style terminal blocks
- Reduce your wiring time thanks to the captive ready to tighten nut feature
- Connecting capacity from 0.5 to 25 mm² (22 to 4 AWG)
- Universal mounting feet
- Elimination of faulty maneuvers thanks to captive jump bars on stud

Surge protection

Joslyn and Current Technology

Surge protection at NEMA standard

Surge Protective Devices are designed to protect against transient surge conditions generated internally and externally at a facility. Lightning and utility switching account for only 20% of transient surges, while 80% is generated within a facility. Though these internal surges may be smaller in magnitude, they occur more frequently, and a continued exposure can degrade sensitive equipment within the facility.

Joslyn catalogue: http://goo.gl/HHqQrW

Benefits

- Surge ratings range from 50kA per mode/100kA per phase up to 300kA per mode/600kA per phase, based on 8x20us wave shape
- Fail-safe design with individually fused Metal Oxide Varistors (MOVs), eliminating single point failure
- Features an internal copper bus conduction path, minimizing system impedances, while maximizing performance
- Tri-colored LEDs that change from green, to orange and red, to communicate the SPD’s remaining useful life
- ModBus and Ethernet connectivity that can report power quality information remotely

One for All
ONE20 Enclosed Switches

Come rain or shine, you can count on the ONE20 to deliver reliable performances for any switching application. It's easy to install and built to withstand even the most extreme weather. It's the only enclosed switch you'll ever need.
It's as simple as that. www.abb.com

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Intelligent Building Solutions

ABB i-bus KNX IP Devices

Connecting KNX to IP networks

The new range of ABB i-bus KNX IP devices, consisting of IP interface and IP router, can be used in all applications in which KNX shall be interfaced to IP networks. The IP interface is especially suitable to connect visualization systems and ETS software to the KNX bus, therefore it features 5 tunneling servers allowing up to 5 IP clients to simultaneously build up a connection. The IP router can be used additionally as fast line and area coupler for KNX installations providing 5 tunneling servers as well. Both devices can be powered via a separate 12 – 30 V DC power supply or via Power over Ethernet (PoE), saving space in the distribution board. Furthermore, the new range supports the ABB i-bus, which significantly facilitates installation and commissioning.

For more information: www.abb.com/knx

Benefits

- 5 Tunneling Server available, simultaneous usage of interface / router with up to 5 IP clients(PC, Smartphone, Tablet) enabling cost savings and additional comfort for end users
- Power supply via PoE is supported (IEEE 802.3af Class 1), no additional 12V – 30V DC power supply is needed in distribution if PoE switch is used
- i-bus Tool for IP discovery and FW update available facilitating installation and commissioning
- Standard multicast communication in IP router can be switched to unicast allowing usage in IT networks in which multicast communication is not permitted

Intelligent Building Solutions

Magnetic Contact EnOcean

Wireless monitoring of windows and doors

The new magnetic contact EnOcean is a wireless device mounted on windows and doors recognizing opening and closing. Using the EnOcean wireless standard does not require any battery or supply voltage – the power is supplied by inbuilt solar cells. When using the ABB KNX/EnOCean gateway, the signal strength can be easily measured with the ABB i-bus Tool, which facilitates the installation.

For more information: www.abb.com/knx

Benefits

- Easy mounting on window or door frame either via screwing or adhesive
- Fully self-supplied via integrated solar cell, no wires need to be run to the contact
- Quick and easy configuration with ABB i-bus KNX/EnOcean gateway since the signal strength can be measured with the ABB i-bus Tool
- Less than 2 hours light per day at 200 Lux required to ensure continuous operation, more than 90 hours operation without any light

Protection

OTDC800…1600

Reliable DC breaking, expanded range

The OTDC range of switch disconnectors are specifically developed for photovoltaic applications, considering the inherent special requirements. Reliability and high performances are ensured beyond normative requirements in order to meet the practical real-world challenges. With the extension of the OTDC range to high currents of up to 1600 A IEC and 1000 A UL, the range now meets the needs and demands of high-power inverters. Given the exceptionally wide range of currents these devices are operating with, great care has been taken to ensure reliable operation and quality performance across all possible current levels.

Brochure: 1SCC301016B0201

Benefits

- Reliable, seamless 1000 V breaking from 0…1600 A
- Enables single-switch solutions for larger inverters
- Critical currents carefully charted, eliminated and operation verified
- Elimination of fire hazards due to prolonged arcing at switching low critical currents
- Safety of personnel and equipment greatly increased

Protection

Busch-Protector®

Protection against overvoltage

Overvoltages can quickly occur even when thunderstorms are far away. TV, video and Hi-Fi systems or the PC react very sensitively to voltage peaks in the mains network and to indirect lightning strikes or faults in the network. By a simple change of the socket outlets, these devices can be protected. The Busch-Protector® safely arrests the overvoltage, thus protecting against damages. Even if the insurance pays - it does not replace the lost data of the computer. The Busch-Protector® offers protection in three stages for different types of networks.

For more information: http://new.abb.com/low-voltage/products/residential-products/socket-outlets/busch-protector

Benefits

- Protection against overvoltage
- Device protection for technical sensitive equipment such as computer, entertainment electronics and building management systems
- Effectively reduces overvoltage peaks occurring between the sub-distribution switch board and SCHUKO® socket outlet

Monitoring

New open-core sensor for circuit monitoring system

Branch monitoring now also for refurbishment applications

The circuit monitoring system (CMS) has now been upgraded with a new open-core sensor that can be installed even in an existing installation. It provides current measurements, both AC, DC and mixed up to 80 A. The sensors are connected as before to the control unit via a flat cable, the signature feature of CMS from ABB, which saves space and ensures flexible installation. The new open-core sensor is offered with connectors for System pro *M* compact breakers, universal mounting on the cable or DIN rail mounted.

For more information: http://new.abb.com/low-voltage/products/system-pro-m/measurement-products-for-din-rail/circuit-monitoring-systems

Benefits

- For retrofitting – can be installed quickly and easily in existing installations without power interruption
- Space saving – the sensors are small and with the flat cable system no additional space is required in the enclosure
- Flexible – with the flat cable system the sensors can be installed in a flexible way making the installation very clean
- Informative – Current monitoring of branches to detect early warnings for increased availability and transparent load consumption

Generating energy safely and efficiently?

Absolutely.

Photovoltaic power systems enable homeowners and businesses to cut their energy bills by generating their own electricity with rooftop photovoltaic modules. The efficiency and quality of each system is determined by the efficiency and quality of each individual component. ABB has a comprehensive portfolio of high-performance products and systems for commercial, residential and industrial solar applications. They meet all installation requirements, cover the entire process on both the direct and alternating current sides, and make solar power generation safe, efficient and cost effective. Everyday the world demands more renewable energy – ABB makes it possible. www.abb.com/solar

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Data Center Solutions

Preconfigured Remote Power Panels

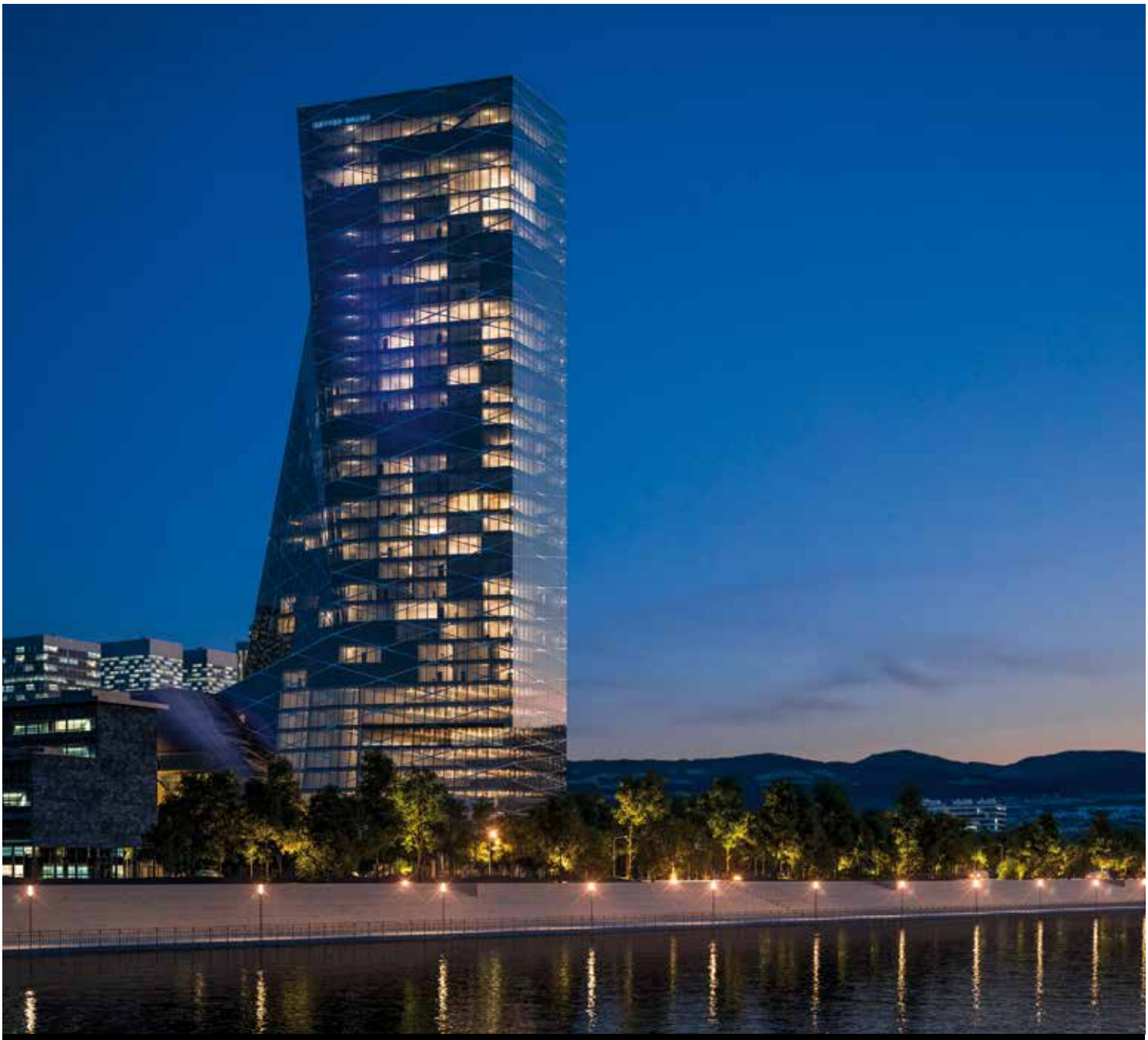
Reliable, flexible infrastructure for the profitability of your data center

The data center is the most crucial asset for nearly any 21st century enterprise. Therefore, its infrastructure should never be merely pieced together from commercial grade components. Rather, the data center must be seen as a coordinated, optimized facility that is built to be an intelligent, highly efficient and immensely flexible operation. ABB's preconfigured Remote Power Panel (RPP) helps to meet the demands of power-intensive applications, delivering unsurpassed power monitoring and distribution with up to 240 poles in a safe, reliable, space-saving footprint.
The RPP is the ideal solution for data center engineers, saving time for planning and drawing of the RPP. The pre-configurable RPP can dramatically reduce the certification costs and ensure continuous power to critical applications.

For more information: 2CCC481017B0201

Benefits

- Upgradable and expandable in the field and during operation thanks to SMISSLINE TP plug-in system and CMS bus-wiring architecture
- Effortless mounting and installation thanks to integrated input wiring and preconfigured free software
- Simple to configure: automatically generate bill of materials and schematics for your pre-type-tested RPP configuration
- Immediate design completion and instant 3D visualization



Check in at a better hotel?

Today, hotel guests expect perfection in everything: design, comfort, safety, service and energy efficiency. ABB offers comprehensive solutions for hotels that meet all these requirements. Discover the ABB Better Space Hotel and experience how everything is connected interactively: energy distribution and management, architecture, air conditioning, lighting and entertainment. Check in to the future now: **www.abb.com/betterspacehotel**

Now.

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ABB

Enclosure

ArTu PB Panelboard

Experience reliable and easy-to-install motor starting

ArTu PB Panelboard is a simple and quick to mount power distribution panel up to 1250A. This board system allows quick switchboard assembly directly on the power plant almost in an instant with very few components. This, along with ease of maintenance, makes the product attractive and easy to sell. The fact that it does not require the assembler to perform any additional test, because of the high-level panels' readiness, makes the offer very attractive. In short the installer should only implement into electrical networks with factory pre-made switchgear and fit it with outgoing MCCB feeders prescribed by the designer. To simplify the adaptation of the product to different markets and to have the best cost benefits there are three different supply formats: Panelboard, Custom Panelboard and Pan Assembly. System pro *E* power ArTu PB distribution panel is tested according to IEC 60439-1 / 61439-1-2 and UL67 and has conformity certificates of LOVAG/ACAE and UL homologation.

Technical catalog: ArTu PB Panelboard – 1STC802005D0204

Benefits

- Option with incoming breaker or direct cable connection kit
- Incoming breaker Tmax XT3, Tmax T5, T6 and T7 up to 1250A
- Available in three sizes with maximum capacity of 6, 12 or 16 (18) outgoing ways
- Possibility to add side cable container, top and bottom extension boxes for metering
- Plug-in copper connection modules for outgoing devices
- High level of safety – all conductive parts are completely isolated
- IEC and UL certification
- 3 and 4 pole versions

Electrical distribution

SlimLine XR ITS2

Intelligent monitoring for easy energy management

Thanks to the intelligent monitoring unit ITS2, which is fully integrated into ABB's SlimLine XR range of switch fuse disconnectors, energy management is simpler and more reliable than ever. The SlimLine XR from 63 to 630 A fulfils all the demands for safe and reliable energy distribution in industrial and commercial buildings, critical power applications and photovoltaic installations.

Technical catalog: 1SEC311001C0201

Benefits

- Plug-in contacts at the distribution busbars, an integrated slide support and increased cable termination
- Installation in horizontal or vertical direction
- High degree of protection (IP41)
- ITS2 unit includes temperature monitoring features and an outstanding alarm system.
- Power consumption is monitored remotely via bus communication
- Network communication is done via Modbus RTU/RS485
- Easy to set-up via ABB Ekip Connect software tool

Create the perfect wind economy with every turn.

Creating the perfect wind economy starts with the drivetrain. The perfect drivetrain should help turbines produce more megawatts, more economically; provide the flexible technology to meet the grid code needs of today and tomorrow; deliver durable, reliable performances and be backed by easily available global life cycle services. At ABB, these goals are the foundation of our electrical drivetrain business, and they help our customers produce more megawatts, more economically. To find out how we can add wind economy to your business, visit us at **www.abb.com/windpower**

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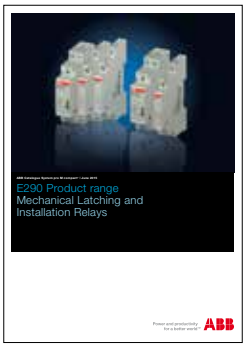
In the news

Many apps, software, Web pages and catalogues are available to provide support, in-depth and detailed product information. Documents and software can be downloaded from http://www.abb.com/abblibrary/DownloadCenter/

Brochure

E 290/ E297 brochure

Mechanical Latching and Installation Relays



You will find our new E 290/ E 297 brochure a useful tool to consult whenever you need specific information such as technical features and characteristics, application examples, mounting variations, order codes and much more. Plenty of data along with diagrams, tips, pictures and approval certificates that will provide you important information in a quick and easy way.

Brochure: 2CCC441020C0201

Poster

E 90 Fuseholder Poster

Uncompromising performance

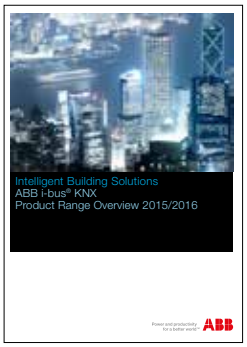
If you are a wholesaler, a distributor or a retailer, you can use our posters to decorate your shop and to promote your business at the same time. These tools are very effective thanks to their simple and attractive design and the high definition pictures of the products, which catch the attention of customers and add momentum to your business.

Poster: 2CSC444002H0201

Catalogue

Intelligent Building Solutions ABB i-bus® KNX

Product Range Overview 2015/16



The actual Intelligent Building Solutions product range overview gives a concise listing and description of the ABB i-bus KNX and building control portfolio including the necessary ordering information. In addition to ABB's KNX offering the ranges of Electricity meters, Newron solutions and WaveLINE Wireless Control are featured.

Catalogue: 2CDC500098C0203

Web Content

Discover the new LP Wind Segment Web page

Low Voltage Products and Solutions for Wind Power

While wind turbines can be enormous in size, it's the smaller components like ABB's control and protection products that help to ensure the availability of electric drive trains, pitch and yaw systems as well as other auxiliary circuits. From breakers to contactors for the electrical drive train, to switches and surge protection devices for the turbine control system, ABB has one of the largest portfolios available to ensure reliable and safe operations.

Visit: http://new.abb.com/low-voltage/industries/wind-power

Web Content

Discover the new ABB Wind multimedia application

Products and Solutions for Wind Power

As one of the largest independent suppliers of electrical components as well as a technology leader in connecting wind farms to the grid, ABB is key-enabler for the wind-industry. The application would give you the opportunity to find out how ABB supports the wind industry along the complete power value chain. This includes consultation, generation, control, collection and connection, transmission and a broad range of services that help operators maintain and optimize their systems.

Visit: http://new.abb.com/windpower

Video

Garage Nuggets

Solutions for Wind Applications

Explore the new Garage Nuggets video dedicated to Wind applications where we explain how you can cut the levelized cost of energy (LCOE) with ABB solutions, improving flexibility, reliability and efficiency of the complete system. The LCOE is the most important term in wind applications. ABB offers smart products and solutions in Wind applications to cut costs and help save space in your panels.

Video: 1SDC000001E0201

Video

Garage Nuggets

Gemini Challenges the Sun

ABB launched a new Garage Nuggets video for String Junction box for Solar application. In this Nugget you can discover how Gemini enclosures can be used to make Junction boxes or String combiner boxes for string protection in solar installations.
As the enclosures are most of the time outdoor mounted, they undergo tough environmental conditions and we show how we overcome this situation with Gemini.

Video: 1SLC805022E0201

Web Content

Discover the new LP Solar Segment webpage

Low Voltage Products and Solutions for solar Photovoltaic

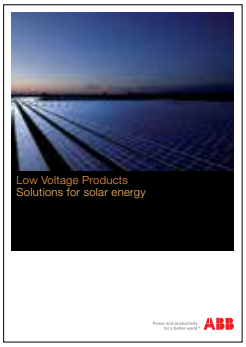
ABB provides the most comprehensive portfolio of products, systems and solutions along the solar PV value chain that enable the generation, transmission and distribution of solar power for both on-grid and off-grid applications.
The ABB product range can be easily found on the dedicated webpage for solar applications on the ABB.com.
On this page you can find sections for Direct current - DC and Alternating Current - AC side products covering the complete value chain in solar.
You can also download directly the catalog for solar applications from the following page.

Visit: http://new.abb.com/low-voltage/industries/solar

Solar Segment Catalog

Low Voltage Products

Solutions for solar energy



In this catalog you will find the complete offer of ABB Low Voltage solutions for photovoltaic.
The catalog is organized by application for residential, commercial and utilities together with a complete technical overview of available products for string protections, surge protection, insulation / string monitoring and junction boxes.

Catalog: 1SDC007350B0203

Any chance of challenging this?

Naturally.

With new OVR QS range, ABB offers a totally updated series of surge protective devices to protect the systems against the transient overvoltage.
The safety reserve systems is the perfect feature to extend the life of your systems and the auxiliary contact "TS" offers easy and quick maintenance.
OVR QS range is the ideal choice to simplify your work and improve the safety of your installations. **www.abb.com/lowvoltage**

ABB France
Division Produits Basse Tension
Pôle Foudre Soulé & Hélita
1, av. des Victimes du 11 juin 1944 - BP 303
F-65203 Bagnères-de-Bigorre / France

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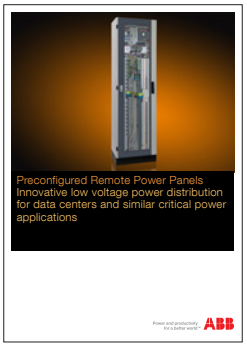
Datacenter solutions

Preconfigured Remote Power Panel

Innovative low voltage power distribution to critical loads like in data centers



The supervision, as well as the dedicated protection of the servers, is a key point in a very demanding and challenging industry such as the data center world. A scalable and intelligent solution is a must to comply with existing and future requests. This brochure provides an overview of the different levels of Remote Power Panels according to protection and safety. The symbiosis of Tmax moulded case circuit breakers with the SMISSLINE TP (Touch proof system) assures the full backup protection and allows live working. Embedded in the System pro E energy enclosures ABB grants IEC 61439-2 type approved solutions. Different levels of intelligence concerning metering and control allow a data center operator to prevent failures, save cost on maintenance effort and keep the cost down on energy as well.Just have a look at the solutions and tools in this new brochure.

Brochure: 2CCC481017B0201

Collateral for distributors

ONE20 Distributor stand

Supporting our distributor's business

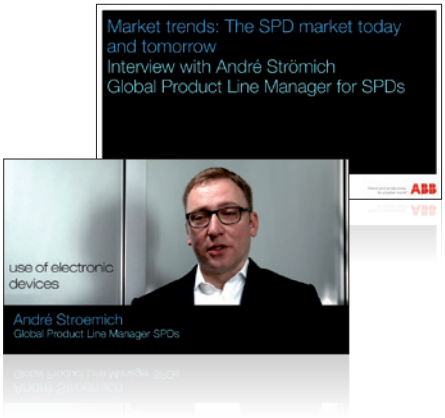
There is no better way to promote our products than by giving the right tools to our distributors. To promote the new ONE20 enclosed switches, we have created an attractive product package and a P.O.S distributor stand. If you are interested in this and would like more information please contact our local sales office.

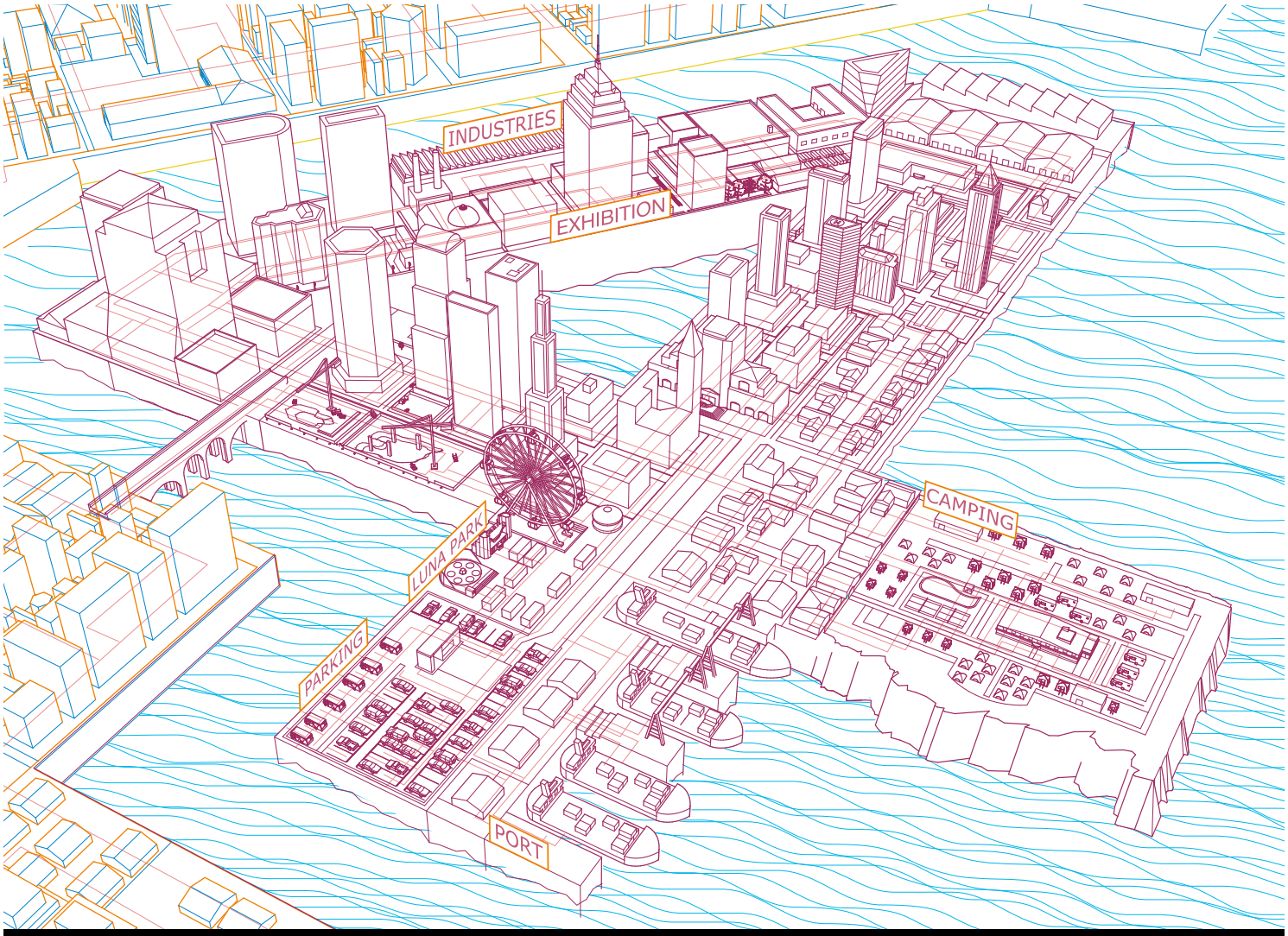
Market trends

Market trends: The SPD market today and tomorrow

Interview with André Stroemich – Global Product Line Manager for SPDs

Surge Protective Devices (SPDs) are becoming more and more important. The market drivers are the increasing use of electronic devices and electrification in our buildings irrespective of whether they are private homes or commercial buildings. These electronic devices need to be secure and protected. Please watch the interview with André Stroemich, ABB's Global Product Line Manager for SPDs, to find out what kind of benefits ABB's SPDs offer and which innovations ABB will present in the next years.





Minimum space, maximum protection
DS203NC: 3P+N RCBOs in 4 modules

Designed to be compact, DS203NC 3P+N RCBOs are suitable in all those applications where size can be an obstacle. They provide reliable and complete protection from overcurrent and earth fault currents. DS203NC RCBOs are available in two ranges with different breaking capacities to cover all the applications in commercial and industrial installations; DS203NC L with 4.5kA and DS203NC with 6kA breaking capacity according to IEC/EN 61009. The range includes types AC, A, APR and S and tripping curves B, C or K. **www.abb.com/lowvoltage**

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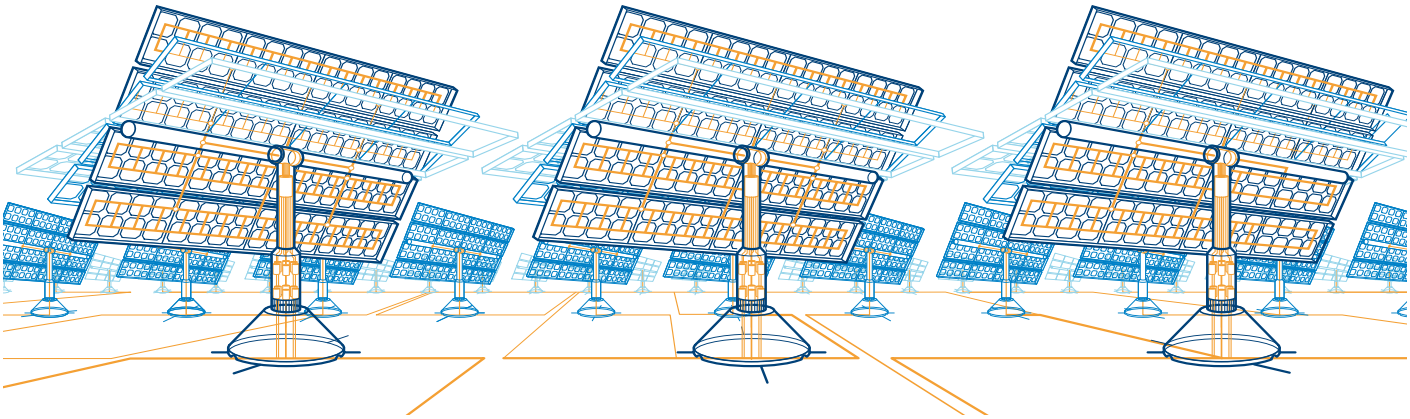
Top 6

ABB solutions to reduce levelized cost of energy (LCOE) of solar and wind power.



Solar power

From source to socket, no one provides more solar solutions

Solar energy plays an important role in matching the world needs for more power with less impact on the environment. ABB offers the industry's most comprehensive portfolio of products, systems, solutions and services to optimize the performance, reliability and return on investment of any solar installation – from residential rooftops to commercial applications and utility-grade power plants. With a proven track record in solar since the 1990s and our expertise in solar technologies, no one in the market provides more solar solutions from source to socket around the world.

1500 V DC product basket

The expansion of solar energy as a well-recognized and viable alternative to traditional energy sources depends on improving efficiency and reducing installation costs. Continuous improvements require continuous innovation. One trend that is quickly gaining mind-share across the industry is the increase of system voltages to 1500 V DC. With this change, installers can improve efficiency and reduce the cost of components and cabling due to lower current levels. However, this requires cleverly designed components that can control systems at a significantly higher voltage level.
As a leader in innovation, ABB is well-prepared with a complete portfolio of low voltage products that have been designed with this trend already in mind. From switch disconnectors and surge protection to monitoring and enclosures, ABB is ready to meet the 1500 V DC challenge with solutions that will help to lead the way toward long-term growth and sustainability.

To find out more, you can refer to the article on page 54.

Complete & innovative monitoring offer

The monitoring used in solar PV installations is much varied and related mainly to production, but also to other needs, such as efficiency, safety, and cost saving.
Thanks to complete and innovative solutions, such as strings, insulation or grid monitoring, ABB provides increased protection, performance and efficiency of the solar PV plants and therefore participate in the reduction of levelized cost of energy (LCOE).

To find out more, you can refer to the article on page 34.

Wind power

Coordinated breaker and contactor solution

Wind speed is not constant over time and rapid changes in wind speed and direction, place high demands on an electrical and mechanical design wind turbine, to maximize power output. This, together with the need to guarantee power quality during network disturbances, has focused attention on the formulation of national grid codes and has resulted in the repeated connection and disconnection for the electrical drive train. Additional safety requirements, such as overload & short-circuit protection, along with the isolation of the electrical sources, has resulted in a well-coordinated, high-performance solution for switching and protecting the electrical drive train. Based on the long experience in the wind industry, ABB can offer fully coordinated solutions (Type 2) with the Emax air circuit breakers and AF contactors that will increase the safety of the turbine, reduce downtime and risk on the asset resulting in a lower LCOE of wind power!

To find out more, you can refer to the article on page 52.

690V motor control solution for auxiliary systems of wind turbines

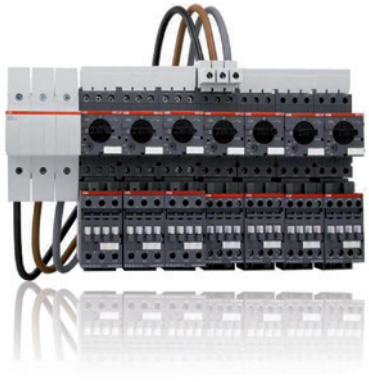


ABB has designed and provided solutions for the electrical part of the wind turbine auxiliary system for over 15 years. They are proven and reliable solutions, which are used in several thousands of turbines all over the world. These solutions, which use 690 volts as a nominal voltage, give several important advantages to the system such as: compactness (which results in a smaller and lighter overall solution), high efficiency (by reducing the power lost) and quick and easy maintenance. All of these participate in reducing the cost of the overall wind turbine and therefore help to reduce the cost of energy.

For more information, please watch the following video:

Complete and coordinated offer for earthing, lightning and overvoltage protection

Lowering the overall cost of energy is also about minimizing the risk to the asset!
Because of their height and exposed location, wind turbines are prone to direct lightning strikes. Transient overvoltages due to lightning can cause severe damage to the wind turbine installation, the equipment and create expensive downtime.
Based on the experience gained over the last decades, ABB provides state-of-the-art low-voltage surge protection devices (SPDs), medium- and high-voltage surge arresters (SAs), earthing and lightning protection (ELP) materials. ABB offers direct protection against lightning strikes and the transient over voltages caused by the secondary effects of lightning.

To find out more browse the following brochure:

Good morning DIN-Rail

ABB answers many questions sent to our experts through email.
Send your technical questions to mail.daybydin@abb.com, the most interesting ones will be published and answered in the next issues of Day by DIN.

Amber Fleming: *Solar Segment Manager - Breakers and Switches*

Key 2014 NEC Code changes for PV installations

The National Electrical Code (NEC) Book was first published in the United States in 1897. It describes a set of best practices for electrical work in houses and businesses. The NEC is updated every three years and the 2014 edition - approved as an American National Standard in August 2013 - has some key changes related to photovoltaic (PV) installations. Electrical engineers, designers or installing contractors should review the 2014 NEC to understand the key changes that have been brought in as these will soon be adopted by many jurisdictions as local code.

A good understanding of the NEC is fundamental to operate a safe electrical design, so this article will focus on some of the most significant changes proposed that involve PV installations and some ABB products that can help with compliance.

DISCLAIMER: The following is a summary of the new or revised sections of the 2014 NEC that are, in ABB's professional opinion, most relevant to PV applications. It represents ABB's professional judgement on the matter, but is by no means intended to convey all NEC requirements. Installers should consider that there are additional Code requirements that may apply to their specific installations.

As regards the ABB products mentioned, further information may be obtained by contacting your local ABB representative, or by visiting www.abb.com.

110.26(E)(2)(b) Requirements for electrical installations (new section)
This section deals with dedicated equipment space and now aligns outdoor installations with indoor installations to ensure future wiring access to the equipment and protection from entry of foreign equipment.

– The space around the equipment must be equal to the width and depth of the equipment and must extend from grade to a height of 6ft above the equipment.

310.15(B)(3)(c) – Wire sizing
The 2014 NEC brings a change to 310.15(B)(3)(c) relevant to PV installations in that raceways and cables exposed to sunlight on rooftops will have temperature adjustment factors applied to their ampacities.

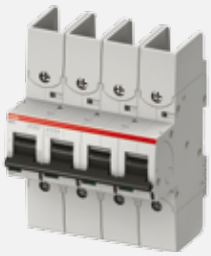
– **Additional temperature adjustments found in table 310.15(B)(3)(c)must be applied to the ambient temperature** when determining the correction factors in table 310.15(B)(2)(a) for sizing cables.

690.5(A) Ground-fault detection and interruption
The revision of section 690.5 came about in the light of recent developments in existing ground fault protection techniques that indicated that additional protection is necessary to provide protection from high impedance and multiple ground faults on PV systems.

Grounded DC PV arrays shall be provided with DC ground-fault protection with a device or system that meets the following requirements:

– Be capable of detecting a ground-fault in the PV array DC current-carrying inductors and components, including any intentionally grounded conductors
– Interrupt the flow of fault current
– Provide an indication of the fault
– **Be listed for providing PV ground fault protection**.

How to Comply with 690.5(A)?
ABB's S804U-PVS5 Ground Fault Detector Interrupter: UL-listed per UL489B



690.7(C) PV source and output

Due to the rapid increase in the number of PV installations and the evolution in the technology, article 690 has been extensively reworked. One particular aspect has been the move from traditional 600 V DC voltage levels to 1000 V DC. Whereas 1000 V DC systems have, in the past, been mostly used by utilities, they are now finding increasing use in domestic installations above a certain size. The new edition of the NEC presents some key considerations to ensure that 1000 V DC systems can be installed as safely as 600 V DC systems.

– In one and two-family dwellings, PV circuits other than lampholders, fixtures, or receptacles may have maximum PV voltage up to 600 V. Other installations with a maximum PV voltage of **1000 V** shall comply with Article 690, Part IX.

690.9 Overcurrent protection

The revised Section 690.9, dealing with overcurrent protection, has been re-organized in order to provide a better overview of requirements. Requirements were added regarding the hardware used for overcurrent protection of PV source and output circuits. This will ensure that the hardware is specifically designed for these systems.

– 690.9(A) All PV circuits and equipment shall be protected **in accordance with the requirements of Article 240**.
– 690.9(D) **Listed PV overcurrent devices** shall be required to provide overcurrent protection in PV circuits.
– 690.9(E) In grounded PV source circuits, a single overcurrent protection device shall be permitted to protect PV modules and conductors. **In ungrounded PV circuits complying with 690.35, an overcurrent protection device shall be installed in each ungrounded circuit conductor**.

690.11 Arc-fault circuit protection

Requirements for series arc-fault protection in DC PV circuits were first introduced in the last edition of the NEC Book. However, these referred specifically to PV systems with a maximum system voltage of 80 V DC or over and with DC circuits that are on or enter a building. The requirements are now expanded to all PV systems with a maximum system voltage of 80 V DC or over, regardless of the location. This should help prevent fire risk.

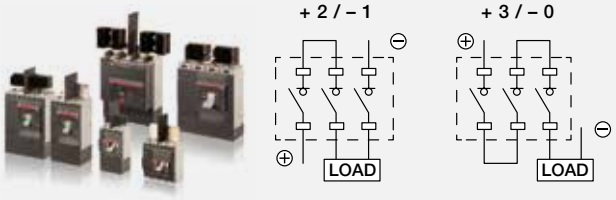
In contrast to five years ago, say, there are now devices available that meet the DC arc-fault requirement, so there is nothing to impede adoption or, indeed, regulatory enforcement.

– PV circuits with system voltage of 80 volts or greater shall be protected by a component or components **that are listed to provide DC arc-fault protection**. The system shall detect and interrupt arcing faults resulting from any failure in the intended continuity of wires.

Amber Fleming
Solar Segment Manager
Breakers and Switches

How to Comply with 690.9?

ABB's Tmax PV Automatic Circuit Breakers: UL-listed per UL489B and with specifically tested configurations for use in grounded or ungrounded systems.



For lower current PV circuits (<32A), see ABB's E90PV fuse disconnectors and E9F PV cylindrical DC fuses.

How to comply with 690.35(C)?
ABB UL Listed PV Inverters are available with integrated Arc Fault Protection functionality.

How to Comply with 690.12?
ABB Micro inverters: control solar panel's outputs individually

or
ABB's PV VAULT Solution: Specifically developed to meet the requirements of NEC Rapid Shutdown, this UL Listed solution is available for all PV system configurations.

How to Comply with 690.35(C)?
ABB's CM-IWN.1 insulation monitoring relays are UL-listed up to 600Vdc and up to 1000Vdc with the addition of the CM-IVN coupling unit. This device can provide feedback to the inverter to cease supplying power during a ground fault condition.

690.12 and 690.56(C) rapid shutdown (new sections)

Section 690.12 introduces some significant changes for designers regarding the rapid shutdown of PV systems on buildings. This deals with situations in which the safety of emergency services, for example, has to be assured after a system shutdown. To minimize shock hazard, there are now restrictions on the duration that conductors in a certain zone can remain energized after a shutdown. Section 690.56(C) deals with appropriate labelling for rapid-shutdown PV installations.

- 690.12: Rapid shutdown of PV systems on buildings
  - Provisions are required for the rapid shutdown of PV for the safety of first responders/firefighters. ALL PV circuits (AC or DC) greater than 30 V and 240 VA and meeting the following conditions must be shut down within 10 seconds after the rapid shutdown initiation.
    - · The portion of conductors that are located more 10 ft from a PV array.
    - · The portion of conductors that are more than 5 ft in length inside of the building
  - The Rapid Shutdown Equipment shall be listed and identified as suitable for the purpose, but no specific method of design is prescribed. It is expected that multiple solutions will evolve within the solar industry, such as contactor-controlled solutions or module/string inverters that are opened when there is a loss of utility power.
- 690.56(C) Labeling for rapid shutdown equipment
  - All buildings with both utility service and a PV system source must have a plaque or sign with the text, PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID **SHUTDOWN**.

690.31 Wire grouping

Section 690.31 clarifies wiring methods, for example separation of conductor types, allowed locations, grounding and cable fixing. Particularly important for PV applications is:

- **PV circuits shall not be combined in the same raceway, cable tray or junction box as non-PV systems or inverter output circuits unless separated by a partition.**

690.35(C) Ground fault protection in ungrounded PV systems

All PV circuits shall be protected by a ground-fault protection device or system that complies with the following.

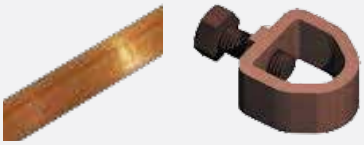
- Detects ground faults in **the PV array DC current-carrying conductors and components**
- Indicates a ground fault has occurred
- Automatically disconnects all conductors or causes the inverter to automatically cease supplying power to the output.
- **Be listed for providing PV ground fault protection**

690.41 System grounding

PV systems shall comply with one of the following with respect to system grounding.

- Ungrounded systems shall comply with 690.35
- Grounded 2-wire systems shall have one conductor grounded or be impedance grounded and the system shall comply with 690.5
- Grounded bipolar systems shall have the reference conductor grounded or be impedance grounded and shall comply with 690.5
- Other methods that accomplish equivalent protection **with equipment listed and identified for the use shall be permitted**.

How to Comply with 690.41?
Thomas and Betts' **furse** product line offers UL-listed copper tapes, tape-to-rod clamps, copper-to-aluminium joints and many other grounding solutions.



690.47(D) Additional auxiliary electrodes for array grounding (new section)
Accidentally omitted from the 2011 NEC Edition, this section is now back in and presents a requirement for a compliant and directly-connected auxiliary grounding electrode. In combination with standard grounding, this helps to protect against lightning events, which may be more likely given in the amount of conductive material in a PV installation.

– A grounding electrode shall be installed in all ground- and pole mounted PV arrays and as close as possible to any roof-mounted array according to 250.52 and 250.54. In some applications, the array mounting structure may also qualify as the grounding electrode, but this must be confirmed.

How to Comply with 690.47(D)?
Thomas and Betts' **furse** product line has multiple UL-listed ground rod solutions.

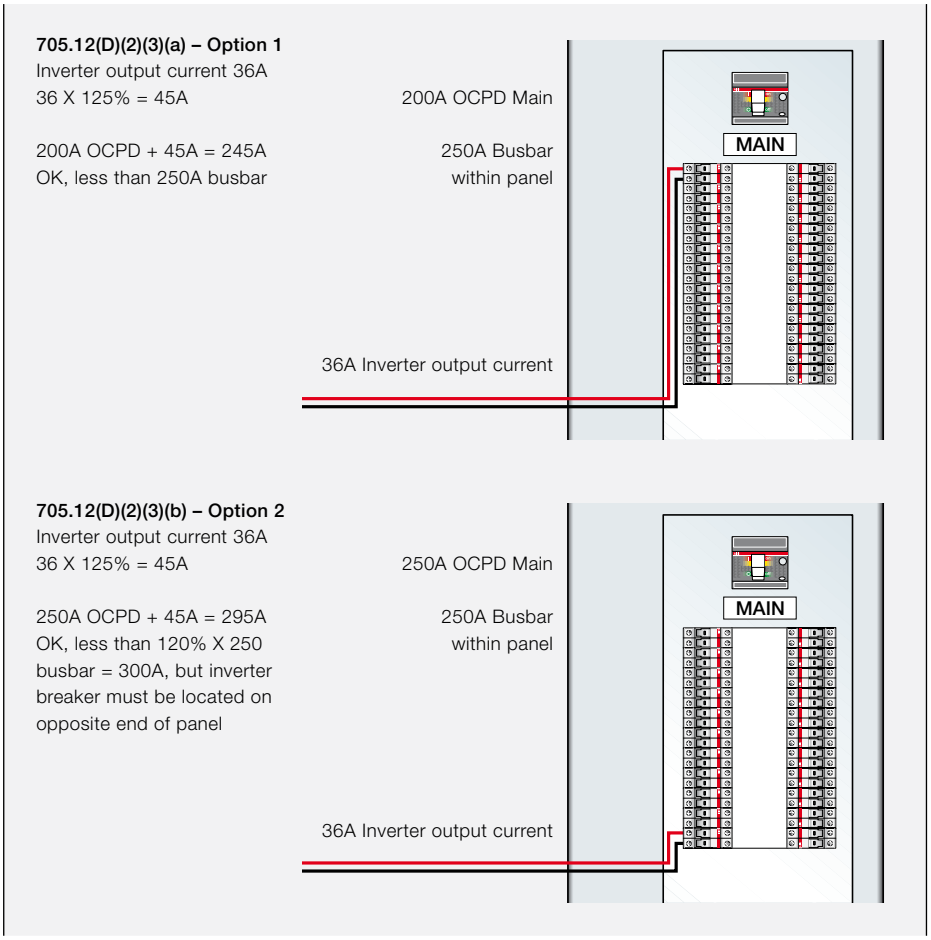
690.71(H) Battery disconnects
Section 690.71(H) has requirements that apply to battery-storage devices that are more than 5ft from connected equipment or where these circuits pass through wall or partition. The five requirements are:

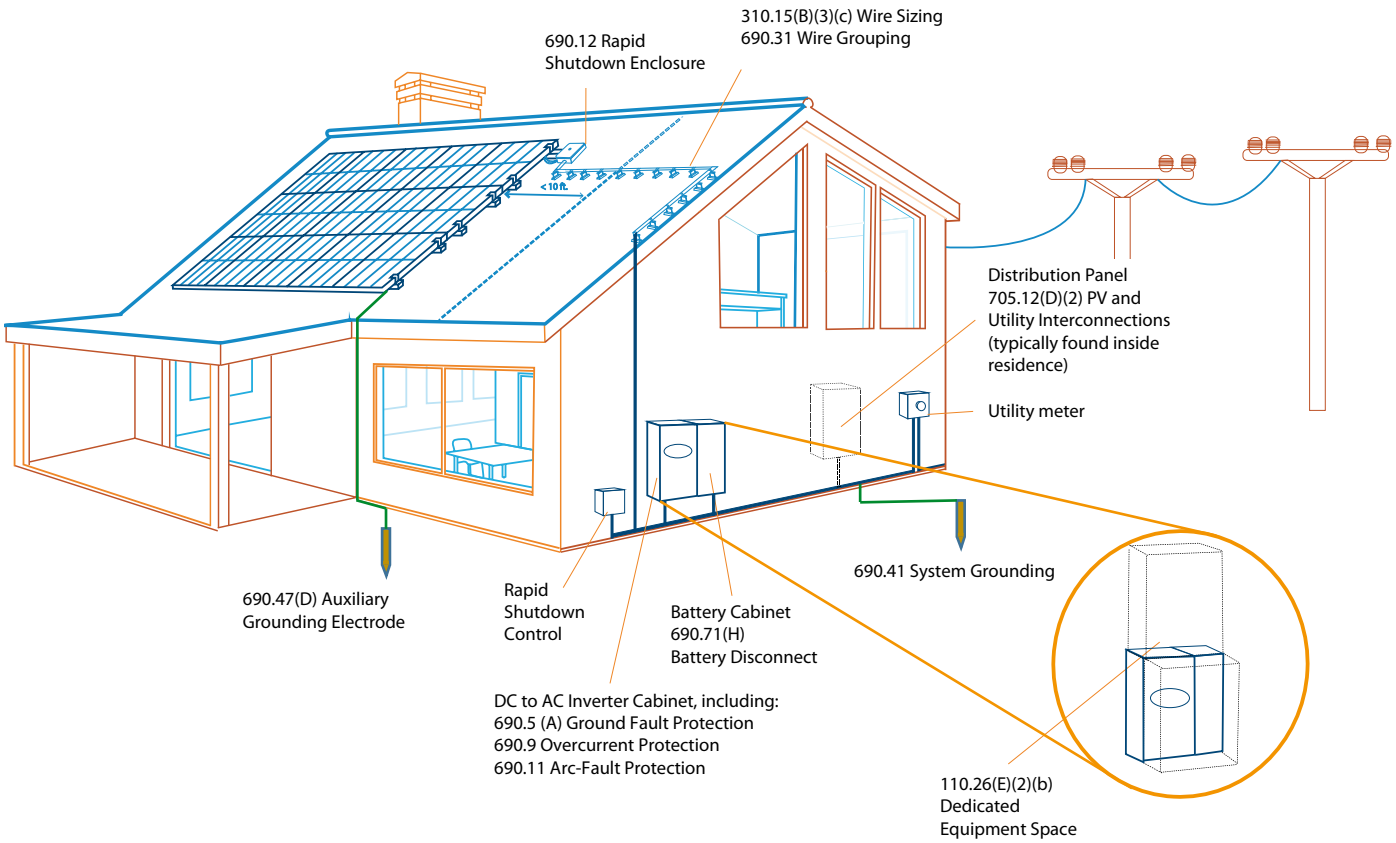
– 690.71(H)(1): A disconnecting means and overcurrent protection device shall be provided at the energy storage device. Fused disconnects or circuit breakers are permitted.
– 690.71(H)(2): Where fused disconnects are used, the line terminals of the disconnect shall be connected toward the energy storage device.
– 690.71(H)(3): These devices shall not be installed in energy storage device enclosures where explosive atmospheres can exist.
– 690.71(H)(4): A second disconnecting means is required at the connected equipment if the disconnect for the energy storage device is not within sight.

How to Comply with 690.71(H)?
ABB's OTDC Disconnect switches are UL-listed and can be used in conjunction with fuses at the energy storage device or as a secondary disconnecting means at the connected equipment.

705.12(D)(2) PV and utility interconnections
When interconnecting a PV source to the (AC) distribution equipment that is capable of supplying multiple branch circuits or feeders, **125% of the inverter output current must be used in the ampacity calculations for the conductors and busbars**. In the previous NEC edition, the ampere rating of the inverter overcurrent device was used in the calculations and there was only one possible calculation method for the sizing of these conductors.

- 705.12(D)(2)(3)(a) – Option 1: 125% of the inverter output current plus the rating of the overcurrent protective device (OCPD) protecting the busbar cannot be greater than the ampacity of the busbar. When applying this option, the backfed PV breaker can be located anywhere within the panel.
- 705.12(D)(2)(3)(b) – Option 2: **125% of the inverter output current plus the rating of the OCPD protecting the busbar cannot be greater than 120% of the ampacity of the busbar**. When applying this option, the backfed PV breaker can **only** be located on the opposite end of the panel from main breaker.
- 705.12(D)(2)(3)(c) – Option 3. The sum of all overcurrent devices (load or supply) within the panel, excluding main OCPB, shall not exceed the ampacity of busbar and the rating of the main OCPD shall not exceed the rating of the busbar. When applying this option, the PV breaker can be located anywhere within the panel.





Maximize energy from dawn to dusk?

Absolutely.

ABB products and systems geared towards photovoltaic power plants guarantee an increased production of energy compared to other solutions currently on the market. The entire portfolio is designed to capture solar energy, convert it into electricity and make it accessible for distribution or direct consumption in an efficient, reliable and secure manner. ABB comprises technologies that are streamlined for control and supervision, high-efficiency solar inverters, monitoring systems and sectioning, protection and measurement devices. These mechanisms enable the power plants to capture the maximum solar energy from sun up to sun down. The global demand for clean energy is ever-increasing. ABB makes it available. To everyone. **www.abb.com/solar**

Power and productivity
for a better world™

ABB

Urban legends Energy Meters - Quality of measurements

If we take any device which measures voltage, current, power or energy and we compare them, there should be no difference in the values provided. Actually, this is not true. There are many parameters that need to be taken into consideration when comparing data provided by a measurement device. The measurement device is installed to provide information and if this information cannot be trusted the device is not providing any value or could even be disastrous, if decisions are being taken on corrupt data. Is it worth taking the risk? As measurement devices are devices made to provide reliable data for the user there are standards to ensure that.

Aron Svedin: *Product Marketing Manager - DIN-Rail Products*

Saving of data

Will the energy data disappear in case of a power interruption?

According to the IEC standard IEC 62052-11 an energy meter has to save the data in a way that in case of a power interruption the values are not lost. When the power comes back the energy meter should continue to accumulate energy measurements from the value saved when the power interruption occurred. The energy meter needs to be able to detect a power interruption and save the data very quickly before it runs out of power.

Does the energy meter need to have a battery to ensure that the data will not be deleted in case of a power interruption?

An energy meter doesn't need to have a battery to ensure that the data is saved. It can for example use non-volatile memory which doesn't need to have power to keep the data. If the energy meter saves both the settings and the measurement data to a non-volatile memory there is no need of a back-up battery to make sure that the meter will continue to accumulate energy measurements from the value it was when the power interruption occurred or lose any settings made. There are few cases when a back-up battery is needed, for example in case of a real time clock (RTC). If the RTC doesn't get power it will be reset. Another example is in case the energy meter should count the downtime or keep the communication working even if there is no power.

Accuracy

All energy meters with accuracy class 1 are measuring equally accurate?

Accuracy is a part of quality measurement and according to the standard IEC 62053-21 – Particular Requirements - Static meters for active energy (classes 1 and 2) there are several thresholds which the meter needs to comply to. Lets assume to have a direct connected meter with a power factor 1. Firstly there is a range from zero current up to 0,05 times of the base (reference) current, lets call it minimum current. In this range the meter doesn't have any restriction on accuracy. From the minimum current up to 0,1 times the base current, lets call it transitional current, the meter will have to measure within 1,5% for a class 1 meter, not within 1%. From the transitional current up to maximum current the meter needs to measure within 1% for a class 1 meter.

In general it is easier to obtain an accurate measurement (in percentage) for a high current than it is for a low current. For a current of 80 A, 1% deviation is 0,8 A. For a current of 1 A, 1% deviation is only 0,01 A. Detecting a change of 0,8 A is easier than detecting one of 0,01 A. One can compare it with a ruler with a precision down to cm to a ruler with precision down to mm. If the difference between two objects in length is only 2 mm it will be hard, if not impossible, to detect the difference with the ruler with precision only down to cm, while it is very much possible to detect it with the ruler with precision down to mm. An energy meter with a high reference current (Iref) could be compared to a ruler with lower precision and an energy meter with a low Iref could be compared to a ruler with a higher precision, i.e. down to mm.

If my transformer connected meter measures very accurate, does it matter which transformer I use?

In case you use a transformer connected meter, the accuracy of the transformer is also needed to be taken into consideration. The total accuracy is effected by the behavior of both the current transformers as well as the meter.

$$\textit{Total accuracy}^2 = \textit{Meter accuracy}^2 + \textit{Transformer accuracy}^2$$

I'm using a central system to read the values of all my meters over a communication interface, does it eliminate all the concerns to get corrupt values?

Today more and more devices are connected to a central system via a communication interface. This system will regularly read the devices and save them into a database. For measurement devices in general this is a very good way to collect a lot of data for monitoring the system or as a basis for decision making. A measurement device is measuring the parameters of the power usually many times per second. A central system will read the measurement devices much less frequently with the risk of missing important information. If a drop in voltage happens, the meter should give an alarm and connect to a central system. The system has to read several parameters for each meter and it will take a certain time to complete a whole circle. If a drop in voltage happens between the readings, the system will miss the event. If instead this monitoring was made locally, and a meter could easily monitor many parameters at the same time (for example voltage phase to neutral, voltage phase to phase, currents, power and more for the total and per phase), even if the drop in voltage on one phase happened just for a couple of seconds, the meter could detect this and then next time the central system reads the meter it could tell that a drop in voltage has happened. Moreover, comparing consumed power in a regular interval, with a central system, it is difficult to ensure that the time between each reading is exactly the same. Especially when the interval is short and the number of meters are many. The data to be compared are then not apples to apples. If the saving of data is done locally by the meter, this will happen with an exact interval every reading. The data range can be read out by the central system and the data to be compared are now apples to apples. The risk of missing a single measuring point due to communication error is also eliminated. To read real time data centrally is giving estimates while logging data locally, which is later read out, is giving much more accurate data, that is quality data.

Aron Svedin
Product Marketing Manager
DIN-Rail Products

Doktor Wise
The expert answers

The monitoring used in renewable energy installations is much varied and related mainly to production, but also to other needs, e.g. safety. This article is using a utility scale solar PV plant as reference point.

Aron Svedin: *Product Marketing Manager - DIN-Rail Products*
Aravind Ramachandran: *Solar Segment Manager - Enclosures and DIN-Rail Products*
Borje Axelsson: *Renewables Segment Manager - Control Products*

String monitoring

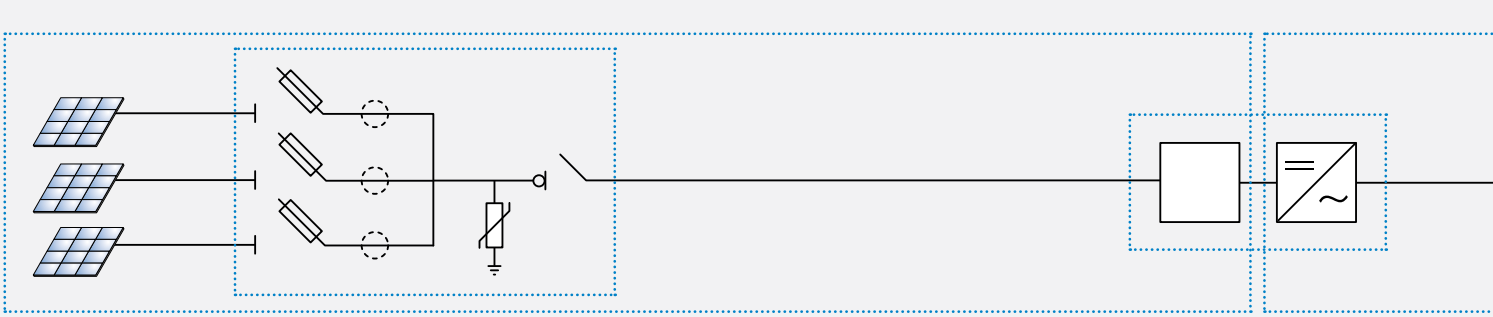
String box / String combiner box:
Solar panels are producing energy as long as the panel absorbs the sun's rays. This means that if there is something blocking the rays from hitting the panels they will not produce any energy. Obstacles like clouds, birds, airplanes, etc. and at night. We can remove some obstacles, like leaves, bird feces, snow etc, but it is not practical to walk around the panels checking them daily. For this reason we have developed a system to remotely monitor each string for obstructions and even broken cables and send notification.

By monitoring the DC current produced by each string and comparing them with each other and their previous performance it is possible to determine their efficiency and maintain it by removing obstacles.

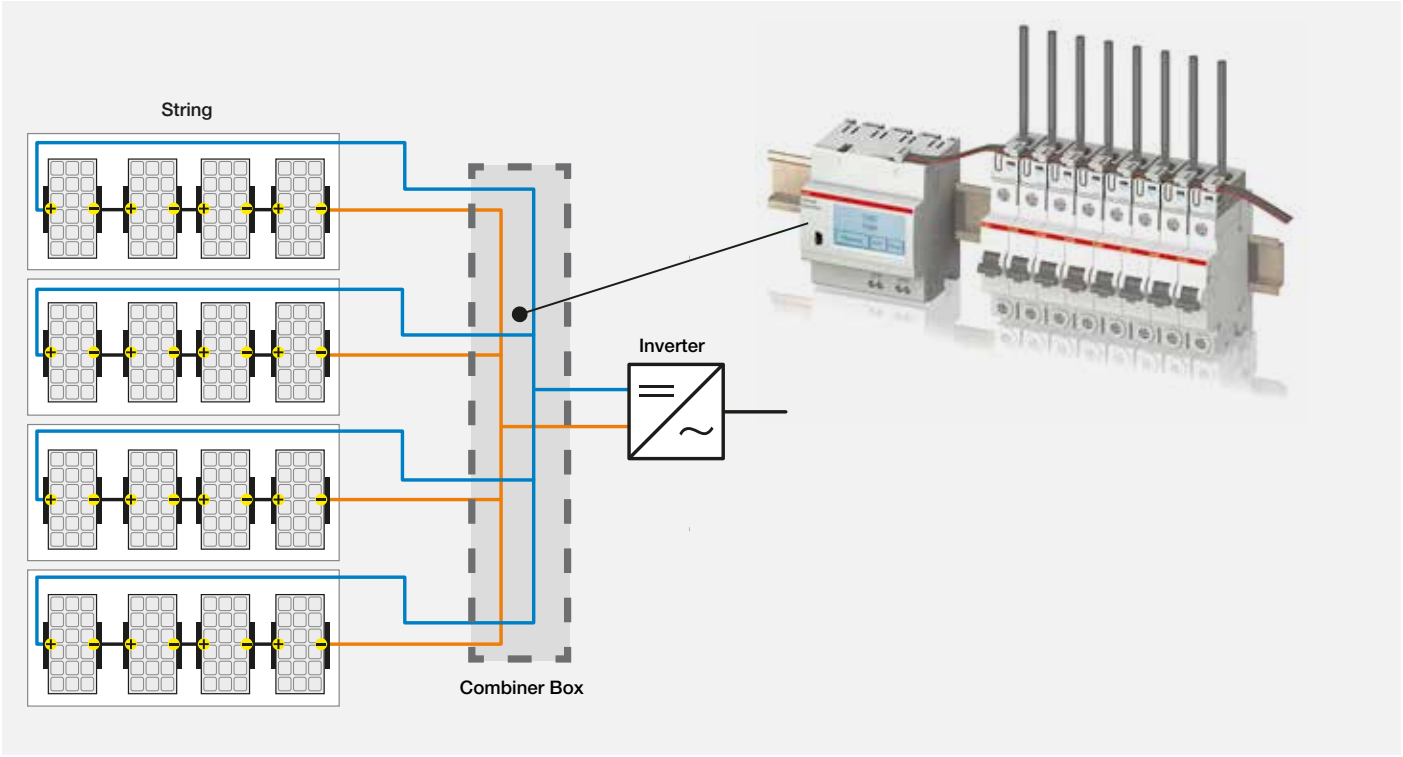
The monitoring device is usually installed in the string box. The string-boxes, also commonly called DC switchboards, combiners or junction boxes, allow protection against over current and over voltage and disconnect when faults are detected. They consist of protection products like fuse disconnectors with fuse links, surge protection devices and switch disconnectors. String boxes are fitted with monitoring systems in most utility scale projects, to perform different kinds of protection, performance and efficiency monitoring.

ABB offers factory assembled combiner solutions of various sizes suitable for a single string up to 32 strings for residential, commercial and utility scale projects with or without monitoring, depending on the requirement of the customer. The combiners comprise the main enclosure Gemini, which is made from a co-injection technique using thermoplastic material with the same mechanical strength as polyester. This enclosure is IP66 with UV resistance, making it suitable for outdoor environments essential for solar. The switchboard can be either wall mounted or floor mounted on a pedestal to suit the site conditions.

System overview



Part A



Monitoring System from ABB:

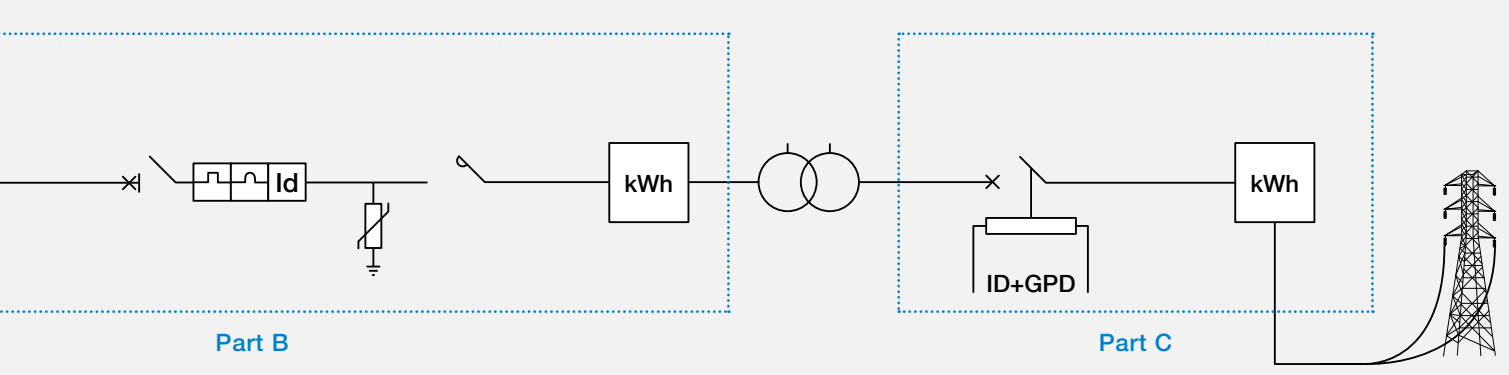
The String monitoring solution from ABB helps to achieve safety, reliability, flexibility and the efficiency of the complete value chain in the solar installations. It helps to compare and analyze individual string currents. This enables precise and reliable monitoring of solar energy generation. This guarantees the highest level of safety in the plant and it helps to achieve the utmost protection for modules by immediately disconnecting faulty strings.

Safety

- Provides accurate monitoring and detection of failure in strings
- Monitors the end of life of the surge arrestors ensuring un-interrupted protection against surge currents
- Measurement of the string currents and hence the power generation at each combiner level
- Improves the safety of the panels and the entire plant

Efficiency

- Reduces the downtime and hence increases productivity, thanks to the monitoring system
- Measures generation from each string and hence each combiner to analyze the output and increase productivity.



Insulation monitoring

Background

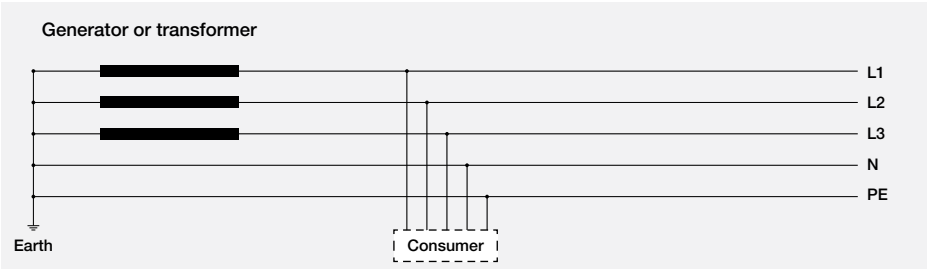
Ground (earth) faults represent a common fault type in electrical power systems (among short circuit faults, 98% is phase to ground). Local regulations and habits can vary widely from country to country, but based on the international standard IEC 60364 every letter has a meaning as following:

T = Terra (ground, earth),
I = Isolation,
N = Neutral,
S = Separate,
C = Common

IEC 60364 distinguishes three main families of grounding arrangement: TN, TT, IT. TN and TT are grounded systems.
IT is an ungrounded system.

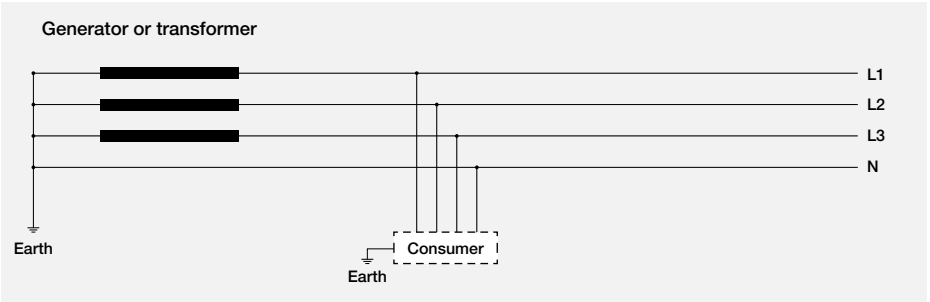
TN-system

The star point of the transformer is earthed, a PE (protective earth) wire connects all loads with the earth potential. In case of a ground fault a TN-system provides a high peak current to trip a circuit breaker or a fuse.



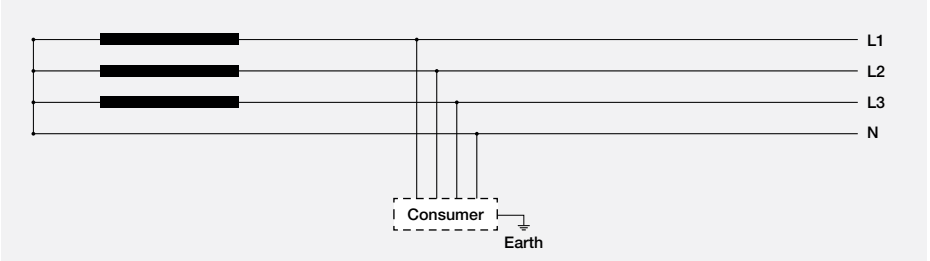
TT-system

In a TT-system the star point is also earthed. All loads are locally earthed.
In case of a ground fault a TT system provides only a small earth leakage current due to the high loop resistance between the earth points. An RCD is the right protection device here.



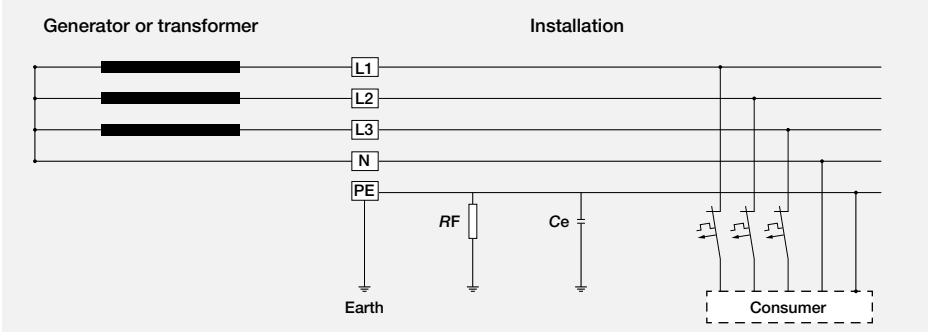
IT-system

In an IT-system the star point is not earthed. The first ground fault will not trip the protective devices. The system therefore keeps running with a first ground fault present. A second earth fault could lead to a short circuit between two lines and trip a circuit breaker or a fuse – thus the first one needs to be detected!



The standard IEC 61557-8 specifies the requirements for insulation monitoring devices.

Two of the most important factors are related to the insulation being monitored: $\mathbf{R_F}$ = Insulation resistance and $\mathbf{C_e}$ = leakage capacitance (from each conductor to earth).



Solar PV

Also in DC systems, e.g. Solar PV plants, both grounded and ungrounded systems can be found.

And also here, ungrounded systems need insulation monitoring, but large PV systems provide some unique challenges. This is related to high-system voltage and high leakage capacitance.

This capacitance rises with the size of the solar installation since the area covered by solar cells over the ground acts as a big capacitor, which means the more PV panels are installed, the higher is the leakage capacitance.

ABB has developed a complete range of products for various power systems, both AC and DC. For Solar PV plants, the product offer covers systems up to 1000 V DC and 2000µF.

Insulation monitors type CM-IWx

Grid monitoring

Background

Traditional public grids typically have had few large (GW) production sites and many smaller consumers.

With renewable energies emerging in the last couple of decades, electrical grids have faced some new challenges.

Today, there are few large production sites but many smaller production sites. Often these smaller production sites are not in the hands of utilities, but can also be indipendent power producers or private households. And some of these producers can also be consumers.

For example when a household can produce enough electricity, typically from a rooftop solar PV installation, it will use this electricity with no further need from the grid. If it produces more than it consumes, it potentially becomes a producer on the public grid. If its need for power is higher than its own production, this household becomes a consumer, seen from the public grid side.

There are three main challenges to this scenario

Safety

The possibility of different power sources at any point in the electrical network means risk of backfeed. For example when maintenance work is done on the grid, all possible power source needs to be disconnected. This is one of the reasons why most of the national standards allow renewable sources to be connected to grid only when the correct voltage is available on the grid.
Another risk could be a fire accident at the plant, read more about how to prevent it on page 27 in the paragraph "690.11 Arc-fault circuit protection".

Billing

With owners of renewable sources being potentially both producers and consumers, there is a need to measure the energy flow in both directions as well as to have rules for any limitation of this, and to know who is paying who (compensation at different scenarios).

Technical

Unfortunately, there is no international standard defining the conditions you may connect to (or disconnect from) the public grid. Solutions for grid monitoring are therefore not fully standardized, but adapted to local regulations. Three main standards have been developed, and many local standards are more or less based on one of these.

They are:

1) Italy based CEI 0-21
2) Germany based VDE-AR-N 4105 (resp. BDEW for medium voltage) and
3) UK based G59/3 and G83/2 (and North American UL508, CAN/CSA C22.2 No.14).

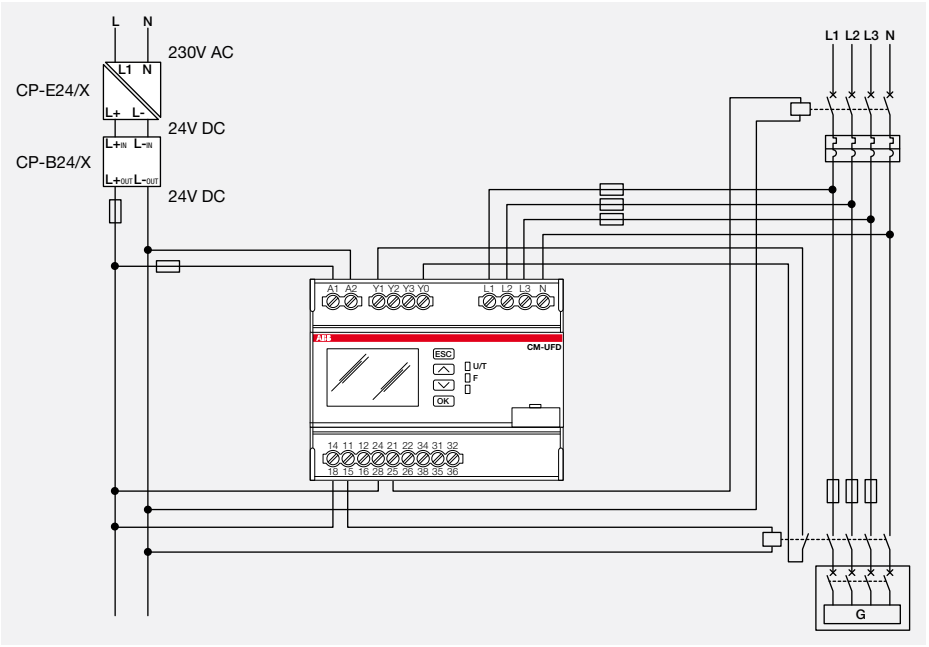
Grid monitoring is done by means of a separate device on the low voltage side of any transformer.

Grid voltage is monitored to be able to keep the status under control by preventing the connection of PV installation when the grid is outside defined thresholds. The typically monitored parameters are: the voltage level (under-/over- voltage, including 10min average), the frequency (under-/over- frequency), the Rate of Change of Frequency (ROCOF) and the vector shift.

ABB CM-UFD serie of grid feeding monitor relays is available in 3 versions, one for each of the above standards but with adjustable thresholds for flexibility.
The standards prescribes attention to details, to make sure solutions fulfil the requirements. The below example shows a solution compliant with CEI 0-21;

- CM-UFD.22 grid monitoring relay (third party certified according to CEI 0-21)
- CP-E power supply for 24VDC control voltage
- CP-B buffer module, which is required to secure available power to operate tripping device also at failure.

Grid monitor CM-UFD



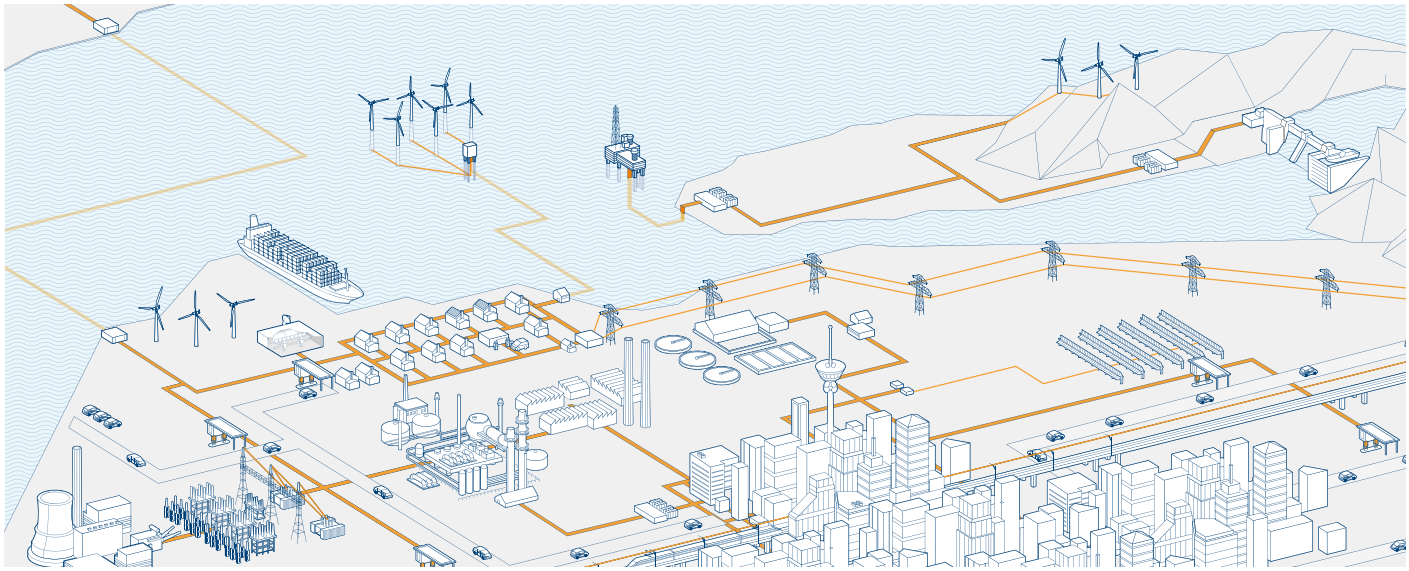
Upcoming events about renewables

Don't miss the chance to attend the events listed below.

Amber Fleming: *Solar Segment Manager - Breakers and Switches*

In 2016 many events, fairs and expo about renewable energies will be organized worldwide: do not miss the opportunity to attend in order to learn about the latest trends, present your new technologies and exchange information with the worldwide renewable experts!

Tradeshow or Event Name	Topic	Dates	City	Country	# of Attendance Last Annual
Solar Canada 2015	Solar	Dec 7-8, 2015	Toronto	Canada	3000
PV China 2015	Solar	Dec 10-12, 2015	Shanghai	China	8000
Solaire Expo Maroc	Solar	February 23-25, 2016	Casablanca	Morocco	4500
Solar Middle East	Solar	March 1-3, 2016	Dubai	UAE	3500
Wind Expo Tokyo	Wind	March 2-4, 2016	Tokyo	Japan	71000
The Solar Show Africa	Solar	March 15-16, 2016	Johannesburg	South Africa	6000
The Solar Show Asia	Solar	March 21-23, 2016	Singapore	Singapore	1000
Intersolar China	Solar	March 29-31, 2016	Beijing	China	12000
Enex - New Energy	Renewables	March 30-31, 2016	Kielce	Poland	5000
Energy Med	Renewables	March 31 - April 2, 2016	Naples	Italy	20000
Green Energy Expo	Renewables	April 6-8, 2016	Daegu	South Korea	40000
Reneo	Renewables	April 6-10, 2016	Budapest	Hungary	45000
Solarex Istanbul	Solar	April 7-9, 2016	Istanbul	Turkey	18731
Green Expo	Renewables	April 19-22, 2016	Kiev	Ukraine	7100
Hannover Messe	Wind	April 25-29, 2016	Hannover	Germany	60700
Solar Energy Exhibition and Conference	Solar	May 4-5, 2016	Melbourne	Australia	4000
All-Energy	Renewables	May 4-5, 2016	Glasgow	United Kingdom	8000
The Solar Show Philippines	Solar	May 18-19, 2016	Manila	Philippines	2000
SNEC 10th International Photovoltaic Power Generation Conference and Exhibition	Solar	May 23-25, 2016	Shanghai	China	51400
AWEA Wind Power	Wind	May 23-26, 2016	New Orleans, LA	USA	unknown
W-Power 2016	Wind	May 24-26, 2016	Shanghai	China	12000
Asean Sustainable Energy Week	Renewables	June 1-4, 2016	Bangkok	Thailand	24000
Renewable Energy World Europe	Renewables	June 21-23, 2016	Milan	Italy	10000
Intersolar Europe and EU PVSEC (newly combined)	Solar	June 21-24, 2016	Munich	Germany	40000
Solar Expo 2016	Solar	June 28-29, 2016	Melbourne	Australia	1200
Intersolar North America	Solar	July 12-14, 2016	San Francisco, CA	USA	18000
Solar Power International	Solar	September 12-15, 2016	Las Vegas, NV	USA	15000
Wind Energy Hamburg	Wind	September 27-30, 2016	Hamburg	Germany	33000



What do AC/DC, a sewing machine, and ABB's miniature circuit breakers have in common?

Some interesting facts about AC/DC, the war of currents and how today's circuit breakers switch currents on and off.

Stefan Riemensperger: *Product Marketing Manager - DIN-Rail Products*

The innovative circuit breakers S 200 M UC © ABB

The AC/DC world tour "Rock or bust" started earlier this year. It's not only the rock band's name that comes from electrical engineering, but a few of their album names as well such as "High Voltage", "Powerage", or "Flick of the Switch." If you are a fan, then you probably know the story about the origin of the band name. Brothers Angus and Malcolm saw the letters "AC/DC" on the back of a sewing machine and thought it would be great for their band's name. As we all know, AC/DC is the English abbreviation for alternating current and direct current.

While the AC/DC band members were pioneers of hard rock, many years earlier there were three pioneers of electrical engineering, Nicola Tesla, George Westinghouse and Thomas Alva Edison. Around 1890 they argued over what was better: alternating (AC) or direct current (DC).

War of currents

At that time, Tesla and Westinghouse were favoring alternating current, while Edison, the inventor of the lightbulb, was supporting direct current. This era was aptly named the "war of currents". By the end of the 19th century, the use of alternating current prevailed in energy transmission and distribution. The argument has never been settled nor is it of concern for our modern times.

Importance of DC

Today, the growing importance of DC can no longer be denied. Special applications, climate change and energy policy all require the use of direct current technology. Renewable energy sources like photovoltaic generate direct current. Electric cars charge noticeably faster with direct current. It is obvious that DC will play a growing role in power generation, storage and use.

On and off – Switching currents as a challenge

In order to switch currents on or off, circuits have to be connected or disconnected. It may sound simple, but it gets more complex with closer scrutiny.
Now for the techy part:
Switching is easy to put in practice for alternating currents. Tripping causes an electric arc that extinguishes on the zero crossing of the sine wave-form of the current. From that point on, currents can be disconnected easily. Devices that disconnect circuits at the zero crossing are called zero point extinguishers.
Our current limiting devices of the series S 200 have energy class 3. Their specialty is to extinguish the electrical arc long before the zero crossing. This reduces the load on connected lines and devices, which increases their life span.
This fundamental ability makes these circuit breakers in DC applications useful as well.

Why can't you operate direct current with any circuit breaker?

There is no zero crossing for direct current applications and the electric arc that comes from opening the contacts does not extinguish by itself. Therefore, you have to come up with an idea for the extinction of the electric arc.

The higher currents escalate in the case of a fault. This increase generates the required magnetic field to draw the arc into the arc extinction chamber.

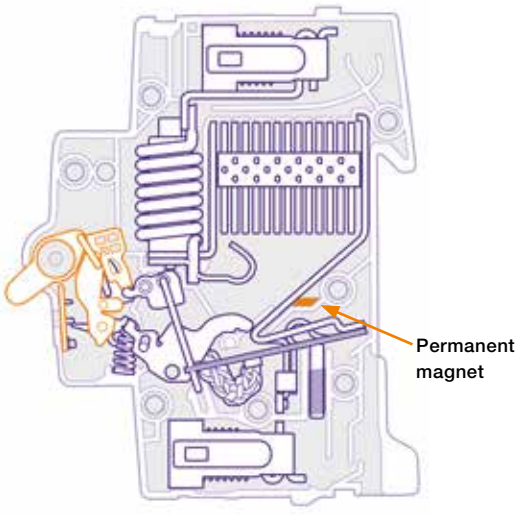
By contrast, the self-induced magnetic field will not suffice for lower currents up to 500A in order to draw the arc into the arc extinction chamber (see graphic). For alternating currents this danger can be avoided easily, since there will always be a zero crossing that allows a disconnection.

This possibility is not given for direct current, as there is no zero crossing. In this case, a permanent magnet ensures that the electric arc is drawn safely and reliably into the extinction chamber at all times (see picture). The basis for this effect is the Lorentz force.

When looking at the case of an AC/DC circuit breaker, you will notice that the circuit points are marked with a plus (+) and a minus (–). The reason is that the correct direction of electric current has to be considered, so the Lorentz force can draw the arc into the extinction chamber.

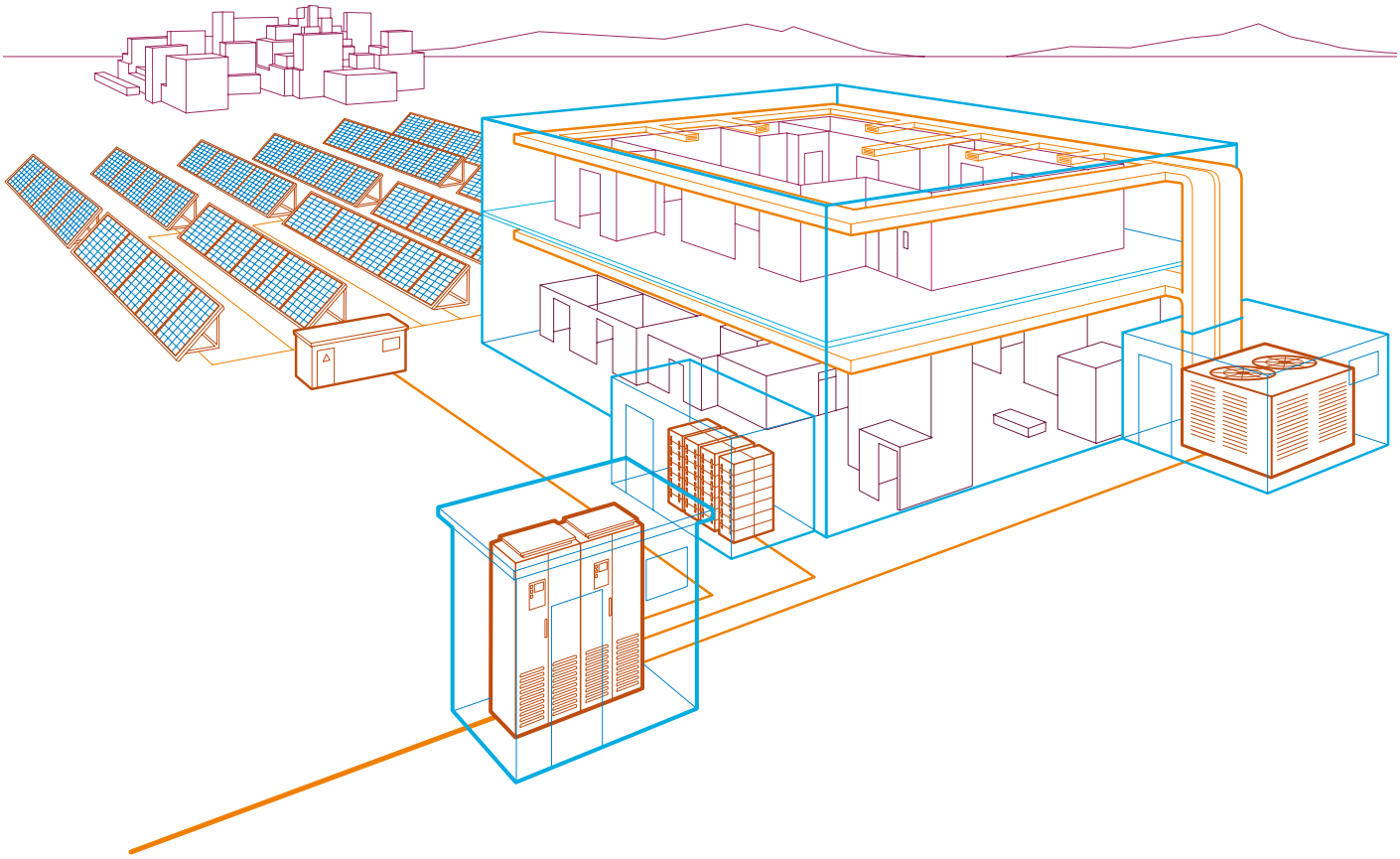
You cannot get a glimpse of how innovative these compact devices are and what complex processes take place inside of them by just looking at the cover. But that's exactly what is fascinating about them: a simple design with a brilliant function.

And who knows? There might even be one or two circuit breakers hidden in the midst of the stage equipment of the famous rock band AC/DC.



Schematic composition of an S 200 M UC with permanent magnet © ABB

Stefan Riemensperger
Product Marketing Manager
DIN-Rail Products



Fault protection of LVDC microgrids

New scenarios in electrical distribution networks, with increasing presence of distributed generation and loads with strict power quality requirements, including DC microgrids with energy storage systems as a replacement for traditional AC systems.

Enrico Ragaini: *R&D - Low Voltage Circuit Breakers*
Marco Carminati: *Global product management - Low Voltage Circuit Breakers*

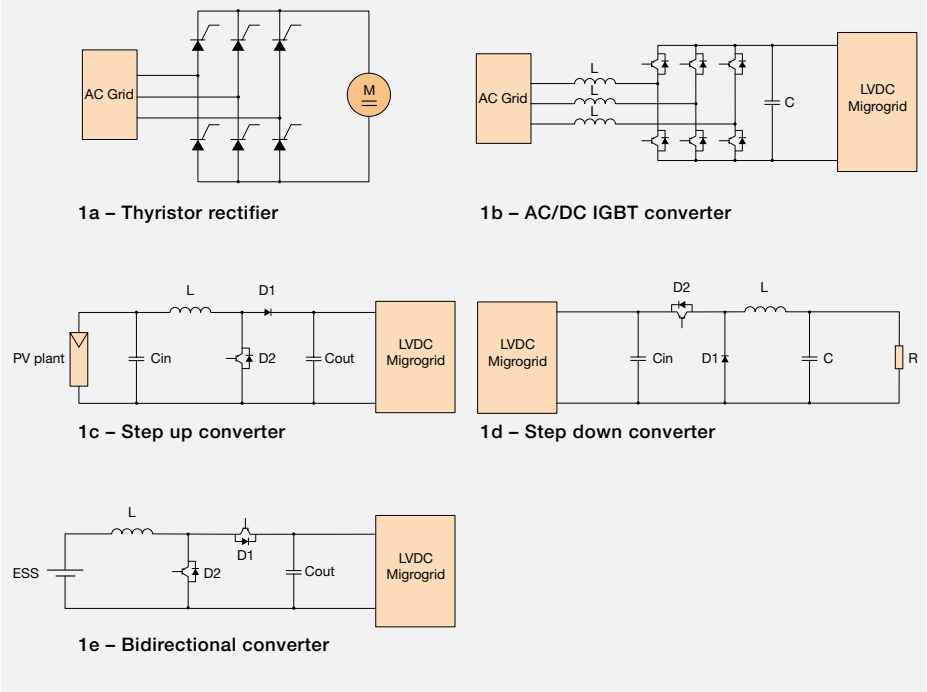


Figure 1 – Most common types of power converters

DC electrical distribution offers several advantages compared to AC in many applications, such as data centers, marine installations and in particular in low voltage distributed generation and storage. Battery energy storage systems and distributed generation such as PV plants or wind microturbines, and their related electronic converters, affect system behavior both during normal operation and in the presence of faults, in a variety of ways depending on the possible grounding schemes.

Most converter systems are actually based on double conversion: a DC bus is interposed between power electronic-based subsystems. In such an arrangement, the DC section is typically of limited extension and totally enclosed in a single switchgear. As a result, the probability of a DC fault is quite low, and used to be neglected in many designs. Nevertheless, in the new scenarios described above, the extension of the DC section becomes more and more significant. In some applications, DC distribution covers the majority of plant extension. (e.g. this happens in marine applications, in DC microgrids, and in DC data centers). In these cases, the probability of a fault in the DC section is no longer negligible, and such faults need to be dealt with thorough proper analysis and protection design.

Conventional wisdom is that converters limit current in any situation, hence the fault current level is no longer a concern in circuit design. While this might be the case for some specific situations, there are others in which converters are not able to limit fault current. This depends on the type and connection of converters, as will be shown.

Some of the most common types of power converters are shown in Figure 1. Each one has defined features and applications:

– three phase thyristor rectifier, which converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Thyristors are commonly used in place of diodes to create a circuit that can regulate the output voltage (application examples: feed and control of DC motors – Figure 1a);
– AC/DC IGBT converter, which is a forced commutated three-phase converter that can be used as a rectifier or as an inverter. Electronic component commutation (from ON to OFF position) occurs a hundred times per period, so it guarantees performances that otherwise could not be reached with thyristors. For example current or voltage may be modulated (PWM – Pulse Width Modulation) producing a low harmonic contribution, the power factor may be controlled and it may follow an established profile; the power reversal occurs by means of the voltage reversal in thyristor rectifiers, while forced commutated rectifiers may be used for current reversal (application examples: HVDC light transmission, DC/AC converter in drives, front-end converter in LVDC microgrids – Figure 1b);
– step up converter (boost converter), which is a DC/DC converter with an output voltage higher than its input voltage (application example: PV plants connected to DC systems – Figure 1c);
– step down converter (buck converter), which is a DC/DC converter with an output voltage lower than its input voltage (application example: DC loads connected to DC systems – Figure 1d);
– DC/DC bidirectional converter (buck boost converter), which is obtained with the combination of the previous two converters. This configuration allows the bidirectional power flow (application example: charging and discharging of energy storage systems can be connected to DC systems – Figure 1e).

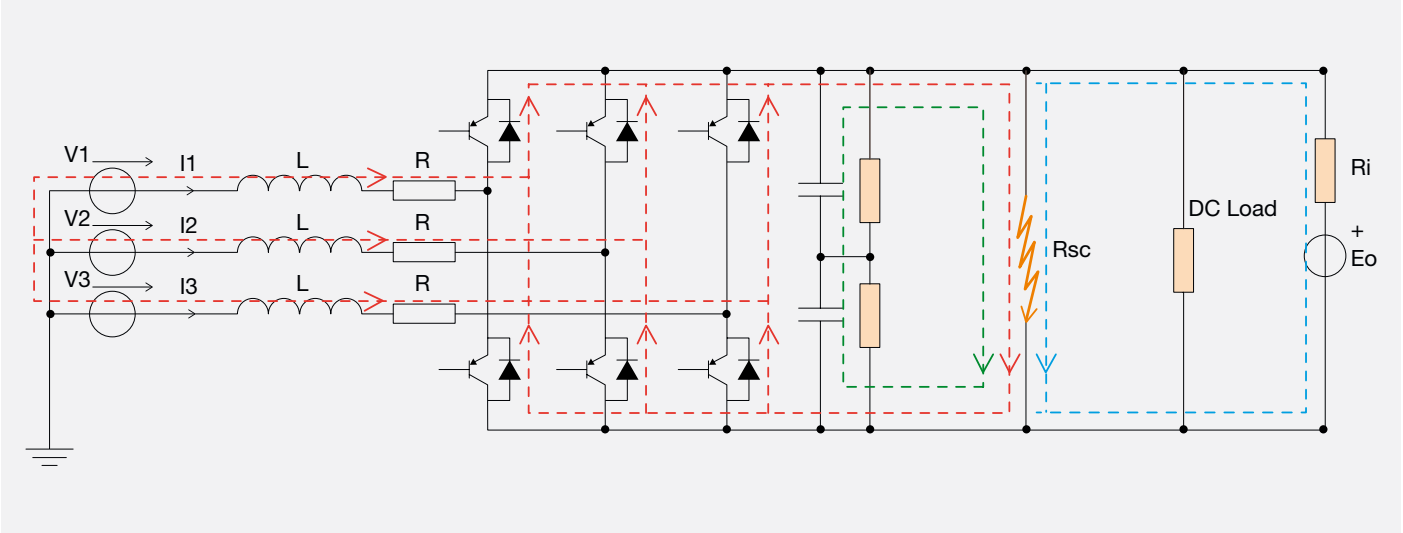


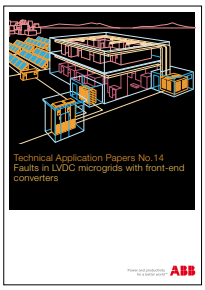
Figure 2 – DC short circuit current components in an active LVDC microgrid

As shown in the pictures, semiconductors with freewheeling diodes are widely employed. The purpose of such diodes is to prevent overvoltages and countervoltages when the semiconductor is switched off. Depending on the type of converter and the type and location of the fault, different effects may occur.

A common situation that is frequently described is the connection of a DC active microgrid (e.g. with PV plant or energy storage system) to the AC grid by means of an IGBT converter. If a short circuit occurs on AC side, the converter is able to limit the fault current. If, on the other hand, the fault is on the DC side, the fault current flows in the freewheeling diodes without any possibility for the IGBTs to limit it, even if the control system sends an IGTB block signal. (Figure 2).

Similar situations occur in all cases in which short circuit current path can include freewheeling diodes, hence all AC/DC IGBT converter, step-up and DC/DC bidirectional converters may suffer from this effect.

Moreover, a similar effect may take place in the case of a DC ground fault in a microgrid with the neutral point of the MV/LV transformer grounded (Figure 3) or DC negative pole grounded. Both grounding configurations are widely used as they guarantee operation safety from overvoltages. However, when a ground fault occurs, the front-end converter may not be able to limit the AC grid contribution to the fault current, even if the DC generator contribution may be switched off by IGBT block. It must be pointed out that ground faults are far more frequent than short circuits in electrical installations, hence DC ground faults are expected to become more frequent as the DC section of installations extends. Similar cases are possible for several other configurations of converters.



Full details can be found in Technical Application Paper No. 14 “Faults in LVDC microgrids with front-end converters”- 1SDC007113G0201

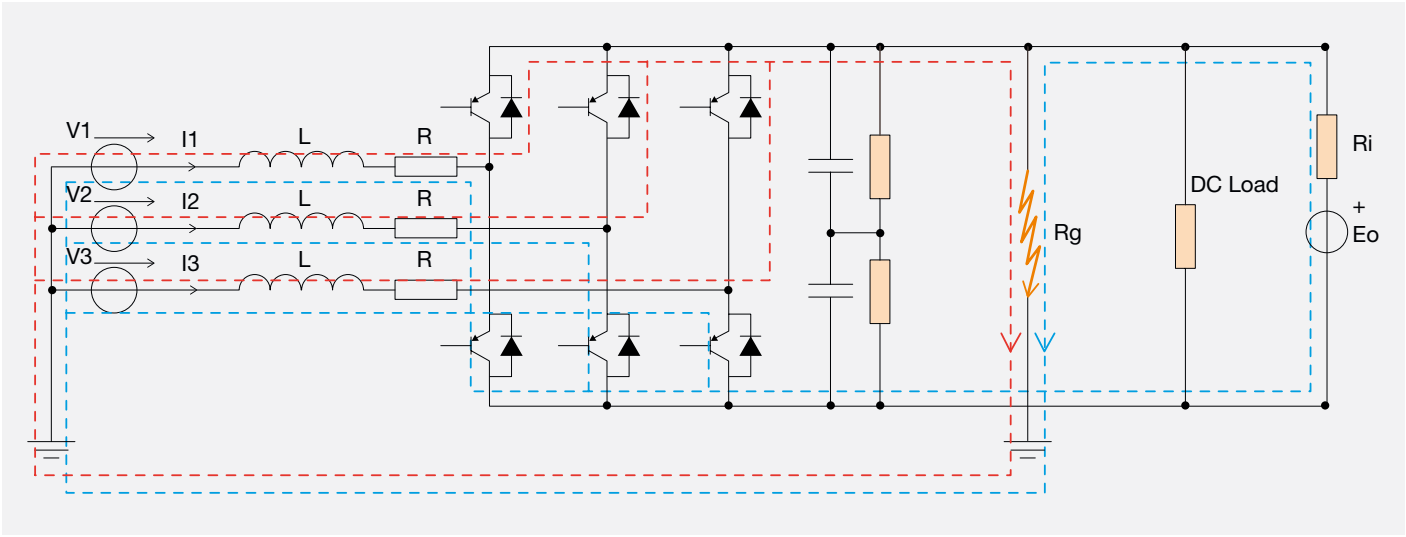


Figure 3 – DC positive pole ground fault current path in an active LVDC microgrid with the neutral point of the MV/LV transformer grounded

Thyristor rectifiers, which do not suffer this problem, can't be applied as front-end converters in DC distribution with distributed generation, because in cases of reversal of power flow, they require voltage polarity to be switched, with obvious serious problems to the devices connected to the DC-Bus.

It is thus clear that the naive statement that fault currents are of no concern, and that protection can be fully implemented by converters, is not generally true. A number of realistic cases have the result that converters can't limit ground or short circuit fault current. A thorough analysis of fault conditions must therefore be carried out, and dedicated protection devices must be employed in order to safeguard installation and operator safety.

There are nearly 300 million streetlights in the world with some 90 million in Europe alone. In Poland, for example, there are nearly 3.3 million street lights consuming 1,500 GWh annually (according to the National Fund for Environmental Protection and Water Management). Sodium vapor lamps account for 65% of these. Mercury vapor lamps, incandescent lamps, neon lamps, and other types account for the remaining 35%. Presently, these light sources boast about 40% efficiency.

The global trend is to upgrade street lighting with LED (light-emitting diode) technology. In France, 10% of lighting installations are replaced with LED lights every year. It is estimated that by 2020, as many as 50% of all installations will have been replaced with LED technology.

LED technology provides a versatile light source with long service life (often as long as 100,000 hours), that meets the joint requirements of cost reduction and energy efficiency. The extent of cost savings depends on the currently used lighting system, and amounts to 60–90% compared to conventional in- candescent lamps, sodium or mercury lamps, and to 10–20% compared to energy-saving CFL lamps.

Overvoltage protection for LED lighting systems

For over 80 years, ABB has been building and offering surge protective devices for protection of electrical and electronic equipment. Today, ABB also offers full solutions for LED lighting systems.

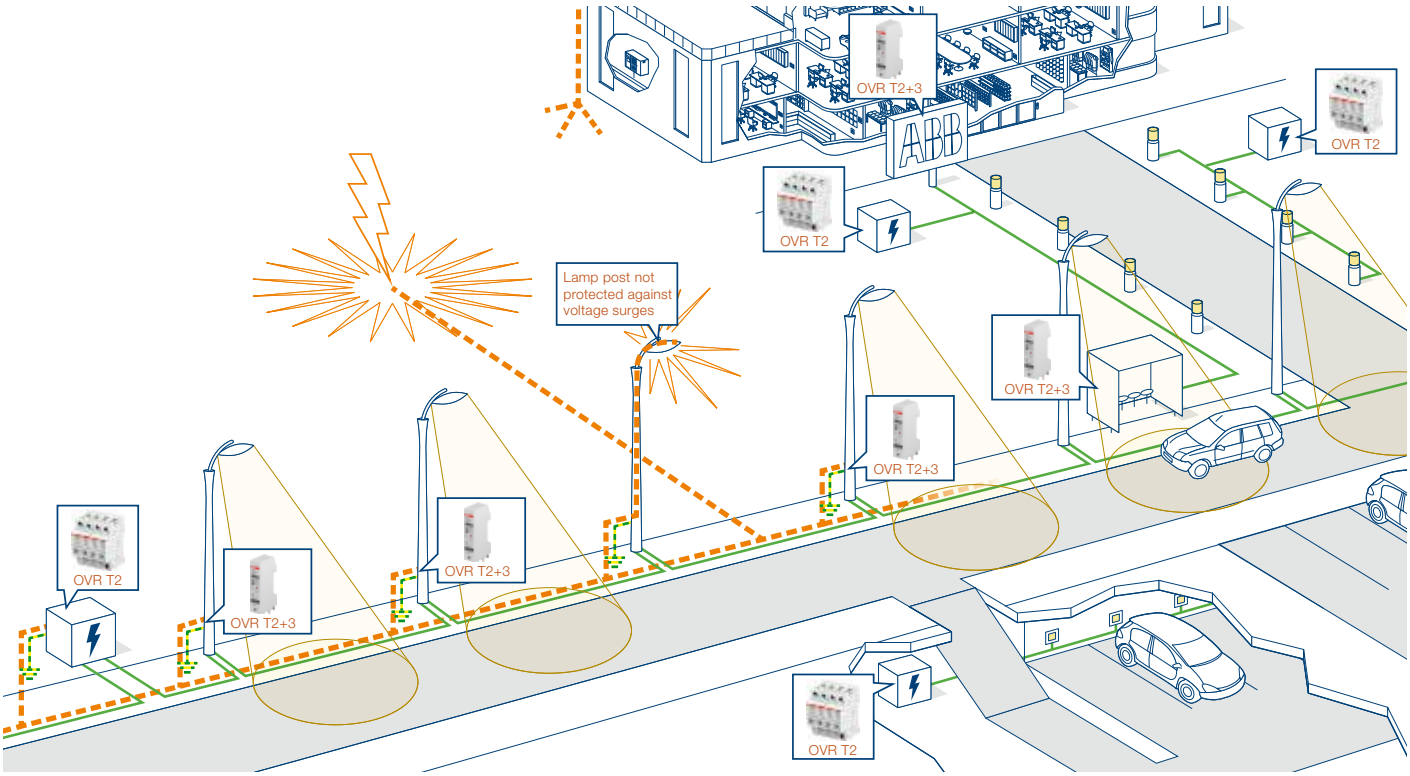
Bertrand Berges: *Product Marketing Manager - DIN-Rail products*

Due to the low energy consumption, LED lamps contribute to the reduction of the number and diameter of copper cables, which results in cost savings on the whole installation. Low operating voltage (<32 V) prevents the risk of electric shock, minimizes the amount of generated heat, ensures better resistance to temperature variations, vibrations, and impacts. LED technology is suitable for applications requiring lighting intensity controls (dimmers), room occupancy sensors or time switches, which adds to power consumption.

There are, however, some weaknesses to LED lamps. Their biggest weakness is low resistance to over voltages in the power supply network and in the light intensity control system. Over voltages could result in permanent damage to the power supply, control electronics, or the diode, or they might result in their premature aging. Electronic devices, such as LED power adapters, are capable of withstanding over voltages of up to 1500 V AC and require protection against transient overvoltages generated by industrial installations or lightning strike. The best solution to this technical problem are special surge arresters.

ABB has joined forces with the main market players (lighting appliance manufacturers, fitters, lighting unions, etc.) to propose a full range of surge protective devices for installation at various points of the LED street light power supply network.

To protect public lighting equipment, it is recommended to install two to three surge arresters as close as possible to the sensitive LED lamp in the cabinet of the lighting mast or traffic lights as well as type 2 surge arresters in the power supply switchboards.



Surge protection for street lights

Bertrand Berges
Product Marketing Manager
DIN-Rail Products

For close equipment protection – SPD Type 2+3

OVR T2-T3 N1 15-275S SL LED lamp surge arrester limits voltage surges occurring between the line (L), the neutral (N) and the Earth (PE) to Up = 1.1 kV at rated discharge current In = 5 kA. Maximum discharge current Imax is 15 kA. The unit is provided with two varistors protecting the system against over voltage. If one is damaged, the other continues to protect the equipment until the surge arrester is replaced.

Due to its highly compact size, the unit can be easily integrated in lamp posts and in small power supply boxes with DIN-rail mounting. The surge arrester is provided with an end of life indicator that allows preventive maintenance. IP32 protection class ensures higher resistance to severe weather and dirt conditions. In fact, the product is placed in the bottom of the pole where it is dirty and sometimes even with small animals. Bottom connection of cables eliminates condensation issues. The phase and neutral cables (with a length of 17 cm) are already connected inside the product housing to reduce the technicians' time. The surge arrester requires installation of additional safety feature in the form of either a gG or gL fuse link, or a B or C trip type circuit breaker rated at < 20 A.

For protection of general power supply cabinets — SPD Type 2

OVR T2 3N 40 275 P LED lamp surge protector limits voltage surges occurring between the line (L), neutral (N), and the Earth (PE) to Up = 1.4 kV at rated discharge current In = 20 kA. Maximum discharge current Imax is 40 kA.

The unit is equipped with plug-in cartridges that can be replaced without cutting off the power or disconnecting wires. It is DIN-rail mounted and provided with an NO/NZ auxiliary contact (TS) that — combined with the end of life indicator — facilitates condition monitoring.

The surge protection device requires installation of additional safety feature in the form of either a gG or gL fuse link, or a B or C trip type circuit breaker rated at < 50 A.

Whether installed in the switchboard or a LED street lamp post, the OVR ensures protection and continuity of operation of lighting systems in public and private areas (streets, car parks), as well as street furniture (bus shelters, billboards, decorative lighting), and light bollards ensuring road traffic safety

Maximizing production from sunrise to sunset?

Certainly.

ABB's tailor-made portfolio of products and systems for photovoltaic power plants generates 15 percent more energy than the market average. The portfolio includes a complete range of products and systems designed to harness the sun's energy, convert it into electricity and transfer it to the grid - efficiently, reliably and safely. It includes high-efficiency solar inverters and optimized control technologies that enable the plant to capture more energy for more hours of the day, from the moment the sun goes up until the moment it goes down.
Everyday the world demands more renewable energy – ABB makes it possible.
www.abb.com/solar

Power and productivity
for a better world™

01

In September 2015 consulting firm Frost & Sullivan released its new analysis on Energy Storage Systems (ESS). The result? This market is forecasted to grow 20 times in the decade between 2014 and 2024. Probably this is the right time to get to know more about ESS.

Alessandro De Danieli: *Product Manager - Low Voltage Breakers*

Energy Storage Systems: much more than a bunch of batteries!

Why Storage?

Thursday, July 9th, 2015 was an unusually windy day in Denmark. So windy that Denmark was able to announce that it was producing 116% of its electricity needs from wind turbines. Between 2am and 4am on Friday, July 10th, when electricity demand slowed down, that figure soared to 140%.[1,2)]

Not every day is so windy, as was seen just one day later on Saturday, July 11th when wind power dropped to just 8%.[2)]

Renewable energies source are far from steady. Take solar as a second example - production on a rainy morning is very different to production on a bright and cold morning, yet demand for electricity on the local grid may be the same. In areas with a high capacity of Solar Photovoltaic (PV) generation the local utility must take suitable precautions when demand and PV generation are out of balance, which is often the case in early mornings and evenings, when demand is high.

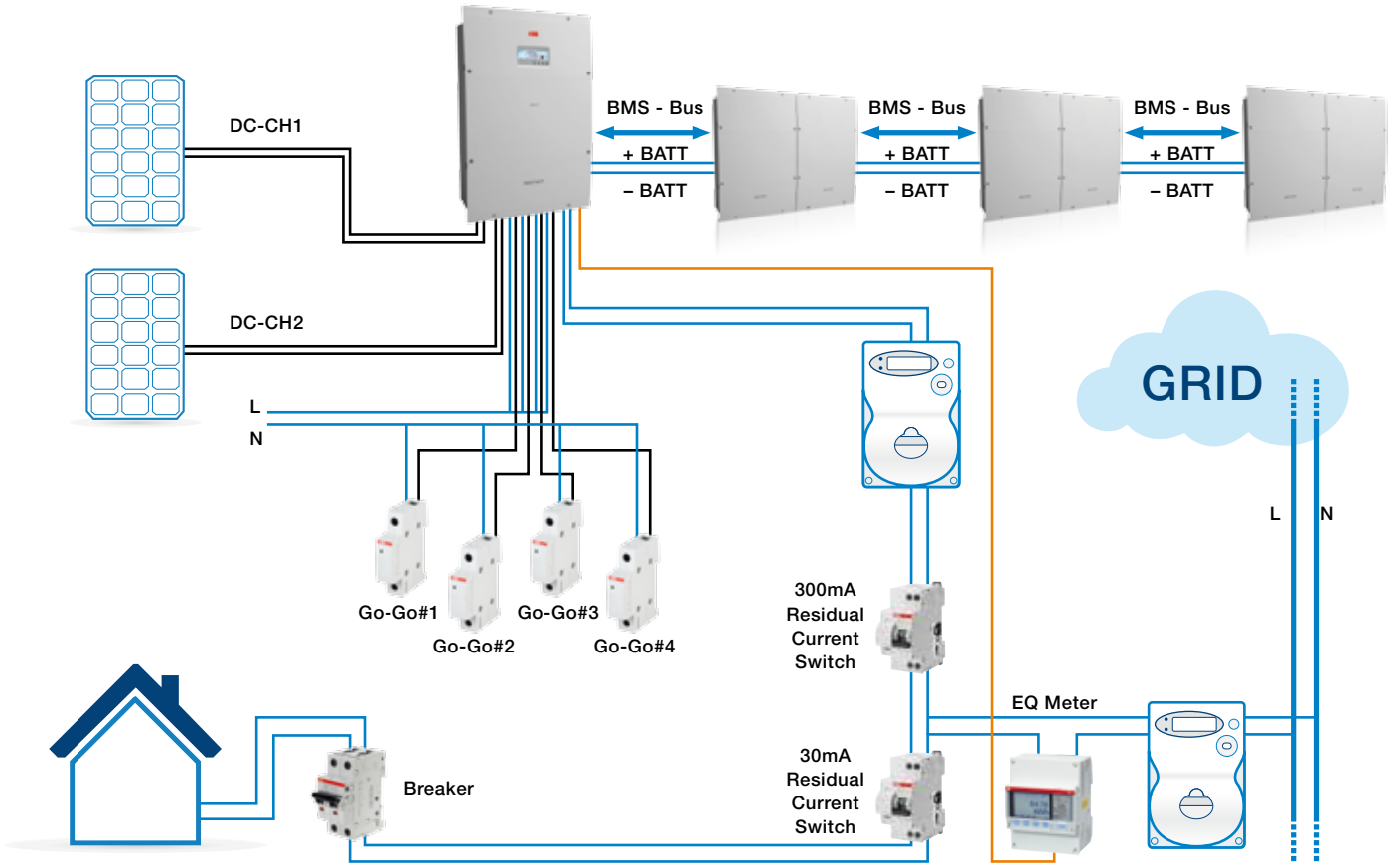
The most obvious solution to this unpredictability is storage: everybody knows that electricity cannot be stored as it is (with the exception of superconductors), and it must be transformed into another kind of energy to be used another time. The most traditional way of storing electrical energy has been to transform it into potential energy; hydropower has been working as power storage for many, many years.

But why did our grandparents need hydropower even before wind and solar became viable modern technologies? Because storing is not only about renewables; storing is also a good way to improve the efficiency of traditional thermal power plants. For example, in Italy more than 5 GW of power are occasionally required, totaling about 100 hours a year, the short fall is provided by hydropower, which can be brought on line rapidly during peaks.

Once the Hydro resource is exploited as much as possible, modern Energy Storage Systems (ESS) tend to rely on battery systems, i.e. a common way of storing electrical energy is to transform it into electrochemical energy.

1) The Guardian, online edition, http://www.theguardian.com/environment/2015/jul/10/denmark-wind-windfarm-power-exceed-electricity-demand

2) Wind Power Monthly, online edition, http://www.windpowermonthly.com/article/1358497/analysis-danish-surplus-exposes-grid-challenges



02

01 A large ESS installation, fitted with Emax Air Circuit Breakers.
02 Example of Solar Photovoltaic domestic installation relying over a battery system. In this case the DC voltage won't be very high, usually not superior to 500 V DC.
03 Logic scheme of a large ESS installation, connected to the grid via a step-up transformer, and relevant Low Voltage products.

The System for Storing Energy

ESS come in a variety of sizes. From residential (3 kW or 6kW) size to large utility-scale solutions (that can top 4 MW, or even more), the variety of installations is stunning.

For example, a domestic ESS network, generally working in conjunction with a PV domestic system, can be built up as in Figure 02.

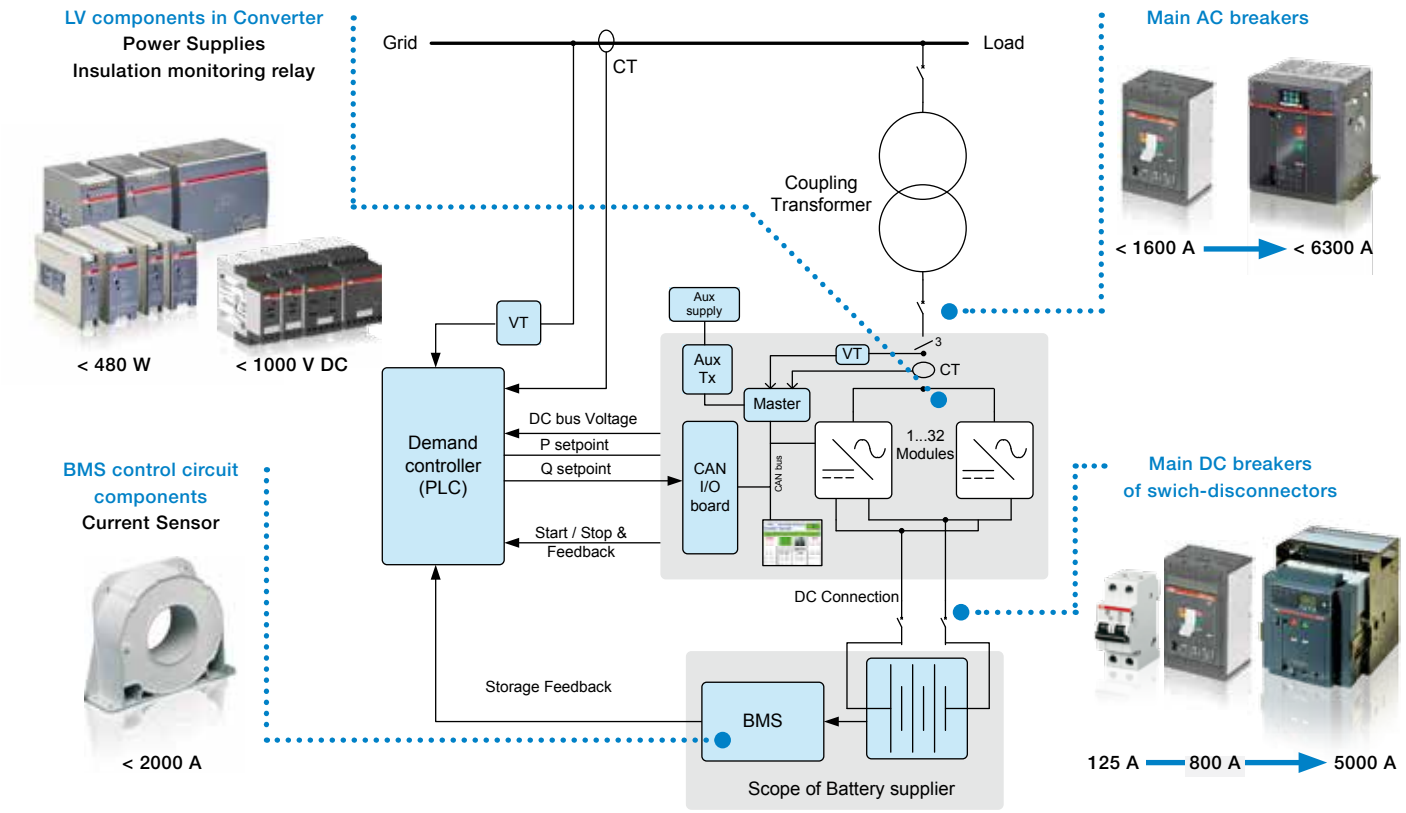
But if we take into consideration large installations, focusing our attention in the Battery Protection section, we can notice that, like in PV systems, ESS can use DC voltages from about 600 V DC up to 1000 V DC or more (even 1500 V DC). Nominal DC current is also comparable with PV systems, and the layout of the plant can also be similar to them (basic battery modules are connected in series, like PV strings). An example of such installation is given in Figure 03.

However, ESS using batteries present two main differences with PV application:

– the prospect of a short-circuit current can be very high (generally speaking, a typical waveform will have a high first peak followed by a steady-state short-circuit current, that can easily reach some tens of kA), while this is not possible within PV applications
– the flow of current is in 2 ways: charging and discharging of the batteries.

ABB can offer suitable bidirectional devices for protection from overload and short-circuit, as well as disconnecting means, even up to 1500 V DC with molded-case switches.

Another section that is worthwhile to be taken into consideration is the AC part of the ESS. Malfunction caused by high harmonic contents can lead to unwanted trips on normal currents, and for this reason it's necessary to select products with a good level of immunity from high harmonics.



03

Not just a system like any other

The presence of a peak in the discharge of batteries (or supercapacitors, for instance) for short-circuit can lead to some unexpected consequences, that must be taken into account.

Let's consider a 500 V DC Energy Storage System, with a rated current of 200 A in the form of supercapacitor system, with a calculated short-circuit peak at 25 kA. With a first analysis, we could think that a reasonable selection for the battery breaker would be molded-case Tmax XT3N , 36 kA of interrupting rating at 500 V DC (3P in series), rated current of 250 A (with a derating in the panel to be taken into account), fixed magnetic threshold at 2500 A (10 times the rated current).

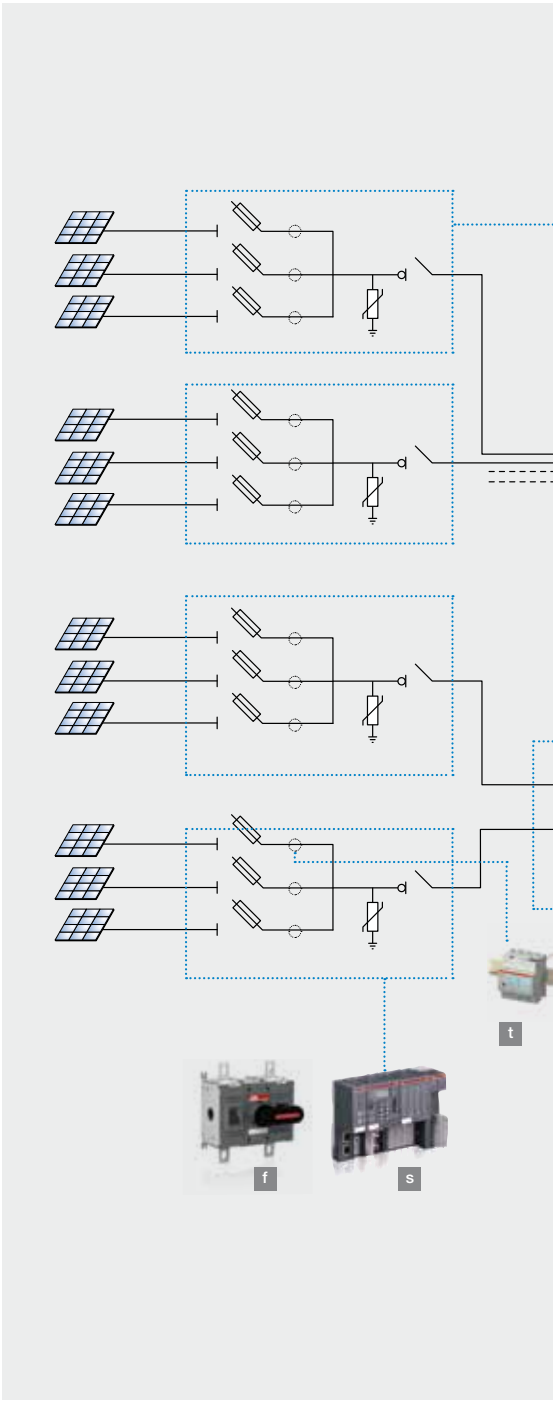
Well, maybe this is correct, or maybe not. The peak at 25 kA is not a real short-circuit current; it's just a spike, normally a very quick one. What can happen is that the contacts may start moving, due to the repulsion created by the short-circuit current, but then they might reclose again. The result? A possible melting of the contacts of the breaker; so that at the end of the transitory the circuit-breaker appears closed and in good condition. But the lever will not operate anymore.

Not exactly what is expected! ABB has the expertise to help designer and project managers choose the most appropriate disconnecting and protecting devices for ESS, in all conditions.

Alessandro De Danieli
Product Manager
Low Voltage Breakers

Next-generation components

Advanced low-voltage components for next-generation 1500 V DC utility-scale PV solar applications



As the solar photovoltaic (PV) industry continues to become an increasingly important share of the energy mix, the balance of system component technology is continually evolving to help lower the cost of energy production. In the past few years, the industry has seen a tremendous jump from 600 V DC inputs to 1000 V DC inputs, which represent the majority of utility-scale solar PV installations. The next step in this trend consists of systems with 1500 V DC inputs, which, by increasing the voltage level, enable higher power output capability by up to 50 percent – thus decreasing system losses and balance-of-plant costs.

ABB has developed 1500 V DC low-voltage components in order to process this new power. These components include switches, molded-case circuit breakers, contactors, surge protection devices and voltage/current sensors. Some components are rated up to 3000 A / 1500 V DC and carry various certifications, UL and IEC included.

Adapting to the solar market

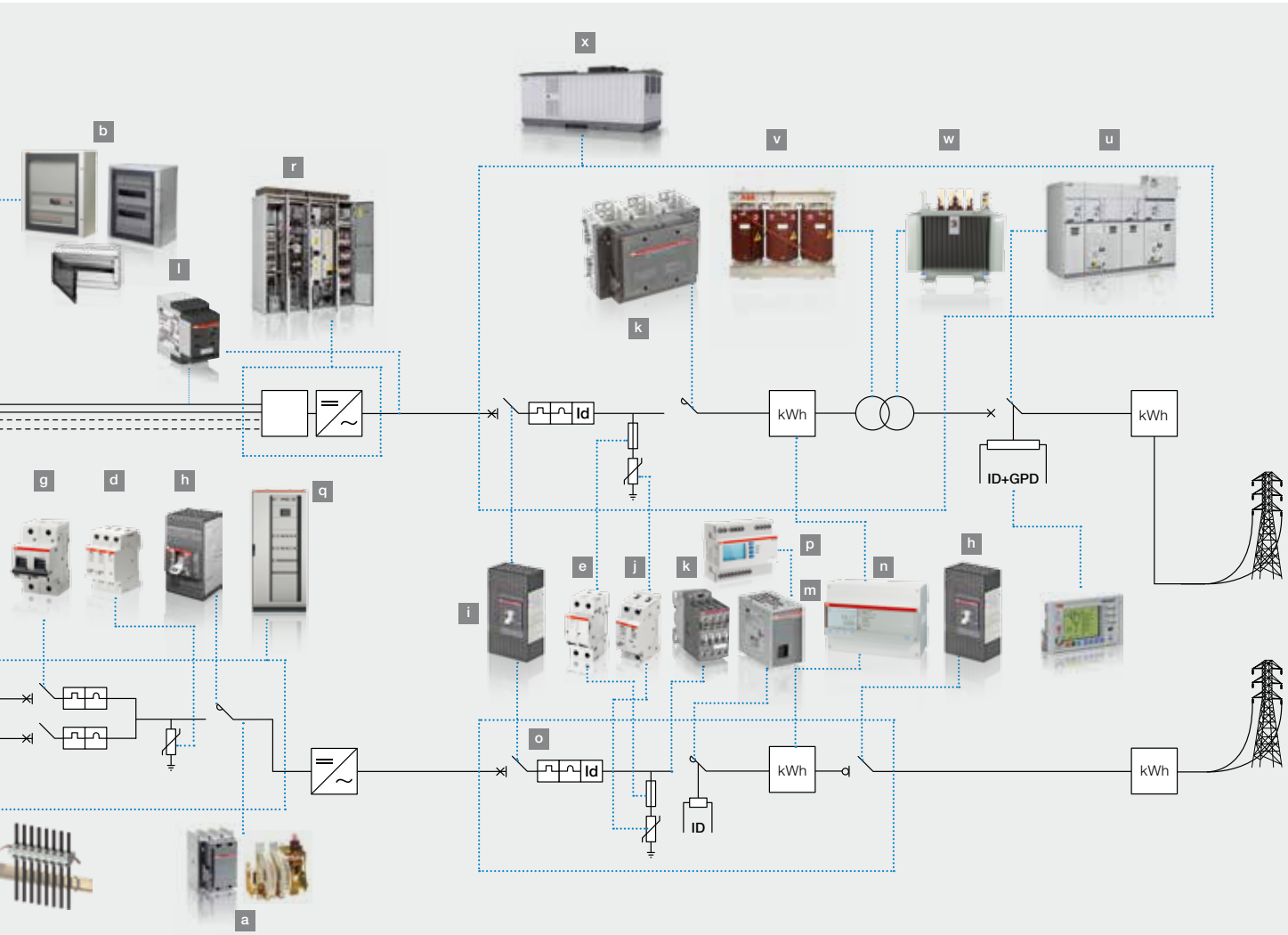
Clearly 1500 V DC is not new – for instance it is used in rail applications – but adapting it to the solar market has brought certain challenges.

A major challenge has been the issue of higher voltage requirements affecting the design of the system and insulation requirements. Temperature is an additional aspect that has to be addressed with components in the PV plant having to operate at higher temperatures, often reaching 70° C. Additionally, components for the 1500 V DC PV utility-scale installations may have to be designed for bidirectional current flow.

The new products also ensure safe processing of 1500 V DC power, as well as reduced power losses, reduced number of poles, visible blade technology, integrated heat dissipating and advanced arc extinguishing technologies.

In addition to the increased voltage, the new products can also handle more current – up to 6000 A depending on the device. This allows utility-scale PV combiner boxes and inverters to handle more power. Some of the new products can handle two 1500 V DC inputs simultaneously.

Already a leading supplier for all photovoltaic applications, ABB can now also provide advanced solar components to its customers that will allow them to begin their own next-generation 1500 V DC PV utility-scale designs, thus enabling them to benefit from higher efficiency and reduced costs for their systems.



Low-voltage products
a – Contactors: GAF series, IOR bar contactors
b – DC string boxes:
Switchboards: Gemini series,
Consumer units: Europa series
d – Surge protective devices: OVR PV
e – Fuse disconnectors: E 90
f – Switches: OTDC series,
Miniature circuit-breaker disconnectors: S800 PV-M
g – Miniature circuit breakers: S800 PV-S
Miniature circuit breakers: S200 M UC Z
h – Switch disconnectors: Tmax PV
i – Molded-case circuit breakers: Tmax
j – Surge protective devices: OVR T1 / T2
k – Contactors: A and AF series
l – Insulation monitoring devices: CM-IWN
m – Power supplies
n – Energy meters: EQ meters
o – Residual current device blocks: DDA 200 B
Residual current devices: F202 PV B and F204 B
Miniature circuit breakers: S 200
p – CM-UFD.M22
q – ArTu switchboards

Solar inverters
r – Central inverters: PVS 800
Remote monitoring portal

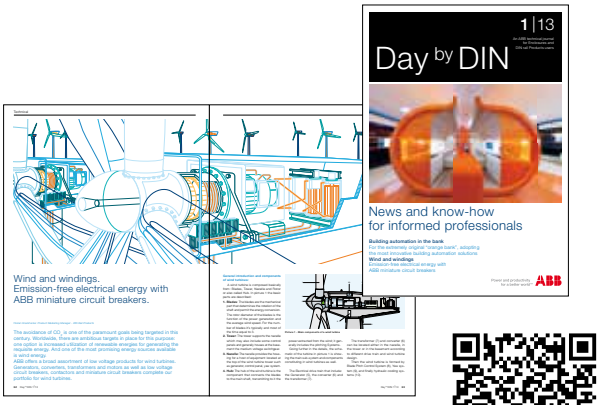
String monitoring
s – PLC AC500
t – Current Measurement System (CMS)

Medium-voltage products
u – Secondary switchgear
v – Dry-type transformers
w – Liquid-type (oil-filled) transformers
x – Compact secondary substations

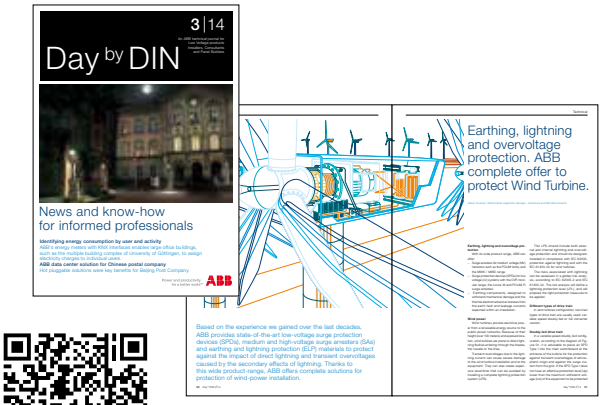
Federico Mai
Marketing Communication Account
LP Division

Day by DIN

In case you missed some editions of Day by DIN, please use the following QR codes with your smartphone or tablet to read the previous articles about renewables



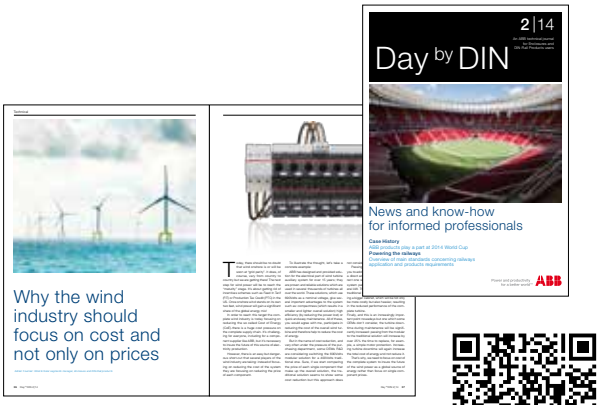
Wind and windings. Emission-free electrical energy with ABB miniature circuit breakers



Earthing, lightning and overvoltage protection. ABB complete offer to protect Wind Turbine

Temperature rise, breakers and disconnectors behavior in photovoltaic application

GFDI - Ground Fault Detection Interruption



Why the wind industry should focus on cost and not only on prices

How to reduce the temperature rise in combiner box using S800PV connectors

Raising output with optimized control?

Absolutely.

A solar thermal power plant can extend over several hectares and comprise thousands of collectors, intricate heat transfer and thermal storage technologies, and plant-wide electrical systems. ABB provides state-of-the-art distributed control systems that control and integrate these complex processes into a single optimized system. Our complete power and automation portfolio for solar thermal power plants includes electrical balance of plant, grid connections, instrumentation and cutting-edge products like high-efficiency motors, programmable logic controllers and variable speed drives. Everyday the world demands more renewable energy – ABB makes it possible.
www.abb.com/solar

Power and productivity
for a better world™

ABB

A "technological house" for the company's premises

Intelligent Building Solutions are crucial at the headquarters of an energy efficiency technology company with a business philosophy that human endeavors cannot survive without nature.

Thomas Rodenbusch-Mohr: *Product Marketing Manager Building Space®*

Rarely we are faced with a cork oak in a company's reception hall. A tree surrounded by stairs leading to the offices on the first floor and illuminated by the natural light filtering through a large skylight, but this is the first visual impact greeting visitors at the new SKY-NRG premises in Castiglione delle Stiviere, Italy. The company specializes in energy efficient technologies and wooden passive houses with low environmental impact.

Straight away, one wonders why place a tree at the entrance? The answer is given by the founders, who point out how the oak has a symbolic significance for a company that has chosen to recognize, first of all, the primary bond of survival that must be restored between human beings and nature.

Following this principle, the company designs and builds using timber from coniferous forests subject to controlled reforestation. They use panels manufactured by certified partners to construct buildings with an extra-low environmental impact, compliant with the principles of ecological design and featuring innovative technologies.

In the construction of "turnkey" houses and in electrical and hydraulic reclassification interventions, SKY-NRG also handles all the aspects related to installations through its in-house design office. The goal is to offer medium-high level installations in terms of quality and functionality.

From this perspective comes the decision to make use of Intelligent Building Solutions and to engage a qualified partner like ABB that, among other things, provides systems compliant with the international KNX standard instead of proprietary solutions.

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01 At SKY-NRG headquarters are implemented the same standards as the passive house with low environmental impact, the core of the company's offer.

02 The oak in the reception hall has a symbolic significance for a company that has chosen to recognize, first of all, the primary bond of survival that ties the human being and the nature.

03 Natural materials and a thoughtful architecture make the SKY-NRG headquarters a comfortable and healthy workplace.

04 The ABB intelligent building control system is the central element, managing all the functions that contribute to comfort and energy efficiency.

Extra-low energy consumption, healthiness and comfort

The possibility to directly experience the best solutions available is more effective than any description; for this reason SKY-NRG used the wood for its headquarters too, adhering to the severe standards of the "passive house" that are at the heart of the company's offer and the essence of its business principles.

The result is a building designed with a special attention to people's mental and physical wellbeing and the improvement of working conditions, by providing high levels of comfort and healthiness of the rooms: all focused on the reduction of energy consumption.

An air-water heat pump with built-in solar storage provides hot and cold water for the air conditioning and domestic hot water at no cost during the summer months and with a minimum expense in the winter. The use of radiant heating (floor systems on the ground floor and ceiling systems on the first floor), allowed further opportunities for energy savings by lowering the heating water temperature and increasing the cooling water temperature, thus minimizing the temperature gradient typical of the heat production by means of a pump.

A mechanical ventilation system provides constant air exchange, which ensures a high degree of comfort. The system also maintains healthy rooms and contributes to energy saving thanks to the influx of clean air at the same temperature as the air extracted. The same installation maintains constant humidity in the summer, dehumidifying when necessary and enabling room cooling through radiant systems. The air exchange rate is also regulated based on the CO_2 concentration.

The adjustment of the parameters that ensure comfort and wellbeing is carried out by the KNX building control system in each room, on the basis of the data detected by temperature, humidity and CO_2 concentration sensors.

Lighting scenarios and other functions

Complete control of the building installations can be carried out either through tablets located in different rooms and connected to the building control system, or remotely via a mobile device connected to the Internet.

The light adjustment depends on the presence of people and the brightness level, detected by specific sensors. In each room it is possible to apply the instant override, either manual or based on customized times. All illumination is provided by LED technology and controlled by a system compliant with the DALI protocol, interfaced with the KNX system.

Different lighting scenarios were also configured to create stunning visual effects, like the evocative lighting of the oak at the reception desk during events or technical meetings with external visitors.

Three scenarios are dedicated to the night lighting; one of them was specially designed to enhance the "splits" in the architectural configuration of the outdoor

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spaces. A "closing" scenario allows indoor lights to be turned off with a single command and simultaneously enable the night security system.

The conference room includes three scenarios for managing lighting and positioning of the blinds depending on use and projection needs. The room is also equipped with a Busch-priOn interface unit with a 3.5" color display and a rotary knob to perform some of the most important functions and to control the whole building.

The building control system also manages the functions of the garden irrigation system, controlled according to the rain sensors and a preset time schedule.

The constant monitoring of energy usage makes it possible to optimized energy needs and its rate of consumption. In this particular case, the monitoring is carried out by electronic meters installed inside the switchboards, which interface with the KNX system so that the data collected can be used to optimize the system.

The control elements of the Busch-priOn series and the compact KNX control devices that can be flush mounted with the range of ABB Mylos plates, complement the input devices of the building control system. Everything is perfectly integrated into high-quality aesthetic design that have determined the style of the new headquarters of SKY-NRG in Castiglione.

Acknowledgments

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Environmental Conditions. How the wind industry is pushing beyond the limits

Adrien Fournier: *Wind Segment Manager - Low Voltage Products*

Due to the application itself, the wind industry OEMs have always been setting up high requirements in terms of environmental conditions for the electrical products installed in the different sub-systems of the turbines. To list the main ones: vibration, pollution degree, lightning & EMC or chemical substance levels are usually reaching, or even going beyond, the limit mentioned in international industrial standards.

For some years, additional requirements are needed.
In the last decades, the installation of wind turbine has continuously increased: the result is that the present available places with ideal wind conditions are fewer and fewer. This fact has pushed the wind industry to consider more “extreme” locations with more severe environmental conditions: very low or high temperature, high humidity or high altitude.

The low temperature challenge:
Some wind turbines are now installed on sites where the temperature can reach -30°C! Considering that such extreme temperatures are totally incompatible with the electronics used in essential sub-systems, such as a converter or a pitch system, so heating systems have been added. However, even with this obvious solution, two challenges remain:

1 Starting the heating system after the disconnection of the wind turbine from the grid and loss of power.
2 Operating electromechanical components that are not typically installed in a closed cabinet with heating, for example, an air circuit breaker that may be located in the pad-mounted transformer outside of the turbine.

In these two cases, it is necessary to select the proper products that can operate at such low temperatures.

To find out more about ABB solution for low temperatures, please refer to the following brochure
Code: 1SDC007405B0202

High altitude, the other big challenge: Recently many wind farm projects have been made at altitudes over 3000m or 3500m. This is due not only to the lack of more ideal locations, but because of the better performance of wind at a high altitude.

At high altitude the air is "thinner" than at sea level. The decrease in air density causes a reduction of its cooling power and consequently reduces its ability to dissipate heat.

It also means that the air has less capacity for electrical isolation.

For most electrical components, no derating is usually needed below 2000 meters above sea level, but at higher altitudes the component selection has to be made carefully, considering the high altitude as a dimensioning factor. Components used in high altitudes therefore need to be derated in terms of nominal and short-circuit currents and also nominal voltage due to the lower capacities of the air.

For example, if component A which is rated at 100A up to 2000m, is installed at an altitude of 3000m, a derating of 10% might be considered, due to the lower cooling capacity, which means that the component's nominal rating at 3000m would become 90A. If the application requires a current higher than 90A, a component with higher amp rating must be selected.

The same will be for voltages, due to the lower capacity of isolation. Components' voltage ratings and air gap between conductors (or conductors to ground/earth) are based on air at sea level, which means that low-voltage components rated at 1000V could be, for example, used only at 690V. Finally, switching and breaking devices, due to the same physical issues, will have more difficulties to extinguish arcs, which means that they will need to be selected with a higher capacity to break current.

In conclusion, the wind industry is pushing the application to its limits and the components within it. This presents a challenge if this industry to grow to ensure a sustainable future.

Adrien Fournier
Wind Segment Manager
Low Voltage Products

In the table, we can summarize what the typical wind industry requirements for low voltage products are, in terms of environmental conditions.

Air Temperature	Humidity	Air density/altitude	Lightning / EMC	Seismicity + vibrations	Pollution degree	Classification of chemically active substances
– 30 to + 70C operating	100% no condensation	no derating up to 2000m + performance table up to 5000m	Table 1 of Rina rules	Level according to IEC 60947-1 class MC2	PD3 according to IEC 60664	Class 3C2 according to IEC 60721-3-3 and 6C2 (or 6C3) according to the IEC 60721-3-6.

Grid compliance – contactors for LVRT (Low Voltage Ride Through)

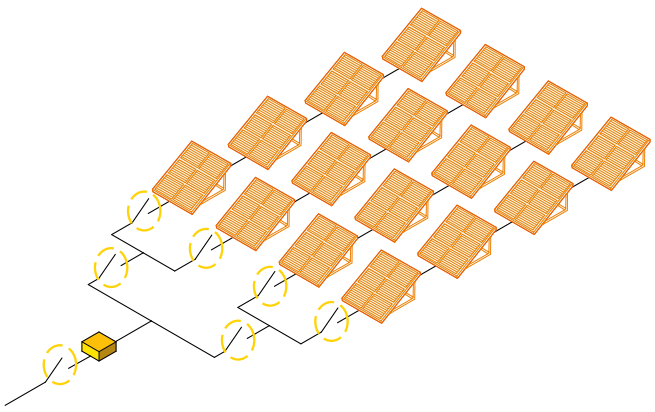
Disturbances on control voltage are very common, including voltage dips and harmonics. To reduce problems wherever contactors are used, ABB developed the AF contactors based on electronically controlled coil, able to operate with both AC and DC and with a wide voltage range. This means they withstand voltage dips (and even 0V for 20ms) without dropping out. However, in some applications, this is not enough, including grid connections for renewables. One cost efficient solution is to use contactors that fulfil LVRT requirements.

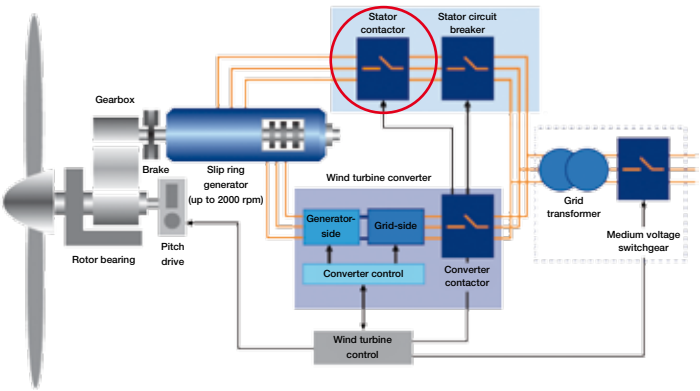
Borje Axelsson: *Renewables Segment Manager - Control Products*

Grid codes define the requirements on power sources feeding energy to public electricity networks. Today, complying with grid codes is a natural part of renewable industries, like wind and solar.

Power grid owners define requirements for their grids, and often a certain grid code is common for all grids in a country. There are also many similarities among the various grid codes from all over the world. One of these similarities is the requirement for the behavior of power sources at disturbance events on the grid. To minimize grid stability problems at events of grid voltage dips, the concept of Low Voltage Ride Through (LVRT) was developed. The idea is that a power source should stay connected to the grid for a certain time during the disturbance, or fault event, to avoid increasing the problem and also to help the grid get back to its normal state (including active requirements like feeding reactive power to grid).

In some cases, the switching device between the power source and the grid can be a contactor, for example the grid side of a solar pv inverter or in the stator circuit of a doubly-fed wind turbine (see figures below).





Borje Axelsson
Renewables Segment Manager
Control Products

The basic contactor functions are: the contactor is operated by applying a control voltage (closing main contacts) or removing the control voltage (opening main contacts). Springs inside keep contacts open when there is no control voltage, and a magnet system provides a force, stronger than the springs, to close it when control voltage is applied. This means the contactor will open as soon as there is no control voltage.

The challenge related to LVRT is to make sure that control voltage is available also at fault on the grid. There are various solutions that can be applied in order to achieve this, including the use of UPS systems.

As a response to this challenge, and to the requests from the market, ABB developed a “LVRT-functionality” as an option to the AF contactor series, which in many cases is still the most cost efficient solution.

The principle of this functionality is to keep up the control voltage in the contactor so that it can stay closed as long as required by grid codes. The figure below shows how it is adapted to today's typical grid code requirement at grid fault with 0V for 0,625s followed by a ramping up to rated system voltage.

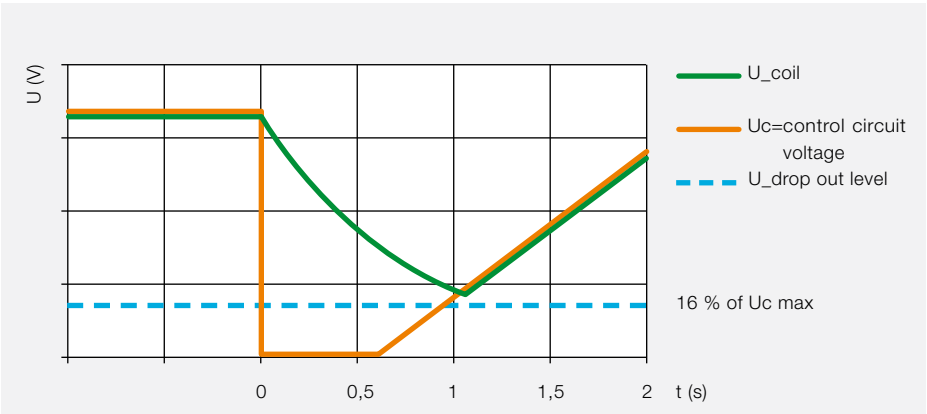
The ABB contactor solution comes in two versions

- Built-in for largest contactors (not adding any space or wiring)
  AF1350T – AF2650T (where AF is the series of electronically controlled contactors, the number indicates the current rating and T is related to LVRT functionality)
- Separate device for smaller contactors (AF1250 and smaller), called RU19

This solution can be the most cost effective one even when a UPS is needed in the system, since contactors require power, both for closing and holding (holding contacts closed). This means that the UPS might be downsized when it does not need to feed control power to contactor, saving space and purchase cost.

AF1650T

AF400 **RU19**



Low Voltage Ride Through (LVRT) Capability AF…T Contactor with Drop-out delay

Protection against arc faults in wind turbines – minimizing unwanted downtime

Borje Axelsson: *Renewables Segment Manager - Control Products*

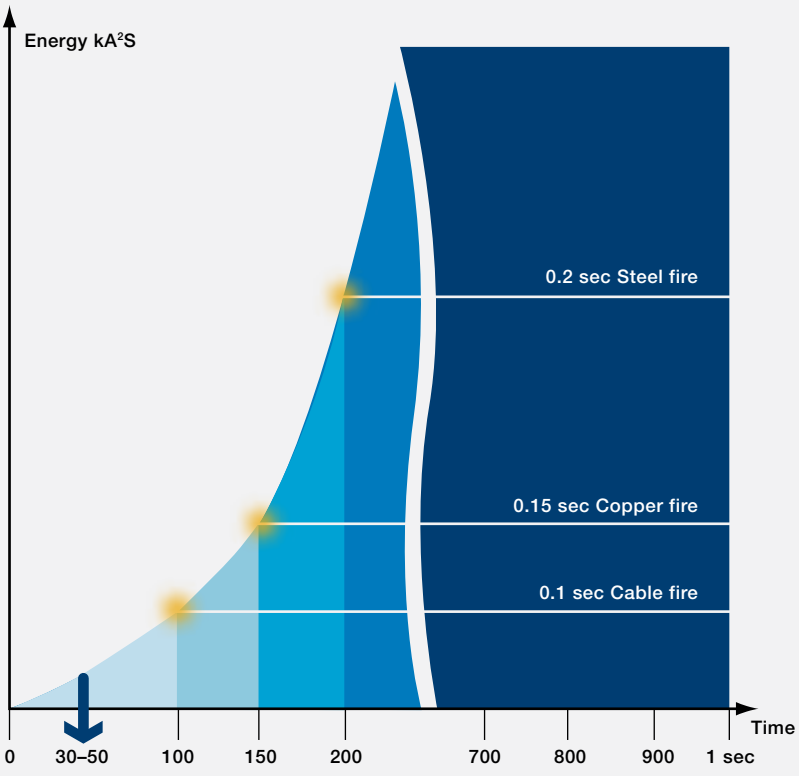
Background

Wind turbines need to produce power when there is wind.

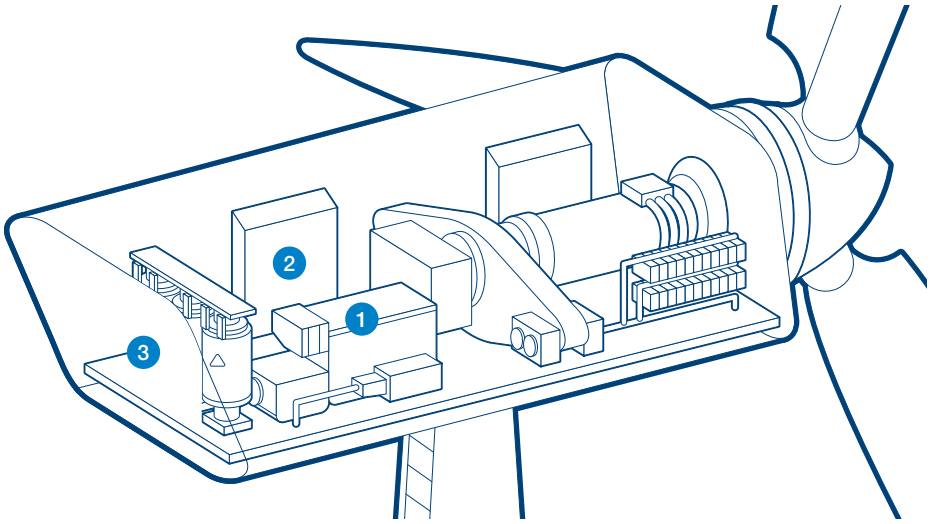
Wind farms are often in remote locations or even offshore, so any unplanned shutdown time must be kept to a minimum. One fault situation that can be fatal and also cause long downtime is an arc fault, i.e. short circuits outside electrical conductors, in the air. This type of accident does happen now and then, and people are killed by electrical arcs every year.

In wind turbines the people are normally not present, but the risk can be great when severe damage to equipment has occurred or worse if a fire causes damage to the nacelle.

Normal short circuit protection, like circuit breakers and fuses, is not enough to protect the equipment in case of arc faults. However the risk of damages can be minimized by additional protection, not based on the current in conductors. And this protection needs to be extremely fast as shown in the figure below.



Total breaking time = ABB ArcGuard System™ + Breaker



Application in wind turbines

There are different approaches to this kind of solution as far as wind turbine protection systems are concerned:

- short-circuit protection of electrical systems (improved by adding optical sensors in addition to current measuring)
- fire protection system (adding fast system to complement the slower smoke detectors etc.)

Example

Few typical locations in wind turbine nacelle where optical detectors may be installed

1) at generator
2) in cabinets
3) at transformer (both LV and MV sides suitable)

ABB solution

The arc guard system, TVOC-2, is an extremely fast system reacting in 1ms and based on optical sensors.

The arc monitor has 10 optical inputs as standard and a detachable display (it is possible to install it separately on the cabinet door).

Optical sensors are delivered as “plug-and-play”, in fixed lengths (1-60m) and factory calibrated to eliminate the need of risky on-site calibration.

One of the unique features is functional safety: TVOC-2 has SIL3 certification.

How it works

The system acts in three phases:

1

Light passes through an optical sensor (Detection)

2

The Arc monitor determines the intensity of light (Recognition)

3

The Arc monitor sends signal to trip breaker(s) (Action)

The Tree of Life for Expo 2015: a matter of pride for both Elgen and ABB

Consorzio "Orgoglio Brescia" chose ABB products to build the switchboards for the Expo 2015 symbol.

Guido Buttarelli: *Editor - Winning Associati*

"In 35 years of work I never had to change an ABB circuit breaker", says Roberto Zanelli, founder of Elgen of Paderno Franciacorta (BS), Italy, the company that built the switchboards for the Expo 2015 Tree of Life using almost exclusively ABB products. This statement summarizes, in an effective way, the confidence in technology and reliability that is at the foundation of the strong partnership between the two companies and pushed Elgen to choose ABB as a technology partner for the development of the Tree of Life, the symbol of Expo 2015.

A symbol in time, like the Eiffel Tower

The Tree of Life is the symbol of the Italian Pavilion at Expo 2015, a sumptuous structure made of 240 sqm of Siberian larch, with a core of 150 tons of galvanized carbon steel and at 35 meters high it is equivalent to a 12-floor building.

It is a real Italian wonder, designed by Marco Balich and erected in just 90 days by the pool of companies Consorzio "Orgoglio Brescia". It aspires to be an icon, like the Eiffel Tower was to Paris Expo in 1889. The Tree of Life is located in front of Palazzo Italia, the representation place of the Italian State and Government, and is visible from the Milan-Turin highway and from the high-speed railway. A series of 1200 shows animate it, with plays of lights, water and colors, and 3D effects made using the most advanced technologies.

The Tree of Life soars into the Lake Arena amphitheater square, the largest open area of the entire exhibition site, in the middle of an artificial lake, fed by the Villoresi canal and brought to life by a system of fountains.

The bottom of the water basin is covered by a layer of dark pebbles that creates a mirroring effect and is surrounded by terraces for 3000 spectators. The whole 28000 sqm square can accommodate 20000 people and is dotted with 100 trees placed on three concentric rings.

From this point all the events related to the Italian Pavilion begin.

The inspiration refers to Michelangelo

The structure of the Tree of Life has its roots in the Renaissance, one of the richest and well-known periods of the Italian art. In 1537, Michelangelo renovated the Piazza del Campidoglio square in Rome by appointment of the Pope and created a new shape. Starting from a lozenge design, for the flooring he conceived and designed a symbolic icon culminating in a twelve-point star, as many as the constellations. The project was actually set

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aside and not used. Only in 1940, after nearly four centuries, the pavement was laid according to Michelangelo's original pattern.

This design is familiar to us, or at least it should be, because it is shown on the 5 cent and on 2007 2 euro coins, in commemoration of the 50th anniversary of the Treaty of Rome, which ratified the foundation of the European Economic Community.

The Tree of Life at Expo 2015 is a three-dimensional representation of the Michelangelo's icon. It is a sign of momentum towards future innovation and technology. A symbol destined to capture the visitors' imagination.

“Orgoglio Brescia”

Initially intended as a symbolic structure of the exhibition, the Tree of Life project ran the strong risk of being abandoned due to a lack of financial resources. At that point the Industrial Association of Brescia voluntarily offered to build the Tree at their own expense in the capacity of technical sponsor, optimizing the skills of the companies of Brescia district in steel and wood technologies. For this purpose, the Consorzio "Orgoglio Brescia" ("Pride of Brescia", a really explanatory name!) was founded and joined by 19 companies, which after the distribution of tasks had borne all costs (about 3 million euro) for materials, design, construction and installation. From Brescia came workers and engineers, and the financial capital. With great efficiency, the construction works only took 90 days to be accomplished. For this reason on the top of the Tree of Life, dominating the site of the exhibition, the Italian flag waves together with the white-blue flag of the city of Brescia, that is called "Lioness of Italy".

Consorzio "Orgoglio Brescia" includes Elgen, the company responsible for the design, construction and installation of the switchboards for the lighting system.

The lighting of the structure was created with RGB LEDs, which made it possible to have the play of lights created by Marco Balich, who in Turin designed the spectacular set for the opening ceremony of the 2006 Winter Olympics.

"Having helped build the Expo 2015 symbol and asking nothing in return, is for us a reason of pride", Zanelli says. "Seeing your own company creating in a very short time the components that are an integral part of the EXPO symbol, which the whole world will admire and that surely will remain in the memory of millions of visitors, gives an indescribable feeling of satisfaction".

From local success to the development of new technologies

Elgen has dealt with electrical systems for plants, industrial system integration and home/building automation since 1980. The company employs 20 people in a 2000 sqm factory and reports annual sales of

01 System Pro E power switchboards wired for the Tree of Life lighting.
02 Elgen engineers during the construction of the Tree of Life, by Consorzio "Orgoglio Brescia", which the company is part of.
03 Elgen premises in Paderno Franciacorta (BS) - Italy

03

about 3.7 million euro. The first customers were the largest traditional companies of the Brescia area. Initially the steel mills (including Lucchini Group) and later the engineering enterprises, including the niche of the Lumezzane district, specializing in brass processing for the production of valves and cutlery.

Elgen has always used ABB components and switchboards, appreciating their technology and reliability. The ongoing training opportunities offered by ABB also made it possible to extend the knowledge, especially the ABB courses, useful to acquire the KNX certification, which contributed to the implementation of Elgen's market strategies. "We are heavily investing in systems based on the KNX protocol, as well as in home automation and system integration solutions, because we believe they can represent the future of the companies that manufacture electrical systems", Roberto Zanelli explains.

In addition, the continuous renewal of the technological know-how sets the conditions for the gradual professional growth of the second generation of the Zanelli family: the daughter Diletta (Technical Office for Building Automation, Marketing and Planning) and the son Samuele (Purchasing, Building Site Management and Foreign Markets Development), who have already been working in the company for years.

A reorganization driven by exports

In addition to investing in new technologies, Elgen is turning to the international markets of the emerging countries, from the Czech Republic to the Middle East (Oman, Qatar, United Arab Emirates and Morocco), which demonstrate great interest in innovative automation solutions.

These new strategies required to rethink the organization's structure.

English courses were provided to allow in-house staff to establish a direct personal relationship with the client. Elgen was awarded the contract also thanks to this commitment and to the fact that the competitor's personnel did not speak English.

Furthermore, a network of international partners was created to facilitate accessing strategic contacts and local regulations.

Even the Italian delocalization is an opportunity

Another interesting opportunity is represented by the production delocalization of Italian companies in places where the labor is much cheaper, but the technology skills are scarce. To these companies Elgen offers not only finished products, but also advice on the design and the engineering of building automation and system integration solutions, in order to create fully integrated production systems. Integration is implemented not only in the various production areas of a single industrial site, but can be extended to the various

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04 From the left: Pietro Salvadori - Agency ABB Tecnoelle, Brescia
Diletta Zanelli - Technical Office, Building Automation, Elgen srl.
Roberto Zanelli - Owner, Elgen srl
Samuele Zanelli - Purchasing/Foreign Markets, Elgen srl

countries involved in the production activities. A single software application is able to monitor and control multiple production sites from locations throughout the world.

The first experience of remote production management dates back to the late '90s, when Pirelli decided to build a 100,000 sqm factory in Romania for the production of tires for Eastern Europe. The basic requirement was the monitoring, from the headquarters in Milan, of key production parameters, such as temperature and humidity of the tyre compounds.

The task was entrusted to Elgen, already known for a collaboration with a Pirelli subsidiary.

In fact, for eight years Elgen had developed systems for the automated management of product handling inside the warehouse, with level 1 and 2 automation.

For the Romanian factory a system was designed that was not only able display the values of temperature and humidity in Italy, but also to monitor and constantly adjust the nitrogen and energy consumption. On that occasion Elgen used, in addition to the KNX low voltage products, a solutions coming from other ABB divisions, including pump inverters and flow generators for the management of the steam.

From this first experience came the idea to propose the Building Automation solutions at the design consultancy stage. Since then they are increasingly present in Elgen specifications for production sites.

The switchboards are compatible with all ABB low voltage devices

For the creation of the power distribution systems for the Tree of Life, the new ABB System pro E power switchboards were used, offering a complete solution for the electricity distribution to infrastructures and industry sectors in accordance with the main reference standards. The new switchboards also ensure synergy and easy assembly of all ABB low voltage units: modular System pro *M* circuit breakers, TMAX T and TMAX XT molded-case circuit breakers and Emax2 open circuit breakers (the latter not used in this project).

The main challenge faced by Elgen was the limited space for the installation of the switchboards, on the first of the eleven floors of the Tree. ABB's System pro *E* power switchboards were the ideal solution, both in terms of overall footprint, since the variety of the solution range made it possible to choose the switchboard with the most appropriate size, and in terms of space optimization within each switchboard, thanks to the wide choice of interior kits, optimized for the mounting of the most compact ABB components.

The switchboards were appreciated for
- their refined look and, in particular, for the design of the closing door and the convex area containing the new ergonomic handle. This is a strength for both Elgen, which always aims at refinement in design, and the end users who in addition to the quality of electrical engineering solution, appreciate the aesthetic appeal. "In fact, the concept of beauty is often associated with good manufacturing", says Attilio Guerini, Director, Switchboard Division;
- the simple and intuitive installation, especially for moulded-case circuit breakers, streamlined by the kit with the rapid click-in fixing system, saves time eliminating the need to consult the instruction manual;
- the impossibility to make a mistake in assembling the structure, which is completely symmetrical;
- faster and more functional mounting and tightening operations thanks to the use Torx screws.

For the lighting of the Tree of Life, which consumes a total power of around 1000 kW, it was necessary to provide 7 columns divided into four sets of switchboards, three dedicated to lighting and one to the preferential UPS energy. For the creation of the various switchboards ABB components including the System pro E power switchboards were selected. The series used include:
- TMAX T and TMAX XT moulded-case circuit breakers
- Series S200 modular circuit breakers
- System pro M command and control series comprising ESB 24-40 contactors and VLM and AMT modular measuring instruments for voltages and currents.

Acknowledgments

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Improved reliability of wind turbines by increased protection.

Fast and Efficient.

ABB has a long tradition in helping wind industry to improve, using innovative solutions. Need for maximum energy production means minimum downtime. In the event of electrical fault or surge due to lightning, the damage on the turbine must be kept to a minimum. Protection of electric equipment using only traditional circuit breakers and surge protective devices is still a good solution. But today ABB offers the ultimate protection, using surge protective devices and circuit breakers specially designed for variable frequency between converter and generator, combined with arc monitor using optical detection of arc faults in few milliseconds anywhere in the turbine.
In addition, this increases safety at maintenance.

Power and productivity
for a better world™

ABB provides combiner boxes to one of the nation's largest mega solar plants

ABB's combiner boxes, PVmax, contribute to the development of the Setouchi region by supporting efficient construction, safe and sustainable operation of mega solar plant.

Aravind Ramachandran: *Solar Segment Manager - Enclosures and DIN-Rail Products*

Tokyo, Japan, September 3, 2015 – ABB has won an order of combiner boxes for one of Japan's largest solar power plant projects in Okayama Prefecture, Japan. The project, funded with market-leading investment by GE Energy Financial Services, Toyo Engineering, Chudenko and Kuni Umi Asset Management, will be an around 230 megawatt facility to boost utilization of renewable energy in the Setouchi region, the coastal area around Setonaikai Inland Sea, west Japan.ABB received the order from Toyo Engineering, which is responsible for Engineering Procurement Construction (EPC) of the project.

The project was chosen among the public proposals to utilize the former Kinkai salt field by Setouchi-city, in view of benefit to the whole city. Toyo Engineering started the construction of the solar photovoltaic plant in October 2014. The project, with approximately USD 0.9 billion scale, is also designed with environmental-responsibility and safety.

The ABB combiner box PVmax* fits very well to this concept. It configures ABB's leading edge low voltage products in Gemini Thermoplastic enclosure, which does not need repainting over 20 years, and can be fully recycled. PVmax fulfills the requirements of the customer to ensure secure and sustainable plant operation. Moreover light weight and easy-to-handle features help increase efficiency in the construction phase. In Japan, metal enclosures used to be conventional before the debut of Gemini. Therefore, Gemini significantly slashed the burden of site workers, and consequently contributed to improve project construction time and cost.

"We are pleased that PVmax was chosen to support one of the largest mega solar power plants in Japan," said Tsuyoshi Yoshida, Local Division Manager, Low Voltage Products Division, ABB Japan.

ABB will deliver approximately 5000 PVmax combiner boxes for the project. ABB's worldclass manufacturing capacity with quality, as well as its leading edge technology in 1000 V DC and above, will help one of the nation's largest solar projects to succeed. The project is expected to reach commercial operations in the second quarter of 2019, and planned to sell its power to Chugoku Electric Power Company for 20 years under Japan's renewable energy fee-in-tariff regime.

*PVmax: Combiner box specifically configured to meet the local market needs in Japan.

ABB's solar business

ABB provides the most comprehensive portfolio of products, systems, solutions and services along the solar PV value chain that enable the generation, transmission and distribution of solar power for grid-connected and microgrid applications. ABB's offering includes inverters, low-voltage products, and monitoring and control systems, grid connection. Stabilization and integration products, as well as complete electrical balance of plant solutions. ABB also offers a wide range of support and maintenance services, including remote operations and diagnostics, helping ensure solar installations deliver optional performance.

Visit the Low Voltage Solar webpage to discover ABB solutions for Photovoltaic applications.

Aravind Ramachandran
Solar Segment Manager
Enclosures and DIN-Rail Products

From Installer to Marketing Expert

Proximity Marketing. Capturing customer attention at the right time with targeted messages

Federico Mai: *Marketing Communication Account - LP Division*

Products, technical specifications, performances, features and application examples are essential items of knowledge to work as a professional electrical system installer. However, it is equally clear that in today's ever increasingly competitive market it becomes even more essential to acquire skills in areas that lie outside the technical sphere and allow you to stand out from the competition in order to increase your business volume. And for this reason this article offers you information, tips and some "tasty tidbits" that we believe can help you better understand certain marketing and communication concepts and practices that can make a difference in approaching a client by stimulating creative thinking for new ideas and solutions. Or simply to help answer questions like, "Where do I start from?" or "How could I do that?"

Proximity Marketing is a marketing technique applied to a geographically limited area. It leverages audio, visual and mobile communication technologies with the purpose to suggest the sale of products and services or to provide information.

Therefore, it allows the promotion of a product or a service in the **proximity of a Point of Sale or a Company**, in a way that involves only the consumers located in its outskirts or inside it. This facilitates the purchase mechanism through the provision of detailed product information, delivering emotional content; collecting feedback or suggesting promotions (e.g. discounts and customized or timed rebates) or purchases related to a new product/service to be advertised or that perhaps had previously attracted the attention of a potential customer, even stimulating a new visit.

How does it work? A device "discovers" all the people in a limited range who, for example, have enabled the Bluetooth feature on their smartphones. On their displays, a message appears giving the chance to download free contents, without going through the telephone company and in an anonymous way. If the customer gives his permission, content like a short video, a jingle or a software application will be displayed shortly after. If the recipient denies the permission, the system will not disturb him anymore. This is a minimally invasive, free and polite, but still effective and controllable system that lets you know exactly how many people have accepted and received the message.

This method, therefore, does not act on a defined target, but only on individuals who find themselves in a specific area and near a device that allows interactive communication with their smartphones, tablets or PCs. This is a technique that, through the distribution of multimedia content, can initiate a dialogue through Bluetooth, Wi-Fi, RFID (Radio Frequency Identification), NFC (Near Field Communication) and, more recently, Beacon and iBeacon* devices based on Apple technology.

The devices can be located in mobile or fixed stations, according to the requirements of each marketing campaign, and inside or outside stores and companies. If necessary, they can be integrated with the work of professional promoters or sales staff, who will draw up reports to determine how many devices were intercepted by the advertisement, how many devices downloaded, displayed and saved the message or how many individuals declined the invitation to view it. For greater support to the Marketing Proximity campaign, you can also encourage users to see your messages through signs, banners, adhesives, interactive totems and more.

In this way, each person can receive useful information to carry out purchases or learn about the benefits related to products and services only after having expressly authorised incoming messages. These messages can contain interactive and linkable applications that can be saved on the consumers' mobile devices in an easy and intuitive way. The Proximity Marketing makes it possible to simultaneously reach a high number of users and prospects and convey messages with diversified content, e.g. during the entire lifecycle of a campaign, with a significant cost reduction compared to traditional campaigns.

You can therefore easily imagine how

many benefits all businesses can enjoy because, when the prospects are before the shop-windows, a message will inform them about special discounts, promotions or lotteries, gift cards, and discount coupons. These are just some of the multiple scenarios, but consider all the information that can be sent to anyone passing in front of a Point of Sale or a Company, advertising any product or service in a simple and innovative way.

We could say that the Proximity Marketing represents the modern version of the direct marketing, becoming today, more than ever before, a very effective tool to generate leads, provide excellent returns on the investments and finally promote a turnover increase. This is because being found by customers is better than looking for them, as customers know what they want and have the resources to choose from many offers, making the most out of multimedia tools, information, social networks and mobile devices. Reaching your prospects directly, offering them the product/service they are currently looking for, is essential to achieve great results with small investments.

Storytelling marketing based on multimedia content, enriches the customer experience without effort, without having to resort to leaflets, brochures or coupons and without doing research. Consumers can receive directly from the "objects" all the information, offers, promotions they need. Here and now.

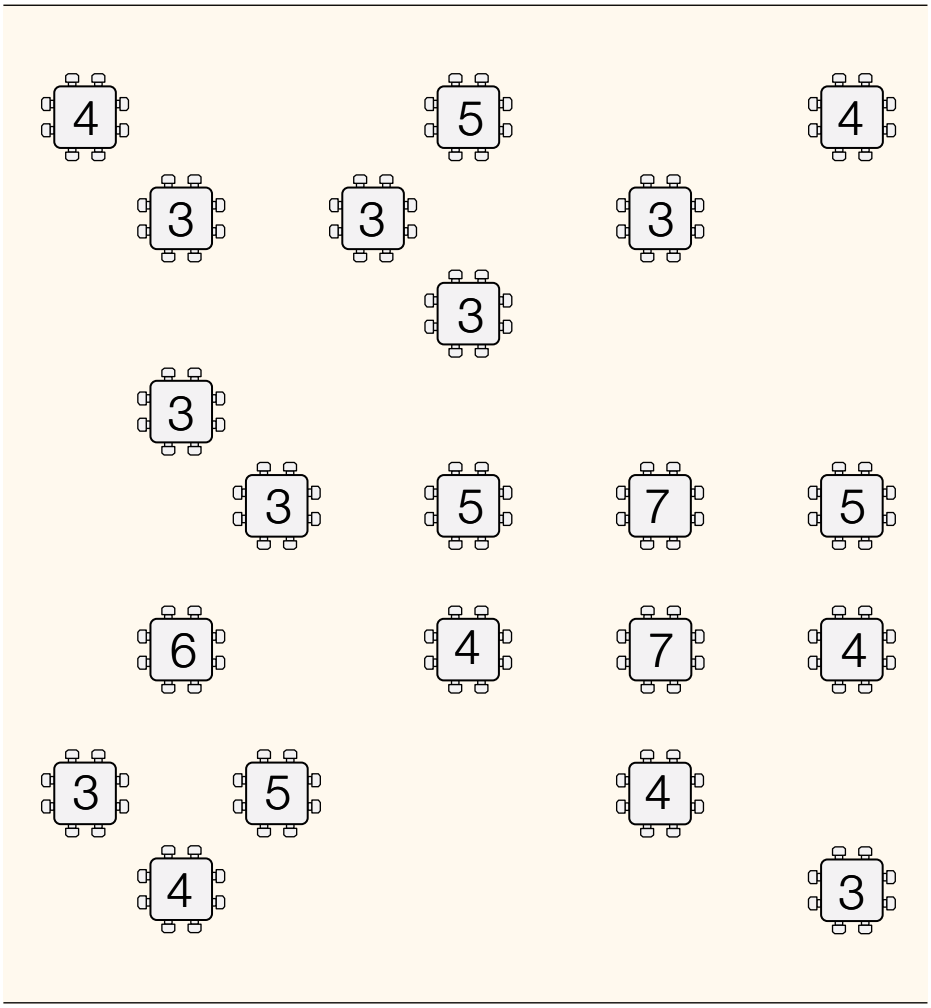
Beacons and Proximity Marketing

They already are and will increasingly be one of the most interesting and richest streams of opportunities around Digital Marketing. According to industry experts, this niche will enjoy double-digit growth rates during the next ten years.

Proximity applications open up new horizons, bridge the imaginary gap between the physical and digital world through widely used low-cost technologies; IoT (Internet of Things), that we are hearing more and more about. Nevertheless, be careful not to be fooled by the name: unlike IoT, the concept of Proximity Marketing itself is focused on the interaction between people and does not identify only the dialogue between machines or devices.

*Beacons and iBeacons are low-cost and small-sized signalling devices that, even if powered by a tiny coin or stylus battery, are able to send signals at intervals of one second or less for months or even years, without exhausting the energy; further, the range of the signal, depending on the power set, may extend from 1 to 50 meters.

Connect the boxes
Train your brain.



Task

You must complete an electrical system by connecting junction boxes with cable conduits.

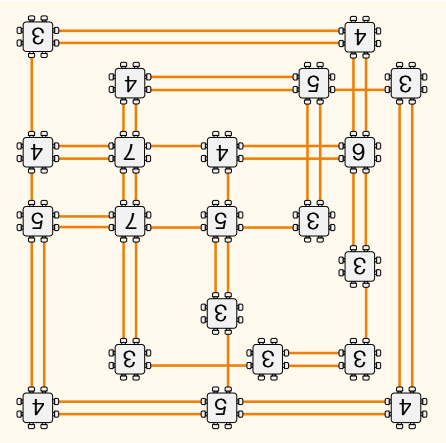
An electrician has already installed all the junction boxes on the wall and laid down the required connections, but then he left the job unfinished without explanation.

Your task is therefore to connect all of the boxes indicated.

Instructions

- Each box must be connected to the others and the number of connections must correspond to that indicated on the box.
- Two different boxes can be connected with each other, but without exceeding two connections.
- Connections can be made either horizontally or vertically. Cross-connections are not allowed.
- There is only one correct solution and can be found purely by logical reasoning. No specific technical skills are required.

The solutions to Connect the boxes



Tracking the movement of the sun accurately?

Certainly.

Solar power plants harness more energy if the panels and collectors are able to accurately follow the sun on its trajectory through the sky. ABB has developed programmable logic controllers (PLCs) that track the path of the sun with unparalleled accuracy, enabling photovoltaic and concentrated solar power plants to capture maximum energy from sunrise to sunset. Equipped with high-efficiency ABB motors and variable speed drives, these robust PLCs withstand the heat and dust of the desert and ensure that optimal output is achieved with minimal energy input. Everyday the world demands more renewable energy – ABB makes it possible.
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Manufacturing with pinpoint precision?

Naturally.

Solar panel efficiency depends on the accuracy of the manufacturing process. A small fault in the production process of cells, wafers and modules can affect the quality of the final product. ABB supplies robots and robot-based solutions that provide high-speed accuracy throughout the photovoltaic manufacturing process – from handling and edge trimming to soldering and interconnection, assembly, packaging and palletizing. ABB also provides manufacturers with complete power and automation solutions that increase the productivity of their factories while lowering costs and environmental impact. Everyday the world demands more renewable energy – ABB makes it possible.
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