# PHOTOVOLTAIC COMPONENTS \& SOLUTIONS 

CATALOGUE
OF PHOTOVOLTAIC
COMPONENTS AND SOLUTIONS
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## Photovoltaic applications

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## Photovoltaic applications

## Introduction

Photovoltaic applications have become widely used alternative source of electric energy. Because of their specific needs in comparison to other applications, they stimulated development of a new generation of DC components.

Main difference of DC part of PV installation in comparison to common DC ones lies mainly in three specific aspects:

1. The first one is related to relatively higher voltage, typically $200-1500 \mathrm{~V}$ DC. Why exactly up to 1500 V DC? In the last few years in the construction of photovoltaic power plants, architectures with 1500 V DC have quickly been adopted and have become standard. The move to higher string voltages results in a significant reduction in the number of source circuits, combiner boxes and electrical equipment needed. Furthermore, there are no intentions to exceed 1500 V DC in the strings in the future, as it wouldn't be cost-efficient.
2. Another follows from the fact that short circuit current of a PV panel is very close to its nominal value.
3. The last and probably the most important one is changing of polarity of DC current on a breaker or switch during faulty operation in comparison to standard operational regime.

All these three issues bring completely new requirements on design, constructionand operation of DC components like circuit breakers or switches.

## Basic principle of PV systems

PV systems can be divided with respect to several parameters. The fundamental division is related to connection of such power station to a (public) grid system. There are three types of solutions, plants connected to a grid, so called off grid ones and hybrid. From the technology point of view, there is hardly any distinction at DC side of both types (the only one can be in requirements for grounding of the systems). Main difference is in inverter converting DC current to AC current. The off grid solutions are also typically equipped with a battery system to store energy which cannot be consumed immediately. Hybrid solutions are combining advantages of both solutions and are also used in combinations with batteries - attractive solution for small house PV plants.

Application scheme of a home PV solution is depicted in Fig. 1 (next page).


Fig. 1 Application scheme of PV system

SOLAR
PANEL


## Photovoltaic applications

## PV panels

The first essential part of any PV system is PV panels. With respect to the total installed power and other conditions, particular panels can be connected in series to so-called strings and strings in parallel (arrays). Common panels are based on polycrystalline silicon technology. This type of panels offers lowest price among the other types with very high efficiency. Another type based on crystalline slices is monocrystalline panels. Their main advantage is highest efficiency. Their price is, however, higher, but they are being used more and more frequently which will downgrade their price in future. The last and newest panel technology with standard commercial use is thin film one. The main advantages are minimum installation height and low weight, but they are less effective nowdays. New technologies of solar panels and improvements of current ones are being invented rapidly, because of the PV systems popularity.

PV panels are characterized with a set of parameters. The most important for design of a PV system are

## STC rated output $P_{\text {mpp }}$ [Wp]

Defines maximum (peak) output power (Wp) of the panel at Standard Test Conditions (STC)

## Rated voltage ( $V_{m p p}$ ) at STC*

Rated voltage of the panel at maximum power point (MPP) measured at Standard Test Conditions (STC)

## Rated current ( $I_{\text {mpp }}$ ) at STC*

Rated current of the panel at maximum power point (MPP) measured at Standard Test Conditions (STC)

## Open circuit voltage ( $V_{o c}$ ) at STC*

Output voltage of the panel with zero output current definedfor Standard Test Conditions (STC), equal to maximum voltage at STC

Short circuit current ( $I_{s c}$ ) at STC*
Short circuit current of the panel defined for Standard Test Conditions (STC), equal to maximum output current of the panel at STC

## Maximum system voltage SCII

Maximum possible voltage of the system in which the panel can be used, limits maximum voltage of a string

## Maximum series fuse rating

Defines maximum back up fuse rating to avoid overload of inverse current blocking diodes and current carrying paths

## Photovoltaic applications

## *Standard Test Conditions STC

Defines industry standard for the conditions under which a solar panel are tested. By using a fixed set of conditions, all solar panels can be more accurately compared and rated against each other. There are three standard test conditions which are:

1. Temperature of the cell $-25^{\circ} \mathrm{C}$

The temperature of the solar cells themself, not the ambient temperature
2. Solar Irradiance - $1000 \mathrm{~W} / \mathrm{m}^{2}$

Refers to the amount of light energy falling on a given area at a given time.
3. Mass of the air -1.5

This parameter can misleads, because it refers to the amount of light that has to pass through Earth's atmosphere before it can hit Earth's surface, and has to do mostly with the angle of the sun relative to a reference point on the earth. This number is minimized when the sun is directly above as the light has to travel a minimum distance straight down, and increases as the sun goes farther from the reference point and has to go at an angle to hit the same spot.


## Photovoltaic applications

## Inventers

The last part of the system at its DC side is DC/AC inverter. It is responsible for conversion of DC current to AC one. Inverters can be sorted based on input and output power, number of output phases, type of the system they are suitable for - grounded or ungrounded, grid connected and off grid one. Main inverter parameters necessary for PV system design are

## Maximum input DC Voltage

Maximum voltage of connected string given as sum of $\mathrm{V}_{\mathrm{OC}}$ of all panels

## MPPT Voltage Range

Range of voltages to which MPP (Maximum Power Point) Tracker can set DC working voltage of connected string to maximize its output power

## Maximum input DC Current

Maximum DC current of connected strings given as sum of $\mathrm{I}_{\mathrm{sc}}$ of all strings

## Maximum DC Power

Maximum input DC power given as multiple of operational voltage and operational current of connected string(s)

## Number of MPP Trackers

Independent MPP trackers allow optimize setting of operational maximum power point of strings separately

## Number of inputs per MPP Tracker

Number of input positions, typically connectors linked to one MPP tracker

## Maximum DC current per input/tracker

Maximum current of inverter input

## Output Power

Maximum AC power from inverter

## Grid Voltage

Range of voltages of grid which the inverter can be connected to

## Number of phases / AC connection

Defines AC output, typically 1phase or 3phase

## Photovoltaic applications

## Current protection of DC part of PV systems

The second block of a PV system belongs to protective and control components. This part typically consists of current protection (circuit breakers, fuses), switch disconnectors, surge protective devices. In large PV applications, there can be used also some monitoring or measuring system. Real configuration depends on a size of the system, a number of strings and arrays, or other specific requirements. This block is usually installed in a special DC board (string box, combiner box, array box, junction box), or for large systems it can be a part of the central inverter.

Arrays of strings may require another level of protection, so-called group breaker. The intention of the group breaker, i.e. a protective device which is used downstream to combiner or junction box, is just protection ofthe cables and devices intheboxagainstoverload. Intypical applicationsitservesalsoas the main disconnector of the DC part from an inverter. DC circuits of larger systems can by typically split into several parts like string protection boxes, combiner boxes, or an array (junction) box, see Fig. 4.


Fig. 4 A large PV system with split functionality of DC protection into string protection boxes, combiner boxes and array box.

String protection boxes contain short circuit and overload protection of strings. Usually miniature circuit breakers or fuses are used for this function. Main role of a combiner box is to combine DC current of parallel strings. There can be done simple junction of input paths. This point is also typical place of installation of surge protective devices. Output of a combiner box is either equipped with a group protection (miniature or moulded case circuit breaker), or if protection is not necessary with a group switch disconnector. Systems for monitoring of a PV plant are also usually built in in a combiner box. Array boxes are used in very large PV systems with central inverters. Their role is similar to combiner boxes. Functionality is limited just to collection of DC currents from combiner boxes and protection of connecting cables. One array box is connected to one input of inverter (there can be single input inverter, parallel input inverter, or multi MPPT inverter used). Array box can also be integrated directly into inverter boards.

For smaller and mid size systems, all functionalities can be integrated in a single DC board. Very often there are joint string protection functions with combiner box ones in small systems.

## Photovoltaic applications

## Other current protections of Photovoltaic panels

In the previous section there is described protection against consequences of short circuitry caused by a broken PV panel or string. Panels themselves need to be protected against currents as well. The problem, which can cause their damage, is reverse currents. Particular diodes in the panels are not able to lead any significant current in their direct polarization. It can happen simply when more strings are connected in parallel with slightly different output Voltage. Lower Voltage of a string can be caused also due to breakdown of some PV diode(s) in the string. If there is no protection, all PV diodes in panels in the string can be destroyed.

Protection against the reverse currents is simple. In parallel to the panel, there is connected standard power diode with the same polarization as PV diodes of the panel, see Fig. 5.


Fig. 5 Diodes to lead the reverse current of a PV panel out.

In case of a current in direct polarization, it flows through this diode (its open Voltage is lower than open Voltage of the serial combination of PV diodes in the panel). All modern polycrystalline and monocrystalline PV panels have such protection diode(s) integrated (D1 in the Figure). Maximum series fuse rating of a panel is defined also and mainly with respect to this protective diode(s). Thin film based PV panels usually do not contain such diode and thus need external protection (D2 in the Figure).

## Photovoltaic applications

Blocking diodes could be designed also as a protection in case of short circuitry caused by electric breakdown of a string. The situation is illustrated in Fig. 6.


Fig. 6 Inappropriate protection against short circuitry by means of serial blocking diodes.

This type of protection is theoretically possible due to polarity change of the normal current and short circuit one. Such protection is designed if the price of the protection is the main criterion for design. As it is described below, such design does not fulfill requirements of IEC 62548-1. The main problem of this solution follows from the fact that application limits of these blocking diodes and PV diodes in panels are very similar. As a result, there is very high probability that blocking diodes will be brokendown in the same time as the diodes in the panels and the protection will not work. There should not be mixed blocking function of the diodes against reverse currents and protection against short circuit currents.

External blocking diodes are used in combination with thin film panels. They have also their use in large PV systems where they serves for blocking of inverse currents among arrays, where there are necessary higher currents diodes then those integrated in the panels. Another application is in connection with battery storage systems to block reverse current flowing to panels from the batteries.

## Photovoltaic applications

## Change of polarity of current in PV applications

Very important phenomena connected mainly with PV applications is possible change of polarity of DC current through the short circuit protective device or disconnector. In most of the standard DC applications, polarity is given by the source and remains unchanged. In PV applications with two or more strings connected in parallel, the situation is different. For the sake of brevity, let us take a case with just two strings into a consideration. Standard operation is depicted in Fig. 7.


Fig. 7 Two strings in parallel during standard operation.

Polarity at circuit breakers is given by the polarity of the source, i.e. the PV strings. Situation dramatically changes in case of electrical breakdown of one string (or even one panel in the string). The circuit breaker connected to the broken string operates with opposite polarity now, see Fig. 8.


Fig. 8. Two strings in parallel in case when one is electrically brokendown.

## Photovoltaic applications

It is important to note, that just this circuit breaker connected to the brokendown string should be tripped during the short circuitry. The same situation is also valid for a group circuit breaker protecting whole array in parallel array configuration. In other switching applications (ON and OFF operations with strings) or tripping of overload, the current polarity is given by the panel. This fact brings a new requirement on DC devices for PV in comparison to general DC applications. All such devices and theirs functionality must be polarity independent.

Similar situation is in circuit breakers protecting a battery storage system, where there is one current direction in case of charging of batteries and the other in the consumption regime. This situation is shown in Fig. 9.


Fig. 9 Change of current direction for charging and discharging of battery storage system.

## Switching and tripping of DC currents

Tripping of DC currents is much more complicated process in comparison to AC case. In AC situation, the arc between two parts of contacts can be simply interrupted when reaching zero value. This is not the case of DC. From this it follows higher requirements on tripping mechanism, its force, speed etc. The situation in PV applications is else complicated by the fact that Voltage can be typically up to 1000 V DC.

The most challenging issue for R\&D engineers is distribution of the arc on the both parts of the contact. In AC case, the distribution is symmetrical between the parts. For DC circuit, it is different. The arc distribution is about $70 \%$ for one part (connected to positive pole) and $30 \%$ for the other part of the contact. Because of the permanent polarity during switching or tripping operation, the arc plasma causes electromigration of metal ions of the contact connect to positive pole of the system (or actual current). It significantly destructs the affected part of the contact system.

Solution of the problem is relatively simple. To make the arc distribution symmetrical, magnetic field can be used. Technically it can be done by permanent magnet. Its magnetic field acts against magnetic field of the positive ions of contact material and blocks their migration. Application of a permanent magnet is a typical solution in standard DC miniature circuit breakers for general applications. Such type of circuit breakers can be identified by its given polarity. When connected in wrong way, the arc distribution would not be improved but the contrary. Magnetic field amplifies the ion migration process and thus speed up the degradation of the contact. During tripping or switching, wrongly connected breaker would be destroyed. From this it is apparent that standard polarized breaker cannot be used for PV string protection, because current has different polarity in normal operation and different when a panel or string is brokendown.

## Photovoltaic applications

Protection of PV strings requires non-polarized circuit breakers and disconnectors. Especially for installation devices, the key task is to modulate the arc distribution on the contact. The polarity independence is achieved through a design using dynamic magnetic field instead of a magnetic field from the permanent magnet. The dynamic field is generated from the operational current. It guarantees that this auxiliary magnetic field changes polarity when changing the polarity of external voltage as well as current. The complexity of the structural design of this auxiliary circuit lies in the fact that the magnitude of the magnetic field depends on the value of actual current. Unlike in permanent magnets, polarity independent DC circuit breaker design demands that the shaping magnetic field has a suitable intensity, e.g. even during manual tripping of the circuit breaker through which only a fraction of its rated current flows.

One important fact must be considered for switching of DC currents. To interrupt current at higher voltage levels typical for PV applications, more contacts connected in series are necessary. By this principle there is achieved contact distance allowing breaking of the DC arc in required short time. Installation devices are designed as combination of several single pole devices, mechanically connected in parallel. Such combination looks like a multipole AC circuit breaker, theirs operational principles are, however, very different. DC breakers are electrically connected in series. For proper functionality all contacts must operate simultaneously to split tripped voltage equally among all of them. If this criterion is not met, the fastest contact is exposed to overall system voltage and can be destroyed. To ensure the proper synchronous operation, the devices have to be combined and tested in production. Absolutely wrong application is to use two separate devices in one system, see Fig. 10.


Fig. 10 Wrong application of two independent 500 V DC MCBs in 1000 V DC PV system.

## Photovoltaic applications

## Legislative requirements on PV systems

There are several legislative requirements on PV system, some of them are specialized in different countries. These are related mainly to inverter parameters and its connection to a grid. The rules are partly given by a local law and partly by Utility companies.

For DC part of a PV system, there are two general basic groups of requirements. The first one is covered with the Harmonized Document HD 60364-7-712 (it is identical to IEC 60364-7-712). In this document, which is adapted into local installation standards in CENELEC countries (all EU countries and some other ones), there are given main rules for PV installations with respect to their safety. As a common general requirement we can find, there is an obligation to use a disconnector in between PV panels and inverter. Especially for ungrounded systems, it is recommended to disconnect both DC poles. Drawings in this standard assume all disconnectors to be 2 pole.


Fig. 11 Mandatory disconnection at DC side of a PV system.

Other requirements come from IEC 62548-1 standard. It handles also with design of protective devices. There is given a simple rule there, tripping current of protective device has to fall into a range from 1.4 to 2.0 of short circuit current $I_{s c}$ of used panel. In actual design, it is necessary to calculate right with real tripping characteristics of used protective device, see the examples in previous sections of this text. An important conclusion follows from this condition. To avoid short circuitry in PV installation, a tripping protective device should be used. Blocking diodes connected in series to a string thus cannot serve as such protection.

In some countries, it is requested to have safety central off for roof top PV installation. It comes from the fact that PV panels produce electric energy when they are exposed to light. It could cause a danger situation e.g. during a fire accident when grid Voltage is disconnected from the affected building. As a solution there can be used e.g. main remote switch in the AC distribution board or undervoltage release connected to a PV panel breakers or disconnectors. The undervoltage release ensures safety disconnection even in case of some fault in the installation. Disadvantage of this approach comes from the fact that any failure of AC grid Voltage causes disconnection of the PV plant which requires manual ON operation.

## Photovoltaic applications

## Selection and design of PV panels

The first step of a design of a PV system is selection of panels and their connection. The electrical design is not affected by choice of the panel technology anyhow. The only exception is the fact than poly and mono crystalline panels are already equipped with diodes for blocking of reverse current, but thin film panels are not.

The selection of particular type of the panel depends on several aspects, including mechanical configuration of the power plant or inverter parameters. Let us assume that inverter can be adapted to the actual design and type of panels first. Then the panel parameters choice depends mainly on total installed power and possible physical configuration of the panels.

To collect total power, panels can be connected in series or in parallel, see Fig. 12.


Fig. 12 Serial (left) and parallel (right) connection of panels. Schematic diagrams only.

## Photovoltaic applications

Basic configuration is a serial connection of panels and creation of so called strings. For larger systems, particular strings can be connected in parallel - directly or via separate inputs of an inverter. The serial connection simplifies design of DC/AC inverter because it ensures DC Voltage value at level allowing direct conversion to AC only by means of switching without any circuit increasing the Voltage. An other reason for this type of connection is reduction of loss. Main part of the total loss at DC side of a PV system is directly linked to actual current - power loss at circuit breaker or fuse, cable losses etc. Limit of Voltage and thus number of panels in series is given by Maximum system Voltage. Its typical value is 1500 V DC. In real design, maximum voltage is limited by other aspects, mainly by parameters of chosen inverter. Because current through the whole string is the same, it is necessary to combine panels of the same type in order to maximize output DC power.

For larger systems more strings need to be operated. There are principally three ways of combination of output currents of parallel strings. The first one is direct combination of output currents at DC side. It is usually done in combiner boxes, or the connection can be also done inside of inverter by means of parallel input connectors. The way of connection significantly affects design of protection circuits. Important requirement for this design is the same Voltage of the connected strings.

The second way is a combination inside of a PV inverter, where there are several MPP trackers. This approach increases efficiency of the systems and allows operate particular strings at different conditions (voltage, current). It can bring significant increase of produced power e.g. in systems where particular string are not operating at the same intensity of sunshine (e.g. rooftop systems installed at rugged roofs).

The last way is to combine the produced energy at AC side. Each string or array of strings has separate inverter. Then the design of DC part is the same as for the first case.

Parallel connection of strings has its sense also for smaller systems where it would be possible to connect all panels into one string. Such situation example is shown in Fig. 13.


Fig. 13 A complex rooftop with different light intensity of particular parts of installation.

## Photovoltaic applications

A string operates with the same current of all panels. The value of this current is given by minimum current among the particular panels. On the assumption that all installed panels are of the same type, their current is defined by intensity of light. Typically on rugged rooftops, intensity at their particular parts can be very different. The only way how to maximize total produced power is to split the system into several strings. If the strings contain the same number of panels, their outputs can be directly combined and there is no other investment into inverters. The parallel configuration of strings should be also considered in case that there is a smokestack on the roof or a tree close to the installation. The same issue is true also for a single panel. A single panel is nothing but serial combination of PV diodes or cells. Output current is defined by the minimum current of the diodes. A shadow on a part of the string has the same effect as if there is a shadow over the whole string, see Fig. 14.


Fig. 14 A shadow on a part of a string reduces current of the whole string.

## Photovoltaic applications

## Design of DC protective and control circuits

Let us take protection of a single string into account at first. Based on requirements of IEC 62548-1, there should be installed a protective device for a panel or a string protection. In general, there are two possible devices to provide this functionality, miniature circuit breaker and fuse disconnector with a fuse link. Design of appropriate rated current for both devices is discussed above.

The most reliable protection of a string can be achieved with miniature circuit breaker. Due to polarity variation in different operational modes of the PV system, such DC circuit breaker has to be polarity independent (line Ex9BP, see Fig. 15).


Fig. 15 Photovoltaic DC circuit breaker Ex9BP up to 1000 V DC.

Standard DC MCBs with fixed polarity cannot provide sufficient protection and service reliability. Main advantages of MCB protection follow from three facts. In case of tripping, the circuit breaker can operate again, there are no additional costs like e.g. for a new fuse link. For applications where it is required to provide some additional remote functionality, an MCB is suitable candidate. There can be installed auxiliary contacts to see status of the device. For remote safety disconnection, undervoltage release can be used. The last issue is that MCB canbeusedalsofordisconnectionfunctiongivenbythe standards and canbeoperated by unskilled persons. It is important mainly for residential rooftop applications.

Basic string protective device is cylindrical fuse disconnector with a fuse link (Ex9FP, see Fig. 16).


Fig. 16 Photovoltaic cylindrical fuse disconnector Ex9FP up to 1000 V DC

## Photovoltaic applications

An advantage of the fuse solution is low initial investment. Another argument to use such device is small installation width. Such disconnectors can operate at 1000 V DC as a single module device. In applications where it is necessary to ensure both pole disconnection of string by this disconnector, two pole device of two module width must be used.

There are, however, a few application limits of fuse disconnector. The lower initial investment is compensated in case of trip of a fuse link, which needs to be replaced. Another issue is that it is not possible to operate such device remotely. But there are even more important differences coming from general design of such devices. The first of them is that DC operated cylindrical fuse disconnectors are not switch disconnectors, i.e. their utilization category is DC-20. In case that the same device should fulfill also the role of the disconnector defined in HD 60364-7-712, there is necessary an additional device which will interrupt current first. Other issue is that all cylindrical fuse disconnectors, including AC ones, are intended and can be operated by skilled personnel only. For this reason, they are not suitable for residential systems.

String boxes can consists also of a disconnector. In case that a circuit breaker is used for protection, the same device can provide also this functionality. Otherwise, special device must be used. DC disconnector must be also polarity independent. Its utilization category must be at least DC-21 to allow switching under load. Fig. 17 shows PV switch disconnector Ex9IP.


Fig. 17 Photovoltaic DC switch disconnector Ex9IP.

## Photovoltaic applications

Special area of protection of PV system is installation of Surge Protective Devices (SPD). Because we are still in DC part of the PV plant, also the SPDs have to be designed for DC protection. Besides SPD class with respective parameters and its operating voltage, the main aspect for design is the fact if the system is grounded or ungrounded.

For effective protection, it is necessary to connect SPD system to the grounding. This fact brings the difference in design of protection for grounded and ungrounded systems. The situation is depicted in Fig. 18.


Fig. 18 Configuration of SPDs in grounded system (left) and ungrounded system (right).

To achieve better characteristics at higher DC voltages, there can be designed two MOV-based SPDs in series on a position of particular SPDs.

Some of available DC/AC inverters are declared as equipped with SPD protection. It is very important to pay attention on real SPD installed. In most of the cases, inverters contain SPD class T3 (III, D) only. It is just fine protection against residual transient overvoltage and it is not able to protect against higher energy surges.

## Photovoltaic applications

For large PV systems consisting of several arrays connected in parallel, when every array consists of parallel strings, there is necessary to take into account a group protection of such system.


Fig. 19 Large PV system consisting of parallel arrays.

For devices used, the requirements are similar. Polarity independent ones are necessary in most of the cases. Circuit breakers and disconnectors are typical devices to be used. The intention of the circuit breakers is overload protection of the system and its wiring. When string protective devices are installed in the same box as the group (array) devices, only a disconnector can be used for this functionality. Its main role is the mandatory disconnection of PV panels from inverter.

## Photovoltaic applications

## Basic criteria for inverter selection

Inverter selection strongly depends on the size of the PV system under consideration. Besides obvious installed power, the size of the systems affects the inverter configuration at all.

One of the first inverter selection criterion is the fact if the system will be connected to a grid or not. It brings completely different solution. Off grid solution are mostly equipped also with energy storage systems (battery banks). The main difference is in the inverter technology, however. Inverters in grid connected systems are driven by the grid. Phase and frequency of produced electricity is synchronized with a grid voltage. Due to safety reasons, grid connected systems have to be equipped with automatic disconnector in case of drop of grid voltage. Such block is usually integrated directly into an inverter. Inverters designed for on grid operation thus cannot be used in off grid solution.

Very important part of any inverter is Maximum Power Point Tracker (MPPT). The key goal for any power plan is to maximize its efficiency and output power. PV panels consist of semiconductor diodes. In blocking polarization of diode voltage, a diode can produce electric current. Its value $I_{\text {el }}$ depends directly on intensity of light $\mathrm{I}_{\mathrm{L}}$.


Fig. 20 Dependence of PV panel output current on intensity of light.

To reach maximum output power given as a multiple of voltage and current, it is important to find a point of the V-A characteristics with maximum value of $U \times I_{\text {el }}$. Because this value depends also on other aspects like actual operating temperature, age of the panel etc., optimum value cannot be selected only based on supplied current. It is necessary to track the V-A characteristics during actual working conditions, see Fig. 21.


Fig. 21 Function of MPP Tracker on V-A characteristics of a PV panel.

## Photovoltaic applications

This is achieved with Maximum Power Point Tracker MPPT. Its function partly affects also selection of string protective devices. Especially during MPPT starting, operating current close to $I_{s c}$ can also be traced.

To one single MPP Tracker, several parallel strings up to maximum input current of the tracker can be connected. Such solution is suitable mainly for large PV systems where all the strings operate under same light conditions (green or brown field solutions, flat rooftop applications). Because MPP Tracker is the most expensive part of an inverter, such solution provides savings on investment, but does not affect power plant efficiency negatively.

Different situation is for system operating under non-uniform conditions, see e.g. situation in Fig. 13. Strings cannot be connected in parallel if they do not operate at the same voltage (i.e. there is different number of panels in particular strings). But also in situation if identical strings are designed, it can be advantageous to use separate MPP Trackers for particular ones. This is a typical situation for systems where strings operate under different light conditions (and thus with different output current). To reach maximum output power with different lighting of the strings, also different output voltages need to be traced. Light distribution over the panel installation affects optimum number of MPPT and thus also the selection of suitable inverter.

Efficiency of transmission of produced electricity is very important design parameter for large systems. Two different approaches can be used, see Fig. 22.


Fig. 22 Large PV system with a central inverter (above) and with distributed inverters (below).

## Photovoltaic applications

The first style is to use a central inverter for whole power plant (or its section for very large systems). This design means to collect produced energy at DC side of the system. Such approach is advantageous for power stations localized in square or round areas, with uniform lighting of strings. This way higher efficiency of inverter and also lower investment to this part can be reached. Due to physical placement of the strings, also the overall length of higher cost DC cables is fully compensated with lower investment to the inverter.

The other approach is to use several lower power inverters for string or small arrays. This way is mostly used for systems installed in differently shaped areas, e.g. if the plant is built in a long and narrow field. Total produced electricity is combined at AC side. It brings lower investment to cables. Long DC cables in such cases could mean higher investment than higher costs per Wp for smaller inverters. Disadvantage of this decentralization lies in more difficulty service of such plant.

The biggest power plants with installed power from ca. 0.5 MWp usually use combination of both the approaches.

For small typically residential rooftop systems, one of the decisions is to choose either 1phase or 3phase inverter solution. Besides costs issues, the main argument for this decision is requirement of Utilities which grid the system will be connected to. In general, there is ca. 5 kW limit for non-three phase solutions (i.e. 1 and 2 phase ones). Utilities very often require 3phase solution even for lower installed power to ensure better balance of the grid.

Last important design point for inverter is grounding of the system. Based on HD 60364-7-712, a PV system can be grounded at its DC side only on condition that there is electric separation between its DC and AC part. One hand this is additional requirement causing some investment. On the other hand grounded system can be much better and more effectively protected e.g. against overvoltage. With inverters designed to be grounded it is necessary to take care which pole of the DC side is intended for that. Grounding of the other will not only mean malfunction of the inverter but the inverter can even be destroyed.

## Connection of PV system to an AC grid

Connection to a grid must follow several regulations and criteria. There have to be followed requirements given by general law as well as specific rules of the particular utility company. At AC side, there must be ensured fulfilling of general safety requirements given e.g. in HD 60364. There are also common specific rules for PV, like grounding of the system, synchronization of the frequency, phase and voltage to the system, disconnection in case of grid voltage drop etc. Local utilities can have slightly different requirements on setting of protection systems (allowed differences in voltage, phase etc.). Special care must be taken for power balance among particular phases as well as power factor. An inherent part of grid connected PV system is energy measurement.


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## DC MCBs Ex9BP up to 1000 V DC



- DC Miniature Circuit Breakers
- Non-polarized, suitable for photovoltaic applications
- Tested according to IEC/EN 60947-2
- Rated short circuit breaking capacity $\mathrm{I}_{\mathrm{cu}} 6 \mathrm{kA}$
- Rated operating voltage $U_{e}$ of 250 V DC per pole
- Width 2 and 4 modules
- Tripping characteristics C, K
- Rated current up to 63A
- Wide range of accessories

DC miniature circuit breakers Ex9BP are designed for direct current applications. Thanks to their polarity independency are suitable for photovoltaic aplications.
It can be combined with wide range of accessories including auxiliary and signal contacts, shunt trip release and undervoltage release. It is possible to create diversed combination of accessories. These combinations are only limited by total number, not by the type of accessories - all components fit together. It can be used up to three units of auxiliary or alarm contacts plus up to two units for release units.

Type Key


## Certification marks

$$
c \epsilon
$$

## DC MCBs Ex9BP up to 1000 V DC

## Accessories



Aux. or signal contacts AX, AL, AXL Up to 3 units

Voltage or trip releases SHT, UVT Up to 2 units

Miniature Circuit Breaker Ex9BP
2, 4-module width

Auxiliary contacts AX31
see installation devices catalogue
Alarm contact AL3
Auxiliary and alarm contact AXL31
Shunt trip releases SHT31
Undervoltage releases UVT31
see installation devices catalogue see installation devices catalogue see installation devices catalogue see installation devices catalogue

All accessories are mounted to the MCBs Ex9BP from the left. The undervoltage release UVT in PV system is intended e.g. for safe remote disconnection of DC part from installation.

## DC MCBs Ex9BP up to 1000 V DC

## C-Characteristic, 2-module, 500 V DC

|  | Rated current | Width | Char. | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 10A | 2MU | C | 111559 | Ex9BP 2P DC500V C10 | 1/6/72 |
|  | 13A | 2MU | C | 111560 | Ex9BP 2P DC500V C13 | 1/6/72 |
|  | 16A | 2MU | C | 111561 | Ex9BP 2P DC500V C16 | 1/6/72 |
|  | 20A | 2MU | C | 111562 | Ex9BP 2P DC500V C20 | 1/6/72 |
| 9.9 | 25A | 2MU | C | 111563 | Ex9BP 2P DC500V C25 | 1/6/72 |
|  | 32A | 2MU | C | 111564 | Ex9BP 2P DC500V C32 | 1/6/72 |
| - | 40A | 2MU | C | 111565 | Ex9BP 2P DC500V C40 | 1/6/72 |
|  | 50A | 2MU | C | 111566 | Ex9BP 2P DC500V C50 | 1/6/72 |
|  | 63A | 2MU | C | 111567 | Ex9BP 2P DC500V C63 | 1/6/72 |

## C-Characteristic, 4-module, 1000 V DC

|  | Rated current | Width | Char. | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - - | 10A | 4MU | C | 111568 | Ex9BP 4P DC1000V C10 | 1/3/36 |
|  | 13A | 4MU | C | 111569 | Ex9BP 4P DC1000V C13 | 1/3/36 |
|  | 16A | 4MU | C | 111570 | Ex9BP 4P DC1000V C16 | 1/3/36 |
|  | 20A | 4MU | C | 111571 | Ex9BP 4P DC1000V C20 | 1/3/36 |
| 4, | 25A | 4MU | C | 111572 | Ex9BP 4P DC1000V C25 | 1/3/36 |
|  | 32A | 4MU | C | 111573 | Ex9BP 4P DC1000V C32 | 1/3/36 |
|  | 40A | 4MU | C | 111574 | Ex9BP 4P DC1000V C40 | 1/3/36 |
|  | 50A | 4MU | C | 111575 | Ex9BP 4P DC1000V C50 | 1/3/36 |
|  | 63A | 4MU | C | 111576 | Ex9BP 4P DC1000V C63 | 1/3/36 |

K-Characteristic, 2-module, 500 V DC

|  | Rated current | Width | Char. | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - - | 10A | 2MU | K | 111577 | Ex9BP 2P DC500V K10 | 1/6/72 |
|  | 13A | 2MU | K | 111578 | Ex9BP 2P DC500V K13 | 1/6/72 |
| * $\square^{*}$ | 16A | 2MU | K | 111579 | Ex9BP 2P DC500V K16 | 1/6/72 |
| 97 | 20A | 2MU | K | 111580 | Ex9BP 2P DC500V K20 | 1/6/72 |
| , 9 | 25A | 2MU | K | 111581 | Ex9BP 2P DC500V K25 | 1/6/72 |
| - - | 32A | 2MU | K | 111582 | Ex9BP 2P DC500V K32 | 1/6/72 |
|  | 40A | 2MU | K | 111583 | Ex9BP 2P DC500V K40 | 1/6/72 |
|  | 50A | 2MU | K | 111584 | Ex9BP 2P DC500V K50 | 1/6/72 |
|  | 63A | 2MU | K | 111585 | Ex9BP 2P DC500V K63 | 1/6/72 |

K-Characteristic, 4-module, 1000 V DC

|  | Rated current | Width | Char. | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - - - | 10A | 4MU | K | 111586 | Ex9BP 4P DC1000V K10 | 1/3/36 |
|  | 13A | 4MU | K | 111587 | Ex9BP 4P DC1000V K13 | 1/3/36 |
| - | 16A | 4MU | K | 111588 | Ex9BP 4P DC1000V K16 | 1/3/36 |
| 1. 4 | 20A | 4MU | K | 111589 | Ex9BP 4P DC1000V K20 | 1/3/36 |
|  | 25A | 4MU | K | 111590 | Ex9BP 4P DC1000V K25 | 1/3/36 |
|  | 32A | 4MU | K | 111591 | Ex9BP 4P DC1000V K32 | 1/3/36 |
|  | 40A | 4MU | K | 111592 | Ex9BP 4P DC1000V K40 | 1/3/36 |
|  | 50A | 4MU | K | 111593 | Ex9BP 4P DC1000V K50 | 1/3/36 |
|  | 63A | 4MU | K | 111594 | Ex9BP 4P DC1000V K63 | 1/3/36 |

## DC MCCBs Ex9MV2S-PV



- DC Moulded Case Circuit Breakers suitable for photovoltaic applications
- Frame size M2
- Rated current up to 250 A
- Rated ultimate short circuit breaking capacity $I_{c u}=15 \mathrm{kA}, \mathrm{I}_{\mathrm{cs}}=100 \% \mathrm{I}_{\mathrm{cu}}$
- Rated voltage 1500 V DC
- Thermomagnetic releases
- Fixed version

DC Moulded Case Circuit Breakers Ex9MV2S-PV are intended mainly for photovoltaic applications. Testing according to IEC / EN 60947-2 standards ensures functions and reliability for wide variety of applications including isolation.

These breakers are offered with breaking capacity of 15 kA . Rated impulse withstand voltage $U_{i m p} 12 \mathrm{kV}$ makes it possible to use them even in systems with occurences of transient overvoltage waves of high intensity.
Utilization category A.

Type Key


## Certification marks

## DC MCCBs Ex9MV2S-PV

## Version Ex9MV2S-PV/DC1500, $I_{c u}=15 \mathrm{kA}$

- DC Moulded Case Circuit Breakers suitable for photovoltaic
- $I_{c s}=I_{c u}=15 \mathrm{kA}$ at 1500 V DC
- Fixed version
- Instantaneous release $I_{i}=I_{n} \times 10$
- Mounting screws and phase barriers in the scope of delivery

| \% | Rated current $I_{n}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
|  | 125 A | 110194 | Ex9MV2S-PV/DC1500 125 | 1/8 |
|  | 160 A | 110195 | Ex9MV2S-PVIDC1500 160 | 1/8 |
|  | 200 A | 110196 | Ex9MV2S-PVIDC1500 200 | 1/8 |
|  | 225 A | 110197 | Ex9MV2S-PVIDC1500 225 | 1/8 |
|  | 250 A | 110198 | Ex9MV2S-PV/DC1500 250 | 1/8 |

## Accessories for MCCBs Ex9MV2S



- Accessories for Ex9MV2S line devices
- Auxiliary contacts synchronous with main contacts
- Signal contacts active on electrical tripping of the circuit breaker (tripping signal contacts)
- Shunt trip releases
- Rotary handles

Accessories suitable for PV Moulded Case Circuit Breakers Ex9MV2S. It is possible to supplement or modify functions of a basic circuit breaker by the installation of suitable accessories.

Circuit breakers can be equipped with auxiliary contacts AX 22 V (or 2 AX 22 V ) and one unit of signal contact AL22 or a combination of both AX+AL22V. Accessories are mounted into specific positions, for this reason parts mounted on the right side are named with a $-R$ in the product name (2AX22VR). One unit of shunt trip relase SHT22VR can be installed in the breaker.

The circuit breakers can also be equipped with an extended rotatory handle for different operation of the toggle, e.g. for door coupling.

Mounting of the device onto plate can be done directly.

## Accessories for MCCBs Ex9MV2S

## Auxiliary and signal contact units

- Auxiliary contacts synchronous with main contacts of the circuit breaker
- Signal contacts active on electrical tripping of the circuit breaker (tripping signal contacts)

|  | Function | Suitable MCCB | Contacts | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Auxiliary | Ex9MV2S | 1 CO | 110199 | AX22V | 1/8 |
|  | Auxiliary | Ex9MV2S | 2 CO | 110200 | 2AX22V | 1/8 |
|  | Signal | Ex9MV2S | 1 CO | 110201 | AL22V | 1/8 |
|  | Auxiliary + Signal | Ex9MV2S | 2 CO | 110202 | AX+AL22V | 1/8 |
|  | Auxiliary | Ex9MV2S | 1 CO | 110206 | AX22VR | 1/8 |
|  | Auxiliary | Ex9MV2S | 2 CO | 110207 | 2AX22VR | 1/8 |

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## Shunt trip releases

- It is possible to use one unit of shunt trip release SHT22VR on the right side of the MCCB

|  | Aux. <br> cont. | Suitable <br> MCCB | Operating <br> Voltage | Article | Type |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| No. |  |  |  |  |  |

Technical data p. 104

## Extended rotary handles

- Rotary handle with extension shaft (extension shaft can be shortened)
- Scope of delivery: mechanism block, extension shaft, rotary handle
- Indication of connected breaker status ON-OFF-TRIP
- Can be locked in ON and OFF position

|  | Suitable <br> MCCB | Length | Colour | Article No. | Type |
| :--- | :--- | :--- | :--- | :--- | :--- |

## Moulded Case Circuit Breakers Ex9M DC TM



- Thermo-magnetic tripping unit for power distribution
- Frame sizes M1-M5
- Rated operating current up to 800 A
- 3 and 4-pole versions
- Rated ultimate short circuit breaking capacity $I_{c u}=I_{c s}$ up to 100 kA
- Rated voltage 750 V DC (3-pole) and 1000 V DC (4-pole)

DC Moulded Case Circuit Breakers Ex9MD Thermo-magnetic (TM) are intended mainly for photovoltaic applications. Testing according to IEC / EN 60947-2 standards ensures functionalities and reliability for wide variety of applications including isolation.

These breakers are offered with breaking capacities from 25 kA up to extreme 100 kA . High rated impulse withstand voltage makes it possible to use them even in system with occurences of transient overvoltage waves of high intensity, e.g. in heavy industry.
Utilization category A circuit breakers.

Type Key


## Certification marks

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## Moulded Case Circuit Breakers Ex9M DC TM

## Internal accessories



Auxiliary contact AX21M
Signal contact AL21M
Shunt trip releases SHT2i
Undervoltage releases UVT2i
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

## Moulded Case Circuit Breakers Ex9M DC TM

## External accessories Ex9M1-M5 DC TM



Phase barriers PHS2i
Terminal cover, short TCV2i
Terminal cover, long TCE2i
Remote operators MOD2i
Direct rotary handles RHD2i
Extended rotary handles ERH2i
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

# Moulded Case Circuit Breakers Ex9M DC TM 

## External accessories Ex9M1-M5 DC TM



Tunnel terminals MC2i W
Mounting depth spacers WG $i$
Screw type terminals MC2i
Screw terminals MCS2i
Din rail DRA2i
see Installation devices catalogue see Installation devices catalogue see Installation devices catalogue see Installation devices catalogue see Installation devices catalogue

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD1B up to $160 \mathrm{~A}, I_{c u}=\mathbf{2 5} \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=25 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| $\log ^{404} 484$ | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 31 | 3 | 16A | 11-16 A | 160 A | 112511 | Ex9MD1B TM 16 3P | 1/12 |
|  | 3 | 20A | 14-20 A | 200 A | 112512 | Ex9MD1B TM 20 3P | 1/12 |
|  | 3 | 25A | 17-25 A | 250 A | 112513 | Ex9MD1B TM 25 3P | 1/12 |
|  | 3 | 32A | 22-32 A | 320 A | 112514 | Ex9MD1B TM 32 3P | 1/12 |
|  | 3 | 40A | 28-40 A | 400 A | 112515 | Ex9MD1B TM 40 3P | 1/12 |
|  | 3 | 50A | 35-50 A | 500 A | 112516 | Ex9MD1B TM 503 P | 1/12 |
|  | 3 | 63A | 44-63 A | 630 A | 112517 | Ex9MD1B TM 63 3P | 1/12 |
|  | 3 | 80A | 56-80 A | 800 A | 112518 | Ex9MD1B TM 80 3P | 1/12 |
|  | 3 | 100A | 70-100 A | 1000 A | 112519 | Ex9MD1B TM 100 3P | 1/12 |
|  | 3 | 125A | 87-125 A | 625-1250 A | 112520 | Ex9MD1B TM 125 3P | 1/12 |
|  | 3 | 160A | 112-160 A | 800-1600 A | 112521 | Ex9MD1B TM 160 3P | 1/12 |
|  | 4 | 16A | 11-16 A | 160 A | 112522 | Ex9MD1B TM 16 4P4T | 1/12 |
|  | 4 | 20A | 14-20 A | 200 A | 112523 | Ex9MD1B TM 20 4P4T | 1/12 |
|  | 4 | 25A | 17-25 A | 250 A | 112524 | Ex9MD1B TM 25 4P4T | 1/12 |
|  | 4 | 32A | 22-32 A | 320 A | 112525 | Ex9MD1B TM 32 4P4T | 1/12 |
|  | 4 | 40A | 28-40 A | 400 A | 112526 | Ex9MD1B TM 40 4P4T | 1/12 |
|  | 4 | 50A | 35-50 A | 500 A | 112527 | Ex9MD1B TM 50 4P4T | 1/12 |
|  | 4 | 63A | 44-63 A | 630 A | 112528 | Ex9MD1B TM 63 4P4T | 1/12 |
|  | 4 | 80A | 56-80 A | 800 A | 112529 | Ex9MD1B TM 80 4P4T | 1/12 |
|  | 4 | 100A | 70-100 A | 1000 A | 112530 | Ex9MD1B TM 100 4P4T | 1/12 |
|  | 4 | 125A | 87-125 A | 625-1250 A | 112531 | Ex9MD1B TM 125 4P4T | 1/12 |
|  | 4 | 160A | 112-160 A | 800-1600 A | 112532 | Ex9MD1B TM 160 4P4T | 1/12 |

## Version Ex9MD1S up to $160 \mathrm{~A}, I_{c u}=36 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $l_{c s}=l_{c u}=36 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery


| Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 3 | 16A | 11-16 A | 160 A | 112533 | Ex9MD1S TM 16 3P | 1/12 |
| 3 | 20A | 14-20 A | 200 A | 112534 | Ex9MD1S TM 203 P | 1/12 |
| 3 | 25A | 17-25 A | 250 A | 112535 | Ex9MD1S TM 25 3P | 1/12 |
| 3 | 32A | 22-32 A | 320 A | 112536 | Ex9MD1S TM 323 P | 1/12 |
| 3 | 40A | 28-40 A | 400 A | 112537 | Ex9MD1S TM 40 3P | 1/12 |
| 3 | 50A | 35-50 A | 500 A | 112538 | Ex9MD1S TM 503 P | 1/12 |
| 3 | 63A | 44-63 A | 630 A | 112539 | Ex9MD1S TM 63 3P | 1/12 |
| 3 | 80A | 56-80 A | 800 A | 112540 | Ex9MD1S TM 803 P | 1/12 |
| 3 | 100A | 70-100 A | 1000 A | 112541 | Ex9MD1S TM 100 3P | 1/12 |
| 3 | 125A | 87-125 A | 625-1250 A | 112542 | Ex9MD1S TM 125 3P | 1/12 |
| 3 | 160A | 112-160 A | 800-1600 A | 112543 | Ex9MD1S TM 160 3P | 1/12 |
| 4 | 16A | 11-16 A | 160 A | 112544 | Ex9MD1S TM 16 4P4T | 1/12 |
| 4 | 20A | 14-20 A | 200 A | 112545 | Ex9MD1S TM 204 4 4 T | 1/12 |
| 4 | 25A | 17-25 A | 250 A | 112546 | Ex9MD1S TM 25 4P4T | 1/12 |
| 4 | 32A | 22-32 A | 320 A | 112547 | Ex9MD1S TM 32 4P4T | 1/12 |
| 4 | 40A | 28-40 A | 400 A | 112548 | Ex9MD1S TM 40 4P4T | 1/12 |
| 4 | 50A | 35-50 A | 500 A | 112549 | Ex9MD1S TM $504 \mathrm{4P4}$ | 1/12 |
| 4 | 63A | 44-63 A | 630 A | 112550 | Ex9MD1S TM 63 4P4T | 1/12 |
| 4 | 80A | 56-80 A | 800 A | 112551 | Ex9MD1S TM 80 4P4T | 1/12 |
| 4 | 100A | 70-100 A | 1000 A | 112552 | Ex9MD1S TM 100 4P4T | 1/12 |
| 4 | 125A | 87-125 A | 625-1250 A | 112553 | Ex9MD1S TM 125 4P4T | 1/12 |
| 4 | 160A | 112-160 A | 800-1600 A | 112554 | Ex9MD1S TM 160 4P4T | 1/12 |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD1N up to $160 \mathrm{~A}, I_{c u}=50 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $l_{c s}=I_{c u}=50 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| $\operatorname{lag}^{4} 8484$ | Poles | Rated current $i_{n}$ | Overcurrent release Ir | instant. release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 16A | 11-16 A | 160 A | 112555 | Ex9MD1N TM 16 3P | 1/12 |
|  | 3 | 20A | 14-20 A | 200 A | 112556 | Ex9MD1N TM 203 3P | 1/12 |
|  | 3 | 25A | 17-25 A | 250 A | 112557 | Ex9MD1N TM 25 3P | 1/12 |
|  | 3 | 32A | 22-32 A | 320 A | 112558 | Ex9MD1N TM 323 3P | 1/12 |
|  | 3 | 40A | 28-40 A | 400 A | 112559 | Ex9MD1N TM 403 P | 1/12 |
|  | 3 | 50A | 35-50 A | 500 A | 112560 | Ex9MD1N TM 503 P | 1/12 |
|  | 3 | 63A | 44-63 A | 630 A | 112561 | Ex9MD1N TM 63 3P | 1/12 |
|  | 3 | 80A | 56-80 A | 800 A | 112562 | Ex9MD1N TM 803 P | 1/12 |
|  | 3 | 100A | 70-100 A | 1000 A | 112563 | Ex9MD1N TM 100 3P | 1/12 |
|  | 3 | 125A | 87-125 A | 625-1250 A | 112564 | Ex9MD1N TM 125 3P | 1/12 |
|  | 3 | 160A | 112-160 A | 800-1600 A | 112565 | Ex9MD1N TM 160 3P | 1/12 |
|  | 4 | 16A | 11-16 A | 160 A | 112566 | Ex9MD1N TM 16 4P4T | 1/12 |
|  | 4 | 20A | 14-20 A | 200 A | 112567 | Ex9MD1N TM 20 4P4T | 1/12 |
|  | 4 | 25A | 17-25 A | 250 A | 112568 | Ex9MD1N TM 25 4P4T | 1/12 |
|  | 4 | 32A | 22-32 A | 320 A | 112569 | Ex9MD1N TM 32 4P4T | 1/12 |
|  | 4 | 40A | 28-40 A | 400 A | 112570 | Ex9MD1N TM 40 4P4T | 1/12 |
|  | 4 | 50A | 35-50 A | 500 A | 112571 | Ex9MD1N TM 50 4P4T | 1/12 |
|  | 4 | 63A | 44-63 A | 630 A | 112572 | Ex9MD1N TM 63 4P4T | 1/12 |
|  | 4 | 80A | 56-80 A | 800 A | 112573 | Ex9MD1N TM 80 4P4T | 1/12 |
|  | 4 | 100A | 70-100 A | 1000 A | 112574 | Ex9MD1N TM 100 4P4T | 1/12 |
|  | 4 | 125A | 87-125 A | 625-1250 A | 112575 | Ex9MD1N TM 125 4P4T | 1/12 |
|  | 4 | 160A | 112-160 A | 800-1600 A | 112576 | Ex9MD1N TM 160 4P4T | 1/12 |

Version Ex9MD1Q up to $160 \mathrm{~A}, I_{c u}=70 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=70 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| $x^{2}+$ | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 16A | 11-16 A | 160 A | 112577 | Ex9MD1Q TM 16 3P | 1/12 |
|  | 3 | 20A | 14-20 A | 200 A | 112578 | Ex9MD1Q TM 203 P | 1/12 |
|  | 3 | 25A | 17-25 A | 250 A | 112579 | Ex9MD1Q TM 25 3P | 1/12 |
|  | 3 | 32A | 22-32 A | 320 A | 112580 | Ex9MD1Q TM 32 3P | 1/12 |
|  | 3 | 40A | 28-40 A | 400 A | 112581 | Ex9MD1Q TM 40 3P | 1/12 |
|  | 3 | 50A | 35-50 A | 500 A | 112582 | Ex9MD1Q TM 503 P | 1/12 |
|  | 3 | 63A | 44-63 A | 630 A | 112583 | Ex9MD1Q TM 63 3P | 1/12 |
|  | 3 | 80A | 56-80 A | 800 A | 112584 | Ex9MD1Q TM 80 3P | 1/12 |
|  | 3 | 100A | 70-100 A | 1000 A | 112585 | Ex9MD1Q TM 100 3P | 1/12 |
|  | 3 | 125A | 87-125 A | 625-1250 A | 112586 | Ex9MD1Q TM 125 3P | 1/12 |
|  | 3 | 160A | 112-160 A | 800-1600 A | 112587 | Ex9MD1Q TM 160 3P | 1/12 |
|  | 4 | 16A | 11-16 A | 160 A | 112588 | Ex9MD1Q TM 16 4P4T | 1/12 |
|  | 4 | 20A | 14-20 A | 200 A | 112589 | Ex9MD1Q TM 20 4P4T | 1/12 |
|  | 4 | 25A | 17-25 A | 250 A | 112590 | Ex9MD1Q TM 25 4P4T | 1/12 |
|  | 4 | 32A | 22-32 A | 320 A | 112591 | Ex9MD1Q TM 32 4P4T | 1/12 |
|  | 4 | 40A | 28-40 A | 400 A | 112592 | Ex9MD1Q TM 40 4P4T | 1/12 |
|  | 4 | 50A | 35-50 A | 500 A | 112593 | Ex9MD1Q TM 50 4P4T | 1/12 |
|  | 4 | 63A | 44-63 A | 630 A | 112594 | Ex9MD1Q TM 63 4P4T | 1/12 |
|  | 4 | 80A | 56-80 A | 800 A | 112595 | Ex9MD1Q TM 80 4P4T | 1/12 |
|  | 4 | 100A | 70-100 A | 1000 A | 112596 | Ex9MD1Q TM 100 4P4T | 1/12 |
|  | 4 | 125A | 87-125 A | 625-1250 A | 112597 | Ex9MD1Q TM 125 4P4T | 1/12 |
|  | 4 | 160A | 112-160 A | 800-1600 A | 112598 | Ex9MD1Q TM 160 4P4T | 1/12 |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD1H up to $160 \mathrm{~A}, I_{c u}=100 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=100 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| $\operatorname{lng}^{8484} 4$ | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 16A | 11-16 A | 160 A | 112599 | Ex9MD1H TM 16 3P | 1/12 |
|  | 3 | 20A | 14-20 A | 200 A | 112600 | Ex9MD1H TM 203 P | 1/12 |
|  | 3 | 25A | 17-25A | 250 A | 112601 | Ex9MD1H TM 25 3P | 1/12 |
|  | 3 | 32A | 22-32 A | 320 A | 112602 | Ex9MD1H TM 323 P | 1/12 |
|  | 3 | 40A | 28-40 A | 400 A | 112603 | Ex9MD1H TM 403 3P | 1/12 |
|  | 3 | 50A | 35-50 A | 500 A | 112604 | Ex9MD1H TM 503 P | 1/12 |
|  | 3 | 63A | 44-63 A | 630 A | 112605 | Ex9MD1H TM 63 3P | 1/12 |
|  | 3 | 80A | 56-80 A | 800 A | 112606 | Ex9MD1H TM 803 3P | 1/12 |
|  | 3 | 100A | 70-100 A | 1000 A | 112607 | Ex9MD1H TM 100 3P | 1/12 |
|  | 3 | 125A | 87-125 A | 625-1250 A | 112608 | Ex9MD1H TM 125 3P | 1/12 |
|  | 3 | 160A | 112-160 A | 800-1600 A | 112609 | Ex9MD1H TM 160 3P | 1/12 |
|  | 4 | 16A | 11-16 A | 160 A | 112610 | Ex9MD1H TM 16 4P4T | 1/12 |
|  | 4 | 20A | 14-20 A | 200 A | 112611 | Ex9MD1H TM 20 4P4T | 1/12 |
|  | 4 | 25A | 17-25A | 250 A | 112612 | Ex9MD1H TM 25 4P4T | 1/12 |
|  | 4 | 32A | 22-32 A | 320 A | 112613 | Ex9MD1H TM 32 4P4T | 1/12 |
|  | 4 | 40A | 28-40 A | 400 A | 112614 | Ex9MD1H TM 40 4P4T | 1/12 |
|  | 4 | 50A | 35-50 A | 500 A | 112615 | Ex9MD1H TM 50 4P4T | 1/12 |
|  | 4 | 63A | 44-63 A | 630 A | 112616 | Ex9MD1H TM 63 4P4T | 1/12 |
|  | 4 | 80A | 56-80 A | 800 A | 112617 | Ex9MD1H TM 80 4P4T | 1/12 |
|  | 4 | 100A | 70-100 A | 1000 A | 112618 | Ex9MD1H TM 100 4P4T | 1/12 |
|  | 4 | 125A | 87-125 A | 625-1250 A | 112619 | Ex9MD1H TM 125 4P4T | 1/12 |
|  | 4 | 160A | 112-160 A | 800-1600 A | 112620 | Ex9MD1H TM 160 4P4T | 1/12 |

## Moulded Case Circuit Breakers Ex9M DC TM

Version Ex9MD2B up to $\mathbf{2 5 0} \mathrm{A}, I_{c u}=\mathbf{2 5} \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=25 \mathrm{kA}$ at 1000 VDC
- $I_{\text {c }}^{c s}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| +4xat | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 125 A | 87-125 A | 875-1500 A | 112621 | Ex9MD2B TM 125 3P | 1/8 |
|  | 3 | 160 A | 112-160 A | 800-1600 A | 112622 | Ex9MD2B TM 160 3P | 1/8 |
|  | 3 | 180 A | 126-180 A | 900-1800 A | 112623 | Ex9MD2B TM 180 3P | 1/8 |
|  | 3 | 200 A | 140-200 A | 1000-2000 A | 112624 | Ex9MD2B TM 200 3P | 1/8 |
|  | 3 | 225 A | 158-225 A | 1125-2250 A | 112625 | Ex9MD2B TM 225 3P | 1/8 |
|  | 3 | 250 A | 175-250 A | 1250-2500 A | 112626 | Ex9MD2B TM 250 3P | 1/8 |
|  | 4 | 125 A | 87-125 A | 875-1500 A | 112627 | Ex9MD2B TM 125 4P4T | 1/8 |
|  | 4 | 160 A | 112-160 A | 800-1600 A | 112628 | Ex9MD2B TM 160 4P4T | 1/8 |
|  | 4 | 180 A | 126-180 A | 900-1800 A | 112629 | Ex9MD2B TM 180 4P4T | 1/8 |
|  | 4 | 200 A | 140-200 A | 1000-2000 A | 112630 | Ex9MD2B TM 200 4P4T | 1/8 |
|  | 4 | 225 A | 158-225 A | 1125-2250 A | 112631 | Ex9MD2B TM 225 4P4T | 1/8 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112632 | Ex9MD2B TM 250 4P4T | 1/8 |

## Version Ex9MD2S up to $250 \mathrm{~A}, I_{c u}=\mathbf{3 6} \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=36 \mathrm{kA}$ at 1000 V DC
- $I_{r}^{c s}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery



## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD2N up to $250 \mathrm{~A}, I_{c u}=50 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $l_{c s}=I_{c u}=50 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| 5484 | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 125A | 87-125 A | 875-1500 A | 112645 | Ex9MD2N TM 125 3P | 1/8 |
|  | 3 | 160 A | 112-160 A | 800-1600 A | 112646 | Ex9MD2N TM 160 3P | 1/8 |
|  | 3 | 180 A | 126-180 A | 900-1800 A | 112647 | Ex9MD2N TM 180 3P | 1/8 |
|  | 3 | 200 A | 140-200 A | 1000-2000 A | 112648 | Ex9MD2N TM 200 3P | 1/8 |
|  | 3 | 225 A | 158-225 A | 1125-2250 A | 112649 | Ex9MD2N TM 225 3P | 1/8 |
|  | 3 | 250 A | 175-250 A | 1250-2500 A | 112650 | Ex9MD2N TM 250 3P | 1/8 |
|  | 4 | 125 A | 87-125 A | 875-1500 A | 112651 | Ex9MD2N TM 125 4P4T | 1/8 |
|  | 4 | 160 A | 112-160 A | 800-1600 A | 112652 | Ex9MD2N TM 160 4P4T | 1/8 |
|  | 4 | 180 A | 126-180 A | 900-1800 A | 112653 | Ex9MD2N TM 180 4P4T | 1/8 |
|  | 4 | 200 A | 140-200 A | 1000-2000 A | 112654 | Ex9MD2N TM 200 4P4T | 1/8 |
|  | 4 | 225 A | 158-225 A | 1125-2250 A | 112655 | Ex9MD2N TM 225 4P4T | 1/8 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112656 | Ex9MD2N TM 250 4P4T | 1/8 |

## Version Ex9MD2Q up to $250 \mathrm{~A}, I_{c u}=70 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $l_{c s}=I_{c u}=70 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery



## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD2H up to $250 \mathrm{~A}, I_{c u}=100 \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=100 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery



## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD3B up to $400 \mathrm{~A}, I_{c u}=25 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=25 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery



## Version Ex9MD3S up to $400 \mathrm{~A}, I_{c u}=35 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=35 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 250 A | 175-250 A | 1250-2500 A | 112689 | Ex9MD3S TM 250 3P | 1/2 |
|  | 3 | 315 A | 220-315 A | 1575-3150 A | 112690 | Ex9MD3S TM 315 3P | 1/2 |
|  | 3 | 350 A | 245-350 A | 1750-3500 A | 112691 | Ex9MD3S TM 350 3P | 1/2 |
|  | 3 | 400 A | 280-400 A | 2000-4000 A | 112692 | Ex9MD3S TM 400 3P | 1/2 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112693 | Ex9MD3S TM 250 4P4T | 1/2 |
|  | 4 | 315 A | 220-315 A | 1575-3150 A | 112694 | Ex9MD3S TM 315 4P4T | 1/2 |
|  | 4 | 350 A | 245-350 A | 1750-3500 A | 112695 | Ex9MD3S TM 350 4P4T | 1/2 |
|  | 4 | 400 A | 280-400 A | 2000-4000 A | 112696 | Ex9MD3S TM 400 4P4T | 1/2 |

## Version Ex9MD3N up to $400 \mathrm{~A}, I_{c u}=50 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=50 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | 3 | 250 A | 175-250 A | 1250-2500 A | 112697 | Ex9MD3N TM 250 3P | 1/2 |
|  | 3 | 315 A | 220-315 A | 1575-3150 A | 112698 | Ex9MD3N TM 315 3P | 1/2 |
|  | 3 | 350 A | 245-350 A | 1750-3500 A | 112699 | Ex9MD3N TM 350 3P | 1/2 |
|  | 3 | 400 A | 280-400 A | 2000-4000 A | 112700 | Ex9MD3N TM 400 3P | 1/2 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112701 | Ex9MD3N TM 250 4P4T | 1/2 |
|  | 4 | 315 A | 220-315 A | 1575-3150 A | 112702 | Ex9MD3N TM 315 4P4T | 1/2 |
|  | 4 | 350 A | 245-350 A | 1750-3500 A | 112703 | Ex9MD3N TM 350 4P4T | 1/2 |
|  | 4 | 400 A | 280-400 A | 2000-4000 A | 112704 | Ex9MD3N TM 400 4P4T | 1/2 |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD3Q up to $400 \mathrm{~A}, I_{c u}=70 \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=70 \mathrm{kA}$ at 1000 VDC
- I $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 250 A | 175-250 A | 1250-2500 A | 112705 | Ex9MD3Q TM 250 3P | 1/2 |
|  | 3 | 315 A | 220-315 A | 1575-3150 A | 112706 | Ex9MD3Q TM 315 3P | 1/2 |
|  | 3 | 350 A | 245-350 A | 1750-3500 A | 112707 | Ex9MD3Q TM 350 3P | 1/2 |
|  | 3 | 400 A | 280-400 A | 2000-4000 A | 112708 | Ex9MD3Q TM 400 3P | 1/2 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112709 | Ex9MD3Q TM 250 4P4T | 1/2 |
|  | 4 | 315 A | 220-315 A | 1575-3150 A | 112710 | Ex9MD3Q TM 315 4P4T | 1/2 |
|  | 4 | 350 A | 245-350 A | 1750-3500 A | 112711 | Ex9MD3Q TM 350 4P4T | 1/2 |
|  | 4 | 400 A | 280-400 A | 2000-4000 A | 112712 | Ex9MD3Q TM 400 4P4T | 1/2 |

## Version Ex9MD3H up to $400 \mathrm{~A}, I_{c u}=100 \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=100 \mathrm{kA}$ at 1000 V DC
- $I_{\text {c }}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Poles | Rated current $i_{n}$ | Overcurrent release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 250 A | 175-250 A | 1250-2500 A | 112713 | Ex9MD3H TM 250 3P | 1/2 |
|  | 3 | 315 A | 220-315 A | 1575-3150 A | 112714 | Ex9MD3H TM 315 3P | 1/2 |
|  | 3 | 350 A | 245-350 A | 1750-3500 A | 112715 | Ex9MD3H TM 350 3P | 1/2 |
|  | 3 | 400 A | 280-400 A | 2000-4000 A | 112716 | Ex9MD3H TM 400 3P | 1/2 |
|  | 4 | 250 A | 175-250 A | 1250-2500 A | 112717 | Ex9MD3H TM 250 4P4T | 1/2 |
|  | 4 | 315 A | 220-315 A | 1575-3150 A | 112718 | Ex9MD3H TM 315 4P4T | 1/2 |
|  | 4 | 350 A | 245-350 A | 1750-3500 A | 112719 | Ex9MD3H TM 350 4P4T | 1/2 |
|  | 4 | 400 A | 280-400 A | 2000-4000 A | 112720 | Ex9MD3H TM 400 4P4T | 1/2 |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD4B up to $630 \mathrm{~A}, I_{c u}=25 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=25 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $i_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD4S up to $630 \mathrm{~A}, I_{c u}=36 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=36 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $\boldsymbol{i}_{n}$ | Overcurrent <br> release $\boldsymbol{I}_{r}$ | instant. <br> release $\boldsymbol{I}_{\boldsymbol{i}}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD4N up to $630 \mathrm{~A}, I_{c u}=50 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=50 \mathrm{kA}$ at 1000 V DC
- $I_{r}^{c s}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $\boldsymbol{i}_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD4Q up to 630 A, $I_{c u}=\mathbf{7 0}$ kA

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=70 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $\boldsymbol{i}_{n}$ | Overcurrent <br> release $\boldsymbol{I}_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD4H up to $630 \mathrm{~A}, I_{c u}=100 \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=100 \mathrm{kA}$ at 1000 V DC
- $I_{\text {c }}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $i_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD5B up to $800 \mathrm{~A}, I_{c u}=25 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=25 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $\boldsymbol{i}_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD5S up to $800 \mathrm{~A}, I_{c u}=36 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=36 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $i_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD5N up to $800 \mathrm{~A}, I_{c u}=50 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=50 \mathrm{kA}$ at 1000 V DC
- $I_{r}^{c s}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $\boldsymbol{i}_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Moulded Case Circuit Breakers Ex9M DC TM

## Version Ex9MD5Q up to $800 \mathrm{~A}, I_{c u}=\mathbf{7 0} \mathrm{kA}$

- 3 (up to 750 V DC) and 4 -pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=70 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

| Poles | Rated <br> current $i_{n}$ | Overcurrent <br> release $I_{r}$ | instant. <br> release $I_{i}$ | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Version Ex9MD5H up to $800 \mathrm{~A}, I_{c u}=100 \mathrm{kA}$

- 3 (up to 750 V DC) and 4-pole (up to 1000 V DC) Moulded Case Circuit Breakers
- $I_{c s}=I_{c u}=100 \mathrm{kA}$ at 1000 V DC
- $I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
- $I_{i}$ can be set in range $(5-10) \times I_{n}$
- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery



## DC fuse disconnectors Ex9FP



- DC fuse disconnectors
- Suitable for PV systems
- Rated short-circuit breaking capacity $I_{\text {cn }}$ with appropriate fuse-link up to 33 kA
- Rated current up to 30 A
- Rated operational voltage 1000 V DC
- Optical tripping indicator
- Fuse-links of size $10 \times 38 \mathrm{~mm}$
- 1 and 2-pole variants
- Utilization category DC-20B

Fuse disconnectors Ex9FP for photovoltaic string protection against short circuit and overload. Suitable for cylindrical fuse-links of size $10 \times 38 \mathrm{~mm}$.
LED optical tripping indicator on the front side is signaling the fuse fault.

## Type Key



## Certification marks

( $\epsilon$

## DC fuse disconnectors Ex9FP

## 1-pole

## 2-pole

|  | Poles | Article No. | Type | Packing |
| :--- | :--- | :--- | :--- | :--- |
| 2 | 101767 | Ex9FP 2P 30A | $1 / 6 / 72$ |  |

## DC isolators Ex9IP



- DC modular isolators
- Non-polarized, suitable for PV systems
- Rated current up to 63 A
- Rated voltage up to 1000 V DC ( 250 V DC per pole/module)
- Rated short-time withstand current lcw = $12 \times$ le, 1 s
- Meet requirements of IEC / EN 60947-3

■ Width 1 to 4 modules

- Utilization category DC-22B
- Wide range of accessories

DC isolators Ex9IP can be used as a main switch in photovoltaic and similar applications. These switches are tested according to IEC / EN 60947-3 standards and fulfill also requirements for isolation function.
Ex9IP isolators can be also combined with wide range of accessories including auxiliary and signal contacts, shunt trip and undervoltage releases.

## Type Key



## Certification marks

## DC Isolators Ex9|P

## Accessories




Aux. or signal contacts AX, AL, AXL Up to 3 units

Voltage or trip releases SHT, UVT Up to 2 units


Auxiliary contacts AX31
Shunt trip releases SHT31
Undervoltage releases UVT31
see Installation devices catalogue see Installation devices catalogue see Installation devices catalogue

All accessories are mounted to the Ex9IP isolators from the left and are same as for Ex9B circuit breakers. The undervoltage release UVT in PV system is intended e.g. for safe remote disconnection of DC part from installation.

## DC Isolators Ex9IP

## 1-module, 250 V DC

| Rated current | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
| 16 A | 1 MU | 101750 | Ex9IP 1P 16A | 1/12/144 |
| 32 A | 1 MU | 101751 | Ex9IP 1P 32A | 1/12/144 |
| 50 A | 1 MU | 101752 | Ex9IP 1P 50A | 1/12/144 |
| 63 A | 1 MU | 101753 | Ex9IP 1P 63A | 1/12/144 |

2-module, 500 V DC

|  | Rated current | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 16 A | 2 MU | 101754 | Ex9IP 2P 16A | 1/6/72 |
|  | 32 A | 2 MU | 101755 | Ex9IP 2P 32A | 1/6/72 |
| - | 50 A | 2 MU | 101756 | Ex9IP 2P 50A | 1/6/72 |
| 9 7 | 63 A | 2 MU | 101757 | Ex9IP 2P 63A | 1/6/72 |

## 3-module, 750 V DC



| Rated current | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
| 16 A | 3 MU | 101758 | Ex9IP 3P 16A | 1/4/48 |
| 32 A | 3 MU | 101759 | Ex91P 3P 32A | 1/4/48 |
| 50 A | 3 MU | 101760 | Ex91P 3P 50A | 1/4/48 |
| 63 A | 3 MU | 101761 | Ex9IP 3P 63A | 1/4/48 |

4-module, 1000 V DC

|  | Rated current | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - - - | 16 A | 4 MU | 101762 | Ex9IP 4P 16A | 1/3/36 |
|  | 32 A | 4 MU | 101763 | Ex9IP 4P 32A | 1/3/36 |
| "-6. | 50 A | 4 MU | 101764 | Ex9IP 4P 50A | 1/3/36 |
| न 9 | 63 A | 4 MU | 101765 | Ex9IP 4P 63A | 1/3/36 |

## DC MCCB Switch Disconnectors Ex9MSD



- DC MCCB Switch Disconnectors
- Frame sizes M1-M6
- Rated operating current up to 1600 A
- Tested according to EN 60947-3
- DC current character
- 3 and 4-pole versions
- Rated voltage 750 V DC (3-pole) and 1000 V DC (4-pole)

DC versions of MCCB based Switch Disconnectors Ex9MSD are used as a main switch in DC applications, such as PV installations. Testing according to IEC / EN 60947-3 standards ensures functions and reliability for wide variety of applications.

These switch disconnectors follows the same design pattern than their circuit breaker equivalents. Therefore there is possibility to use the fully compatible range of external and internal accessories including extended rotary handles, auxiliary contacts, tripping units and many others.

Type Key


## Certification marks

## DC MCCB Switch Disconnectors Ex9MSD

## Internal accessories Ex9M1-M5 DC SD




Auxiliary contact AX21M

2

Shunt trip release SHT2i 1 unit or UVT2i
(3)

Undervoltage release UVT2i 1 unit or SHT2i

Auxiliary contact AX21M
Shunt trip releases SHT2i
Undervoltage releases UVT2i
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

## DC MCCB Switch Disconnectors Ex9MSD

## External accessories Ex9M1-M5 DC SD



Phase barriers PHS2i
Terminal cover, short TCV2i
Remote operators MOD2i
Extended rotary handles ERH2i
Terminal cover, long TCE2i
Direct rotary handles RHD2i
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

## DC MCCB Switch Disconnectors Ex9MSD

## External accessories Ex9M1-M5 DC SD



Tunnel terminals MC2i W
Mounting depth spacers WG $i$
Screw type terminals MC2i
Screw terminals MCS2i
Din rail DRA2i
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

## DC MCCB Switch Disconnectors Ex9M6SD

## Internal accessories Ex9M6 DC SD



Auxiliary contact AX21M
Shunt trip releases SHT26
Undervoltage releases UVT26
see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue see Moulded Case Circuit Breakers catalogue

## DC MCCB Switch Disconnectors Ex9M6SD

## External accessories Ex9M6 DC SD




## Extended handle

 LHD26

Front connection
plate
JP26

Extended rotary handles ERH26
see Installation devices catalogue
Extended handles LHD26
Front connection plate JP26
see Installation devices catalogue
see Installation devices catalogue

## DC MCCB Switch Disconnectors Ex9MSD

## 3-pole versions

- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Rated <br> current $i_{n}$ | Frame <br> size | Article No. |
| :--- | :--- | :--- | :--- |

## 4-pole versions

- Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

|  | Rated <br> current $i_{n}$ | Frame <br> size | Article No. |
| :--- | :--- | :--- | :--- |

## B type RCCBs Ex9LB63



- Residual Current Circuit Breakers according to IEC/EN 61008-1 and IEC/EN 62423
- Cond. rated short circuit strength $\mathrm{I}_{\mathrm{nc}} 10 \mathrm{kA}$
- B type
- 2 and 4-pole versions
- Rated residual current 30, 100 and $\mathbf{3 0 0} \mathbf{~ m A}$
- Rated current up to 63 A
- Rated operational voltage 230/400 V AC
- Indication of electrical tripping
- Suitable for applications from -25 to $+40^{\circ} \mathrm{C}$

Residual current circuit breakers B type Ex9LB63 are suitable for domestic as well as industrial applications, where are used frequency inveters, PV plant, EV chargers and similar elements. B type provides a sensitivity to residual $A C$, pulsating and smooth DC current, together with high frequencies up to 1 kHz .
They are based on electronic technology, which brings advantages of more accurate measuring of residual current and, as a consequence, reduction of unwanted tripping. These devices also do not suffer with magnetization of the tripping unit. Thus, there is no mandatory testing period, but they must be tested regularly. On this testing period local law or regulations may apply. Recommend is to test it every 6 months in fair enviroment and every month in heavy condition.

Type Key


## Certification marks

## B type RCCBs Ex9LB63

## B type, 2-pole

- B type - sensitivity to residual AC, pulsating and smooth DC current, high frequency up to 1 kHz
- Without time delay
- Surge current-proof 3000 A
- 30 mA version suitable for protection of people in case of direct and indirect contact with live parts and exposed conductive parts during a fault, respectively

|  | Rated <br> current | Rated <br> residual <br> current | Poles | Article <br> No. | Type |
| :--- | :--- | :--- | :--- | :--- | :--- |

## B type, 4-pole

|  | Rated <br> current | Rated <br> residual <br> current | Poles | Article <br> No. | Type |
| :--- | :--- | :--- | :--- | :--- | :--- |

## Smart Energy Meters Ex9EMS



- Smart Energy Meters according to EN 50470-1/3
- MID certification
- Mounting on DIN rails
- Operating voltage Ue 230/400 V AC
- Fixed rated current or adjustable by CT
- 1 or 2-tariff versions
- LCD display
- Optional M-Bus or ModBus communication
- 1, 2 or 4-module width versions
- Infrared eye
- Software and hardware for IR communication

Energy Meters Ex9EMS are smart meters of electric energy. We provide wide range of types with various parameters. Rated current can be fixed or adjustable by Current Transformer. LCD display is a matter of course together with infrared eye for easy read out. Possibility of M-Bus or ModBus communication do from energy meters proper smart device.

Installation Smart Energy Meters Ex9EMS are suitable for residential and industrial applications. The biggest advatage is mounting on DIN rails inside cunsomer units. They will find their use everywhere where it is needed to count consumed energy.
We offer even cable for IR communication and software can be downloaded from our website.
Energy meters are offered in 1, 2 or 4-modules width versions.

## Type Key

| Ex9 | EMS | 1P | 1M | 45A |  | 1 T |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\downarrow$ | $\downarrow$ |  | $\downarrow$ |  |  |
| Product family | Product | Poles | Modules | Rated current | Communication | Tarifís |
| Ex9 | EMS: <br> Smart <br> Energy <br> Meters | $\begin{aligned} & 1 P \\ & 3 P \end{aligned}$ | $\begin{aligned} & 1 \mathrm{M} \\ & 2 \mathrm{M} \\ & 4 \mathrm{M} \end{aligned}$ | 45A 100A CT: current transformer | MB: M-Bus MO: ModBus | 1T: 1 tariff 2T: 2 tariffs |

## Certification marks

## Smart Energy Meters Ex9EMS

## Smart Energy Meters - 1 pole 1 module

- 1 or 2-tariff versions
- Optional M-Bus or ModBus communication
- Direct connection
- Width 1MU

|  | Rated <br> current | Communication | Article No. | Type |
| :--- | :--- | :--- | :--- | :--- |

## Smart Energy Meters - 1 pole 2 modules

- 1 or 2-tariff versions
- Optional M-Bus or ModBus communication
- Direct connection
- Width 2MU

|  | Rated <br> current | Communication | Article No. | Type |
| :--- | :--- | :--- | :--- | :--- | Packing

## Smart Energy Meters - 3 poles 4 modules

- Optional M-Bus or ModBus communication
- Direct or CT connection
- Width 4MU

|  | Rated current | Communication | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 100A | - | 107295 | Ex9EMS 3P 4M 100A 2T | 1/1/36 |
|  | 100A | M-Bus | 107296 | Ex9EMS 3P 4M 100A MB 2T | 1/1/36 |
|  | 100A | ModBus | 107297 | Ex9EMS 3P 4M 100A MO 2T | 1/1/36 |
|  | CT | - | 107298 | Ex9EMS 3P 4M CT 2T | 1/1/36 |
|  | CT | M-Bus | 107299 | Ex9EMS 3P 4M CT MB 2T | 1/1/36 |
|  | CT | ModBus | 107300 | Ex9EMS 3P 4M CT MO 2T | 1/1/36 |

## Smart Energy Meters Ex9EMS

## IR connecting cable

- Infrared connecting cable with USB
- Magnetic connection with bracket to prevent movement
- Need to use a bracket

|  | Description | Article No. | Type |
| :--- | :--- | :--- | :--- |
| IR connecting cable with USB | 109855 | $I R$ USB | 1 |

## Bracket for IR cable

- Size depends on modular width of EMS energy meter

|  | For <br> energy meters | Article <br> No. | Type |
| :--- | :--- | :--- | :--- | Packing

## DC surge protection devices Ex9UEP



- DC Surge Protection Devices suitable for Photovoltaic systems
- PV T2 (Class II, Type 2, C) class SPDs
- Meet requirements of EN 50539-11
- Nominal discharge current $\mathrm{I}_{\mathrm{n}} 20 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$ per path
- Maximum discharge current $I_{\max } 40$ kA (8/20 $\mu \mathrm{s})$
- Max. continuous operational voltage UCPV from 600 to 1500 V DC
- For grounded and ungrounded PV systems
- Plug-in module design with status indication
- Optional remote indication contact

DC Surge protection devices Ex9UEP are suitable for photovoltaic applications. These SPDs are designed and tested according PV T2 class from EN 50539-11 standard.
Indication front window helps users to know the status of device and remote-signal port is able to provide remote indication and alarm.

Plug-in module design make it convenient to change module without device disconnection.

Type Key


## Certification marks

## DC surge protection devices Ex9UEP

## Complete devices for grounded PV systems, 1-pole

|  | Max. oper. voltage $\mathrm{U}_{\mathrm{CPV}}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | 600 V DC | 1 | no | 108016 | Ex9UEP 20 1P 600 | 1/96 |
| - | 600 V DC | 1 | yes | 108017 | Ex9UEP 20R 1P 600 | $1 / 96$ |
| \% | 750 V DC | 1 | no | 110171 | Ex9UEP 20 1P 750 | $1 / 96$ |
|  | 750 V DC | 1 | yes | 110172 | EX9UEP 20R 1P 750 | $1 / 96$ |

Connection diagram:


## Complete devices for ungrounded PV systems, 2-pole



| Max. oper. voltage $\mathrm{U}_{\mathrm{CPV}}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 600 V DC | U | no | 108018 | Ex9UEP 20 2P 600 | 1/81 |
| 600 V DC | U | yes | 108019 | Ex9UEP 20R 2P 600 | 1/81 |
| 750 V DC | U | no | 110173 | Ex9UEP 20 2P 750 | 1/81 |
| 750 V DC | U | yes | 110174 | Ex9UEP 20R 2P 750 | 1/81 |

Connection diagram:


## DC surge protection devices Ex9UEP

## Complete devices for grounded PV systems, 2-pole



| Max. oper. voltage $\mathbf{U}_{\text {cPv }}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1000 V DC | U | no | 110175 | Ex9UEP 20 2P 1000 | 1/81 |
| 1000 V DC | U | yes | 110176 | Ex9UEP 20R 2P 1000 | 1/81 |
| 1200 V DC | U | no | 108020 | Ex9UEP 20 2P 1200 | 1/81 |
| 1200 V DC | U | yes | 108021 | Ex9UEP 20R 2P 1200 | 1/81 |
| 1500 V DC | U | no | 110179 | Ex9UEP 202 P 1500 | 1/81 |
| 1500 V DC | U | yes | 110180 | Ex9UEP 20R 2P 1500 | 1/81 |

Connection diagram:


Complete devices for ungrounded PV systems, 3-pole

|  | Max. oper. voltage $\mathbf{U}_{\text {cpv }}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - - - | 1000 V DC | Y | no | 110177 | Ex9UEP 20 3P 1000 | 1/54 |
| - 0 | 1000 V DC | Y | yes | 110178 | Ex9UEP 20R 3P 1000 | 1/54 |
| - $\mathrm{K}^{+4}$ | 1200 V DC | Y | no | 108022 | Ex9UEP 203 P 1200 | 1/54 |
| ce cc c6 | 1200 V DC | Y | yes | 108023 | Ex9UEP 20R 3P 1200 | 1/54 |
| 3 O | 1500 V DC | Y | no | 110181 | Ex9UEP 203 P 1500 | 1/54 |
|  | 1500 V DC | Y | yes | 110182 | Ex9UEP 20R 3P 1500 | 1/54 |

Connection diagram:


## Spare plug-in module

|  | Max. oper. <br> voltage U | Suitable for <br> device | Article No. | Type |
| :--- | :--- | :--- | :--- | :--- | Packing

## DC Surge Protection Devices Ex9UEP1+2



- DC Surge Protection Devices suitable for Photovoltaic systems
- PV T1+T2 (Class I+II, Type 1+2, B+C) class SPDs
- Nominal discharge current $\mathrm{I}_{\mathrm{n}} 20 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$ per path
- Maximum discharge current $I_{\max } 40$ kA ( $8 / 20 \mu \mathrm{~s}$ )
- Impulse discharge current $\mathrm{I}_{\mathrm{imp}} 6.25 \mathrm{kA}$ (10/350 $\mu \mathrm{s}$ )
- Max. continuous operational voltage $\mathbf{U}_{\mathrm{CPV}}$ from 500 to 1500 V DC
- For grounded and ungrounded PV systems

DC Surge Protection Devices Ex9UEP1+2 are suitable for photovoltaic applications. These SPDs are designed and tested according PV I+II class from EN 61643-31 standard.
Indication front window helps users to know the status of device and remote-signal port is able to provide remote indication and alarm.

Plug-in module design make it convenient to change module without device disconnection.

Type Key

| Ex9 | UEP | 1+2 | 6.25 | R | 3P | 1500 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\dagger$ |  | $\downarrow$ |  |  |  |  |
| Product family | Product | Class | Current | Signaling contact | Module width | Max. oper. voltage | Plug-in module |
| Ex9 | UEP: DC Surge Protective Devices | $\begin{gathered} \mathrm{PV} \text { T1+T2 } \\ \text { class I+II } \\ \mathrm{B}+\mathrm{C} \\ \mathrm{~T} 1+\mathrm{T} 2 \end{gathered}$ | $\begin{aligned} & \mathrm{I}_{\mathrm{mp}}(10 / 350 \mu \mathrm{~s}) \\ & 6.25 \mathrm{kA} \end{aligned}$ | R: Yes <br> _ : No | 1P: 1 MU 2P: 2 MU 3P: 3 MU | 500 V DC <br> 600 V DC <br> 750 V DC <br> 1000 V DC <br> 1200 V DC <br> 1500 V DC | _: Complete device M: Plug-in module only |

## Certification marks

## DC Surge Protection Devices Ex9UEP1+2

## Complete devices for grounded PV systems, 1-pole

|  | Max. oper. voltage $\mathrm{U}_{\mathrm{CPV}}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 500 V DC | 1 | no | 111739 | Ex9UEP1+2 6.25 1P 500 | 1/96 |
| 0 | 500 V DC | 1 | yes | 111740 | Ex9UEP1+2 6.25R 1P 500 | 1/96 |
| 3 | 600 V DC | 1 | no | 111741 | Ex9UEP1+2 6.25 1P 600 | 1/96 |
|  | 600 V DC | 1 | yes | 111742 | Ex9UEP1+2 6.25R 1P 600 | 1/96 |
|  | 750 V DC | 1 | no | 111743 | Ex9UEP1+2 6.25 1P 750 | 1/96 |
|  | 750 V DC | 1 | yes | 111744 | Ex9UEP1+2 6.25R 1P 750 | 1/96 |

Connection diagram:


Complete devices for ungrounded PV systems, 2-pole


| Max. oper. voltage $U_{\text {CPV }}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 500 V DC | U | no | 111745 | Ex9UEP1+2 6.25 2P 500 | 1/81 |
| 500 V DC | U | yes | 111746 | Ex9UEP1+2 6.25R 2P 500 | 1/81 |
| 600 V DC | U | no | 111747 | Ex9UEP1+2 6.25 2P 600 | 1/81 |
| 600 V DC | U | yes | 111748 | Ex9UEP1+2 6.25R 2P 600 | 1/81 |
| 750 V DC | U | no | 111749 | Ex9UEP1+2 6.25 2P 750 | 1/81 |
| 750 V DC | U | yes | 111750 | Ex9UEP1+2 6.25R 2P 750 | 1/81 |

Connection diagram:


## DC Surge Protection Devices Ex9UEP1+2

## Complete devices for grounded PV systems, 2-pole

|  | Max. oper. voltage $\mathrm{U}_{\mathrm{CPV}}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1000 V DC | U | no | 111751 | Ex9UEP1+2 6.25 2P 1000 | 1/81 |
| - - | 1000 V DC | U | yes | 111752 | Ex9UEP1+2 6.25R 2P 1000 | 1/81 |
| - | 1200 V DC | U | no | 111753 | Ex9UEP1+2 6.25 2P 1200 | 1/81 |
|  | 1200 V DC | U | yes | 111754 | Ex9UEP1+2 6.25R 2P 1200 | 1/81 |
| * | 1500 V DC | U | no | 111755 | Ex9UEP1+2 6.25 2P 1500 | 1/81 |
|  | 1500 V DC | U | yes | 111756 | Ex9UEP1+2 6.25R 2P 1500 | 1/81 |

Connection diagram:


Complete devices for ungrounded PV systems, 3-pole

|  | Max. oper. voltage $\mathrm{U}_{\mathrm{CPV}}$ | Connection configuration | Signaling contact | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1000 V DC | Y | no | 111759 | Ex9UEP1+2 6.25 3P 1000 | 1/54 |
|  | 1000 V DC | Y | yes | 111760 | Ex9UEP1+2 6.25R 3P 1000 | 1/54 |
|  | 1200 V DC | Y | no | 111761 | Ex9UEP1+2 6.25 3P 1200 | 1/54 |
|  | 1200 V DC | Y | yes | 111762 | Ex9UEP1+2 6.25R 3P 1200 | 1/54 |
|  | 1500 V DC | Y | no | 111763 | Ex9UEP1+2 6.25 3P 1500 | 1/54 |
|  | 1500 V DC | Y | yes | 111764 | Ex9UEP1+2 6.25R 3P 1500 | 1/54 |

Connection diagram:


## Spare plug-in module

| max | Max. oper. <br> voltage $\mathrm{U}_{\mathrm{CPV}}$ | Suitable for device | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 500 V DC | Ex9UEP1+2 6.25 1P 500 | 111765 | Ex9UEP1+2 6.25 1P 500 M | 1 |
| $\pm$ | 600 V DC | Ex9UEP1+2 6.25 1P 600 | 111767 | Ex9UEP1+2 6.25 1P 600 M | 1 |
| \% $=0$ | 750 V DC | Ex9UEP1+2 6.25 1P 750 | 111769 | Ex9UEP1+2 6.25 1P 750 M | 1 |
| C€ | 500 V DC | Ex9UEP1+2 6.25 2P 500 | 111771 | Ex9UEP1+2 6.25 2P 500 M | 1 |
|  | 600 V DC | Ex9UEP1+2 6.25 2P 600 | 111773 | Ex9UEP1+2 6.25 2P 600 M | 1 |
|  | 750 V DC | Ex9UEP1+2 6.25 2P 750 | 111775 | Ex9UEP1+2 6.25 2P 750 M | 1 |
|  | 1000 V DC | Ex9UEP1+2 6.25 2P 1000 | 111777 | Ex9UEP1+2 6.25 2P 1000 M | 1 |
|  | 1200 V DC | Ex9UEP1+2 6.25 2P 1200 | 111779 | Ex9UEP1+2 6.25 2P 1200 M | 1 |
|  | 1500 V DC | Ex9UEP1+2 6.25 2P 1500 | 111781 | Ex9UEP1+2 6.25 2P 1500 M | 1 |
|  | 1000 V DC | Ex9UEP1+2 6.25 3P 1000 | 111785 | Ex9UEP1+2 6.25 3P 1000 M | 1 |
|  | 1200 V DC | Ex9UEP1+2 6.25 3P 1200 | 111787 | Ex9UEP1+2 6.25 3P 1200 M | 1 |
|  | 1500 V DC | Ex9UEP1+2 6.25 3P 1500 | 111789 | Ex9UEP1+2 6.25 3P 1500 M | 1 |

## Surface-mounted IP65 Consumer Units PHS



- Surface-mounted consumer units PHS
- Rated oper. voltage 400 V AC, 1500 V DC
- Degree of protection IP65
- 4 up to 48 modules
- 1 up to 4 rows
- Transparent door

Consumer units PHS are intended for general applications including industrial ones with requirements for high degree of IP protection. Their design is suitable for surface mounting. Scope of delivery consists of enclosure, door, device DIN rails, $\mathrm{N}+\mathrm{PE}$ terminals, front cover with device cutout, cover for empty place, mounting material.

Type Key


## Certification marks

( $\in$

## Surface-mounted IP65 Consumer Units PHS

## Consumer units PHS with transparent door

- Surface mounted version
- 4, 6, 8, 12 or 18 modules per row
- 1 up to 4 rows
- Scope of delivery: enclosure, door, device DIN rails, N + PE terminals, front cover with device cutout, cover for empty place, mounting material


| N+PE <br> terminals | Number <br> of rows | Total <br> modules | Article No. | Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $4+4$ | 1 | 4 | 101492 | PHS 4T | 1 |
| $6+6$ |  |  |  |  |  |

## Spare door, transparent

- Spare door for consumer unit
- Suitable for PHS line of consumer units
- Packed separately



## Surface-mounted IP65 Consumer Units PHS

## Lock with key

- Lock with key
- For subsequent mounting onto enclosure door
- Metal version of lock

|  | Version of lock | For consumer <br> units | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- |
| Metal | PHS | 101571 | LK PH M |  |

## Cover for empty place

- Cover for unused 45 mm device cutout
- White, grey or black colour
- Total width 224 mm , can be shortened
- Segmented as $1 \times 15 \mathrm{~mm}, 22 \times 1 / 2$ module width, $1 \times 15 \mathrm{~mm}$

| Colour | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
| White | 224 mm | 101574 | B CC45 | 1/500 |
| Grey | 224 mm | 113277 | B CC45 G | 1/500 |
| Black | 224 mm | 110192 | B CC45 B | 1/500 |

## Spare mounting material

- For IP65 surface mounted consumer units
- Package contains: screws, wall plugs, screw covers, stickers, empty place cover

|  | Description | Article No. | Type | Packing |
| :--- | :--- | :--- | :--- | :--- |
| Spare mounting material, IP65 | 106182 | SMM IP65S | 1 pack |  |

## Cable grommets

- Cable grommets suitable for cutouts prepared on the enclosures
- Used material allows to use various diameter of the conductors (up to $50 \mathrm{~mm}^{2}$ )
- Packed separately


| Description | Diameter | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
| Cable grommet | 16 mm | 106860 | CGQS M16 | 1 |
| Cable grommet | 20 mm | 106208 | CGQS M20 | 1 |
| Cable grommet | 25 mm | 106209 | CGQS M25 | 1 |
| Cable grommet | 32 mm | 106210 | CGQS M32 | 1 |

## Surface-mounted IP65 Consumer Units PHS FB



- Surface-mounted consumer units PHS
- Rated oper. voltage 400 V AC, 1500 V DC
- Degree of protection IP65
- Flat bottom - without marked cutouts
- 4 up to 48 modules
- 1 up to 4 rows
- Transparent door

Consumer units PHS FB are intended for general applications including industrial ones with requirements for high degree of IP protection. Their design is suitable for surface mounting. Flat bottom version without marked cutouts. Scope of delivery consists of enclosure, door, device DIN rails, N + PE terminals, front cover with device cutout, cover for empty place, mounting material.

Type Key


## Certification marks

( $\in$ 웅

## Surface-mounted IP65 Consumer Units PHS FB

## Consumer units PHS FB with transparent door

- Surface mounted version
- 4, 6, 8, 12 or 18 modules per row
- 1 up to 4 rows
- Scope of delivery: enclosure, door, device DIN rails, N + PE terminals, front cover with device cutout, cover for empty place, mounting material


| N+PE terminals | Number of rows | Total modules | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 4+4 | 1 | 4 | 110821 | PHS 4T FB | 1 |
| 6+6 | 1 | 6 | 113264 | PHS 6T FB | 1 |
| 8+8 | 1 | 8 | 109051 | PHS 8T FB | 1 |
| $10+10$ | 1 | 12 | 110684 | PHS 12T FB | 1 |
| $10+10$ | 1 | 18 | 113265 | PHS 18T FB | 1 |
| $10+10$ | 2 | 24 | 110685 | PHS 24T FB | 1 |
| $10+10$ | 3 | 36 | 110822 | PHS 36T FB | 1 |
| 10+10 | 4 | 48 | 113266 | PHS 48T FB | 1 |

## Spare door, transparent

- Spare door for consumer unit
- Suitable for PHS FB line of consumer units
- Packed separately



## Surface-mounted IP65 Consumer Units PHS FB

## Lock with key

- Lock with key
- For subsequent mounting onto enclosure door
- Metal version of lock

|  | Version of lock | For consumer <br> units | Article No. Type | Packing |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Metal | PHS-FB, PHS | 101571 | LK PH M | 1 |

## Cover for empty place

- Cover for unused 45 mm device cutout
- White, grey or black colour
- Total width 224 mm , can be shortened
- Segmented as $1 \times 15 \mathrm{~mm}, 22 \times 1 / 2$ module width, $1 \times 15 \mathrm{~mm}$

| Colour | Width | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: |
| White | 224 mm | 101574 | B CC45 | 1/500 |
| Grey | 224 mm | 113277 | B CC45 G | 1/500 |
| Black | 224 mm | 110192 | B CC45 B | 1/500 |

## Spare mounting material

- For IP65 surface mounted consumer units
- Package contains: screws, wall plugs, screw covers, stickers, empty place cover

|  | Description | Article No. | Type | Packing |
| :--- | :--- | :--- | :--- | :--- |
| Spare mounting material, IP65 | 106182 | SMM IP65S | 1 pack |  |

## Cable grommets

- Cable grommets suitable for cutouts prepared on the enclosures
- Used material allows to use various diameter of the conductors (up to $50 \mathrm{~mm}^{2}$ )
- Packed separately


(4)
Unique design
Our design language will
set you apart from the masses

0Reliable protection
B type RCCB integrated.


## 5 Year Warranty

We stand behind the qualit y of our products.

The European quality standards


## Wall-mounted EV chargers Ex9EV



- Tested according to IEC/EN 61851
- Installation directly on wall
- 1phase or 3phase versions
- Charging current up to 32 A
- Plug type 1 (5 pins) or type 2 ( 7 pins)
- Including RCCB B type
- Degree of protection IP44

Ex9EV is a wall-mounted charger for electric vehicles (EVs) with intentions to be used in a household. Our solution is equipped with B type Residual Current Circuit Breaker, which is a neccessery protection of EV chargers. The battery of EV is working on DC principe and it can occur a DC current leakage. The internal B type RCCB is able to detect leakages in DC, AC and pulsating current in a high frequency.

We are offering a chargers with charging current up to 32 A in 1 or 3 phase connection. Connection cable with lenght of 5 m with one of two most common plugs (Type 1 or Type 2 ) is a part of delivery.

Type Key


## Certification marks

## Wall-mounted EV chargers Ex9EV

## EV charging wallboxes

- 1phase or 3phase version
- Plug type 1 or type 2
- Charging current up to 32 A
- Integrated RCCB type B

| Noark | Maximal charging current | Number of phases | Plug type CAR | Article No. | Type | Packing |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 10A | 1 phase | Type 1 | 110256 | Ex9EV1 T1 10A | 1/4 |
|  | 16A | 1 phase | Type 1 | 110494 | Ex9EV1 T1 16A | 1/4 |
|  | 20A | 1 phase | Type 1 | 110495 | Ex9EV1 T1 20A | 1/4 |
|  | 25A | 1 phase | Type 1 | 110496 | Ex9EV1 T1 25A | 1/4 |
|  | 32A | 1 phase | Type 1 | 110497 | Ex9EV1 T1 32A | 1/4 |
|  | 10A | 1 phase | Type 2 | 110257 | Ex9EV1 T2 10A | 1/4 |
|  | 16A | 1 phase | Type 2 | 110498 | Ex9EV1 T2 16A | 1/4 |
|  | 20A | 1 phase | Type 2 | 110499 | Ex9EV1 T2 20A | 1/4 |
|  | 25A | 1 phase | Type 2 | 110500 | Ex9EV1 T2 25A | 1/4 |
|  | 32A | 1 phase | Type 2 | 110501 | Ex9EV1 T2 32A | 1/4 |
|  | 10A | 3 phase | Type 2 | 110258 | Ex9EV3 T2 10A | 1/4 |
|  | 16A | 3 phase | Type 2 | 110502 | Ex9EV3 T2 16A | 1/4 |
|  | 20A | 3 phase | Type 2 | 110503 | Ex9EV3 T2 20A | 1/4 |
|  | 25A | 3 phase | Type 2 | 110504 | Ex9EV3 T2 25A | 1/4 |
|  | 32A | 3 phase | Type 2 | 110505 | Ex9EV3 T2 32A | 1/4 |



Type 1


Type 2

## Cable EV chargers Ex9EVC



- Tested according to IEC/EN 61851
- Mobile solution of EV charging
- 1phase or 3phase versions
- Adjustable charging current up to $13 / 16$ or 32 A
- EV plug Type 1 (5 pins) or Type 2 ( 7 pins)
- Grid plug UNISCHUKO, Type G 13A fused (UK standard), CEE 16A/5p or CEE 32A/5p
- Integrated RCCB type B
- All necessary protections
- Degree of protection IP55 (plugs IP44)

EV charging cable Ex9EVC is a mobile solution for charging your EV (electric vehicle). It can be used as complementary charger or replace the main charger, if you don't want to have a wall-box installed in your facility. All you need is a grid plug. Charging current can be set before start charging so you can configure charging time and control the energy consumption.

Charging cables provide all necessary protection as temperature, overvoltage and undervoltage monitoring, checking the ground and neutral wires connection and electronic status before starting charging. The battery of EV is working on DC principe and it can occur a DC current leakage. The integrated B type RCCB is able to detect leakages in DC, AC and pulsating current in a high frequency.
All versions of cable chargers Ex9EVC are providen in 5 m length with one of the two most common plugs at the EV connection side - Type 1 and Type 2. Grid plug is depended on a number of phases and maximal charging current.

Type Key


## Certification marks

## Cable EV chargers Ex9EVC

## EV charging cables

- 1phase or 3phase versions
- Adjustable charging current up to $13 / 16$ or 32 A
- EV plug Type 1 (5 pins) or Type 2 ( 7 pins)
- Grid plug UNISCHUKO, Type G 13A fused (UK standard), CEE 16A/5p or CEE 32A/5p
- Integrated RCCB type B

|  | Maximal <br> charging <br> current | Number <br> of <br> phases | Plug <br> type <br> CAR | Plug <br> type <br> GRID | Article <br> No. | Pape |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

EV plug types


Type 1


Type 2

## Technical Data



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## Technical Data Ex9BP up to 1000 V DC

## DC Miniature Circuit Breakers up to 1000 V DC

## General parameters

Non-polarized, suitable for general DC as well as Photovoltaic applications
Accessories

| Auxiliary contacts | AX3111, AX3122 | 100540,100542 |
| :--- | :--- | :--- |
| Alarm contact | AL3111 | 100541 |
| Auxiliary and alarm contact | AXL31 | 100543 |
| Shunt trip releases | SHT31, SHT3111 | $100544-100546,100547-100549$ |
| Undervoltage releases | UVT31, UVT3101, UVT3110 | $100550-100551,100552-100553,100554-100555$ |
| Max. number of installed accessories is 3 pcs of one contact units (AX3111, AL3111) or 2 pcs of two contact units (AX3122,  <br> AXL31) and 2 pcs of releases (SHT31, UVT31)  |  |  |

## Electrical parameters

| Tested according to | IEC/EN 60947-2 |
| :--- | :---: |
| Rated operating voltage $U_{e}$ | $500(2 P), 1000(4 P)$ V DC |
| Rated breaking capacity $\mathrm{I}_{\mathrm{cu}}$ | 6 kA |
| Rated current $\mathrm{I}_{\mathrm{n}}$ | $10-63 \mathrm{~A}$ |
| Tripping characteristics | $\mathrm{C}, \mathrm{K}$ |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | $4 \mathrm{kV}(2 \mathrm{P}), 6 \mathrm{kV}(4 \mathrm{P})$ |
| Rated insulation voltage $\mathrm{U}_{\mathrm{i}}$ | 1000 V DC |
| Electrical service life | 300 operation cycles |
| Line voltage connection | arbitrary above or below |


| Mechanical parameters |  |
| :---: | :---: |
| Device width | 18 mm (per pole/module) |
| Device height | 83 mm (89 mm including rail clip) |
| Frame size | 45 mm |
| Mounting | easy fastening onto 35 mm device rail (DIN) |
| Degree of protection | IP20 terminals |
| Terminals | combined lift + open mouthed |
| Terminal capacity | $1-35 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | 3.5 Nm |
| Busbar thiskness | $0.8-2 \mathrm{~mm}$ |
| Mechanical service life | 20000 operation cycles |
| Ambient temperature | $-35-+70^{\circ} \mathrm{C}$ |
| Altitude | $\leq 2000 \mathrm{~m}$ |
| Relative humidity | $\leq 95 \%$ at $20^{\circ} \mathrm{C}, \leq 50 \%$ at $40^{\circ} \mathrm{C}$ |
| Resistance to humidity and heat | class 2 |
| Pollution degree | 3 |
| Installation class | III |
| Weight | 0.12 kg (per pole/module) |

## Technical Data Ex9BP up to 1000 V DC

## DC Miniature Circuit Breakers up to 1000 V DC

## Dimensions



## Wiring diagrams



Tripping characteristics


## Technical Data Ex9BP up to 1000 V DC

## DC Miniature Circuit Breakers up to 1000 V DC

Dependence of tripping characteristics on ambient temperature

| $\begin{gathered} \mathrm{T} \\ {\left[{ }^{\circ} \mathrm{C}\right]} \end{gathered}$ | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})$ [A] |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 10 A | 13 A | 16 A | 20 A | 25 A | 32 A | 40 A | 50 A | 63 A |
| -20 | 13.5 | 16:3 | 20.0 | 24.5 | 29.8 | 39.5 | 50.5 | 60.0 | 77.5 |
| -15 | 13.3 | 15.9 | 19.8 | 24.3 | 29.7 | 39.3 | 50.4 | 59.8 | 76.3 |
| -10 | 13.0 | 15.7 | 19.5 | 24.0 | 29.5 | 39.0 | 50.2 | 59.5 | 75.0 |
| -5 | 12.7 | 15.4 | 19.2 | 23.8 | 29.3 | 38.8 | 50.0 | 59.2 | 73.0 |
| 0 | 12.5 | 15 | 19.1 | 23.7 | 29.2 | 38.6 | 48.8 | 59.0 | 71.8 |
| 5 | 12.3 | 14.7 | 18.8 | 23.5 | 29.0 | 38.4 | 48.6 | 58.8 | 70.6 |
| 10 | 12.1 | 14.3 | 18.6 | 23.3 | 28.8 | 38.2 | 48.4 | 56.5 | 69.0 |
| 15 | 12.0 | 14 | 18.5 | 23.1 | 28.6 | 38.0 | 48.1 | 55.0 | 67.5 |
| 20 | 11.8 | 13.7 | 18.3 | 22.8 | 28.4 | 37.8 | 47.8 | 54.5 | 66.2 |
| 25 | 11.5 | 13.4 | 18.0 | 22.6 | 28.2 | 37.5 | 47.0 | 52.5 | 64.5 |
| 30 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 |
| 35 | 9.9 | 12.8 | 15.7 | 19.7 | 24.6 | 31.5 | 39.2 | 48.8 | 61.5 |
| 40 | 9.8 | 12.5 | 15.4 | 19.3 | 24.3 | 31.1 | 38.8 | 47.0 | 58.7 |
| 45 | 9.8 | 12.2 | 15.1 | 18.8 | 24.0 | 30.8 | 38.3 | 45.5 | 55.8 |
| 50 | 9.6 | 12 | 14.9 | 18.5 | 23.8 | 30.1 | 38.0 | 44.0 | 53.5 |
| 55 | 9.5 | 11.7 | 14.7 | 18.2 | 23.5 | 29.5 | 36.5 | 42.5 | 51.7 |
| 60 | 9.0 | 11.5 | 14.5 | 17.8 | 23.0 | 28.5 | 35.0 | 41.5 | 49.2 |
| 65 | 8.6 | 11.2 | 14.0 | 17.5 | 22.0 | 27.5 | 34.0 | 40.5 | 47.9 |
| 70 | 8.0 | 11 | 13.8 | 17.3 | 21.5 | 27.0 | 32.5 | 38.0 | 46.8 |


| Power loss per pole |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\mathrm{n}}$ [A] | 10 A | 13 A | 16 A | 20 A | 25 A | 32 A | 40 A | 50 A | 63 A |
| P [W] | 1.8 | 3.1 | 3.1 | 3.1 | 3.9 | 3.9 | 4.7 | 4.7 | 6.2 |

## Technical Data Ex9MV2S

## DC Moulded Case Circuit Breakers for photovoltaic

## General parameters

| Suitable for photovoltaics application |  |  |
| :--- | :--- | :--- |
| Internal accessories |  |  |
| Left auxiliary contact unit | AX22V | 110199 |
| Right auxiliary contact unit | 2AX22V | 110200 |
|  | AX22VR | 110206 |
| Left alarm contact unit | 2AX22VR | 110207 |
| Left auxiliary + alarm contact unit | AX+AL22V | 110201 |
| Right shunt trip releases | SHT22VR | 110202 |
| External accessories |  | $110208-110210$ |
| Extended rotary handle | ERH-1 | 110211 |

Mounting screws as well as phase barriers in the scope of delivery

## Accesories position



## Electrical parameters

| Tested according to | IEC/EN 60947-2 |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Rated op. voltage $U_{e}$ | 1500 V DC |  |  |  |
| Rated insulation voltage $U_{i}$ | 1500 V |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |  |  |  |
| Rated ultimate short-circuit breaking capacity $I_{\text {cu }}$ | 15 kA |  |  |  |
| Rated service short-circuit breaking capacity $\mathrm{I}_{\mathrm{cs}}$ | 15 kA |  |  |  |
| Rated current | 125 A, 160 A, 200 A, 225 A, 250 A |  |  |  |
| Utilization category | A |  |  |  |
| Electrical service life | 2000 operation cycles |  |  |  |
| Maximum frequency of switch. cycles | 120 cycles per hour |  |  |  |
| Total disconnection time at short circuit | < 40 ms |  |  |  |
| Power loss per pole | $\max 32 \mathrm{~W}$ |  |  |  |
| Altitude | 2000 m | 3000 m | 4000 m | 5000 m |
| Rated operational current $I_{n}$ | $1 \times \mathrm{I}_{\mathrm{n}}$ | $0.97 \times \mathrm{I}_{\mathrm{n}}$ | $0.93 x \mathrm{I}_{\mathrm{n}}$ | $0.89 \mathrm{x} \mathrm{I}_{\mathrm{n}}$ |
| Rated operational voltage $U_{\text {e }}$ | 1500 V DC | 1350 V DC | 1200 V DC | 1050 V DC |
| Rated insulation voltage $U_{i}$ | 1500 V | 1500 V | 1500 V | 1500 V |
| Dielectric properties | 3110 V DC | 2890 V DC | 2700 V DC | 2500 V DC |

## Technical Data Ex9MV2S

DC Moulded Case Circuit Breakers for photovoltaic

| Mechanical parameters |  |
| :---: | :---: |
| Device width | 135 mm |
| Device height | 200 mm |
| Device depth | 103 mm |
| Mounting | onto panel |
| Degree of protection | IP20 |
| Mechanical service life | 10000 operation cycles |
| Terminals | M10 screws |
| Busbar thickness | $\leq 4 \mathrm{~mm}$ |
| Busbar width | $\leq 29 \mathrm{~mm}$ |
| Cable lug width | $\leq 50 \mathrm{~mm}$ |
| Fastening torque of terminals | 25 Nm |
| Ambient temperature | $-40-+70^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40{ }^{\circ} \mathrm{C}, \leq 90 \%$ at $20^{\circ} \mathrm{C}$ |
| Pollution degree | 3 |
| Weight | 3.3 kg |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

## Wiring diagram



## Dimensions



## Technical Data Ex9MV2S

DC Moulded Case Circuit Breakers for photovoltaic
Installation space

## Tripping characteristics



## Temperature derrating curve



## Technical Data Ex9MV2S Accessories

## Accessories for Moulded Case Circuit Breakers Ex9MV2S

## Auxiliary and signal contact units AX22V, AL22V and combinations

## General parameters

Contact units for auxiliary and signal contact functions are suitable for all MCCB frame sizes
Auxiliary contacts synchronous with main contacts of the circuit breaker
Signal contacts active on electrical tripping of the circuit breaker (tripping signal contacts)
With connection wires

| Electrical parameters |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | AX22V | 2AX22V | AL22V | AX+AL22V | AX22VR | 2AX22VR |
| Contacts | 1 changeover (CO) | 2 changeover (CO) | 1 changeover (CO) | 2 changeover (CO) | 1 changeover (CO) | 2 changeover (CO) |
| Contact function | auxiliary left | auxiliary left | signal left | auxiliary + signal left | auxiliary right | auxiliary right |
| Maximum op. voltage $U$ | AC400V/DC220V |  |  |  |  |  |
| Rated frequency | $50 / 60 \mathrm{~Hz}$ |  |  |  |  |  |
| Rated op. current $I_{e} A C$ | 1.5A |  |  |  |  |  |
| Rated op. current $I_{e}$ DC | 0.15A |  |  |  |  |  |
| Rated thermal current $\mathrm{I}_{\text {th }}$ | 3 A |  |  |  |  |  |
| Rated op. current $I_{e}$, ut. cat. AC-15 | $5 \mathrm{~A}(240 \mathrm{~V}), 2 \mathrm{~A}(415 \mathrm{~V})$ |  |  |  |  |  |
| Rated op. current $I_{e}$, ut. cat. DC-13 | $1 \mathrm{~A}(110 \mathrm{~V}), 0.25 \mathrm{~A}(220 \mathrm{~V})$ |  |  |  |  |  |
| Rated insulation voltage $U_{i}$ | 400 V |  |  |  |  |  |


| Mechanical parameters |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | AX22V | 2AX22V | AL22V | AX+AL22V | AX22VR | 2AX22VR |
| Suitable for | Ex9MV2S |  |  |  |  |  |
| Connection | Equipped with connection wires |  |  |  |  |  |

## Wiring diagrams



2AX22V
2AX22VR


AX22V
AX22VR
AX+AL22V


AL22V
AX+AL22V

## Technical Data Ex9MV2S Accessories

## Accessories for Moulded Case Circuit Breakers Ex9MV2S

## Shunt trip releases SHT22VR

## General parameters

It is possible to use one unit of shunt trip release SHT22VR on the right side of the MCCB
Can be used for remote switch off
With connection wires

| Electrical parameters |  |
| :--- | :---: |
|  | SHT22VR |
| Rated operating voltage $U_{e}$ | 24 V DC |
| (according to type) | 230 VAC |
| Rated frequency | 400 V AC |
| Rated insulation voltage $U_{i}$ | $50 / 60 \mathrm{~Hz}$ |
| Tripping time | 400 V |


| Mechanical parameters |  |
| :--- | :--- |
|  | SHT22VR |
| Suitable for | Ex9MV2S |
| Connection | Equipped with connection wires |

## Wiring diagrams



SHT22VR

## Technical Data Ex9MV2S Accessories

Accessories for Moulded Case Circuit Breakers Ex9MV2S

## Extended rotary handles ERH-1

## General parameters

Rotary handle with extension shaft
Scope of delivery: mechanism block, extension shaft, rotary handle
Can be locked in ON and OFF position with padlocks (not in the scope of delivery)
Extension shaft can be shortened

## Electrical parameters

|  | ERH-1 |
| :--- | :--- | :--- |
| Degree of protection | IP20 |


| Mechanical parameters |  |
| :--- | :--- |
|  |  |
| Suitable for | ERH-1 |
| Length of the extension shaft | Ex9MV2S |
| Indication | 300 mm (min 50 mm if shorted) |
| Mounting | Connected breaker status ON-OFF-TRIP |
| Toggle colour | Directly onto breaker |

## Dimensions



## Technical Data Ex9M1 DC TM

## DC TM Moulded Case Circuit Breakers up to 160 A

## General parameters

Suitable for commercial as well as industrial applications
$I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
$I_{i}$ can be set in range $(5-10) \times I_{n}$ for 125 A and 160 A types, otherwise is fixed at $10 \times I_{n}$
$I_{i N}$ fixed at $10 \times I_{n}$
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Alarm contact unit | AL21M | 112072 |
| Shunt trip releases | SHT21 | $101397-101405$ |
| Undervoltage releases | UVT21 | $101406-101407$ |

Max. number of installed internal accessories is 2 pcs of $\mathrm{AX} 21 \mathrm{M}, 1 \mathrm{pc}$ of AL21M and 1 pc of a release (SHT21 or UVT21)
External accessories

| Direct rotary handle | RHD21 | 101410 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH21 | 101409 |
| Remote motor operators | MOD21 | $101411-101415$ |
| Terminal cover, short | TCV21 3P, 4P | 101439,102372 |
| Terminal cover, long | TCE21 3P, 4P | 101440,102373 |
| Phase barrier | PHS21 | 112110 |
| Connection terminals | MC21 | $103705-103708$ |
| DIN-rail adapter | DRA21 | 106319 |
| Plug-in base | PIA 21 | $112875,112876,112881,112882$ |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Derating coefficient of Tripping Characteristics on accessories combination

| Combined accessory | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})[\mathrm{A}]$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 16-50 A | 63 A | 80 A | 100 A | 125 A | 160 |
| PIA 21 | 1 | 1 | 1 | 1 | 0.95 | 0.95 |

## Technical Data Ex9M1 DC TM

## DC TM Moulded Case Circuit Breakers up to 160 A

| Electrical parameters |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Ex9M1B | Ex9M1S | Ex9M1N | Ex9M1Q | Ex9M1H |
| Tested according to | IEC/EN 60947-2 |  |  |  |  |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |  |  |  |  |
| Rated insulation voltage $U_{i}$ | 1000 V |  |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV |  |  |  |  |
| Rated frequency | DC |  |  |  |  |
| Rated ultimate short-circuit breaking capacity $\mathrm{I}_{\mathrm{cu}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | $100 \mathrm{kA} / 1000 \mathrm{~V}$ |
| Rated service short-circuit breaking capacity $I_{\text {cs }}$ | 25 kA / 1000V | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | $100 \mathrm{kA} / 1000 \mathrm{~V}$ |
| Rated current | 16 / 20 / 25 / 32 / 40 / $50 / 63$ / $80 / 100 / 125 / 160$ A |  |  |  |  |
| Utilization category | A |  |  |  |  |
| Mechanical service life | 15000 operation cycles |  |  |  |  |
| Electrical service life | 2000 operation cycles / 1000 V |  |  |  |  |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |  |  |  |  |
| Line voltage connection | arbitrary above or below |  |  |  |  |

## Dependence of Tripping Characteristics on Ambient Temperature

| $\begin{gathered} \mathrm{T} \\ {\left[{ }^{\circ} \mathrm{C}\right]} \end{gathered}$ | $I_{n}(T)[A]$ |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 16 A | 20 A | 25 A | 32 A | 40 A | 50 A | 63 A | 80 A | 100 A | 125 A | 160 A |
| -40 | 22.5 | 28 | 35 | 45 | 56 | 70 | 88 | 112 | 140 | 175 | 224 |
| -35 | 22 | 27.5 | 34 | 44 | 55 | 68.5 | 86.5 | 110 | 137 | 172 | 220 |
| -25 | 20.5 | 26.5 | 33 | 42 | 53 | 66 | 83 | 106 | 132 | 165 | 212 |
| -15 | 20 | 25.5 | 32 | 41 | 51 | 64 | 80 | 102 | 127 | 159 | 204 |
| -5 | 19.5 | 24.5 | 30.5 | 39 | 49 | 61 | 77 | 98 | 122 | 153 | 196 |
| 0 | 19 | 24 | 30 | 38 | 48 | 60 | 75 | 96 | 120 | 150 | 192 |
| 10 | 18.5 | 23 | 28 | 37 | 46 | 57.5 | 72 | 92 | 115 | 144 | 184 |
| 20 | 17.5 | 22 | 27 | 35 | 44 | 55 | 69 | 88 | 110 | 137 | 176 |
| 30 | 17 | 21 | 26 | 33 | 42 | 52.5 | 66 | 84 | 105 | 131 | 168 |
| 40 | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| 50 | 15 | 19.5 | 24 | 30.5 | 37 | 47.5 | 58.5 | 74.5 | 93 | 116 | 149 |
| 60 | 14.5 | 18.5 | 22.5 | 29 | 33.5 | 45 | 53 | 67 | 84 | 105 | 135 |
| 70 | 14 | 18 | 22 | 28 | 29 | 40 | 46 | 56 | 80 | 91 | 117 |

Power dissipation characteristics

| $\mathbf{I}_{\mathbf{n}}$ | $\mathbf{1 6} \mathbf{A}$ | $\mathbf{2 0} \mathbf{A}$ | $\mathbf{2 5} \mathbf{A}$ | $\mathbf{3 2} \mathbf{A}$ | $\mathbf{4 0} \mathbf{A}$ | $\mathbf{5 0} \mathbf{A}$ | $\mathbf{6 3} \mathbf{A}$ | $\mathbf{8 0} \mathbf{A}$ | $\mathbf{1 0 0} \mathbf{A}$ | $\mathbf{1 2 5} \mathbf{A}$ | $\mathbf{1 6 0} \mathbf{A}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Pole resistance $(\mathrm{m} \Omega)$ | 8.8 | 8.8 | 5.2 | 4.5 | 2.6 | 1.8 | 1.7 | 1.3 | 0.88 | 0.8 | 0.8 |
| Pole power dissipation $(\mathrm{W})$ | 2.3 | 3.5 | 3.3 | 4.6 | 4.2 | 4.5 | 6.7 | 8.3 | 8.8 | 12.5 | $\mathbf{2 0 . 5}$ |

## Technical Data Ex9M1 DC TM

DC TM Moulded Case Circuit Breakers up to 160 A

| Mechanical parameters |  |
| :---: | :---: |
| Device width 3P / 4P | $90 \mathrm{~mm} / 120 \mathrm{~mm}$ |
| Device height | 140 mm |
| Device depth | 81.6 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | box |
| Terminal capacity | $4-95 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | 8 Nm |
| Ambient temperature | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $1.2 \mathrm{~kg} / 1.7 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $I_{n}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 8 kV | 8 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=8 \mathrm{kV}$ ) | 3110 V DC | 2892 V DC | 2705 V DC | 2488 V DC |

Dimensions
$3 P$

mm


## Wiring diagram



3P / 750 V DC



4P / 1000 V DC

## Technical Data Ex9M1 DC TM

DC TM Moulded Case Circuit Breakers up to 160 A
Installation space


## Tripping characteristics



## Technical Data Ex9M2 DC TM

## DC TM Moulded Case Circuit Breakers up to 250 A

## General parameters

Suitable for commercial as well as industrial applications
$I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
$I_{i}$ can be set in range $(7-12) \times I_{n}$ for 125 A and $(5-10) \times I_{n}$ for other devices up to 250 A
$I_{i N}=I_{i}$
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Alarm contact unit | AL21M | 112072 |
| Shunt trip releases | SHT22 | $101416-101424$ |
| Undervoltage releases | UVT22 | $101425-101426$ |

Max. number of installed internal accessories is 2 pcs of AX21M, 1 pc of AL21M and 1 pc of a release (SHT22 or UVT22)
External accessories

| Direct rotary handle | RHD22 | 101429 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH22 | 101428 |
| Remote motor operators | MOD22 | $101430-101434$ |
| Terminal cover, short | TCV22 3P, 4P | 101442,102374 |
| Terminal cover, long | TCE22 3P, 4P | 101443,102375 |
| Phase barrier | PHS22 | 112111 |
| Connection terminals | MC22 | $103709,103869,103711,103713$ |
| DIN-rail adapter | DRA22 | 106320 |
| Plug-in base | PIA 22 | $112877,112878,112883,112884$ |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

Derating coefficient of Tripping Characteristics on accessories combination

| Combined accessory | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})[\mathrm{A}]$ |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 125 A | 160 A | 180 A | 200 A | 225 A | 250 A |
| PIA 22 | 1 | 1 | 1 | 0.95 | 0.95 | 0.95 |

## Technical Data Ex9M2 DC TM

## DC TM Moulded Case Circuit Breakers up to 250 A

| Electrical parameters |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Ex9M2B | Ex9M2S | Ex9M2N | Ex9M2Q | Ex9M2H |
| Tested according to | IEC/EN 60947-2 |  |  |  |  |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |  |  |  |  |
| Rated insulation voltage $\mathrm{U}_{\mathrm{i}}$ | 1000 V |  |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV |  |  |  |  |
| Rated frequency | DC |  |  |  |  |
| Rated ultimate short-circuit breaking capacity $\mathrm{I}_{\mathrm{cu}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | 100 kA / 1000V |
| Rated service short-circuit breaking capacity $\mathrm{I}_{\mathrm{cs}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | 100 kA / 1000V |
| Rated current | 125 / 160 / 180 / 200 / 225 / 250 A |  |  |  |  |
| Utilization category | A |  |  |  |  |
| Mechanical service life | 15000 operation cycles |  |  |  |  |
| Electrical service life | 1500 operation cycles / 1000 V |  |  |  |  |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |  |  |  |  |
| Line voltage connection | arbitrary above or below |  |  |  |  |

Dependence of Tripping Characteristics on Ambient Temperature

| $\begin{gathered} \mathbf{T} \\ {\left[{ }^{\circ} \mathrm{C}\right]} \end{gathered}$ | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})$ [A] |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 125 A | 160 A | 180 A | 200 A | 225 A | 250 A |
| -40 | 175 | 224 | 252 | 280 | 315 | 35 |
| -35 | 172 | 220 | 247 | 275 | 309 | 343 |
| -25 | 165 | 212 | 238 | 265 | 300 | 332 |
| -15 | 159 | 204 | 229 | 255 | 288 | 319 |
| -5 | 153 | 196 | 220 | 245 | 276 | 306 |
| 0 | 150 | 192 | 212 | 240 | 270 | 300 |
| 10 | 144 | 184 | 207 | 230 | 259 | 287 |
| 20 | 137 | 176 | 198 | 220 | 247 | 275 |
| 30 | 131 | 168 | 189 | 210 | 236 | 262 |
| 40 | 125 | 160 | 180 | 200 | 225 | 250 |
| 50 | 118 | 152 | 171 | 190 | 213 | 237 |
| 60 | 106 | 136 | 157 | 175 | 196 | 218 |
| 70 | 96 | 120 | 144 | 166 | 180 | 207 |

Power dissipation characteristics

| $\mathbf{I}_{\mathbf{n}}$ | $\mathbf{1 2 5 ~ A}$ | $\mathbf{1 6 0 ~ A}$ | $\mathbf{1 8 0} \mathbf{A}$ | $\mathbf{2 0 0} \mathbf{A}$ | $\mathbf{2 2 5} \mathbf{A}$ | $\mathbf{2 5 0} \mathbf{A}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.7 | 0.55 | 0.55 | 0.55 | 0.4 | 0.4 |
| Pole power dissipation $(\mathrm{W})$ | 10.9 | 14.1 | 17.8 | 22 | 20.3 | 25 |

## Technical Data Ex9M2 DC TM

DC TM Moulded Case Circuit Breakers up to 250 A

| Mechanical parameters |  |
| :---: | :---: |
| Device width 3P / 4P | $105 \mathrm{~mm} / 140 \mathrm{~mm}$ |
| Device height | 157 mm |
| Device depth | 96.5 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | box |
| Terminal capacity | $10-120 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | 25 Nm |
| Ambient temperature | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $1.85 \mathrm{~kg} / 2.5 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $I_{n}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $\mathrm{U}_{\mathrm{e}}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV | 8 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=8 \mathrm{kV}$ ) | 3110 V DC | 2892 V DC | 2705 V DC | 2488 V DC |

## Dimensions



## Wiring diagram



3P / 750 V DC


4P / 1000 V DC

## Technical Data Ex9M2 DC TM

## DC TM Moulded Case Circuit Breakers up to 250 A

Installation space

Tripping characteristics


## Technical Data Ex9M3 DC TM

## DC TM Moulded Case Circuit Breakers up to 400 A

## General parameters

Suitable for commercial as well as industrial applications
$I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
$I_{i}$ can be set in range $(5-10) \times I_{n}$
$I_{\text {in }}=I_{i}$
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Alarm contact unit | AL21M | 112072 |
| Shunt trip releases | SHT22 | $101416-101424$ |
| Undervoltage releases | UVT22 | $101425-101426$ |

Max. number of installed internal accessories is 2 pcs of AX21M, 1 pc of AL21M and 1 pc of a release (SHT22 or UVT22)
External accessories

| Direct rotary handle | RHD23 | 101483 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH23 | 101482 |
| Remote motor operators | MOD23 | $101484-101488$ |
| Terminal cover, short | TCV23 3P, 4P | 101489,102376 |
| Terminal cover, long | TCE23 3P, 4P | 101490,102377 |
| Phase barrier | PHS23 | 112112 |
| Connection terminals | MC23 | $103715-103722$ |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M3 DC TM

## DC TM Moulded Case Circuit Breakers up to 400 A

| Electrical parameters |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Ex9M3B | Ex9M3S | Ex9M3N | Ex9M3Q | Ex9M3H |
| Tested according to | IEC/EN 60947-2 |  |  |  |  |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |  |  |  |  |
| Rated insulation voltage $U_{i}$ | 1000 V |  |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 12 kV |  |  |  |  |
| Rated frequency | DC |  |  |  |  |
| Rated ultimate short-circuit breaking capacity $I_{\text {cu }}$ | 25 kA / 1000V | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | 100 kA / 1000V |
| Rated service short-circuit breaking capacity $\mathrm{I}_{\mathrm{cs}}$ | 25 kA / 1000V | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | $100 \mathrm{kA} / 1000 \mathrm{~V}$ |
| Rated current | 250 / 315 / $350 / 400 \mathrm{~A}$ |  |  |  |  |
| Utilization category | A |  |  |  |  |
| Mechanical service life | 15000 operation cycles |  |  |  |  |
| Electrical service life | 1500 operation cycles / 1000 V |  |  |  |  |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |  |  |  |  |
| Line voltage connection | arbitrary above or below |  |  |  |  |

## Dependence of Tripping Characteristics on Ambient Temperature

| $\begin{gathered} \mathrm{T} \\ {\left[{ }^{\circ} \mathrm{C}\right]} \end{gathered}$ | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})$ [A] |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | 250 A | 315 A | 350 A | 400 A |
| -40 | 350 | 441 | 490 | 560 |
| -35 | 343 | 433 | 481 | 550 |
| -25 | 332 | 418 | 465 | 530 |
| -15 | 319 | 402 | 447 | 510 |
| -5 | 306 | 386 | 429 | 490 |
| 0 | 300 | 378 | 420 | 480 |
| 10 | 287 | 362 | 402 | 460 |
| 20 | 275 | 346 | 385 | 440 |
| 30 | 262 | 331 | 367 | 420 |
| 40 | 250 | 315 | 350 | 400 |
| 50 | 237 | 300 | 332 | 380 |
| 60 | 225 | 286 | 295 | 360 |
| 70 | 212 | 271 | 276 | 320 |


| Power dissipation characteristics |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| $\mathbf{I}_{\mathbf{n}}$ | $\mathbf{2 5 0} \mathbf{~ A}$ | $\mathbf{3 1 5} \mathbf{~ A}$ | $\mathbf{3 5 0} \mathbf{~ A}$ | $\mathbf{4 0 0} \mathbf{A}$ |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.35 | 0.25 | 0.25 | 0.15 |
| Pole power dissipation $(\mathrm{W})$ | 21.9 | 24.8 | 30.6 | $\mathbf{2 4}$ |

## Technical Data Ex9M3 DC TM

## DC TM Moulded Case Circuit Breakers up to 400 A

| Mechanical parameters |  |
| :--- | :---: |
| Device width 3P / 4P | $140 \mathrm{~mm} / 185 \mathrm{~mm}$ |
| Device height | 255 mm |
| Device depth | 118.5 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | $\mathrm{M10} \mathrm{screws}$ |
| Busbar thickness | $\leq 8 \mathrm{~mm}$ |
| Busbar width | $\leq 30 \mathrm{~mm}$ |
| Cable lug width | $\leq 30 \mathrm{~mm}$ |
| Fastening torque of terminals | 25 Nm |
| Ambient temperature |  |
| Relative humidity | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Pollution degree |  |
| Weight 3P / 4P |  |
| Mounting position |  |


| Derating coefficient of technical parameters based on altitude |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $\mathrm{U}_{\mathrm{e}}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Dimensions


$3 P$


4P

## Wiring diagram



## Technical Data Ex9M3 DC TM

## DC TM Moulded Case Circuit Breakers up to 400 A



## Tripping characteristics



## Technical Data Ex9M4 DC TM

## DC TM Moulded Case Circuit Breakers up to 630 A

## General parameters

Suitable for commercial as well as industrial applications
$I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
$I_{i}$ can be set in range $(5-10) \times I_{n}$
$I_{i n}=I_{i}$
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Alarm contact unit | AL21M | 112072 |
| Shunt trip releases | SHT24 | $103723-103730$ |
| Undervoltage releases | UVT24 | $103722-103740$ |

Max. number of installed internal accessories is 2 pcs of $\mathrm{AX} 21 \mathrm{M}, 1 \mathrm{pc}$ of AL21M and 1 pc of a release (SHT24 or UVT24)
External accessories

| Direct rotary handle | RHD24 | 103742 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH24 | 103741 |
| Remote motor operators | MOD24 | $103743-103747$ |
| Terminal cover, short | TCV24 3P, 4P | 103748,103750 |
| Terminal cover, long | TCE24 3P, 4P | 103749,104855 |
| Phase barrier | PHS24 | 112113 |
| Connection terminals | MC24 W2 | 106314 |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M4 DC TM

## DC TM Moulded Case Circuit Breakers up to 630 A

| Electrical parameters |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Ex9M4B | Ex9M4S | Ex9M4N | Ex9M4Q | Ex9M4H |
| Tested according to | IEC/EN 60947-2 |  |  |  |  |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |  |  |  |  |
| Rated insulation voltage $\mathrm{U}_{\mathrm{i}}$ | 1000 V |  |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |  |  |  |  |
| Rated frequency | DC |  |  |  |  |
| Rated ultimate short-circuit breaking capacity $\mathrm{I}_{\mathrm{cu}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | 100 kA / 1000V |
| Rated service short-circuit breaking capacity $\mathrm{I}_{\mathrm{cs}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | 100 kA / 1000V |
| Rated current | 400 / 500 / 630 A |  |  |  |  |
| Utilization category | A |  |  |  |  |
| Mechanical service life | 10000 operation cycles |  |  |  |  |
| Electrical service life | 1500 operation cycles / 690 V AC |  |  |  |  |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |  |  |  |  |
| Line voltage connection | arbitrary above or below |  |  |  |  |

## Dependence of Tripping Characteristics on Ambient Temperature

| $\begin{gathered} \mathrm{T} \\ {\left[{ }^{\circ} \mathrm{C}\right]} \end{gathered}$ | $\mathrm{I}_{\mathrm{n}}(\mathrm{T})[\mathrm{A}]$ |  |  |
| :---: | :---: | :---: | :---: |
|  | 400 A | 500 A | 630 A |
| -40 | 560 | 700 | 882 |
| -35 | 550 | 687 | 866 |
| -25 | 530 | 662 | 836 |
| -15 | 510 | 637 | 804 |
| -5 | 490 | 612 | 772 |
| 0 | 480 | 600 | 756 |
| 10 | 460 | 575 | 724 |
| 20 | 440 | 550 | 693 |
| 30 | 420 | 525 | 661 |
| 40 | 400 | 500 | 630 |
| 50 | 390 | 490 | 580 |
| 60 | 370 | 460 | 530 |
| 70 | 320 | 400 | 490 |


| Power dissipation characteristics |  |  |  |
| :--- | :---: | :---: | :---: |
| $\mathbf{I}_{\mathbf{n}}$ | $\mathbf{4 0 0} \mathbf{~ A}$ | $\mathbf{5 0 0} \mathbf{~ A}$ | $\mathbf{6 3 0} \mathbf{A}$ |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.08 | 0.08 | 0.08 |
| Pole power dissipation $(\mathbf{W})$ | 12.8 | 20 | 31.8 |

## Technical Data Ex9M4 DC TM

DC TM Moulded Case Circuit Breakers up to 630 A

| Mechanical parameters |  |
| :--- | :---: |
| Device width 3P / 4P | $195 \mathrm{~mm} / 260 \mathrm{~mm}$ |
| Device height | 300 mm |
| Device depth | 142 mm |
| Mounting | IP40, IP20 terminals |
| Degree of protection | $\mathrm{M12} \mathrm{screws}$ |
| Terminals | $\leq 10 \mathrm{~mm}$ |
| Busbar thickness | $\leq 50 \mathrm{~mm}$ |
| Busbar width | $\leq 50 \mathrm{~mm}$ |
| Cable lug width | 30 Nm |
| Fastening torque of terminals | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Ambient temperature |  |
| Relative humidity |  |
| Pollution degree |  |
| Weight 3P / 4P |  |
| Mounting position |  |


| Derating coefficient of technical parameters based on altitude |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Dimensions



## Wiring diagram



3P / 750 V DC


4P / 1000 V DC

## Technical Data Ex9M4 DC TM

## DC TM Moulded Case Circuit Breakers up to 630 A

Installation space


## Tripping characteristics



## Technical Data Ex9M5 DC TM

## DC TM Moulded Case Circuit Breakers up to 800 A

## General parameters

Suitable for commercial as well as industrial applications
$I_{r}$ can be set in range $(0.7-1.0) \times I_{n}$
$I_{i}$ can be set in range $(5-10) \times I_{n}$
$I_{i N}=I_{i}$
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Alarm contact unit | AL21M | 112072 |
| Shunt trip releases | SHT24 | $103723-103730$ |
| Undervoltage releases | UVT24 | $103722-103740$ |

Max. number of installed internal accessories is 2 pcs of AX21M, 1 pc of AL21M and 1 pc of a release (SHT24 or UVT24)
External accessories

| Direct rotary handle | RHD24 | 103742 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH24 | 103741 |
| Remote motor operators | MOD24 | $103743-103747$ |
| Terminal cover, short | TCV24 3P, 4P | 103748,103750 |
| Terminal cover, long | TCE24 3P, 4P | 103749,104855 |
| Phase barrier | PHS24 | 112113 |
| Connection terminals | MC24 W2 | 106314 |
| Withdrawable base | DOB24 | $108891,108903,108897,108909$ |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Derating coefficient of Tripping Characteristics on accessories combination

| Combined <br> accessory | $\mathbf{6 3 0 ~ A}$ | $\mathbf{I}_{\mathbf{n}}(\mathbf{T})[\mathrm{A}]$ | $\mathbf{8 0 0 ~ A}$ |
| :---: | :---: | :---: | :---: |
| DOB 24 | 0.95 | $\mathbf{7 0 0 ~ A}$ | 0.9 |

## Technical Data Ex9M5 DC TM

## DC TM Moulded Case Circuit Breakers up to 800 A

| Electrical parameters |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Ex9M5B | Ex9M5S | Ex9M5N | Ex9M5Q | Ex9M5H |
| Tested according to | IEC/EN 60947-2 |  |  |  |  |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |  |  |  |  |
| Rated insulation voltage $U_{i}$ | 1000 V |  |  |  |  |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |  |  |  |  |
| Rated frequency | DC |  |  |  |  |
| Rated ultimate short-circuit breaking capacity $\mathrm{I}_{\mathrm{cu}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | $100 \mathrm{kA} / 1000 \mathrm{~V}$ |
| Rated service short-circuit breaking capacity $\mathrm{I}_{\mathrm{cs}}$ | $25 \mathrm{kA} / 1000 \mathrm{~V}$ | $36 \mathrm{kA} / 1000 \mathrm{~V}$ | $50 \mathrm{kA} / 1000 \mathrm{~V}$ | 70 kA / 1000V | $100 \mathrm{kA} / 1000 \mathrm{~V}$ |
| Rated current | 630 / 700 / 800 A |  |  |  |  |
| Utilization category | A |  |  |  |  |
| Mechanical service life | 10000 operation cycles |  |  |  |  |
| Electrical service life | 1000 operation cycles / 1000 V DC |  |  |  |  |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |  |  |  |  |
| Line voltage connection | arbitrary above or below |  |  |  |  |

## Dependence of Tripping Characteristics on Ambient Temperature

| $\mathbf{T}$ |  | $\mathbf{I}_{\mathbf{n}}(\mathbf{T})[\mathbf{A}]$ |  |
| :---: | :---: | :---: | :---: |
| $\left.{ }^{\circ} \mathbf{C}\right]$ | $\mathbf{6 3 0 ~ A}$ | $\mathbf{7 0 0} \mathbf{A}$ | $\mathbf{8 0 0} \mathbf{A}$ |
| $\mathbf{- 4 0}$ | 882 | 980 | 1120 |
| $\mathbf{- 3 5}$ | 866 | 962 | 1100 |
| $\mathbf{- 2 5}$ | 836 | 927 | 1060 |
| $\mathbf{- 1 5}$ | 804 | 892 | 1020 |
| $\mathbf{- 5}$ | 772 | 857 | 980 |
| $\mathbf{0}$ | 756 | 840 | 960 |
| $\mathbf{1 0}$ | 724 | 805 | 920 |
| $\mathbf{2 0}$ | 693 | 770 | 880 |
| $\mathbf{3 0}$ | 661 | 735 | 840 |
| $\mathbf{4 0}$ | 630 | 700 | 800 |
| $\mathbf{5 0}$ | 580 | 670 | 735 |
| $\mathbf{6 0}$ | 530 | 645 | 670 |
| $\mathbf{7 0}$ | 490 | 575 | 625 |


| Power dissipation characteristics |  |  |  |
| :--- | :---: | :---: | :---: |
| $\mathbf{I}_{\mathbf{n}}$ | $\mathbf{6 3 0} \mathbf{A}$ | $\mathbf{7 0 0} \mathbf{~ A}$ | $\mathbf{8 0 0} \mathbf{A}$ |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.08 | 0.08 | 0.08 |
| Pole power dissipation $(W)$ | 31.8 | 39.2 | 51.2 |

## Technical Data Ex9M5 DC TM

DC TM Moulded Case Circuit Breakers up to 800 A

| Mechanical parameters |  |
| :---: | :---: |
| Device width 3P / 4P | $195 \mathrm{~mm} / 260 \mathrm{~mm}$ |
| Device height | 300 mm |
| Device depth | 142 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | M12 screws |
| Busbar thickness | $\leq 10 \mathrm{~mm}$ |
| Busbar width | $\leq 50 \mathrm{~mm}$ |
| Cable lug width | $\leq 50 \mathrm{~mm}$ |
| Fastening torque of terminals | 30 Nm |
| Ambient temperature | $-40-+70^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $10.5 \mathrm{~kg} / 13.5 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |


| Derating coefficient of technical parameters based on altitude |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Altitude | $\leq 2000 \mathrm{~m}$ | 3000 m | 4000 m | 5000 m |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{\text {e }}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Dimensions



3P


4P

## Wiring diagram


$3 P / 750$ V DC

$4 \mathrm{P} / 1000 \mathrm{~V}$ DC

## Technical Data Ex9M5 DC TM

## DC TM Moulded Case Circuit Breakers up to 800 A

Installation space


## Tripping characteristics



## Technical Data Ex9FP

## DC fuse disconnectors

## General parameters

For protecting against overload and short-circuit current in direct current and PV applications
Modular design, width 1 MU per pole
Fuse fault indicator
Fuse disconnector cannot be operated by unskilled person (EN 60947-3)

## Electrical parameters

| Tested according to | IEC / EN 60947-3 |
| :--- | :---: |
| Rated operating voltage $U_{e}$ | 1000 V DC |
| Rated current $I_{e}$ DC-20B 1000 V DC | up to 30 A |
| Number of poles | 1,2 |
| Rated insulation voltage $U_{i}$ | 1000 V DC |
| Rated impulse withstand voltage $U_{\text {imp }}$ | 6 kV |
| Utilization category | DC-20B |
| Rated short-time breaking capacity | $33 \mathrm{kA}(30 \mathrm{kA}$ from 20A) |
| Rated conditional short-circuit current | 20 kA |
| Maximum power loss of fuse link | 4 W |


| Mechanical parameters |  |
| :--- | :---: |
| Device width | 18 mm (per pole) |
| Device height | $83 \mathrm{~mm}(89 \mathrm{~mm}$ including rail clip) |
| Frame size | 45 mm |
| Mounting | easy fastening onto 35 mm device rail (DIN) |
| Degree of protection | IP 20 |
| Terminal capacity | $2.5-10 \mathrm{~mm}^{2}$ |
| Ambient temperature | $-30-70^{\circ} \mathrm{C}$ |
| Altitude | $\leq 2000 \mathrm{~m}$ |
| Relative humidity | $\leq 95 \%$ |
| Resistance to humidity and heat | class 2 |
| Pollution degree | 3 |
| Installation class | III |
| Fuse dimension | $10 \times 38 \mathrm{~mm}$ |
| Weight | 0.07 kg per pole |

## Technical Data Ex9FP

## DC fuse disconnectors

Dimensions


Wiring diagrams


## Technical Data Ex9|P

## Modular DC isolators up to 63 A

## General parameters

Main switches with isolation function suitable for direct current and Photovoltaic applications
Non-polarized
Modular design, DIN-rail mounting
Max. number of installed accessories is 3 pcs of one contact units (AX3111) or 2 pcs of two contact units (AX3122) and 2 pcs of releases (SHT31, UVT31)

## Electrical parameters

| Tested according to | IEC/EN 60947-3 |
| :---: | :---: |
| Rated operating voltage $\mathrm{U}_{\mathrm{e}}$ | 250 (1P), 500 (2P), 750 (3P), 1000 V DC (4P) |
| Rated current $I_{\text {e }}$ | 16, 32, 50, 63 A |
| Module width | 1, 2, 3, 4 |
| Utilization category | DC-22B |
| Rated insulation voltage $U_{i}$ | 1000 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 6 kV |
| Rated short-time withstand current $\mathrm{l}_{\mathrm{cw}}, 1 \mathrm{~s}$ | $12 \times \mathrm{l}$ |
| Rated short-circuit making capacity I ${ }_{\text {cm }}$ | $20 \times 1$ e |
| Mechanical service life | 20000 operation cycles |
| Electrical service life | 2000 operation cycles |


| Mechanical parameters |  |
| :--- | :---: |
| Device width | 18 mm (per pole/module) |
| Device height | $83 \mathrm{~mm}(89 \mathrm{~mm}$ including rail clip) |
| Frame size | easy fastening onto 35 mm device rail (DIN) |
| Mounting | IP40, terminals IP20 |
| Degree of protection | combined lift + open mouthed |
| Terminals | $10-35 \mathrm{~mm}^{2}$ |
| Terminal capacity | $2-3.5 \mathrm{~nm}$ |
| Fastening torque of terminals | $0.8-2 \mathrm{~mm}$ |
| Busbar thiskness | $-30-700^{\circ} \mathrm{C}$ |
| Ambient temperature | $\leq 2000 \mathrm{~m}$ |
| Altitude | $\leq 95 \%$ |
| Relative humidity | class 2 |
| Resistance to humidity and heat |  |
| Pollution degree | 3 |
| Installation class |  |
| Weight |  |

## Technical Data Ex9|P

## Modular DC isolators up to 63 A

## Dimensions


Wiring diagrams

## Technical Data Ex9M1SD DC

## DC Moulded Case Switch Disconnectors up to 160 A

## General parameters

Suitable for commercial as well as industrial applications
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Shunt trip releases | SHT21 | 101397 - 101405 |
| Undervoltage releases | UVT21 | 101406 - 101407 |

Max. number of installed internal accessories is 2 pcs of AX21M and 1 pc of a release (SHT21 or UVT21)
External accessories

| Direct rotary handle | RHD21 | 101410 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH21 | 101409 |
| Remote motor operators | MOD21 | $101411-101415$ |
| Terminal cover, short | TCV21 3P, 4P | 101439,102372 |
| Terminal cover, long | TCE21 3P, 4P | 101440,102373 |
| Phase barrier | PHS21 | 112110 |
| Connection terminals | MC21 | $103705-103708$ |
| DIN-rail adapter | DRA21 | 106319 |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M1 AC SD

## DC Moulded Case Switch Disconnectors up to 160 A

## Electrical parameters

| Tested according to | IEC/EN 60947-3 |
| :---: | :---: |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV |
| Rated frequency | DC |
| Rated short-time making capacity $\mathrm{I}_{\mathrm{cm}}$ | 2 kA |
| Rated short-time withstand current $l_{\text {cw }}$ | $\begin{aligned} & 2 \mathrm{kA} / 1 \mathrm{~s} \\ & 2 \mathrm{kA} / 3 \mathrm{~s} \end{aligned}$ |
| Rated current | 160 A |
| Utilization category | DC-22A, DC-23A, DC-PV2 |
| Mechanical service life | 15000 operation cycles |
| Electrical service life | 2000 operation cycles / 1000 V DC |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |
| Line voltage connection | arbitrary above or below |

## Power dissipation characteristics

| $\mathbf{I}_{\mathrm{n}}$ | $\mathbf{1 6 0 ~ A}$ |
| :--- | :---: |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.8 |
| Pole power dissipation $(\mathrm{W})$ | 20.5 |

## Mechanical parameters

| Device width 3P / 4P |  |
| :--- | :---: |
| Device height | $90 \mathrm{~mm} / 120 \mathrm{~mm}$ |
| Device depth | 140 mm |
| Mounting | 81.6 mm |
| Degree of protection | onto panel |
| Terminals | IP40, IP20 terminals |
| Terminal capacity | box |
| Fastening torque of terminals | $4-95 \mathrm{~mm}^{2}$ |
| Ambient temperature | 8 Nm |
| Relative humidity | $-40-+70^{\circ} \mathrm{C}$ |
| Pollution degree | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Weight 3P /4P |  |
| Mounting position |  |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $I_{n}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV | 8 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=8 \mathrm{kV}$ ) | 3110 V DC | 2892 V DC | 2705 V DC | 2488 V DC |

## Technical Data Ex9M1SD DC

## DC Moulded Case Switch Disconnectors up to 160 A

## Dimensions

$3 P \quad 3$


4P
mm


Wiring diagram


3P


4P

## Installation space



## Technical Data Ex9M2SD DC

## DC Moulded Case Switch Disconnectors up to 250 A

## General parameters

| Suitable for commercial as well as industrial applications |  |  |  |
| :--- | :---: | :---: | :---: |
| Internal accessories |  |  |  |
| Auxiliary contact unit |  |  |  |
| Shunt trip releases |  |  |  |
| Undervoltage releases |  |  |  |


| Max. number of installed internal accessories is 2 pcs of AX21M and 1 pc of a release (SHT22 or UVT22) |  |  |
| :--- | :--- | :--- | :--- |
| External accessories | RHD22 | 101429 |
| Direct rotary handle | ERH22 | 101428 |
| Extended rotary handle | MOD22 | $101430-101434$ |
| Remote motor operators | TCV22 3P, 4P | 101442,102374 |
| Terminal cover, short | TCE22 3P, 4P | 101443,102375 |
| Terminal cover, long | PHS22 | 112111 |
| Phase barrier | MC22 | $103709,103869,103711,103713$ |
| Connection terminals | DRA22 | 106320 |
| DIN-rail adapter |  |  |
| Mounting screws, screw type terminals as well as phase barriers in the scope of delivery |  |  |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M2SD DC

## DC Moulded Case Switch Disconnectors up to 250 A

| Electrical parameters |  |
| :---: | :---: |
| Tested according to | IEC/EN 60947-3 |
| Rated op. voltage $U_{\text {e }}$ | 750 / 1000 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 8 kV |
| Rated frequency | DC |
| Rated short-time making capacity ${ }_{\mathrm{cm}}$ | 3.2 kA |
| Rated short-time withstand current $\mathrm{I}_{\mathrm{cw}}$ | $\begin{aligned} & 3.2 \mathrm{kA} / 1 \mathrm{~s} \\ & 3.2 \mathrm{kA} / 3 \mathrm{~s} \end{aligned}$ |
| Rated current | 250 A |
| Utilization category | DC-22A, DC-23A, DC-PV2 |
| Mechanical service life | 15000 operation cycles |
| Electrical service life | 1500 operation cycles / 1000 V DC |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |
| Line voltage connection | arbitrary above or below |

## Power dissipation characteristics

| $\mathbf{I}_{\mathrm{n}}$ | $\mathbf{2 5 0 ~ A}$ |
| :--- | :--- |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.4 |
| Pole power dissipation $(\mathrm{W})$ | 25 |

## Mechanical parameters

| Device width 3P / 4P | $105 \mathrm{~mm} / 140 \mathrm{~mm}$ |
| :---: | :---: |
| Device height | 157 mm |
| Device depth | 96.5 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | box |
| Terminal capacity | $10-120 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | 25 Nm |
| Ambient temperature | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $1.85 \mathrm{~kg} / 2.5 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $I_{n}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 8 kV | 8 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=8 \mathrm{kV}$ ) | 3110 V DC | 2892 V DC | 2705 V DC | 2488 V DC |

## Technical Data Ex9M2SD DC

## DC Moulded Case Switch Disconnectors up to 250 A

## Dimensions

## 3P



4P


Side view
mm


## Wiring diagram



3P


4 P

## Installation space



## Technical Data Ex9M3SD DC

## DC Moulded Case Switch Disconnectors up to 400 A

## General parameters

Suitable for commercial as well as industrial applications
Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Shunt trip releases | SHT22 | $101416-101424$ |
| Undervoltage releases | UVT22 | $101425-101426$ |

Max. number of installed internal accessories is 2 pcs of AX 21 M and 1 pc of a release (SHT22 or UVT22)
External accessories

| Direct rotary handle | RHD23 | 101483 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH23 | 101482 |
| Remote motor operators | MOD23 | $101484-101488$ |
| Terminal cover, short | TCV23 3P, 4P | 101489,102376 |
| Terminal cover, long | TCE23 3P, 4P | 101490,102377 |
| Phase barrier | PHS23 | 112112 |
| Connection terminals | MC23 | $103715-103722$ |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M3SD DC

## DC Moulded Case Switch Disconnectors up to 400 A

## Electrical parameters

| Tested according to | IEC/EN 60947-3 |
| :---: | :---: |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |
| Rated frequency | DC |
| Rated short-time making capacity $I_{c m}$ | 5 kA |
| Rated short-time withstand current $\mathrm{I}_{\mathrm{cw}}$ | 5 kA/ 1 s $5 \mathrm{kA} / 3 \mathrm{~s}$ |
| Rated current | 400 A |
| Utilization category | DC-22A, DC-23A, DC-PV2 |
| Mechanical service life | 15000 operation cycles |
| Electrical service life | 1500 operation cycles / 1000 V DC |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |
| Line voltage connection | arbitrary above or below |

## Power dissipation characteristics

| $\mathbf{I}_{\mathrm{n}}$ | 400 A |
| :--- | :--- |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.15 |
| Pole power dissipation $(\mathrm{W})$ | 24 |

## Mechanical parameters

| Device width 3P / 4P |  |
| :--- | :---: |
| Device height | $140 \mathrm{~mm} / 185 \mathrm{~mm}$ |
| Device depth | 255 mm |
| Mounting | 118.5 mm |
| Degree of protection | onto panel |
| Terminals |  |
| Busbar thickness | M 10 screws |
| Busbar width | $\leq 8 \mathrm{~mm}$ |
| Cable lug width | $\leq 30 \mathrm{~mm}$ |
| Fastening torque of terminals | $\leq 30 \mathrm{~mm}$ |
| Ambient temperature | 25 Nm |
| Relative humidity | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Pollution degree | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Weight 3P /4P |  |
| Mounting position |  |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Technical Data Ex9M3SD DC

## DC Moulded Case Switch Disconnectors up to 400 A

## Dimensions



3P


4P

Wiring diagram


3P


4P

## Installation space



## Technical Data Ex9M4SD DC

## DC Moulded Case Switch Disconnectors up to 630 A

## General parameters

| Suitable for commercial as well as industrial applications |  |  |  |
| :--- | :--- | :--- | :--- |
| Internal accessories |  |  |  |
| Auxiliary contact unit | AX21M | 112071 |  |
| Shunt trip releases | SHT24 | $103723-103730$ |  |
| Undervoltage releases | UVT24 | $103722-103740$ |  |
| Max. number of installed internal accessories is 2 pcs of AX21M and 1 pc of a release (SHT24 or UVT24) |  |  |  |
| External accessories | RHD24 | 103742 |  |
| Direct rotary handle | ERH24 | 103741 |  |
| Extended rotary handle | MOD24 | $103743-103747$ |  |
| Remote motor operators | TCV24 3P, 4P | 103748,103750 |  |
| Terminal cover, short | TCE24 3P, 4P | 103749,104855 |  |
| Terminal cover, long | PHS24 | 112113 |  |
| Phase barrier | MC24 W2 | 106314 |  |
| Connection terminals |  |  |  |
| Mounting screws, screw type terminals as well as phase barriers in the scope of delivery |  |  |  |

## Technical Data Ex9M4SD DC

## DC Moulded Case Switch Disconnectors up to 630 A

| Electrical parameters |  |
| :---: | :---: |
| Tested according to | IEC/EN 60947-3 |
| Rated op. voltage $U_{e}$ | 750 / 1000 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |
| Rated frequency | DC |
| Rated short-time making capacity ${ }_{\mathrm{cm}}$ | 14 kA |
| Rated short-time withstand current $I_{\mathrm{cw}}$ | 8 kA/ 1 s $8 \mathrm{kA} / 3 \mathrm{~s}$ |
| Rated current | 630 A |
| Utilization category | DC-22A, DC-23A, DC-PV2 |
| Mechanical service life | 10000 operation cycles |
| Electrical service life | 1000 operation cycles / 1000 V DC |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |
| Line voltage connection | arbitrary above or below |

## Power dissipation characteristics

| $\mathbf{I}_{n}$ | $\mathbf{6 3 0} \mathbf{A}$ |
| :--- | :--- | :--- |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.08 |
| Pole power dissipation $(W)$ | 31.8 |

## Mechanical parameters

| Device width 3P / 4P | 195 mm / 260 mm |
| :---: | :---: |
| Device height | 300 mm |
| Device depth | 142 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | M12 screws |
| Busbar thickness | $\leq 10 \mathrm{~mm}$ |
| Busbar width | $\leq 50 \mathrm{~mm}$ |
| Cable lug width | $\leq 50 \mathrm{~mm}$ |
| Fastening torque of terminals | 30 Nm |
| Ambient temperature | $-40-+70^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $9.5 \mathrm{~kg} / 12.5 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\mathrm{imp}}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Technical Data Ex9M4SD DC

## DC Moulded Case Switch Disconnectors up to 630 A

Dimensions


3P


4P
mm

## Wiring diagram


$3 P$


Installation space


## Technical Data Ex9M5SD DC

## DC Moulded Case Switch Disconnectors up to 800 A

## General parameters

Suitable for commercial as well as industrial applications

## Internal accessories

| Auxiliary contact unit | AX21M | 112071 |
| :--- | :--- | :--- |
| Shunt trip releases | SHT24 | $103723-103730$ |
| Undervoltage releases | UVT24 | $103722-103740$ |

Max. number of installed internal accessories is 2 pcs of AX21M and 1 pc of a release (SHT24 or UVT24)
External accessories

| Direct rotary handle | RHD24 | 103742 |
| :--- | :--- | :--- |
| Extended rotary handle | ERH24 | 103741 |
| Remote motor operators | MOD24 | $103743-103747$ |
| Terminal cover, short | TCV24 3P, 4P | 103748,103750 |
| Terminal cover, long | TCE24 3P, 4P | 103749,104855 |
| Phase barrier | PHS24 | 112113 |
| Connection terminals | MC24 W2 | 106314 |

Mounting screws, screw type terminals as well as phase barriers in the scope of delivery

## Technical Data Ex9M5SD DC

## DC Moulded Case Switch Disconnectors up to 800 A

## Electrical parameters

| Tested according to | IEC/EN 60947-3 |
| :---: | :---: |
| Rated op. voltage $U_{e}$ | 1000 V DC |
| Rated insulation voltage $U_{i}$ | 1250 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |
| Rated frequency | DC |
| Rated short-time making capacity $\mathrm{I}_{\mathrm{cm}}$ | 17 kA |
| Rated short-time withstand current $\mathrm{I}_{\mathrm{cw}}$ | $\begin{aligned} & 10 \mathrm{kA} / 1 \mathrm{~s} \\ & 10 \mathrm{kA} / 3 \mathrm{~s} \end{aligned}$ |
| Rated current | 800 A |
| Utilization category | DC-22A, DC-23A, DC-PV2 |
| Mechanical service life | 10000 operation cycles |
| Electrical service life | 1000 operation cycles / 1000 V DC |
| Total disconnection time at short circuit | $<2 \mathrm{~ms}$ |
| Line voltage connection | arbitrary above or below |

## Power dissipation characteristics

| $\mathbf{I}_{\mathrm{n}}$ | $\mathbf{8 0 0 ~ A}$ |
| :--- | :--- | :--- |
| Pole resistance $(\mathrm{m} \Omega)$ | 0.08 |
| Pole power dissipation $(\mathrm{W})$ | 51.2 |

Mechanical parameters

| Device width 3P / 4P | 195 mm / 260 mm |
| :---: | :---: |
| Device height | 300 mm |
| Device depth | 142 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | M12 screws |
| Busbar thickness | $\leq 10 \mathrm{~mm}$ |
| Busbar width | $\leq 50 \mathrm{~mm}$ |
| Cable lug width | $\leq 50 \mathrm{~mm}$ |
| Fastening torque of terminals | 30 Nm |
| Ambient temperature | $-40-+70^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $9.5 \mathrm{~kg} / 12.5 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Technical Data Ex9M5SD DC

## DC Moulded Case Switch Disconnectors up to 800 A

## Dimensions



3P


4P

Wiring diagram


3P


4 P

## Installation space



## Technical Data Ex9M6SD DC

## DC Moulded Case Switch Disconnectors up to 1600 A

## General parameters

| Suitable for household as well as industrial applications |  |  |
| :---: | :---: | :---: |
| Internal accessories |  |  |
| Auxiliary contact unit | AX21M | 112071 |
| Shunt trip releases | SHT26 | $110460-110467$ |
| Undervoltage releases | UVT26 | 110468-110469 |
| Max. number of installed internal accessories is 2 pcs of AX21 and 1 pc of a release (SHT26 or UVT26) |  |  |
| External accessories |  |  |
| Extended handle | LHD26 | 110698 |
| Extended rotary handle | ERH26 | 108846 |
| Front connection plate | JP26 | 110694 - 110697 |
| Mounting screws, screw type terminals as well as phase barriers in the scope of delivery |  |  |

## Technical Data Ex9M6SD DC

## DC Moulded Case Switch Disconnectors up to 1600 A

| Electrical parameters |  |
| :---: | :---: |
| Tested according to | IEC/EN 60947-3 |
| Rated op. voltage $\mathrm{U}_{\text {e }}$ | 750 / 1500 V DC |
| Rated insulation voltage $U_{i}$ | 1500 V |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV |
| Rated frequency | DC |
| Rated short-time making capacity $\mathrm{I}_{\mathrm{cm}}$ | 19.2 kA |
| Rated short-time withstand current $\mathrm{I}_{\mathrm{cw}}$ | 19.2 kA / 1 s |
| Rated current | $800 / 1000 / 1250 / 1600 \mathrm{~A}$ |
| Utilization category | DC-22A, DC-22B |
| Mechanical service life | 6000 operation cycles |
| Electrical service life | 1000 operation cycles/1000 V DC |
| Total disconnection time at short circuit | < 2 ms |
| Line voltage connection | arbitrary above or below |


| Power dissipation characteristics |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\mathrm{n}}$ | 800 A | 1000 A | 1250 A | 1600 A |
| Pole resistance ( $\mathrm{m} \Omega$ ) | 0.08 | 0.08 | 0.04 | 0.04 |
| Pole power dissipation (W) | 51.2 | 80.0 | 62.5 | 102.4 |


| Mechanical parameters |  |
| :---: | :---: |
| Device width 3P / 4P | $210 \mathrm{~mm} / 280 \mathrm{~mm}$ |
| Device height | 286 mm |
| Device depth | 191 mm |
| Mounting | onto panel |
| Degree of protection | IP40, IP20 terminals |
| Terminals | M10 screws |
| Busbar thickness | $\leq 10 \mathrm{~mm}$ |
| Busbar width | $\leq 50 \mathrm{~mm}$ |
| Cable lug width | $\leq 50 \mathrm{~mm}$ |
| Fastening torque of terminals | $25-30 \mathrm{Nm}$ |
| Ambient temperature | $-40-+70^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 50 \%$ at $40^{\circ} \mathrm{C}, \leq 90 \%$ monthly average |
| Pollution degree | 3 |
| Weight 3P / 4P | $13 / 17 \mathrm{~kg}$ |
| Mounting position | vertical, can be rotated by $90^{\circ}$ in each axis |

Derating coefficient of technical parameters based on altitude

| Altitude | $\leq 2000$ m | 3000 m | 4000 m | 5000 m |
| :---: | :---: | :---: | :---: | :---: |
| Derrating op. current $\mathrm{I}_{\mathrm{n}}$ coefficient | 1 | 0.96 | 0.93 | 0.9 |
| Maximum rated op. voltage $U_{e}$ | 1000 V DC | 900 V DC | 850 V DC | 800 V DC |
| Rated insulation voltage $U_{i}$ | 1000 V DC | 930 V DC | 870 V DC | 800 V DC |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 12 kV | 10 kV | 8 kV | 8 kV |
| Dielectric properties ( $\mathrm{U}_{\mathrm{imp}}=12 \mathrm{kV}$ ) | 3600 V DC | 3350 V DC | 3110 V DC | 2985 V DC |

## Technical Data Ex9M6SD DC

## DC Moulded Case Switch Disconnectors up to 1600 A

Dimensions


## Wiring diagram



Installation space


## Technical Data Ex9LB63

## Residual Current Circuit Breakers type B, 10 kA

## General parameters

Electronic evaluation principle - more accurate measuring of residual current
Suitable for household as well as industrial applications
B type - sensitivity to residual AC, pulsating and smooth DC current, high frequency up to 1 kHz
Device must be tested regularly. Local laws or regulations can be applied. Recommend is a testing period of 6 months in normal condition, 1 month in heavy conditions

In case all wires are not connected at 4-pole RCCB, it is necessary to ensure that circuit of the test button T is supplied with appropriate voltage (by means of mutual connection of respective terminals of the RCCB, see wiring diagram)
Internal SPD protection to improve service life and make it applicable to multiple installation environments
Parallel construction of the type $A / A C$ and type $B$ internal parts. If required voltage is not available for type $B$ internal electronics, the protection type $A$ and $A C$ will be still provided

Indication of electrical tripping

## Electrical parameters

| Tested according to | IEC/EN 61008-1, IEC/EN 62423 |
| :---: | :---: |
| Rated operational voltage $U_{e}$ | $\begin{aligned} & 230 / 240 \text { V AC (2-pole) } \\ & 400 / 415 \text { V AC (4-pole) } \end{aligned}$ |
| Min. voltage for RCD function | voltage independent for type $A$ and $A C$ voltage dependent for type B (from 85 V AC) |
| Voltage range of the test button T | $\begin{aligned} & 150-254 \text { V AC (2-pole) } \\ & 150-440 \text { V AC (4-pole) } \end{aligned}$ |
| Rated frequency f | 50 Hz |
| Conditional short circuit strength $\mathrm{I}_{\text {nc }}$ | 10 kA |
| Rated current $I_{n}$ | 25, 40, 63 A |
| Rated residual current $I_{\Delta n}$ | 30, 100, 300 mA |
| Sensitivity to residual current | B type - residual AC, pulsating and smooth DC current, high frequency (1 kHz) |
| Rated impulse withstand voltage $\mathrm{U}_{\text {imp }}$ | 4 kV |
| Rated insulation voltage $\mathrm{U}_{i}$ | 500 V |
| Surge current proof | 3000 A |
| Mechanical service life | 10000 operation cycles |
| Electrical service life | 2000 operation cycles |
| Back-up fuse for overload |  |
| $\mathrm{I}_{\mathrm{n}}=25 \mathrm{~A}$ | max. 25 AgG |
| $\mathrm{I}_{\mathrm{n}}=40 \mathrm{~A}$ | max. 32 AgG |
| $\mathrm{I}_{\mathrm{n}}=63 \mathrm{~A}$ | max. 50 AgG |
| Back-up fuse for short circuit |  |
| $\mathrm{I}_{\mathrm{n}}=25 \mathrm{~A}$ | max. 63 AgG |
| $\mathrm{I}_{\mathrm{n}}=40 \mathrm{~A}$ | max. 63 AgG |
| $\mathrm{I}_{\mathrm{n}}=63 \mathrm{~A}$ | max. 63 AgG |
| Rated making capacity $I_{m}$ (rated residual making capacity $I_{\Delta m}$ ) |  |
| $\mathrm{I}_{\mathrm{n}}=25 \mathrm{~A}$ | 500 A |
| $\mathrm{I}_{\mathrm{n}}=40 \mathrm{~A}$ | 500 A |
| $\mathrm{I}_{\mathrm{n}}=63 \mathrm{~A}$ | 630 A |
| Line voltage connection | arbitrary above or below |

## Technical Data Ex9LB63

## Residual Current Circuit Breakers type B, 10 kA

| Mechanical parameters |  |
| :---: | :---: |
| Device width | 54 mm (2-pole), 72 mm (4-pole) |
| Device height | 91 mm including rail clip |
| Frame size | 45 mm |
| Mounting | easy fastening onto 35 mm device rail (DIN) |
| Degree of protection | IP20 |
| Terminals | combined lift + open mouthed |
| Terminal capacity | $1-25 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | 2.5 Nm |
| Busbar thickness | $0.8-2 \mathrm{~mm}$ |
| Ambient temperature | $-25-+40^{\circ} \mathrm{C}$ |
| Altitude | $\leq 2000 \mathrm{~m}$ |
| Relative humidity | $\leq 95$ \% |
| Resistance to humidity and heat | class 2 |
| Pollution degree | 2 |
| Installation class | III |
| Weight | 0.28 kg (2-pole), 0.43 kg (4-pole) |

## Dimensions



## Wiring diagrams



## Technical Data Ex9LB63

## Residual Current Circuit Breakers type B, 10 kA

## Tripping characteristics

$\square 30 \mathrm{~mA} \quad \square 100 \mathrm{~mA} \quad \square 300 \mathrm{~mA}$


| Power loss |  |  |  |
| :---: | :---: | :---: | :---: |
| $\mathrm{I}_{\mathrm{n}}$ | $\mathrm{I}_{\Delta}$ | 2P | 4P |
| 25 A | 30 mA | 6.6 W | 8.6 W |
|  | 100 mA | 4.3 W | 8.6 W |
|  | 300 mA | 4.3 W | 8.6 W |
| 40 A | 30 mA | 6.9 W | 13.7 W |
|  | 100 mA | 10.5 W | 13.7 W |
|  | 300 mA | 10.5 W | 13.7 W |
| 63 A | 30 mA | 16.5 W | 21.6 W |
|  | 100 mA | 10.9 W | 21.6 W |
|  | 300 mA | 10.9 W | 21.6 W |

## Technical Data Ex9EMS

## Smart Energy Meters

## General parameters

All products have MID certification
1 or 2-tariff versions
Optional M-Bus or ModBus communication
Direct or CT connection

## Electrical parameters

|  | Ex9EMS 1P 1M | Ex9EMS 1P 2M | Ex9EMS 3P 4M |
| :---: | :---: | :---: | :---: |
| Tested according to | EN 50470-1/3 |  |  |
| Nominal voltage $U_{n}$ | 230 V AC | 230 V AC | $3 \times 230 / 400 \mathrm{~V}$ AC |
| Operational voltage | 195-253 V AC | 195-253 V AC | $3 \times 230 / 400 \mathrm{~V} \pm 20 \%$ |
| Rated frequency f | $50 \mathrm{~Hz} \pm 10 \%$ | $50 \mathrm{~Hz} \pm 10 \%$ | $45-60 \mathrm{~Hz}$ |
| Insulation capabilities: |  |  |  |
| AC voltage withstand | 4 kV for 1 minute |  |  |
| Impulse voltage withstand | $6 \mathrm{kV}-1.2 \mu \mathrm{~s}$ waveform |  |  |
| Basic current $\mathrm{I}_{\mathrm{b}}$ | 5 A | 5 A | 5 A (1.5 A for CT version) |
| Maximum rated current $I_{\text {max }}$ | 45 A | 100 A | 100 A (6 A for CT version) |
| Operational current range | $0.4 \% \mathrm{l}_{\mathrm{b}}-\mathrm{I}_{\text {max }}$ |  |  |
| Overcurrent withstand | $30 * 1_{\text {max }}$ for 0.01 s |  |  |
| Power consumption (active - reactive) | $\leq 2 \mathrm{~W} /$ phase - $\leq 10 \mathrm{~W} /$ phase |  |  |
| Test output flash rate (RED LED) | $10000 \mathrm{lmp} / \mathrm{kWh}$ |  |  |
| Pulse output rate | 10 000/2 000/1 000/100/10/1/0.1/0.01 Imp/kWh |  |  |
| Pulse width | $\begin{aligned} & \leq 5625 \mathrm{~W} . . .32 \mathrm{~ms} \\ & >5625 \mathrm{~W} . .11 .2 \mathrm{~ms} \end{aligned}$ | 1 000/100/10/1/0.1/0.01 Imp/kWh ... 31 ms <br> $2000 \mathrm{lmp} / \mathrm{kWh}<30 \mathrm{~kW} . . .31 \mathrm{~ms}$ $2000 \mathrm{lmp} / \mathrm{kWh}>30 \mathrm{~kW} . . .15 \mathrm{~ms}$ $10000 \mathrm{lmp} / \mathrm{kWh}<6 \mathrm{~kW} . . .31 \mathrm{~ms}$ $10000 \mathrm{Imp} / \mathrm{kWh}>6 \mathrm{~kW} . . .15 \mathrm{~ms}$ $10000 \mathrm{lmp} / \mathrm{kWh}>12 \mathrm{~kW} . . .5 \mathrm{~ms}$ | 1 000/2 000/10 000 pulses <br> - 0-4 999 W ... 40 ms <br> - 5000-9 999 W ... 20 ms <br> -10 000-19 999 W ... 10ms <br> - 20 000-39 999 W ... 5 ms <br> -> 40000 W ... 2.5 ms <br> 100 pulses <br> - < 50000 W ... 40 ms <br> -> $50000 \mathrm{~W} . . .20 \mathrm{~ms}$ <br> Other pulses <br> - always ... 40 ms |
| Data store | The data can be stored for more than 10 years without power |  |  |
| Accuracy class | B (=1\% accuracy) |  |  |
| Basic errors: |  |  |  |
| $0.05{ }^{*} \mathrm{l}_{\mathrm{b}}$ | $\operatorname{Cos} \varphi=1 \ldots \pm 1.5 \%$ |  |  |
| $0.1{ }^{*} \mathrm{l}_{\mathrm{b}}$ | $\begin{aligned} & \operatorname{Cos} \varphi=0.5 \mathrm{~L} \ldots \pm 1.5 \% \\ & \operatorname{Cos} \varphi=0.5 \mathrm{C} \ldots \pm 1.5 \% \end{aligned}$ |  |  |
| $0.1{ }^{*} I_{b}-I_{\text {max }}$ | $\operatorname{Cos} \varphi=1 \ldots \pm 1.0 \%$ |  |  |
| $0.2{ }^{*} I_{b}-I_{\text {max }}$ | $\begin{aligned} & \operatorname{Cos} \varphi=0.5 \mathrm{~L} \ldots \pm 1.0 \% \\ & \operatorname{Cos} \varphi=0.5 \mathrm{C} \ldots \pm 1.0 \% \end{aligned}$ |  |  |
| Infrared specification |  |  |  |
| Infrared wavelengths | 900-1 000 nm |  |  |
| Communication distance | Direct contact |  |  |
| Protocol | IEC62056-21:2002 (IEC1107) |  |  |
| M-Bus com. spec. (MB version only) |  |  |  |
| Bus type | M-Bus |  |  |
| Baud rate | 300,600, $1200,2400,4800$, and 9600 (default) |  |  |
| Range | $\leq 1000 \mathrm{~m}$ |  |  |
| Downlink signal | Master to slave. Voltage modulation |  |  |
| Uplink signal | Slave to master. Current modulation |  |  |

## Technical Data Ex9EMS

Smart Energy Meters

| Electrical parameters | Ex9EMS 1P 1M | Ex9EMS 1P 2M | Ex9EMS 3P 4M |
| :--- | :---: | :---: | :---: |
| M-Bus com. spec. (MB version only) |  |  |  |
| Cable |  | JYSTY (nx2x0.8) |  |
| Protocol |  | EN13757-3 |  |
| Max. number of meters | $64^{*}$ |  |  |
| ModBus com. spec. (MO version only) |  | RS485 |  |
| Bus type |  | ModBus RTU with 16 bit CRC |  |
| Protocol | 1200, 2400,4800 and 9600 (default) |  |  |
| Baud rate | $1-247$ user settable |  |  |
| Address range | 60 meters per bus* |  |  |
| Maximum bus load | 1000 m |  |  |
| Range |  |  |  |

*Note that the maximum number of meters is dependent on the converter, baudrate (the higher the baudrate, the smaller the number of meters which can be used) and the circumstances under which the meters are installed.

Software for programing energy meters thru infrared eye can be downloaded from our website www.noark-electric.eu.
For more informations and settings of Smart Energy Meters please see User Manual from our website.

| Mechanical parameters |  |  |  |
| :---: | :---: | :---: | :---: |
|  | Ex9EMS 1P 1M | Ex9EMS 1P 2M | Ex9EMS 3P 4M |
| Device width | 17.5 mm | 35.8 mm | 70 mm |
| Device height | 90 mm | 92.5 mm | 92.4 mm |
| Frame size |  | 45 mm |  |
| Mounting | onto 35 mm device rail (DIN) |  |  |
| Degree of protection | IP 50 |  |  |
| Terminals | lift and screw terminals |  |  |
| Max. L and N terminals capacity |  |  |  |
| Solid copper | $8 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ |
| Flex core | - | - | $25 \mathrm{~mm}^{2}$ |
| Fastening torque of L and N terminals | 2.4 Nm |  |  |
| Max. Auxiliary terminals capacity | $2.5 \mathrm{~mm}^{2}$ |  |  |
| Fastening torque of auxiliary terminals | 0.1 Nm |  |  |
| Ambient temperature | $-25^{\circ} \mathrm{C}-+55^{\circ} \mathrm{C}$ | $-40^{\circ} \mathrm{C}-+70^{\circ} \mathrm{C}$ | $\begin{aligned} & \text { Direct: }-40^{\circ} \mathrm{C}-+70^{\circ} \mathrm{C} \\ & \text { CT: }-25^{\circ} \mathrm{C}-+70^{\circ} \mathrm{C} \end{aligned}$ |
| Operating humidity | $\leq 75 \%$ |  |  |
| Insulation class | 11 |  |  |
| Weight | 0.08 kg | 0.16 kg | 0.39 kg |

## Dimensions



Ex9EMS 1P 2M


## Technical Data Ex9EMS

## Smart Energy Meters

## Dimensions

## Ex9EMS 3P 4M



## Wiring diagrams

Ex9EMS 1P 1M


Ex9EMS 1P 2M


Phase line in (L-IN)
Phase line out (L-OUT)
Neutral line in ( N )
Neutral line out (N)
M-Bus/ModBus communication contact
(Ex9EMS 1P 2M 100A MB 2T \& Ex9EMS 1P 2M 100A MO 2T only)
External tariff input (Ex9EMS 1P 2M 100A 2T only)
Pulse output contact (SO) forward
Pulse output contact (SO) reverse

## Technical Data Ex9EMS

## Smart Energy Meters

## Wiring diagrams

Ex9EMS 3P 4M - Direct connected - 3P 3W Delta
L2

Ex9EMS 3P 4M - Direct connected - 1P 2W Single phase


Ex9EMS 3P 4M-CT - 3P 4W


Ex9EMS 3P 4M - CT - 3P 3W Open Delta (Aron)


## Technical Data Ex9EMS

## Smart Energy Meters

## Wiring diagrams

Ex9EMS 3P 4M - CT - 1P 2W - Single phase


CT1 (in) Phase 1 input - CT1 (out) Phase 1 output CT2 (in) not used - CT2 (out) not used
CT3 (in) not used - CT3 (out) not used
UN (in) Neutral input - UN (out) neutral output
0/11 Phase 1 - UL1
12/13 not used
14/15 not used
16/17 not used
18/19 Forward pulse output contact (S0)
20/21 Reverse pulse output contact (SO)
22/23 M-Bus / ModBus communication contact
24/25 External tariff input (230V)

## Technical Data Ex9UEP

DC surge protection devices PV T2, $\mathrm{I}_{\mathrm{n}}=20 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$

## General parameters

Designed and suitable for photovoltaic applications
Modular devices, plug-in module design
Indication window helps users to know the status of device
Optional remote-signaling contact

## Electrical parameters

|  | Ex9UEP 20(R) 1P 600 / 750V |  | Ex9UEP 20(R) 2P 600 / 750V |  | $\begin{gathered} \text { Ex9UEP 20(R) } \\ \text { 2P } \\ 1000 / 1200 / 1500 V \end{gathered}$ |  |  | $\begin{gathered} \text { Ex9UEP 20(R) } \\ 3 P \\ 1000 / 1200 / 1500 V \end{gathered}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Tested according to | EN 50539-11 |  |  |  |  |  |  |  |  |  |
| Classified type (test class) | PV T2 (Class II, C, Type 2) |  |  |  |  |  |  |  |  |  |
| Technology | MOV (Varistor) |  |  |  |  |  |  |  |  |  |
| Protection function | thermal |  |  |  |  |  |  |  |  |  |
| Protection mode |  |  |  |  |  |  |  |  |  |  |
| Connection configuration | 1 |  | U |  | U |  |  | Y |  |  |
| Rated operational DC voltage $U_{n}$ | 600 V | 750 V | 600 V | 750 V | 1000 V | 1200 V | 1500 V | 1000 V | 1200 V | 1500 V |
| $\begin{aligned} & \text { Max. continuous op. DC voltage } U_{C P V} \\ & \quad+\rightarrow P E,-\rightarrow P E \\ & +\leftrightarrow- \end{aligned}$ | $\begin{aligned} & 600 \mathrm{~V} \\ & 600 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 750 \mathrm{~V} \\ & 750 \mathrm{~V} \end{aligned}$ | $\begin{gathered} 600 \mathrm{~V} \\ 1200 \mathrm{~V} \end{gathered}$ | $\begin{gathered} 750 \mathrm{~V} \\ 1500 \mathrm{~V} \end{gathered}$ | $\begin{aligned} & 1000 \mathrm{~V} \\ & 1000 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 1200 \mathrm{~V} \\ & 1200 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 1500 \mathrm{~V} \\ & 1500 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 1000 \mathrm{~V} \\ & 1000 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 1200 \mathrm{~V} \\ & 1200 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & 1500 \mathrm{~V} \\ & 1500 \mathrm{~V} \end{aligned}$ |
| Max. system voltage $U_{\text {OC max }}$ (according to general design rules IEC 62548, IEC/HD 60364-7-712) | 545 V | 680 V | 545 V | 680 V | 905 V | 1090 V | 1365 V | 905 V | 1090 V | 1365 V |
| Nominal frequency f | DC |  |  |  |  |  |  |  |  |  |
| Nominal discharge current $I_{n}(8 / 20 \mu s)$ | 20 kA |  |  |  |  |  |  |  |  |  |
| Max. discharge current $I_{\text {max }}(8 / 20 \mu \mathrm{~s})$ | 40 kA |  |  |  |  |  |  |  |  |  |
| Total discharge current $\mathrm{I}_{\text {TOTAL }}(8 / 20 \mu \mathrm{~s})$ | - |  | 40 kA |  | 40 kA |  |  | 40 kA |  |  |
| $\begin{aligned} & \text { Protection voltage } U_{p} \text { at } I_{n} \\ & \quad+\rightarrow P E,-\rightarrow P E \\ & +\leftrightarrow- \end{aligned}$ | $\begin{aligned} & 2.3 \mathrm{kV} \\ & 2.3 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 2.5 \mathrm{kV} \\ & 2.5 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 2.3 \mathrm{kV} \\ & 4.2 \mathrm{kV} \end{aligned}$ | $\begin{gathered} 2.5 \mathrm{kV} \\ 5 \mathrm{kV} \end{gathered}$ | $\begin{aligned} & 3.8 \mathrm{kV} \\ & 3.8 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 4.2 \mathrm{kV} \\ & 4.2 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 5 \mathrm{kV} \\ & 5 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 3.8 \mathrm{kV} \\ & 3.8 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 4.2 \mathrm{kV} \\ & 4.2 \mathrm{kV} \end{aligned}$ | $\begin{aligned} & 5 \mathrm{kV} \\ & 5 \mathrm{kV} \end{aligned}$ |
| Residual current $I_{\text {PE }}$ at $U_{\text {REF }}$ DC | $<50 \mu \mathrm{~A}$ |  |  |  |  |  |  |  |  |  |
| Residual current $I_{\text {PE }}$ at $U_{\text {REF }} A C$ | $<1 \mathrm{~mA}$ |  |  |  |  |  |  |  |  |  |
| Short-circuit current rating $\mathrm{I}_{\text {SCPV }}$ | 1000 A |  |  |  |  |  |  |  |  |  |
| Number of ports | 1 |  |  |  |  |  |  |  |  |  |
| Type of LV system | DC, gr PV sy | unded tems | DC, ungrou PV sys | rounded stems | DC, grounded PV systems |  |  | DC, ungrounded PV systems |  |  |
| SPD overload behaviour mode | OCM |  |  |  |  |  |  |  |  |  |
| Remote contact (optional) | 1 changeover (CO) |  |  |  |  |  |  |  |  |  |
| Remote contact op. voltage / current $\begin{aligned} & \mathrm{ACU} U_{\max } / I_{\max } \\ & \mathrm{DC} \mathrm{U}_{\max } \\ & I_{\max } \end{aligned}$ | $\begin{gathered} 250 \mathrm{~V} \mathrm{AC} \mathrm{/} \mathrm{0.5} \mathrm{~A} \\ 250 \mathrm{~V} \mathrm{DC} / 0.1 \mathrm{~A} ; 75 \mathrm{~V} \text { DC / } 0.5 \mathrm{~A} \end{gathered}$ |  |  |  |  |  |  |  |  |  |

## Technical Data Ex9UEP

DC surge protection devices PV T2, $I_{\mathrm{n}}=20 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$

| Mechanical parameters |  |
| :---: | :---: |
| Device width | 17.5 mm (per module) |
| Device height | 83 mm (89 mm including rail clip) |
| Frame size | 45 mm |
| Method of mounting | fixed |
| Mounting | easy fastening onto 35 mm device rail (DIN) |
| Mounting position | arbitrary |
| Degree of protection | IP40, terminals IP20 |
| Terminals | lift, M5 screws |
| Terminal capacity | $2.5-25 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | $2-3.5 \mathrm{Nm}$ |
| Remote contact terminal capacity | $0.14-1.5 \mathrm{~mm}^{2}$ |
| Location | indoor |
| Installation class | III |
| Pollution degree | 2 |
| Accessibility | inaccessible |
| Ambient temperature | $-40-+70{ }^{\circ} \mathrm{C}$ |
| Altitude | $\leq 2000 \mathrm{~m}$ |
| Relative humidity | $5-95$ \% |
| Weight (per pole) | 0.12 kg |

Table of tolerance zones at 1 mA

Max. continuous operational voltage $U_{c}$ 500/1000 V 600/1200 V 750/1500 V

Voltage tolerance zone at 1 mA 643.5-786.5 V

738-902V
950-1100 V

## Technical Data Ex9UEP

## DC surge protection devices PV T2, $I_{\mathrm{n}}=20 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$

## Dimensions



Ex9UEP 202 P
Ex9UEP 20R 2P

Ex9UEP 202 2
Ex9UEP 20R 2P


Ex9UEP 20 3P Ex9UEP 20R 3P



## Connection diagrams, protection mode



Ex9UEP 20 1P Ex9UEP 20R 1P


Ex9UEP $202 P$
Ex9UEP 20R $2 P$


Ex9UEP 20 2P Ex9UEP 202 P
Ex9UEP 20 R 2 P
 Ex9UEP 203 3
Ex9UEP 20R $3 P$

## Technical Data Ex9UEP1+2

DC Surge Protection Devices PV T1+T2, $\mathrm{I}_{\mathrm{imp}}=6.25 \mathrm{kA}(10 / 350 \mu \mathrm{~s})$

## General parameters

Designed and suitable for photovoltaic applications
Modular devices, plug-in module design
Indication window helps users to know the status of device
Optional remote-signaling contact

## Electrical parameters

|  | $\begin{gathered} \text { Ex9UEP1+2 6.25(R) } \\ 1 \mathrm{P} \\ 500 / 600 / 750 \mathrm{~V} \end{gathered}$ |  |  | $\begin{gathered} \text { Ex9UEP1+2 6.25(R) } \\ 2 \mathrm{P} \\ 500 / 600 / 750 \mathrm{~V} \end{gathered}$ |  |  | $\begin{gathered} \text { Ex9UEP1+2 6.25(R) } \\ 2 P \\ 1000 / 1200 / 1500 V \end{gathered}$ |  |  | $\begin{gathered} \text { Ex9UEP1+2 6.25(R) } \\ 3 P \\ 1000 / 1200 / 1500 V \end{gathered}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Tested according to | EN 61643-31 |  |  |  |  |  |  |  |  |  |  |  |
| Classified type (test class) | PV T1+T2 (Class I+II, B+C, Type 1+2) |  |  |  |  |  |  |  |  |  |  |  |
| Technology | MOV (Varistor) |  |  |  |  |  |  |  |  |  |  |  |
| Protection function | thermal |  |  |  |  |  |  |  |  |  |  |  |
| Protection mode | $\begin{aligned} & +\rightarrow \mathrm{PE} \\ & -\rightarrow \mathrm{PE} \\ & +\leftrightarrow- \end{aligned}$ |  |  |  |  |  |  |  |  |  |  |  |
| Connection configuration | 1 |  |  | U |  |  | U |  |  | Y |  |  |
| Rated operational DC voltage $\mathrm{U}_{\mathrm{n}}[\mathrm{V}]$ | 500 | 600 | 750 | 500 | 600 | 750 | 1000 | 1200 | 1500 | 1000 | 1200 | 1500 |
| Max. continuous op. DC voltage $\mathrm{U}_{\text {cpv }} \mathrm{M}$ $\begin{aligned} & +\rightarrow \mathrm{PE},-\rightarrow \mathrm{PE} \\ & +\leftrightarrow- \end{aligned}$ | $\begin{aligned} & 500 \\ & 500 \end{aligned}$ | $\begin{aligned} & 600 \\ & 600 \end{aligned}$ | $\begin{aligned} & 750 \\ & 750 \end{aligned}$ | $\begin{gathered} 500 \\ 1000 \end{gathered}$ | $\begin{gathered} 600 \\ 1200 \end{gathered}$ | $\begin{gathered} 750 \\ 1500 \end{gathered}$ | $\begin{aligned} & 1000 \\ & 1000 \end{aligned}$ | $\begin{aligned} & 1200 \\ & 1200 \end{aligned}$ | $\begin{aligned} & 1500 \\ & 1500 \end{aligned}$ | $\begin{aligned} & 1000 \\ & 1000 \end{aligned}$ | $\begin{aligned} & 1200 \\ & 1200 \end{aligned}$ | $\begin{aligned} & 1500 \\ & 1500 \end{aligned}$ |
| Nominal frequency f | DC |  |  |  |  |  |  |  |  |  |  |  |
| Nominal discharge current $\mathrm{I}_{\mathrm{n}}(8 / 20 \mu \mathrm{~s})$ | 20 kA |  |  |  |  |  |  |  |  |  |  |  |
| Max. discharge current $I_{\text {max }}(8 / 20 \mu \mathrm{~s})$ | 40 kA |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{aligned} & \text { Impulse current } I_{\text {imp }}(10 / 350 \mu \mathrm{~s}) \\ & \quad+\rightarrow \mathrm{PE}, \rightarrow \rightarrow \mathrm{PE} \\ & +\leftrightarrow- \end{aligned}$ | $\begin{aligned} & 6.25 \mathrm{kA} \\ & 6.25 \mathrm{kA} \end{aligned}$ |  |  | $\begin{aligned} & 6.25 \mathrm{kA} \\ & 6.25 \mathrm{kA} \end{aligned}$ |  |  | $\begin{aligned} & 6.25 \mathrm{kA} \\ & 6.25 \mathrm{kA} \end{aligned}$ |  |  | $\begin{aligned} & 6.25 \mathrm{kA} \\ & 6.25 \mathrm{kA} \end{aligned}$ |  |  |
| $\begin{aligned} & \text { Protection voltage } U_{p} \text { at } I_{n}[k V] \\ & \quad+\rightarrow P E, \rightarrow P E \\ & +\leftrightarrow- \end{aligned}$ | $\begin{aligned} & 2.0 \\ & 2.0 \end{aligned}$ | $\begin{aligned} & 2.3 \\ & 2.3 \end{aligned}$ | $\begin{aligned} & 2.5 \\ & 2.5 \end{aligned}$ | $\begin{aligned} & 2.0 \\ & 3.8 \end{aligned}$ | $\begin{aligned} & 2.3 \\ & 4.2 \end{aligned}$ | $\begin{aligned} & 2.5 \\ & 5.0 \end{aligned}$ | $\begin{aligned} & 3.8 \\ & 3.8 \end{aligned}$ | $\begin{aligned} & 4.2 \\ & 4.2 \end{aligned}$ | $\begin{aligned} & 5.0 \\ & 5.0 \end{aligned}$ | $\begin{aligned} & 3.8 \\ & 3.8 \end{aligned}$ | $\begin{aligned} & 4.2 \\ & 4.2 \end{aligned}$ | $\begin{aligned} & 5.0 \\ & 5.0 \end{aligned}$ |
| Residual current $I_{\text {PE }}$ at $U_{\text {REF }}$ DC | $<50 \mu \mathrm{~A}$ |  |  |  |  |  |  |  |  |  |  |  |
| Residual current $I_{\text {PE }}$ at $U_{\text {REF }} A C$ | $<1 \mathrm{~mA}$ |  |  |  |  |  |  |  |  |  |  |  |
| Short-circuit current rating $\mathrm{I}_{\text {SCPV }}$ | 1000 A |  |  |  |  |  |  |  |  |  |  |  |
| Number of ports | 1 |  |  |  |  |  |  |  |  |  |  |  |
| Type of LV system | DC, grounded PV systems |  |  | DC, ungrounded PV systems |  |  | DC, grounded PV systems |  |  | DC, ungrounded PV systems |  |  |
| SPD overload behaviour mode | OCM |  |  |  |  |  |  |  |  |  |  |  |
| Remote contact (optional) | 1 changeover (CO) |  |  |  |  |  |  |  |  |  |  |  |
| Remote contact op. voltage / current $\begin{aligned} & \mathrm{ACU} U_{\max } / I_{\max } \\ & \mathrm{DC} \mathrm{U}_{\max } \\ & I_{\max } \end{aligned}$ | 250 V AC / 1 A <br> 250 V DC / 0.1 A; 75 V DC / 0.5 A |  |  |  |  |  |  |  |  |  |  |  |

## Technical Data Ex9UEP1+2

DC Surge Protection Devices PV T1+T2, $\mathrm{I}_{\mathrm{imp}}=6.25 \mathrm{kA}(10 / 350 \mu \mathrm{~s})$

| Mechanical parameters |  |
| :--- | :---: |
| Device width | 17.5 mm (per module) |
| Device height | $83 \mathrm{~mm}(89 \mathrm{~mm}$ including rail clip) |
| Frame size | 45 mm |
| Method of mounting | fixed |
| Mounting | easy fastening onto 35 mm device rail (DIN) |
| Mounting position | arbitrary |
| Degree of protection | IP20 |
| Terminals | lift, M5 screws |
| Terminal capacity | $2.5-25 \mathrm{~mm}^{2}$ |
| Fastening torque of terminals | $2-3.5 \mathrm{Nm}^{2}$ |
| Remote contact terminal capacity |  |
| Location | $0.14-1.5 \mathrm{~mm}^{2}$ |
| Installation class | indoor |
| Pollution degree | III |
| Accessibility | 2 |
| Ambient temperature | inaccessible |
| Altitude | $-40-+80^{\circ} \mathrm{C}$ |
| Relative humidity | $\leq 2000 \mathrm{~m}$ |
| Weight (per pole) | $5-95 \%$ |
|  |  |

## Dimensions

## Ex9UEP $1+26.251 P$

 Ex9UEP $1+26.252 \mathrm{P}$Ex9UEP1 $1+26.25 R 2 \mathrm{R}$ Ex9UEP1+26.25 2 P Ex9UEP $1+26.253$ 3P
Ex9UEP $1+26.25 R 3$


## Technical Data Ex9UEP1+2

DC Surge Protection Devices PV T1+T2, $I_{\text {imp }}=6.25 \mathrm{kA}(10 / 350 \mu \mathrm{~s})$
Connection diagrams, protection mode


Ex9UEP $1+26.252 \mathrm{P}$
Ex9UEP $1+26.25 \mathrm{R} 2 \mathrm{P}$


EX9UEP $1+26,252 P$
Ex9UEP $1+26.25 R 2 P$


Ex9UEP $1+26.253$ P
Ex9UEP1+2 $6.25 R 3$ R

## Technical Data PHS

Plastic consumer units, IP65, surface mounted

## General parameters

Consumer units for general and industrial applications
Surface mounted version
Scope of delivery: enclosure, door, device DIN rails, N + PE terminals, front cover with device cutout, cover for empty place, mounting material

## Electrical parameters

| Tested according to | EN 60670, EN 62208 |
| :--- | :---: |
| Rated op. voltage $U_{n}$ | 400 V AC |
| Rated current $\mathrm{I}_{\mathrm{n}}$ | 1500 V DC |
| Rated frequency | 63 A |
| Degree of protection | 50 Hz |
| Protection class | $\mathrm{IP65}$ |
| Rated insulating voltage $U_{i}$ | II |
| Maximum power dissipation of all <br> installed devices at ambient <br> temperature 30 ${ }^{\circ} \mathrm{C}$ | 690 V AC <br> PHS 4T |
| PHS 6T | 1500 V DC |
| PHS 8T |  |
| PHS 12T | 10 W |
| PHS 18T | 10 W |
| PHS 24T | 13 W |
| PHS 36T | 16 W |
| PHS 48T | 20 W |


| Mechanical parameters |  |
| :--- | :---: |
| Glow-wire test | $650^{\circ} \mathrm{C}$ |
| Mechanical impact resistance | IK08 |
| Used plastics | Halogen-free |
| Body color | RAL7035 |
| UV stable | Yes |
| Temperature | $-25^{\circ} \mathrm{C}-+60^{\circ} \mathrm{C}$ |
| Material | Acrylonitrile acrylic styrene |

## Technical Data PHS

Plastic consumer units, IP65, surface mounted

## Dimensional drawings



## Dimensions

| Type | Dimensions [mm] |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | A | B | C | D | E | F |
| PHS 4T | 201 | 128 | 120 | - | - | 140 |
| PHS 6T | 201 | 165 | 118 | - | 63 | 140 |
| PHS 8T | 201 | 202 | 120 | - | 100 | 140 |
| PHS 12T | 259 | 319 | 144 | - | 210 | 130 |
| PHS 18T | 259 | 428 | 144 | - | 259 | 130 |
| PHS 24T | 384 | 319 | 144 | 125 | 210 | 255 |
| PHS 36T | 508 | 319 | 144 | 125 | 210 | 380 |
| PHS 48T | 664 | 319 | 144 | 125 | 210 | 505 |

## Technical Data PHS FB

## Plastic consumer units, IP65, surface mounted

## General parameters

Consumer units for general and industrial applications
Surface mounted version
Flat bottom - without marked cutouts
Scope of delivery: enclosure, door, device DIN rails, $\mathrm{N}+\mathrm{PE}$ terminals, front cover with device cutout, cover for empty place, mounting material

| Electrical parameters |  |
| :--- | :---: |
| Tested according to | EN 60670, EN 62208 |
| Rated op. voltage $U_{n}$ | 400 V AC |
| Rated current $\mathrm{I}_{\mathrm{n}}$ | 1500 V DC |
| Rated frequency | 63 A |
| Degree of protection | 50 Hz |
| Protection class | $\mathrm{IP65}$ |
| Rated insulating voltage $U_{i}$ | II |
| Maximum power dissipation of all | 690 V AC |
| installed devices at ambient |  |
| temperature 30 ${ }^{\circ} \mathrm{C}$ | 1500 V DC |
| PHS 4T FB |  |
| PHS 6T FB |  |
| PHS 8T FB | 10 W |
| PHS 12T FB | 10 W |
| PHS 18T FB | 13 W |
| PHS 24T FB | 16 W |
| PHS 36T FB | 20 W |
| PHS 48T FB | 24 W |


| Mechanical parameters |  |
| :--- | :---: |
| Glow-wire test | $650^{\circ} \mathrm{C}$ |
| Mechanical impact resistance | IK08 |
| Used plastics | Halogen-free |
| Body color | RAL7035 |
| UV stable | Yes |
| Temperature | $-25^{\circ} \mathrm{C}-+60^{\circ} \mathrm{C}$ |
| Material | Acrylonitrile acrylic styrene |

## Technical Data PHS FB

Plastic consumer units, IP65, surface mounted
Dimensional drawings


## Dimensions

| Type | Dimensions [mm] |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | A | B | C | D | E | F |
| PHS 4T FB | 201 | 128 | 120 | - | - | 140 |
| PHS 6T FB | 201 | 165 | 118 | - | 63 | 140 |
| PHS 8T FB | 201 | 202 | 120 | - | 100 | 140 |
| PHS 12T FB | 259 | 319 | 144 | - | 210 | 130 |
| PHS 18T FB | 259 | 428 | 144 | - | 259 | 130 |
| PHS 24T FB | 384 | 319 | 144 | 125 | 210 | 255 |
| PHS 36T FB | 508 | 319 | 144 | 125 | 210 | 380 |
| PHS 48T FB | 664 | 319 | 144 | 125 | 210 | 505 |

## Technical Data Ex9EV

## EV charging wallboxes

## General parameters

Static EV charging solution - installation directly on a wall
Charging current from 10 to 32 A
Integrated RCCB type B (Ex9LB63)
Information about setting and usage are in manual available at www.noark-electric.eu

## Electrical parameters

|  | Ex9EV1 T1 | Ex9EV1 T2 | Ex9EV3 T2 |
| :---: | :---: | :---: | :---: |
| Tested according to | IEC/EN 61851 |  |  |
| Rated operating voltage $U_{\text {e }}$ | $230 \vee$ AC $\pm 10 \%$ | $230 \mathrm{VAC} \pm 10 \%$ | $400 \mathrm{VAC} \pm 10 \%$ |
| Rated frequency f | 50 / 60 Hz |  |  |
| Maximal charging current $I_{\text {max }}$ | 10 / 16 / 20 / 25 / 32 A |  |  |
| Maximal charging power $\mathrm{P}_{\text {max }}$ | 2.3 / 3.7 / 4.6 / 5.8 / 7.4 kW |  | 6.9 / 11.0 / 13.8 / 17.3 / 22.1 kW |
| Integrated RCCB |  |  |  |
| sensitivity to residual current | B type - residual AC, pulsating and smooth DC current, high frequency (1 kHz) |  |  |
| rated residual current $\mathrm{I}_{\Delta \mathrm{n}}(\mathrm{AC} / \mathrm{DC})$ | $30 \mathrm{~mA} / 6 \mathrm{~mA}$ |  |  |
| Connection | inlet cable from superior switchboard |  |  |
| Charging mode | mode 3 |  |  |
| Compatible network | TN-S |  |  |
| Self consumption | < 10 W |  |  |


| Mechanical parameters |  |  |  |
| :---: | :---: | :---: | :---: |
| Cable length | 5 m |  |  |
| Cable dimension | $3 \times 6 \mathrm{~m}$ | $\mathrm{m}^{2}+2 \times 0.5 \mathrm{~mm}^{2}$ | $5 \times 6 \mathrm{~mm}^{2}+2 \times 0.5 \mathrm{~mm}^{2}$ |
| Recommended cross-section of inlet cable (10 / 16 / 20 / 25 / 32 A) | 2.5 / 2.5 / 4 / 4 / 6 mm ${ }^{2}$ |  |  |
| EV plugs | Type 1 / SAE J1772 | Type 2 / IEC 62196-2 |  |
| Degree of protection |  |  |  |
| wallbox | IP44 |  |  |
| plugs (when connected) | IP44 |  |  |
| Ambient temperature | $-25^{\circ} \mathrm{C}-+40^{\circ} \mathrm{C}$ |  |  |
| Altitude | $\leq 2000 \mathrm{~m}$ |  |  |
| Relative humidity | $\leq 75 \%$ |  |  |
| Insulation class | II |  |  |
| Weight | 4.75 kg |  | 6 kg |

## Technical Data Ex9EV

## EV charging wallboxes

Dimensions


## Technical Data Ex9EV

## EV charging wallboxes

## Wiring diagram

Ex9EV1 T1 / Ex9EV1 T2


Ex9EV3 T2

inlet connection

## Technical Data Ex9EVC

## EV charging cables

## General parameters

## Mobile solution of EV charging

Adjustable charging current up to $13 / 16$ or 32 A
Integrated RCCB type B
All necessary protections
temperature monitoring
overvoltage and undervoltage monitoring
automatically check the electronics before charging
check of ground and neutral connection before charging

## Electrical parameters

$\left.\begin{array}{|l|c|c|c|c|}\hline & \text { Ex9EVC1 T1 16A } & \begin{array}{c}\text { Ex9EVC1 T2 16A } \\ \text { (Ex9EVC1 T2 13A UK) }\end{array} & \text { Ex9EVC1 T1 32A } \\ \hline \text { Tested according to } & & \text { IEC/EN } 61851\end{array}\right]$

## Mechanical parameters

| Cable length | 5 m |  |  |
| :---: | :---: | :---: | :---: |
| Cable dimension | $4 \times 2.5 \mathrm{~mm}^{2}$ | $4 \times 2.5 \mathrm{~mm}^{2}$ | $4 \times 4 \mathrm{~mm}^{2}$ |
| Plugs |  |  |  |
| car connection side | Type 1 / SAE J1772 | Type 2 / IEC 62196-2 | Type 1 / SAE J1772 |
| grid connection side | UNISCHUKO | UNISCHUKO <br> (Type G 13 A fused - UK) | CEE 32A/5p |
| Degree of protection |  |  |  |
| cable and box |  | IP55 |  |
| plugs (when connected) |  | IP44 |  |
| Ambient temperature |  | $-30{ }^{\circ} \mathrm{C}-+65{ }^{\circ} \mathrm{C}$ |  |
| Insulation class |  | 11 |  |
| Weight | 2.5 kg | 2.5 kg | 3.1 kg |

## Technical Data Ex9EVC

## EV charging cables

| Electrical parameters |  |  |  |
| :---: | :---: | :---: | :---: |
|  | Ex9EVC1 T2 32A | Ex9EVC3 216 16A | Ex9EVC3 T2 32A |
| Tested according to | IEC/EN 61851 |  |  |
| Rated operating voltage $\mathrm{U}_{\text {e }}$ | $200-260$ V AC | $380-440$ V AC |  |
| Rated frequency f | $50 / 60 \mathrm{~Hz}$ |  |  |
| Maximal charging current $\mathrm{I}_{\text {max }}$ | 32 A | 16 A | 32 A |
| Adjusting steps of current | 10/13/16/25/32 A | 6/8/10/13/16A | 10 / 13 / 16 / $25 / 32 \mathrm{~A}$ |
| Charging power per step | 2.3 / 3.0 / 3.7 / 5.8 / 7.4 kW | $4.1 / 5.5$ / $6.9 / 9.0 / 11.0$ kW | $6.9 / 9.0 / 11.0 / 17.3 / 22.1$ kW |
| Integrated RCCB |  |  |  |
| sensitivity to residual current | B type - residual AC, pulsating and smooth DC current, high frequency ( 1 kHz ) |  |  |
| rated residual current $\mathrm{I}_{\triangle n}(\mathrm{AC} / \mathrm{DC})$ | $30 \mathrm{~mA} / 6 \mathrm{~mA}$ |  |  |
| Connection | directly to the grid plug and EV plug |  |  |
| Charging mode | mode 2 |  |  |
| Compatible network | TN-S, IT |  |  |
| Self consumption | <1 W |  |  |


| Mechanical parameters |  |  |  |
| :---: | :---: | :---: | :---: |
| Cable length | 5 m |  |  |
| Cable dimension | $4 \times 4 \mathrm{~mm}^{2}$ | $5 \times 2.5 \mathrm{~mm}^{2}+0.75 \mathrm{~mm}^{2}$ | $5 \times 4 \mathrm{~mm}^{2}+0.75 \mathrm{~mm}^{2}$ |
| Plugs |  |  |  |
| car connection side | Type 2 / IEC 62196-2 |  |  |
| grid connection side | CEE 32A/5p | CEE 16A/5p | CEE 32A/5p |
| Degree of protection |  |  |  |
| cable and box | IP55 |  |  |
| plugs (when connected) | IP44 |  |  |
| Ambient temperature | $-30^{\circ} \mathrm{C}-+65^{\circ} \mathrm{C}$ |  |  |
| Insulation class | 11 |  |  |
| Weight | 3.1 kg | 2.9 kg | 3.9 kg |

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| PHS FB | 88 | 164 |
| SHT22VR | 38 | 104 |
| SMM IP65S | 85 |  |



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## INSTALLATION DEVICES

- Miniature Circuit Breakers
- Fuse Holders and Disconnectors
- Isolators
- Residual Current Devices
- Energy Meters
- Motor Protective Circuit Breakers
- Accessories for Installation Devices
- Surge Protection Device
- Installation Relays and Contactors
- Switches and Signal Lamps
- Timers and Light Intensity Switches
- Other Installation Devices


## MOULDED CASE CIRCUIT BREAKERS

- AC Thermomagnetic Moulded Case Circuit Breakers Ex9M
- AC Electronic Moulded Case Circuit Breakers Ex9M SU20L (DIP switches version)
- AC Electronic Moulded Case Circuit Breakers Ex9M SU20S (LCD version)
- AC MCCB Switch Disconnectors Ex9MSD
- DC Thermomagnetic Moulded Case Circuit Breakers Ex9M
- DC MCCB Switch Disconnectors Ex9MSD
- Accessories for MCCBs


## INDUSTRIAL DEVICES

- Contactors and Relays
- Motor Protective Circuit Breakers
- Overload Relays
- Accessories
- Panel Mounted Devices


## Catalogues and assortment overview



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## CONSUMER UNITS

- Plastic Consumer Units
- Plastic Consumer Units with Sheet Steel Door
- Plastic Consumer Units for Outdoor Use
- Metal Flat Enclousures
- Metal Enclosures with Mounting Plates
- Interconnection Systems


## PHOTOVOLTAIC <br> COMPONENTS

\& SOLUTIONS


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- Miniature Circuit Breakers
- Fuse Disconnectors
- Isolators
- Surge Protection Devices
- Moulded Case Circuit Breakers and Switch Disconnectors
- EV chargers


## PHOTOVOLTAIC COMPONENTS AND SOLUTIONS

## AIR CIRCUIT BREAKERS

- Digital Tripping Units
- Air Circuit Breakers
- Air Switch Disconnectors
- Accessories

