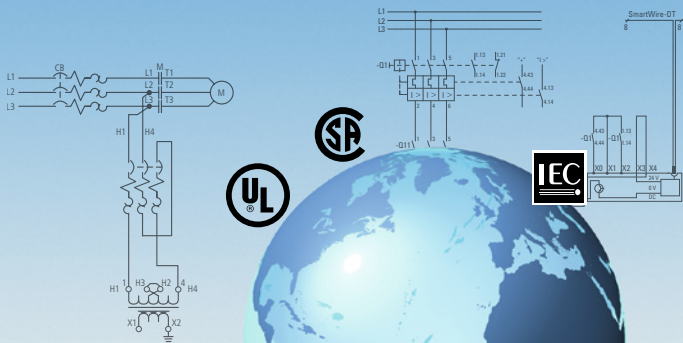


Wiring Manual | 2011



EAT•N

Powering Business Worldwide

All brand and product names are trade marks
or registered trademarks of the owner concerned

Updated edition 2011, publication date 06/11

© 2008 by Eaton Industries GmbH, 53105 Bonn

Editorial: Walter Heumann, Thomas Kracht, Barbara Petrick,
Heidrun Riege, René Wiegand

All the connections are designed according to our best expertise
and have been carefully tested. They serve as practical examples.
Eaton Industries GmbH does not accept any liability for any errors.

All rights reserved, also for the translation.

No part of this Wiring Manual may be reproduced in any form
(printed, photocopy, microfilm or any other process) or processed,
duplicated or distributed by means of electronic systems without
the written permission of Eaton Industries GmbH, Bonn, Germany.

Subject to alteration.

Printed on paper made from cellulose bleached without the use of
chlorine or acid.

Eaton Wiring Manual

	Chapter
Eaton Wiring Manual	0
Switching, control, visualization	1
Electronic motor starters and drives	2
Pilot devices	3
Cam switches	4
Contactors and relays	5
Motor-protective circuit-breakers	6
Circuit-breakers	7
All about Motors	8
Export to World Markets and North America	9
Standards, formulae, tables	10
Index	11

Eaton Wiring Manual

0

	Page
Moeller is Eaton	0-3
Eaton Stromversorgungsqualität	0-4
Eaton Medium Voltage Systems	0-6
What's new in this edition?	0-7
Competence and Experience from a Single Source	0-8
Support Portal	0-10
Eaton Online Catalog	0-11
After Sales Service	0-12
Photovoltaics in residential buildings	0-14
Eaton power distribution equipment	0-22

Moeller is Eaton

Moeller's strengths remain – and Eaton is building on them.

Now that the integration of Moeller in the global Eaton Corporation has been completed, it's not just the Moeller name that is being preserved. Our range of services also benefits from the alliance. The Moeller name will continue to exist as a product series designation. Recognizing the values transferred to Eaton, "Moeller®Series" appears on former Moeller products, while the packaging features the Eaton logo.

With our constantly growing range of services, we help you to meet the increasing demands of the market every day. We develop standards and remain true to our core competencies. You are holding a good example of this in your hands right now. With the latest version of the switching manual, we are proud to again provide you with a fit companion to your daily work.

EATON



EATON

EATON


 Klöckner
 MOELLER


MOELLER


 MOELLER
 An Eaton Brand

EATON

Powering Business Worldwide

Eaton Wiring Manual

Eaton power supply quality

0

Get to know Eaton's products for power supply quality

Eaton Technologies

Eaton has been developing innovative technical solutions for protecting power supplies since 1962 (first patent application). With new, advanced and patented technologies, Eaton responds to customers' rapidly changing requirements.










Nine power supply problems at a glance

How a UPS is part of the solution

Eaton UPS systems offer protection against all nine typical power supply problems described below. They meet the requirements for assured power supply quality, energy distribution and power management for computer networks and data centers as well as for telecommunications, healthcare and industrial applications.

Eaton product overview

Eaton's product range for protecting power supply quality comprises an extensive selection of power management solutions from a single source. It includes UPS systems, surge protection equipment, power distribution units (ePDUs), remote monitoring, testing devices, interconnect materials, housings, cabinets and services. Our portfolio for power supply quality is designed to customers' specific requirements; comprehensive solutions are offered for both new systems as well as

Power supply problem		
1	Power supply failure	
2	Voltage dip	
3	Voltage surges	
4	Undervoltage (voltage drop)	
5	Overvoltage	
6	Electrical disturbance signals	
7	Frequency deviations	
8	Spikes due to switching operations	
9	Harmonic distortion (harmonic waves)	

existing ones. With all its products, Eaton strives for continuous success in advancing technical innovation in order

Eaton Wiring Manual

Eaton power supply quality

0

Definition	Cause	Solution
Total failure of supply network	Can occur from a number of events: lightning strike, breaking of transmission lines, network congestion, accidents and natural disasters	<div>Single-phase UPS series 3</div> <div>Single-phase UPS series 5</div> <div>Single-phase and three-phase UPS series 9</div>
Temporary under-voltage	Triggered by major power consumers being switched on, switching in the supply network, failure of grid facilities, lightning strike and power supply systems unable to meet requirements. In addition to possible device failure, hardware can also be damaged.	
Temporary voltage surge of more than 110 percent of the nominal value	Can be caused by lightning strike and temporarily increase mains voltage to over 6,000 volts. A voltage peak almost always causes data losses or hardware damage.	
Reduced mains voltage for a period of between a few minutes to a few days	Can occur if the mains voltage is intentionally reduced to reduce power during peak consumption periods or if the connected consumer load exceeds the supply capacity.	
Increased mains voltage for a period of between a few minutes and a few days	Triggered by strong load reduction, major power consumers being switched off and other switching operations in the network. Hardware can be destroyed as a result.	
Disturbance signals with higher frequencies	These can be triggered by electromagnetic interference (EMI) or radio frequency interference (RFI) from welding equipment, transmitting equipment, printers, thunderstorms etc.	
Instability of mains frequency	These occur as a result of load variations, in particular in smaller generator installations. Frequency deviations can cause processes to fail, data losses, system breakdowns and damage to equipment.	
Temporary voltage dips	Spikes of this kind last a very short time, within the nanosecond range.	
Distortion of sinusoidal waveform, usually caused by non-linear loads	Switching mode power supplies, stepper motors, copiers and fax machines are examples of non-linear consumer loads. They can cause communication errors, overheating and hardware damage.	

to develop next-generation solutions. The products and services listed below represent examples from our extensive

solutions range. To view the entire range or request a product catalog, please visit www.eaton.com/powerquality.

Eaton Wiring Manual

Eaton Medium Voltage Systems

0

Medium voltage systems

The quality of Eaton's medium voltage systems is founded on over 100 years of experience.

Vacuum Technology

Vacuum technology is at the heart of Eaton's switching systems. Eaton has over 30 years of experience in applying vacuum technology in circuit-breakers and load-break switches. The use of this technology results in a maximally environmentally-friendly switchgear solution.

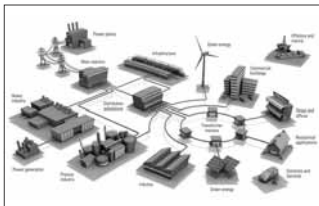
Primary switchgear

As its name says, primary switchgear is the first stage in transmitting electrical current from the supply network to the end customer. The importance of the strategic position of the substation and its switchgear within the system reflects the fact that layout, construction and operation must be designed for maximum availability and reliability. For this reason, Eaton's portfolio includes the MMS – a compact stationary switchgear unit with single or double busbar – and PowerXpert® UX, a switchgear unit with removable circuit-breakers, switches and contactors.

Secondary switchgear

Eaton has developed universal, modular secondary switchgear under the SVS and Xiria product series. It is suitable for use in supply networks, business premises, infrastructure projects, industrial applications and for structures relating to renewables such as wind farms and

combined heat and power plants. The design of the SVS and Xiria is based on a combination of vacuum and epoxy resin technology. There are a multitude of different types of switchgear suitable for every kind of application. With its compact dimensions and SF₆-free design, SVS and Xiria are also the ideal solution for underground applications on infrastructure projects.



Ring main units

Electrical energy has become an indispensable element of modern society. A reliable and constant energy supply is increasing in importance every day. From the standpoint of energy companies and the industry, this means that the power distribution network must cope with ever increasing demand. It goes without saying that safety and operational reliability play a significant role.

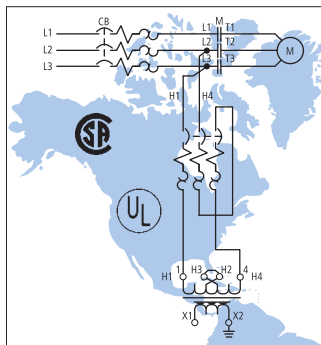
www.eaton.com
www.eaton.com/electrical



Eaton Wiring Manual

What's new in this edition?

Export to the world market and to North America



The target markets of machine and system builders are international. Eaton knows these markets and is a competent partner worldwide in all issues relating to the export of switchgear and switchgear systems. The special requirements on the export of products to North America (USA and Canada) are taking on increasing importance, see chapter 9.

Photovoltaics in residential buildings

The use of regenerative energy is becoming increasingly important. Eaton is a competent PV supplier and this publication describes the technical background information and range of components required, see → page 0-14.

The way to a safe machine



Safety Technology
Control the unexpected

easySafety – Fulfills the highest safety demands.

The safety of people and machines must be taken into account for the total lifecycle of a machine/system. For personnel protection safety components such as position switches, light curtains, two-hand control switches or emergency switching off pushbuttons come into use. The safety information is monitored and evaluated by the new easySafety control relay which complies with the highest safety requirements, → Section "The way to the safe machine", page 1-29.

Always up-to-date

We make every effort to adapt and update every new edition of the Wiring Manual according to the ever increasing requirements of the markets.

The many example circuits in particular are continually being updated by our specialists to the best of their knowledge and carefully tested. They serve as practical examples. Eaton Industries GmbH does not accept any liability for any errors.

Eaton Wiring Manual

Competence and Experience from a Single Source

0

www.wiringmanual.com



Edition 1958

The Wiring Manual has been classic for over 50 years and is probably the most popular publication of the company. Worldwide distribution has given it new impetus in recent years. The 2005 edition was translated for the first time into nine languages:

- English,
- French,
- Italian,
- Spanish,
- Dutch,
- Russian,
- Czech,
- Romanian,
- Swedish



Edition 1986

Its contents are also available online at www.wiringmanual.com.

The online version combines the proven expertise with the latest Internet technology. For example, full text searches are also possible.

A special page with links to all the different language versions available is provided as a service to users from all over the world.

www.eaton.com/moeller/support
(Wiring Manual)

Eaton Wiring Manual

Competence and Experience from a Single Source

www.Eaton.com – the Products of the Moeller® series

Eaton offers you a range of products and services that can be optimally combined with one another. Visit our website on the Internet. You will find there everything about Eaton, such as:

- Up-to-date information about Eaton products,
- The addresses of the Eaton sales offices and representatives worldwide,
- Information about the European activities of Eaton,
- Publications in the press, specialist press,
- References,
- Exhibition dates and events,
- Technical support in the Eaton Support Portal.

www.eaton.com/moeller/support – The Support Portal

You can receive technical support for all Eaton products just by a mouse click. And tips and tricks, Frequently Asked Questions (FAQs), updates, software modules, PDF downloads, demo programs and much more.

You can also put your name down to receive the Eaton Newsletters.

Uncomplicated and quick way of finding the information you need:

- PDF downloads, Internet-supported browser catalogs, smartphone apps
 - Catalogs
 - Manuals and instructional leaflets
 - Product information, such as brochures, selection aids, technical essays, declarations of conformity and of course
 - Eaton Wiring Manual
- Software Downloads
 - Demo versions
 - Updates
 - Software modules and user modules
- Selection aids
 - Motor starters → Section "Selection aids", page 8-3

Eaton Wiring Manual

Support Portal

0

You can also find a link to the Eaton After Sales Service via the Support Portal (→ Section "After Sales Service", page 0-12).

You can send your queries directly to the Technical Support/pre-sales service by e-mail. Simply select the e-mail form that meets your requirements to the -Eaton experts.



Eaton Wiring Manual

Eaton Online Catalog

0

The efficient way to detailed product information

From detailed product information right up to the enquiry for your products by email or fax from your Eaton product supplier. All this and more you can find in the Eaton Online Catalog.



This gives you fast access to new innovations as well as extensive information on the current Eaton ranges.

- Industrial switchgear,
- Drives,
- Automation systems, drives,
- Power distribution systems.

Create a comprehensive data sheet for a product and save it as a PDF document or print it out.

The Search tools

Several search options are available to enable the right access for any product search.

- The product group tree structure enables simple searching in just a few clicks of the mouse
- Selection tools provide logical filters in product groups containing several products
- A powerful search function with a proposal list ensures above-average search results

A number of links to additional product information and all aspects of it enable you to ensure optimum use of the product:

- Application examples and project design notes,
- Approvals
- Instructional leaflets,
- Manuals,
- Software etc.

Choose "Your" Online Catalog on the Internet.

http://ecat.moeller.net/?locale=en_EN

The Online Catalog on the Internet is updated regularly.

Eaton Wiring Manual

After Sales Service

0

As close as you wish

Service Specialists

Gain the benefit of our Service personnel. Comprehensive expertise linked with long term experience and modern equipment help you find the solution to your tasks.

Material characteristic

Components, cards and spare parts of our product range are available for your use.

Logistics

Personnel and material are furnished according to your requirements, professionally and on time.

Helpline

Hotline

You will receive competent and quick telephone assistance round the clock in the event of unscheduled machine stops and plant down-times, system faults and device break-downs.

Help desk

During business hours, you will receive support for commissioning, application queries right through to fault analysis, which can also be carried out using remote diagnostics.

Specialists are available in the areas of automation, drives, low-voltage power distribution or switchgear.

Onsite Service

Troubleshooting onsite

Qualified technicians and specialists can visit you in order to rectify faults quickly and reliably.

Mounting and commissioning support

Contact us if you require fast and competent support in installing and commissioning tasks.

Conversions and expansions

Whether with controllers, circuit-breakers or other components, we can bring your machines and plants up to the latest state-of-the-art.

Inspection and maintenance

The legal requirements and regulations demand the regular testing of electrical equipment in order to ensure its proper condition. Further information is available from our website.

www.eaton.com/moeller/aftersales

The After Sales Service therefore offers appropriate services for circuit-breakers and low-voltage distribution boards.

We support you in the inspection and maintenance of the circuit-breakers and low-voltage distribution boards supplied by us, determine the condition of your systems and carry out the necessary work. If required, thermography or network analysis are also carried out with this work.

Eaton Wiring Manual

After Sales Service

Service seminars

Tailored service seminars that meet your individual requirements to train up your personnel.

Thermography

Thermography gives us an efficient way of analysing your electrical systems and controls during operation.

Network analysis

Network analysis provides clear information about the specific state of your networks without the need for lengthy and expensive fault retrieval.

Bus monitoring

Please enquire whether we can inspect the communication networks of your systems with the latest technical equipment.

Repairs

Direct exchange

In the event of a fault, the direct exchange service for selective products considerably reduces the downtime of your production plant.

Repairs

The repair of products in our Service Center is an inexpensive alternative for fault rectification.

Share parts/Replacement devices

We reduce maintenance costs with selected spare parts and devices for current/discontinued product lines.

Online Service

Online troubleshooting

We can provide special assistance if you wish to analyse and rectify faults on products. You can carry out interactive troubleshooting via the Internet with direct access to our Service-database.

FAQ - Frequently Asked Questions

There are some questions about our products that our customers very often ask. You can benefit from the answers. You can read the FAQ with the corresponding answers on all aspects of automation.

Downloads

You're at the right place here if you require updates, software, documentation and declarations of conformity. Visit the Eaton Download Center to obtain all the information you require.

Contact

Hotline for faults

In the event of a fault contact your local representative

www.eaton.com/moeller/aftersales

or the After Sales Service directly
+49 (0) 180 522 3822, 24/7 (round the clock)

Help desk

Tel.: +49 (0) 228 602 3640
(Mon. – Fri. 08:00 – 16:00 CET).

email

AfterSalesEGBonn@eaton.com

Internet

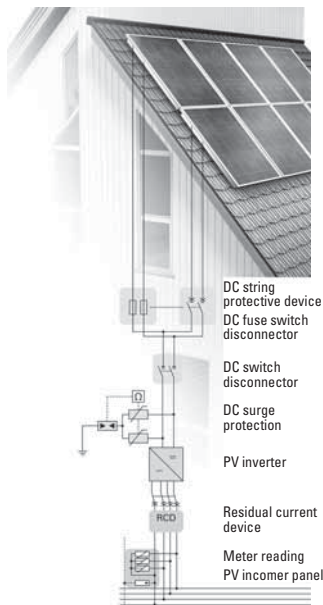
www.eaton.com/moeller/aftersales

Eaton Wiring Manual

Photovoltaics in residential buildings

0 Using solar energy safely – Solutions from Eaton

Safe photovoltaic systems



Photovoltaic systems use solar cells to convert solar energy into electrical energy. If the system is connected to the grid, the generated electricity is fed directly into it. Unlike grid independent systems the complicated temporary storage of electricity is not required, however, the generated DC current has to be converted to AC.

Apart from the PV panels, a grid-connected system consists of one or several inverters and switching devices, for operation, maintenance and protection in the event of a fault – such as:

- a DC string protective device,
- DC switch-disconnector
- DC surge protection
- PV inverter
- Residual current device (RCD),
- AC surge protection
- and xComfort system (optional).

The PV panels are connected in series (as a string) in order to provide the required input DC voltage for the inverter.

Two or several strings are connected in parallel to increase the power of the system. For safety reasons, all electrical equipment must be isolated, protected and secured with switching devices which must likewise be protected with enclosures. All these important protective devices can be sourced directly from Eaton.

Safe isolation, switching and protecting.

In order to feed the generated electricity into the public grid or even to use it, inverters are required to convert the DC current of the solar cells in the AC current.

The frequency and voltage values are adjusted to the grid parameters at hand.

Also here, Eaton offers reliable protective and grid isolation devices such as inverters from 1500 to 4000 W for indoor use and from 4000 to 4600 W for outdoor applications.

Eaton Wiring Manual

Photovoltaics in residential buildings

Converting solar energy efficiently



Grid-connected power inverters from 1500 to 4600 W

Each photovoltaic installation is as individual as the requirements of its user.

Eaton therefore offers a complete line of single-phase power inverters from 1500 to 4600 W:

- Suitable for monocrystalline and polycrystalline PV generators.
- Maintenance free, highly reliable and very easy to install.
- Integrated LCD display simplifies operation.
- Optimum efficiency with maximum power point tracking (MPPT).
- Fan-free thanks to natural convection cooling.
- High performance compared to size.
- Particularly quiet and low pollution operation.
- Standard RS232 ENS interface in accordance with VDE0126-1-1/DK5940.
- Compact elegant modern design.

Indoor use

The ISG series with degree of protection IP43 is designed for indoor installation.

Outdoor use

The ISG series with degree of protection IP65 is designed for both indoor and outdoor applications.

Specifications

All power inverters are designed for ambient temperatures from -20 to +55 °C. Optimum operation is achieved at ambient air temperatures between 0 and +40 °C.

The power of the sun – used optimally

The total output of a photovoltaic system not only depends on the total area of the PV panels, their alignment and the inclination angle of the modules.

Components such as inverters play an important part in the efficiency of the system. Eaton inverters ensure you have the maximum output.

Requirements, the DC isolation gap

DC switch-disconnector

The IEC 60364-7-712 standard stipulates the installation of a switch-disconnector between the PV generator and the inverter. Eaton offers enclosed and open switch-disconnectors for DC voltages up to 1000V. In accordance with the regulations of VDI 6012 they can be used as separate switching points, so that a faulty inverter can be completely de-energized safely. All switch-disconnectors switch two poles and are therefore also suitable for ungrounded systems. All switches are TÜV certified.

Eaton Wiring Manual

Photovoltaics in residential buildings

0



Compact disconnectors for inverters

Eaton offers both enclosed and open switch-disconnectors in its range. The open P-SOL switch disconnectors are designed for mounting in customized enclosures or inverters. They are mounted on 35-mm top-hat rails, and their terminals enable a connection to all commonly used cable types.

Perfectly enclosed for outdoor installation

Eaton's enclosed SOL switch-disconnectors are ready to fit and are therefore very easy to install. Variants for 2, 3, 4 or 8 strings are available for the most common connector types such as MC4 or metric glands. The enclosure is protected to IP65 and is suitable for outdoor installation. The lockable mechanism ensures safety during maintenance work. A pressure-equalizing element prevents the formation of condensation, preventing malfunctions caused by flashovers.

Fireman's switch – small investment, massive protection

In the event of a house fire, the fire brigade can often only rescue persons or animals or prevent the fire spreading to neighboring buildings. This is due to the voltage of up to 1000 V generated by PV systems, which is still present after the inverter has been isolated. Rescue services are thus exposed to fatal risks when entering the building due to the possibility of damaged DC cables. Eaton's SOL30-SAFETY fireman's switch provides a solution here, and de-energizes the line from the solar modules to the inverter, thus making safe any fire fighting activities.

Although VDE 0100-7-712 stipulates the use of a DC isolator, it does not stipulate the location. The isolator is frequently integrated in the inverter so that the cable between this and the house terminal is safe, whilst a DC voltage of up to 1000V is still present in the solar modules and DC cables up to that point, with up to ~8A for each string.

Eaton Wiring Manual

Photovoltaics in residential buildings



Simple installation

Fireman's switches are installed in direct proximity to the PV modules and inserted in the DC cable directly after the entry point into the building between the panels and the power inverter. The PV modules are disconnected automatically using undervoltage releases in the fireman's switch, when the AC voltage of the building is isolated either by the fire brigade or the local utility company or on site via a PV-OFF switch.

DC-string protection

If a PV installation has three or more strings, a string protection device using DC fuses or DC string circuit-breakers is recommended. These protect the PV panels from leakage and feedback currents that can occur on faulty strings, and prevent the feedback of good panels to panels with short-circuits. Compared to fuses, string circuit-breakers have the advantage that they are immediately operational again after the fault is rectified

as well as having the ability to send trip indications via auxiliary contacts to thus avoid any losses in yield. A further feature of the DC string circuit-breaker is the variable tripping range for short-circuit currents: it reacts already from 1.05 ... 1.3 times the residual current. Eaton offers both fuse switch-disconnectors as well as string circuit-breakers that can be combined easily with other components as required.

Fuse switch-disconnectors with integrated short-circuit protective device

The task of the FCFDC10DISOL fuse switch-disconnector for the ASFLC10-SOL cylindrical fuse cartridges for fuse sizes 10 x 38 is to protect PV panels from short-circuit currents. A flash function can optionally be used to indicate a blown fuse.

String circuit-breakers

The Eaton PKZ-SOL string circuit-breakers are the fuseless alternative for protection against short-circuit currents. Its variable tripping range enables optional settings to the actual short-circuit current of a string. A thermal release responds already at 1.05 ... 1.3 times the current, whilst the magnetic release responds at 6 times the current. Non-enclosed string circuit-breakers are designed for installation in customized generator terminal boxes.

Eaton Wiring Manual

Photovoltaics in residential buildings

0

DC surge protection

Surge protective devices for PV applications

The Eaton SPPT2PA surge arrester is specially developed for photovoltaic applications and offers protection from transient overvoltages that can occur through the indirect effect of lightning. Eaton offers types for both grounded and non-grounded systems in which the use of a spark gap ensures galvanic isolation. The units can be supplied pre-wired as ready to use connection units.

Increasing building safety and comfort

AC switching devices for buildings, such as miniature circuit-breakers and residual current devices offer maximum safety.

Eaton products of the xPole series combine all functional, mounting and safety benefits: intelligent design solutions exclude the possibility of mounting faults. They even offer optimum safety for the end user:

Personnel protection in the form of residual current devices and protection of the electrical installation in the form of overvoltage protection and MCBs. The portfolio is rounded off with an extensive range of intelligent switching devices such as remote switches, restart devices and others.

Digital residual current device FI

With the development of digital technology a new level of precision was achieved that enables the avoidance of nuisance tripping. This can occur for example with permanent residual currents of electrical devices or temporary faults caused by storms. Here too, Eaton is also one step ahead:

Eaton is the first company worldwide to offer a digital residual current device. The continuous status monitoring of the installation allows unwanted and annoying disconnections to be considerably reduced, thus guaranteeing optimum system availability. Three LEDs use the "traffic light" principle to indicate when a differential current has reached the 30% warning threshold. In this way, countermeasures can be taken in the installation before the situation gets worse. The installation user is thus provided with increased safety – with greater convenience.

Combination switch

The benefits of MCBs and RCDs combined in a single device – this is the Eaton combination switch. It saves space, whilst ensuring complete safety: reliable fire and personnel protection (30 mA) with enough space for flexible generous cabling.

The surge current proof design prevents unwanted disconnection and selective types enable the selective disconnection of faulty system sections.

Eaton Wiring Manual

Photovoltaics in residential buildings

Miniature circuit-breakers

Regardless of whether plug terminal connections or screw terminals are required, Eaton has the right MCB for residential buildings and for industrial applications. Extensive accessories such as auxiliary contacts, shunt releases, restart devices and intelligent busbar solutions enable a host of applications and automation solutions.

Distribution systems

From the compact distribution board to the meter cabinet and the data network cabinet, Eaton offers a complete product portfolio. All applications can thus be covered for the infrastructure in residential and non-residential buildings as well as in the industrial sector.

Surge protection

Lightning strikes and overvoltages not only pose a risk for electrical installations but also for their operators. Eaton offers an extensive range of surge protective devices. Attachable auxiliary contacts also enable the monitoring of device functions.

Wireless monitoring of PV installation and simple energy management

Energy measuring sensor up to 16 A and Room Manager

Convenient monitoring of electricity generation from your living room – modern home automation makes this possible.

With xComfort, Eaton is offering the Room Manager with integrated energy management software (Energy Manager) for a powerful solution.

The connection of the Eaton energy sensor with the inverter enables the electrical energy currently fed into the grid to be measured.

This data is then transferred wirelessly to the Room-Manager which is installed in one of the living areas. Here, the user of the system can view values such as energy (kWh), power (kW), voltage (V) and amps (A) on a display.

Eaton Wiring Manual

Photovoltaics in residential buildings

0



Eaton Wiring Manual

Photovoltaics in residential buildings

0



Comfort, safety and energy management

Wireless home automation enables lighting management, shade control, monitoring and danger warnings, as well as energy saving control concepts for heating, cooling and ventilation.

Eaton's xComfort and Energy Manager thus offer transparency, comfort and safety combined:

- Consumption control
- Cost saving
- Reduction of CO₂ emission

EU regulations stipulate that the actual energy consumption must be clearly visible to end consumers. The Eaton Room Manager covers this requirement by displaying and controlling the energy consumption of specific electrical or gas devices in the entire home.

Entering the price per unit of measure makes it possible to calculate the costs for a consumption cycle quickly and simply, for example for a bath or a washing machine cycle.

More consumption and cost control is offered by a function that reads the history of the previous 24 hours right through to the last 12 months from the archive and shows it as a value or a trend on the display. It is also possible to output a warning message as soon as a user-defined limit value is exceeded. All this makes Eaton's energy management software a useful tool for identifying possible savings and reducing electricity costs for private system users.

Eaton Wiring Manual

Eaton power distribution equipment

0 xEnergy – Safe energy distribution up to 5000 A

The modular system consists of perfectly fitting function modules that are type tested to IEC/EN 61439 with Form 1 to Form

4 internal partitioning, and which take European and local (DIN, VDE, CEI, NF, UNE) installation practice into account.



xEnergy provides the panel builder with a flexibly combinable product range for power distribution systems up to 5000 A. The operation of the system couldn't be simpler, despite its complexity. The modular design enables the creation of intelligent combinations.

Switching and protective devices, as well as the associated mounting technology and extensive housing components are perfectly matched and form both a technical as well as an economic unit.

This practically oriented system platform enables individual project design, maximum flexibility and fast production in the workshop. On the one hand, this saves time, money and space, whilst type tested mounting units offer a higher level of safety. The modular system can furthermore be extended with little effort to meet future requirements.

Eaton Wiring Manual

Eaton power distribution equipment

The panel builder is provided with efficient tools for tasks ranging from planning to quotations, right through to ordering. The entire range is supplied in functional flat packs or as pre-assembled switch cabinets.

System features:

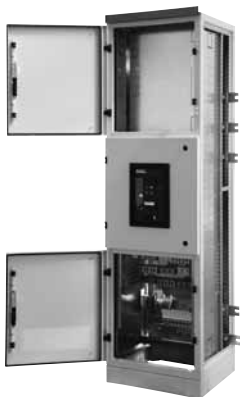
- Rated operational voltage 400 to 690 V AC
- Rated operational current 630 to 5000 A
- Rated short-time withstand current to 100kA (1 s)
- Main busbar current to 5000 A
- Dropper bar current up to 2000 A
- Sheet steel housing for combination and separate mounting
- Degree of protection to IP31 and IP55
- Colour RAL 7035
- Internal separation up to Form 4

- Dimensions: Height 2000 mm
Width 425, 600, 800, 850, 1000, 1100, 1200, 1350 mm
Depth 400, 600, 800, 1000 mm

0

Available technologies

- Fixed mounting
- Removable compartments
- Withdrawable compartments



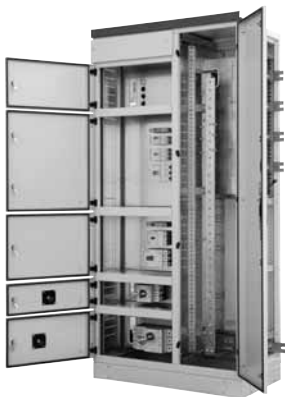
xEnergy XP (Power)

- Incoming units/feeder units, outgoers and couplings with NZM or IZM circuit-breakers up to 5000 A
- Circuit-breakers in fixed mounting or withdrawable units
- 3 or 4 pole circuit-breakers
- Internal separation up to Form 4
- Cable connection from top or bottom
- Incomer system for drill-free cable connection

Eaton Wiring Manual

Eaton power distribution equipment

0



xEnergy XF (Fixed) compartment design

- Outgoers with PKZ or NZM circuit-breakers up to 630 A
- Circuit-breakers in fixed mounting or withdrawable units
- 3- or 4-pole circuit-breakers
- Outgoers with SL fuse-strip units up to 630 A
- Individual outgoers, e.g. controllers, motor starters, small energy outgoers, ...
- Internal separation up to Form 3 or Form 4
- Cable connection from top or bottom



xEnergy XR (Removable) removable compartment design

- Outgoers with PKZ and NZM circuit-breakers up to 630 A
- Outgoers with strip-type switch-fuse units up to 630 A
- Flexible surface mounting using plug-in contacts
- Plug-in modules and switch-fuse units exchangeable under conditions
- Straightforward maintenance, minimal downtime
- Internal separation up to Form 4
- Cable connection from top or bottom

Eaton Wiring Manual

Eaton power distribution equipment



xEnergy XW (Withdrawable) withdrawable compartment design

- Outgoers with PKZ and NZM circuit-breakers up to 630 A
- Outgoers for motor starters up to 250 kW
- Empty drawer-units for every application
- Uniform, straightforward operation for all drawer-unit sizes
- No special tool required
- Flexible assembly with plug-in contacts (incoming and outgoing)
- Withdrawable modules exchangeable whilst live
- Unambiguous position indication for Operation, Test, De-energized
- Straightforward maintenance, minimal downtime
- Internal separation up to Form 4
- Cable connection from top or bottom



xEnergy XG (General) empty sections

- Power factor correction
- Mounting system for subdistribution system with modular installation devices
- Control technology with Sasy60i and xStart
- Individual fixed mounted components on mounting plate

Eaton Wiring Manual

Eaton power distribution equipment

0

xVtl add-on board

The xVtl side-by-side distribution system is designed to take switchgear for applications up to 2500 A.

Typical uses are as power distribution systems in utility buildings or as control panel enclosures in industry. This is where the xVtl can demonstrate the benefits of its rugged design.



The xVtl is a stable, side-by-side mountable distributor made of sheet steel that is also best suited for stand-alone installation. It protects persons from coming into direct contact with conducting parts and even from possible electric shock, and reliably fends off damaging exterior influences. It carries out these functions according to the specific requirements, with protection degrees of IP40 or IP55. While the former is suited to diverse uses in functional buildings such as schools or hospitals, it is

also recommended for harsher conditions such as wind energy systems, or in industry, in a foam-type polyurethane sealing design. Abrasion-proof protection against corrosion is guaranteed thanks to structured paint finish using a powder coating RAL 7035.

Overall, the technical design of the xVtlL complies with the IEC/EN 62208 and EN 60529 standards, as well as with

Eaton Wiring Manual

Eaton power distribution equipment

IEC 60439-1, as long as it is used as a low-voltage energy distribution system.

System features:

- Common platform with xEnergy: Several design elements such as mounting frames, bottom and top plates, as well as side and rear panels can be used for both xVtl and xEnergy.
- Installation mounting systems: Profi+, EP and IVS
- Rated operational voltage 415 V AC
- Rated operational current to 2500 A
- Rated short-time withstand current to 65 kA (1 s)
- Sheet steel housing for combination and separate mounting
- Degree of protection to IP40 and IP55
- Colour RAL 7035
- Internal separation up to Form 2
- Dimensions:
Height 1400, 1600, 1800, 2000 mm
Width 425, 600, 800, 850, 1000, 1100, 1200, 1350 mm
Depth 400, 600, 800 mm



xVtl low-voltage energy distribution system

- Incoming units /feeder units, outgoers and couplings with NZM and IZM circuit-breakers up to 2500 A
- Outgoers with SL fuse-strip units up to 630 A
- Internal separation up to Form 2
- Circuit-breakers in fixed mounting or withdrawable units
- 3- or 4-pole circuit-breakers
- Cable connection from top or bottom
- Incomer system for drill-free cable connection
- Outgoers with NZM circuit-breakers
- Compensation sections
- Individual fixed mounted components on mounting plate

Eaton Wiring Manual

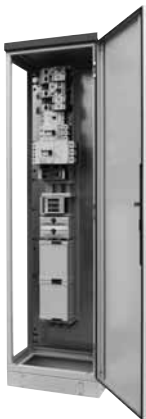
Eaton power distribution equipment

0



xVtl subdistribution system

- Installation mounting systems Profi+, EP and IVS
- Mounting modules for
 - for NZM
 - NH switch-disconnectors
 - Low-voltage h.b.c. fuse switch disconnectors
 - Busbar mounting fuses
 - Modular installation devices
 - Individual devices



xVtl control centres

- Control technology with Sasy60i and xStart
- Individual fixed mounted components on mounting plate
- Air conditioning and ventilation
- Automation engineering

Eaton Wiring Manual

Eaton power distribution equipment

Modular switchgear systems MODAN®



The MODAN is a type-tested modular power distribution system in compliance with IEC/EN 61439-1. It is used wherever large amounts of energy have to be distributed safely and reliably or where motor controllers have to be integrated into processes.

MODAN combines the greatest possible flexibility with safety and reliability, as well as profitability for the long term.

Straightforward engineering, effective commissioning and fault-free operation by the modular construction using Eaton products for switching, protection, control and visualization.

Full and comprehensive integration of the primary control is implemented on the basis of networked functional groups.

For personnel and system protection, the arc fault protection system ARCON® can be integrated without problems.

MODAN® P – Power

- Operating voltage 400 to 690 V AC
- Rated operational current 630 to 6300 A
- Short-circuit strength to 100 kA (1 s)
- Connection from top and bottom for cables and busbars (LX, LD, BD)
- Internal partitioning up to Form 4b



Eaton Wiring Manual

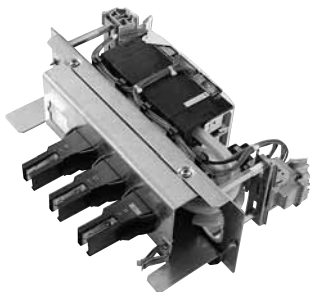
Eaton power distribution equipment

0



MODAN® R – Removable

- Section for up to 15 removable compartments for power outgoers and motor starters or
- Section for up to 27 fuse combination -units
- Flexible surface mounting using plug-in contacts
- Plug-in modules exchangeable whilst live
- Straightforward maintenance and reduced downtime

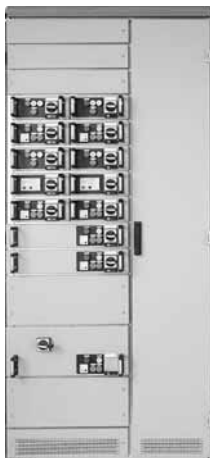


Removable compartments

- Power outgoers up to 630 A
- Motor starters up to 90 kW
- Module is for plugging in, i. e. the incoming unit is removable

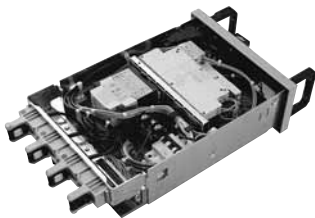
Eaton Wiring Manual

Eaton power distribution equipment



MODAN® W – Withdrawable

- Section for up to 30 drawer units for power outgoers and motor starters
- High packing density
- Uniform, straightforward operation for all drawer-unit sizes
- No special tool required
- Withdrawable modules exchangeable whilst live
- Straightforward maintenance and minimal downtime
- Internal partitioning up to Form 4b



MODAN for withdrawable units

- Power outgoers up to 630 A
- Motor starters up to 200 kW
- Drawer-unit is withdrawable, i. e. all electrical connections are plug connections
- Exchangeable whilst live
- All drawer units positions lockable
- Unambiguous and clearly visible indication for all possible drawer unit positions (Operation, Test, De-energized)

Eaton Wiring Manual

Eaton power distribution equipment

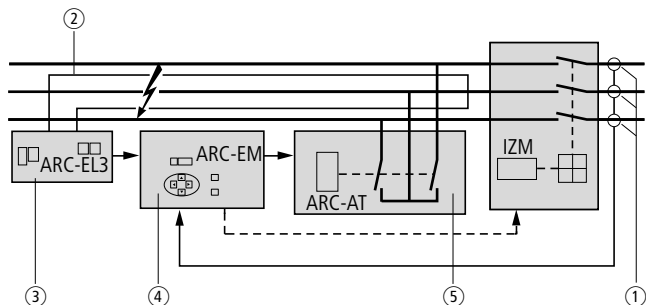
0

ARCON® arc fault protective system

Maximum personnel and system safety, especially during continuous production processes, made possible using the ARCON arc-fault protection system. The system offers protection from 6 to 100 kA_{rms} arc fault current.

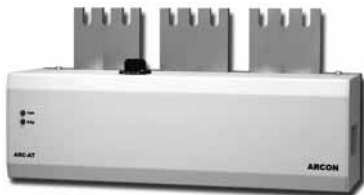
Detection of the arc faults is by light and current sensors. The evaluation unit

responds when light and current signals are present. A tripping signal is applied to the quenching device and to the feeder circuit-breakers. The fault arc is quenched in less than 2 ms. The system can be put back into operation as soon as the fault is eliminated and the quenching device is renewed.



- ① Current transformer
- ② ARC-SL... linear light sensor
- ③ Electronic evaluation unit (slave) ARC-EL3
- ④ Electronic evaluation unit (master) ARC-EM
- ⑤ ARC-AT quenching device

ARCON® – Quenching device



Eaton Wiring Manual

Eaton power distribution equipment

Sheet steel wall-mounting enclosure CS with mounting plate

0



The robust CS enclosure series with solid sheet steel is used wherever a particularly effective protection against direct contact with live parts or the protection of all installed equipment from harmful external influences is required. Thanks to its high degree of protection to IP 66 (UL/CSA Types 1, 12) with a continuous foam polyurethane gasket, water, oil or dirt is prevented from penetrating inside the enclosure. This makes the CS enclosure particularly suitable for subdistribution boards in control panels in industrial and utility buildings, as well as for machine building applications.

The stable sheet steel enclosure meets the requirements of impact resistance category IK09 to EN 62262. Impact resistant metal locks provide additional safety. The hinge pins with quick change technology enable the door hinge to be replaced quickly since each metal pin can be

removed without any tools. Wall fixing brackets enable the switch cabinet to be mounted on a wall.

The PHZ-A comfort rotary handle with locked position indication clearly shows on the outside whether the cylinder is in the opened or closed position. The comfort rotary handle can be retrofitted quickly, without the need to remove the standard lock - thus eliminating the need for the use of rotary levers.

The galvanized sheet steel mounting plate with a maximum thickness of 3 mm ensures the safe installation of the switchgear and basic EMC protection.

The CS enclosure can be turned through 180°, so that the cables can be fed in either via the top or bottom. The large flange plate openings allow the fitter more flexible handling.

Eaton Wiring Manual

Eaton power distribution equipment

0

The foam gasket of the flange plate saves users the time required for gluing in foam rubber seals. Both flange and mounting plates are incorporated in the grounding concept, thus eliminating the need for an additional protective ground connection.

Their powder coated surface provides an abrasion and corrosion resistant protection. As a special service, Eaton also offers individual solutions tailored to customer specifications.

Compact distribution board for flush mounting and surface mounting

KLV-U flush mounted compact distribution board



The plastic enclosure suitable for cavity walls offers an outstanding level of stability whilst the flat design of the sheet steel door makes it inconspicuous in any room. An adjustment tolerance of up to 18 mm for compensating any unevenness in walls and plaster significantly simplifies flush mounting in wall openings.

The zero and protective ground terminals are already prefitted. The KVL-U distribution board enclosure with protection class II and degree of protection IP30 are available in 1 to 4-row versions each with 12 + 2 module widths.

The following door variants are available: Sheet steel door flat and super flat, plastic design door white and transparent.

BC-A surface mounted compact distribution board



Wherever it is not possible to install in cavity walls, the rugged BC-A surface mounted compact distribution board protects the inside from mechanical damage and harmful environmental influences. In addition to degree of protection IP30, the unit meets the requirements of protection class II when used in conjunction with the back plate and the cover plate.

In spite of its compact dimensions, up to 4 rows of 13 space units are available for each distribution board enclosure. The BC-A surface mounted compact distribution board comes standard with white and transparent doors.

Eaton Wiring Manual

Eaton power distribution equipment

IVS service distribution system



The IVS service distribution board up to 630 A is primarily used for the safe and economical power supply in industrial, building and commercial applications.

The range therefore includes wall and standard enclosures, each with protection to IP30 and IP54.

The mounting space with an even division into standard 250 x 375 mm sections ensures a particularly clear design. Planning, ordering and mounting are thus simplified accordingly.

- The link between the enclosure and the mounting units is the mounting system with insulated support brackets. The mounting system can be lifted out of the enclosure after the plates have been removed and the screws released.
- A number of mounting units that are tailored to original Eaton switching and protective devices allow for time saving and simple mounting.
- Insulated covers are used for protecting the mounting units from direct contact.

Applicable standard for manufacturing is IEC EN 60439-1 "Type-tested low-voltage switchgear assemblies".

Eaton Wiring Manual

Eaton power distribution equipment

0

K terminal



The connection terminal consists of a combination of several very stable terminal blocks. It is used for connecting two or several conductors.

A very wide range is available as standard with 6 sizes and terminal capacities from 16 to 3 x 240 mm² (160 to 1000 A).

Copper conductors can be inserted quickly into the box terminals from above without bending.

The Eaton terminals are designed for copper strips or busbars as well as copper conductors. Each terminal pair is moulded in a plastic Duroplast shell. Each of the 6 sizes is available from stock as a 1-pole, 3-pole, 4-pole or 5-pole terminal combination.

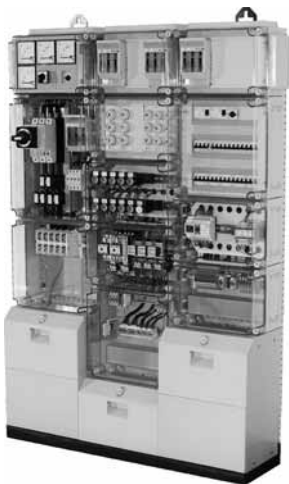
Accessories such as the transparent plastic cover, auxiliary conductor terminals or conversion kits also enable the creation of your own terminal variants.

Eaton Wiring Manual

Eaton power distribution equipment

CI insulated distribution boards, totally insulated

0



The assembly of the CI system demonstrates its flexibility. Whether as an individual enclosure, wall-mounted or floor standing distribution board of any size, the modular CI insulated distribution board up to 1600 A always offers the right solution in harsh ambient conditions.

The modular system makes it easy to adapt to a wide range of conditions.

- IP65 protection ensures protection from dust, humidity and water jets,
- Pressure relief by means of liftable covers with spring-loaded enclosure bolts,

- "Total insulation" provides maximum personnel protection and operational safety.
- Transparent neutral cover allows unrestricted view,
- Lock mechanism actuated with cylinder lock or tool,
- Floor standing distribution boards with base covers for routing, fixing or covering large cable cross-sections.

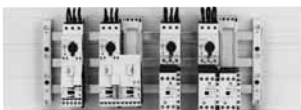
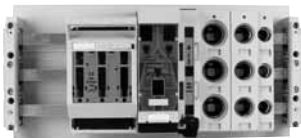
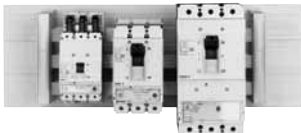
Enclosed distribution boards are type-tested switchgear assemblies (TTA) in accordance with VDE 0660 part 500 or Type Tested Assemblies (TTA) to IEC 60439.

Eaton Wiring Manual

Eaton power distribution equipment

0

SASY60i busbar system for the world market



The SASY60i modular busbar system from Eaton is designed for effective power distribution in the control panel.

Thanks to the innovative mounting technology feeder and outgoing circuit-breakers can be mounted quickly and compactly. SASY60i is safe and reliable.

In conjunction with the latest generation of Eaton motor protective circuit-breakers and other circuit-breakers, the SASY 60i provides a universal, UL certified solution for switching, controlling, protecting and distributing energy. Together with the appropriate switching and protective devices, the busbar system is designed for worldwide use.

The larger clearances and creepage distances required in compliance with the UL 508A in America have been considered in the construction of the busbar components.

When used in North America, the insulated bottom plate must be mounted under the system. Components approved for IEC such as NH fuse switch-disconnectors or D busbar mounting fuses can also suitably for perfectly matched fitting.

As SASY60i requires few system components the new Eaton busbar system also reduces the stock-keeping and ordering required.

These benefits naturally also apply to Eaton's SASY185i and SASY Compact busbar systems.