

Protection and control relays

# Protection and control relays for your power systems



**EATON**

*Powering Business Worldwide*



Automotive



Aerospace



Truck



Hydraulics



Electrical

# Powering business worldwide

Eaton delivers the power inside hundreds of products that are answering the demands of today's fast changing world.

We help our customers worldwide manage the power they need for buildings, aircraft, trucks, cars, machinery and entire businesses. And we do it in a way that consumes fewer resources.

## Next generation transportation

Eaton is driving the development of new technologies – from hybrid drivetrains and emission control systems to advanced engine components – that reduce fuel consumption and emissions in trucks and cars.

## Higher expectations

We continue to expand our aerospace solutions and services to meet the needs of new aviation platforms, including the high-flying light jet and very light jet markets.

## Building on our strengths

Our hydraulics business combines localised service and support with an innovative portfolio of fluid power solutions to answer the needs of global infrastructure projects, including locks, canals and dams.

## Powering Greener Buildings and Businesses

Eaton's Electrical Group is a leading provider of power quality, distribution and control solutions that increase energy efficiency and improve power quality, safety and reliability. Our solutions offer a growing portfolio of "green" products and services, such as energy audits and real-time energy consumption monitoring. Eaton's Uninterruptible Power Supplies (UPS), variable-speed drives and lighting controls help conserve energy and increase efficiency.



# MV Switchgear Technology is in our DNA

Eaton's knowledge and understanding of industries, applications, technology and products enables us to offer customers safe, reliable and high performance solutions. We have been part of the Medium Voltage switchgear technology creation and therefore carry what's needed with us – always!

## Complete MV switchgear solutions

The series of Eaton Medium Voltage systems offers switchgear and components for applications in distribution networks (main stations, substations and transformer stations) and industrial power supplies. These technically high quality systems are air- or epoxy-resin insulated and are always equipped with circuit-breakers based on proprietary vacuum interrupters.

The medium voltage switchgear systems carrying Eaton's brand are based on the use of vacuum circuit-breakers combined with solid insulation material. This is an environmentally-friendly technology in comparison with the methods used by many other suppliers, which use SF<sub>6</sub> as an insulation medium.

Eaton thus has a wide range of switching systems and components that offer an environmentally friendly solution for every application. Additionally, Eaton's global service network provides maximum customer support in all regions of the world.

## Industry leading vacuum and solid insulation technology

Through more than eighty years of innovation and experience, Eaton has developed environmentally friendly vacuum interrupters capable of reliably switching both normal load currents and high stress fault currents.

Eaton is one of the few companies in the world producing vacuum interrupters and has succeeded in developing world class products with international patents. This has been achieved through company acquisitions over the years of Westinghouse®, Cutler-Hammer®, MEM® and Holec®.

To increase the dielectric strength of the vacuum interrupter, Eaton has also designed vacuum interrupters that are encapsulated in epoxy resin material. The medium voltage IEC circuit breaker family utilizes this solid insulation technology that has been catering to a wide range of applications for more than 40 years.

Eaton's range of  
SF<sub>6</sub> free switchgear  
for Medium Voltage



# Power Protection for any application

Eaton delivers sophisticated power protection for low- and medium voltage applications. The Protective Relays provide you with unique microprocessor-based device that eliminates unnecessary trips, isolate faults, protect motors and breakers, and provides system information to help you better manage your system.



The Eaton Relay line is now the fourth generation of performance protection relays, working with dual core processor technology.

With the further development of modern protection technology - with microprocessors - Eaton makes a significant contribution to a reliable energy supply.

- Eaton Relays are in line with the IEC 61850
- As standard, the devices are fully equipped with all functions required by the corresponding application. For example, the Feeder Protection Relay MRA 4 provides functions such as Auto Reclosing, Vector Surge,  $df/dt$  (ROCOF) and six Frequency,  $Q \rightarrow U<$ , LVRT, Protection Stages onboard, without extra charge.
- All devices in the Eaton relay line arrive with a clear manual
- All current and ground current inputs are designed for 1 A and 5 A
- All terminals can be easily removed, and the current connections are equipped with automatic short circuiters. The nominal voltage of the voltage inputs and the switching thresholds of the digital inputs can be adjusted via software. The wide range power supply unit covers all standard auxiliary voltages, both for AC and DC. The integrated non-volatile disturbance recorder records up to 120 seconds with 32 samples per cycle.

## Types of protective relays

	MR <sup>1)</sup>	MC <sup>2)</sup>
• Directional feeder protection	<b>MRA4</b>	<b>MCA4</b>
• Overcurrent and earth fault protection OC&EF protection	<b>MRI4</b>	
• Voltage and frequency protection	<b>MRU4</b>	
• Engine	<b>MRM4</b>	
• Motor protection with voltage measurement	<b>MRMV4</b>	
• Generator protection with voltage measurement		<b>MCGV4 <sup>3)</sup></b>
• Generator differential protection		<b>MCDGV4 <sup>3)</sup></b>
• Transformer differential protection	<b>MRDT4</b>	
• Transformer differential protection with voltage measurement		<b>MCDTV4 <sup>3)</sup></b>
• Power differential protection with voltage measurement		<b>MCDLV4 <sup>3)</sup></b>

<sup>1)</sup> MR = Protection

<sup>2)</sup> MC = Control and protection

<sup>3)</sup> Please ask for availability

# Complete range of protective relays



## MRA4

### Directional feeder protection

The MRA4 is specifically tailored to the protection of incoming and outgoing feeders in MV systems and can be used for grid and generator protection.



## MCA4

### Directional feeder protection

The MCA4 is designed for the protection and control of mid-range voltage feeders. In addition to numerous protection functions for feeder protection and the utility connection point, the switch control can be fully monitored and controlled by the MCA4 by remote control or on location.



## MRI4

### Non-directional feeder protection

The MRI4 is a non-directional overcurrent and earth fault relay. The relay is used for incoming and outgoing feeder applications. The relay can also be used as backup protection for differential protection systems.



## MRU4

### Voltage and frequency protection

The MRU4 is designed to protect electrical equipment from dangerous voltage and frequency fluctuations, and is used for busbar, generator and feeder protection.



## MRM4

### Motor protection

The MRM4 is designed for the protection of motors. All the protection functions based on current, as well as monitoring functions, such as motor start-up and incomplete start-up sequence for motor protection are covered by the MRM4.



## MRMV4

### Motor protection with voltage measurement

Compared with the MRM4, the MRMV4 also features voltage measurement and is therefore able to monitor power, voltage and frequency.



## MCGV4

### Generator protection with voltage measurement

The MCGV4 protects electrical generators over a wide frequency range. Multiple protection features, such as voltage-gated and voltage-controlled overcurrent, loss of excitation, overexcitation, power and power factor control, and voltage and frequency monitoring, completes the protection package.



## MRDT4

### Non-directional transformer differential protection

The MRDT4 is a transformer differential relay designed to protect two winding transformers. The relay can also be used as a generator differential protection and also incorporates backup protection functions.

# Functions

Protection devices		MRA4	MCA4	MRI4	MRU4	MRM4	MRMV4	MCGV4*	MRDT4
<b>Protection functions</b>	<b>ANSI</b>								
Phase current stages (non-directional)	50/51	-	-	6	-	6	6	-	4/6*
Phase current stages (non-directional and directional)	50/51/67	6	6	-	-	-	-	6	-
Voltage restrained current protection	51V	•	•	-	-	-	•	•	-
Voltage controlled current function	51C	•	•	-	-	-	•	•	-
Earth current stages (non-directional)	50N/51N	-	-	4	-	4	4	-	4
Earth current stages (non-directional and directional)	50N/51N/67N	•	•	-	-	-	-	4	-
Negative sequence stages (current)	46	2	2	2	-	2	2	2	2
Overload protection with thermal replica	49	•	•	•	-	•	•	•	•
Voltage stages	27/59	6	6	-	4/6*	-	6	6	-
Residual voltage stages	59N	2	2	-	2	-	2	2	-
Frequency stages	81 U/O	6	6	-	6	-	6	6	-
Inrush detection IH2 (2 <sup>nd</sup> harmonic)		•	•	•	-	-	-	•	•
Voltage transformer supervision	60FL	•	•	-	•	-	•	•	•
Current transformer supervision	60L	•	•	•	-	•	•	•	•
Auto reclosing	79	•	•	•	-	-	-	-	-
Negative / positive sequence stages (voltage)	47	6	6	-	6	-	6	6	-
Trip/auxiliary function	86	•	•	•	•	•	•	•	•
Circuit breaker failure protection	50 BF	•	•	•	•*	•	•	•	•
Trip circuit supervision	74TC	•	•	•	•	•	•	•	•
Frequency gradient df/dt (ROCOF)	81R	•	•	-	•	-	•	•	-
Vector surge	78	•	•	-	•	-	•	•	-
Power protection: P, Q, Qr, S, Pr	32F, 37F, 32Q, 37Q, 37QR, 32S, 37S, 37R	6	6	-	-	-	6	6	-
Power factor cos (φ)	55	2	2	-	-	-	2	2	-
QU protection (undervoltage- directional reactive power protection)		•	•	-	-	-	-	•	-
Synchro check	25	•*	•	-	•*	-	-	•	-
Cold load pick up	37	•*	•	•*	-	-	-	•	•*
I< underload protection	37	-	-	-	-	2	2	2	-
Switch onto fault		•*	•	•*	-	•	•	•	•*
Motor Start supervision		-	-	-	-	•	•	-	-
Locked rotor protection	49S/51	-	-	-	-	2	2	-	-
JAM protection	50J	-	-	-	-	•	•	-	-
LVRT (low voltage ride through)		•	•	-	•*	-	-	•	-
Protection parameter sets		4	4	4	4	4	4	4	4
Reverse interlocking		•	•	•	-	•	•	•	•
Event/fault/disturbance recorder		•	•	•	•	•	•	•	•
Start-/trend recorder		•*	•	•*	•*	•	•	•	•*
Transformer differential protection (2 windings)	87T	-	-	-	-	-	-	-	2
Ground differential protection (high stabilized)	87N (64REF)	-	-	-	-	-	-	-	2
Overexcitation V/Hz	24	-	-	-	-	-	-	•	-
Loss of excitation	40	-	-	-	-	-	-	•	-
100% Stator earth fault protection with 3 Harmonics	59TN/27TN	-	-	-	-	-	-	•	-
<b>Control</b>									
Control functionality up to 6 switchgears		-	•	-	-	-	-	•	-
Control functionality of 1 switchgear		•*	-	•*	•*	•	•	-	•*
Logic (up to 80 equations)		•*	•	•*	•*	•	•	•	•*
<b>Measuring functions</b>									
Currents: IL1, IL2, IL3, IE, I0, I1, I2		•	•	•	-	•	•	•	•
Currents: IL1H2, IL2H2, IL3H2, IEH2		•	•	•	-	-	-	•	•
Overload θ		•	•	•	-	•	•	•	•
Voltages: VL1, VL2, VL3, VL12, VL23, VL31, VE, V0, V1, V2		•	•	-	•	-	•	•	-
Frequency f		•	•	-	•	-	•	•	-
Power: P, Q, S, Pr, PF (cos φ), Wp+, Wp-, Wq+, Wq-		•	•	-	-	-	•	•	-
<b>Hardware</b>									
Number of binary output relays <sup>1)</sup>		7	7	6	6	6 <sup>1)/4<sup>1)</sup></sup>	7	11	7
Number of optional binary output relays <sup>1)</sup>		6/o	6/o	-	-	-	6/o	-	6/o
Number of digital inputs <sup>1)</sup>		8	8	8	8	8 <sup>1)/4<sup>1)</sup></sup>	8	16	8
Number of optional digital inputs* <sup>1)</sup>		8/o	8/o	-	-	-	8/o	-	8/o
Number of analogue in- and outputs <sup>1)</sup>		-	-	-	-	0/1 <sup>1)</sup>	-	2+2	-
<b>Communication</b>									
IEC61850 (RJ45 interface)		o*	o	o*	o*	o	o	o	o*
MODBUS RTU (via fibre optic (FO) or RS485)		o	o	o	o	o	o	o	o
IEC60870-5-103 (via fibre optic (FO) or RS485)		o	o	o	o	o	o	o	o
Modbus TCP (RJ45 interface)		o	o	o	o	o	o	o	o
Profibus DP (via LWL or RS485)		o	o	o	o	o	o	o	o
IRIG-B interface (time synchronization)		•	•	•	•	•	•	•	•

• = standard; o = optional; <sup>1)</sup> = depends on type of device; \* = information on availability on request.

# Characteristics of the relays

- **Intuitive operation**

with guiding texts

- **Plausibility test**

prevent inadmissible inputs

- **Control interface**

SCADA connection

- **International certifications**

KEMA, UL, Gost-R, CSA

- **Wide range power supply**

for all standard auxiliary voltage ranges

- **Current inputs**

for 1 A and 5 A

- **Nominal voltages**

and switching thresholds are adjustable for digital inputs

## Smart view software

Our software tool offers:

- Menu-controlled parameter setting incl. validity checks
- Offline configuration of all relay types
- Reading and evaluating of statistical data and measuring values
- Commissioning functions
- Device status display
- Error analysis with event and fault memory
- Automatic software updates when a new, more current, older or unknown device is connected.

## Data visualization

With the Eaton relays your fault recording becomes transparent and clear:

- Analysis and graphical representation of the fault recordings
- Representation of digital and analog recordings with 32 samples per period
- Immediate evaluation of individual measurements
- Import and export of fault records in the ASCII and COMTRADE formats

Eaton protection relays are ideally suited for application in Eaton medium voltage switchgear



Xiria E



Power Xpert® FMX



Power Xpert® UX

Eaton's Electrical Sector is a global leader in power distribution, power quality, control and automation, and monitoring products. When combined with Eaton's full-scale engineering services, these products provide customer-driven PowerChain™ solutions to serve the power system needs of the data center, industrial, institutional, public sector, utility, commercial, residential, IT, mission critical, alternative energy and OEM markets worldwide.

PowerChain™ solutions help enterprises achieve sustainable and competitive advantages through proactive management of the power system as a strategic, integrated asset throughout its life cycle, resulting in enhanced safety, greater reliability and energy efficiency. For more information, visit [www.eaton.com/electrical](http://www.eaton.com/electrical).

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