

Eaton's E-Series protective relay family

Microprocessor-based design



Powering Business Worldwide

Eaton's E-Series relay family introduction

The protective relay family

Eaton's E-Series protective relays offer a microprocessor-based overcurrent design that is compatible with both ANSI and IEC applications. They are panel-mounted, self-contained units that operate from either AC or DC control power. Eaton's E-Series relays provide you with unique microprocessor-based devices that protect motors, feeder distribution circuits, transformers and generators. All E-Series relays have the option for zone selective interlocking and maintenance mode.

E-Series relay "programmable logic equations" allow for configurations such as M-T-M (no, open or closed) retransfer and M-M preferred source schemes to easily be added, eliminating the requirement for separate PLC controls. AND, NAND, OR and NOR gates are included using a standard assignment list (protective function states, breaker states, system alarms and module inputs). Up to 80 logic elements are available with four inputs each, including internal and output timer logic gates.



EDR-5000

Feeder distribution relay

Feeder distribution relays provide complete protection for medium voltage feeder distribution lines.

Models include:

- EDR-3000
- EDR-5000



EMR-3000

Motor relay

Motor relays provide complete and reliable motor protection for any size motor at different voltage levels, including diagnostics, monitoring and starting control functions.

Models include:

- EMR-3000
- EMR-4000
- EMR-5000



ETR-5000

Transformer relay

Transformer relays provide primary protection, control and backup protection of transformers, including current differential, restricted ground differential and overcurrent protection.

Models include:

- ETR-4000
- ETR-5000



EGR-5000

Generator relay

Generator protection relays can be used to protect any size generators. They may be used as primary or backup protection in standby generators and cogeneration applications.

Models include:

- EGR-4000
- EGR-5000

Common software tools

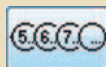
All E-Series relays use PowerPort-E software for easy access to information and programming groups. Whether you are using the front panel or the software, the interface is the same on all models.



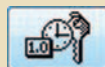
Operation



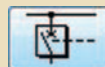
System Parameters



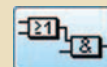
Protection Parameters



Device Parameters



Control



Logic



Device Planning



Service

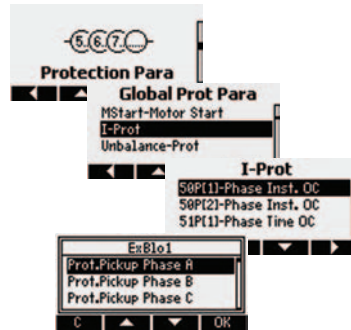
Download PowerPort-E software at www.eaton.com/pr

Common features

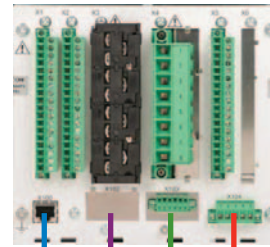
Front Panel Access



RS-232 Port (Standard)



Communication Interfaces



Rear View

- IRIG-B Time Sync ❶
- RS-485 Connector (Standard) ❶
- Fiber Optic Port—URTD Module ❶
- Ethernet (RJ-45) Port ❶

❶ Reference order guide for availability by model.

E-Series Relay Family Feature Comparison Chart

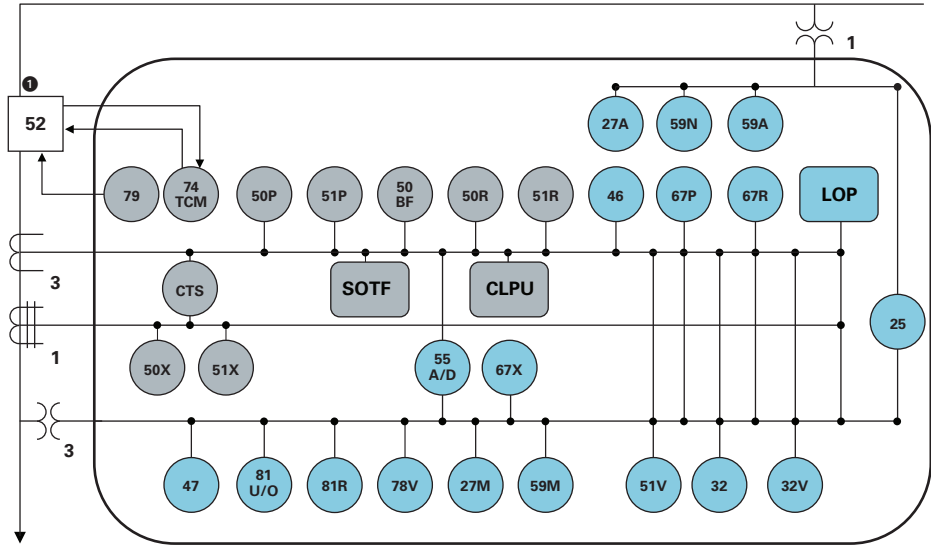
Description	EDR-3000	EDR-5000	EMR-3000	EMR-4000	EMR-5000	ETR-4000	ETR-5000	EGR-4000	EGR-5000
Communications Protocols									
Modbus RTU (RS-485)—standard	■	■	■	■	■	■	■	■	■
IEC-61850 MMS (Ethernet)—optional	■	■	N/A	■	■	■	■	■	■
IEC-61850 Goose (Ethernet)—optional	■	■	N/A	■	■	■	■	■	■
Modbus TCP/IP (Ethernet)—optional	■	■	■	■	■	■	■	■	■
Metering and Monitoring Features									
Current (pos, neg and zero seq.)	■	■	■	■	■	■	■	■	■
Current demand	—	■	■	■	■	■	■	■	■
Differential current	—	—	—	—	■	—	■	—	■
Voltage (pos, neg and zero seq.)	—	■	—	■	■	—	■	■	■
Phase angles	—	■	—	■	■	■	■	■	■
Volt-amperes and VA demand	—	■	—	■	■	—	■	■	■
Watts and kW demand	—	■	—	■	■	—	■	■	■
kWh (forward, reverse and net)	—	■	—	■	■	—	■	■	■
VARs and kVAR demand	—	■	—	■	■	—	■	■	■
kVARh (lead, lag and net)	—	■	—	■	■	—	■	■	■
Power factor	—	■	—	■	■	—	■	■	■
Frequency	—	■	—	■	■	—	■	■	■
Volts/Hz	—	—	—	—	—	—	—	—	■
3rd harmonic voltage	—	—	—	—	—	—	—	—	■
% THD current	—	■	■	■	■	■	■	■	■
% THD voltage	—	—	—	■	■	—	■	■	■
Magnitude THD current	—	■	■	■	■	—	■	■	■
Magnitude THD voltage	—	—	—	■	■	—	■	■	■
Min./max. recording	■	■	■	■	■	■	■	■	■
Sync values	—	■	—	—	—	—	—	■	■
Temperature with remote URTD module	—	—	■	■	■	■	■	■	■
Trip circuit monitoring	■	■	■	■	■	■	■	■	■
Breaker wear	■	■	■	■	■	■	■	■	■
CT supervision	■	■	■	■	■	—	■	■	■
VT supervision	—	—	—	■	■	—	—	—	—
Waveform recorder (6000 cycles typical)	3600 cycles	■	■	■	■	■	■	■	■
Fault recorder (20 events)	■	■	■	■	■	■	■	■	■
Sequence of events recorder (300 events)	■	■	■	■	■	■	■	■	■
Trend recorder	—	■	■	■	■	■	■	■	■
Motor history	—	—	■	■	■	—	—	—	—
Motor start trending	—	—	■	■	■	—	—	—	—
Generator hours of operation	—	—	—	—	—	—	—	■	■
Programmable logic equations	■	■	—	■	■	■	■	■	■

Eaton's distribution relay family—EDR Series

Model comparison guide—protective functions

EDR-3000	EDR-5000
Protection functions 50BF—Breaker failure 50P—Phase instantaneous overcurrent elements 50R—Calculated ground or neutral instantaneous overcurrent elements 50X—Measured ground or neutral instantaneous overcurrent elements 51P—Phase overcurrent protection per time-current curve elements 51R—Calculated ground fault protection per time-current curve elements 51X—Measured ground or neutral fault protection per time-current curve elements CLPU—Cold load pickup SOTF—Switch on to fault CTS—Current transformer supervision 74TCM—Trip coil monitor (option) ZI—Zone selective interlocking (option)	The EDR-5000 has all of the same protection functions as the EDR-3000 with additional features. Enhanced protection functions 27A/M—Auxiliary and main three-phase undervoltage elements 46—Phase unbalance negative sequence overcurrent elements 47—Phase voltage unbalance and sequence protection elements 55A/D—Apparent and displacement power factor elements 59A/M—Auxiliary and main three-phase overvoltage elements 59N—Ground fault overvoltage elements 67P—Directional overcurrent elements 67X—Calculated directional overcurrent elements 78V—Vector surge element 81U/O/R—Under and over and rate of change frequency elements LOP—Loss of power 25—Sync check 32—Forward and reverse watts elements 32V—Forward and reverse VARs elements 51V—Voltage restraint elements 79—Auto-reclosing

Typical one-line example—ANSI protective elements guide



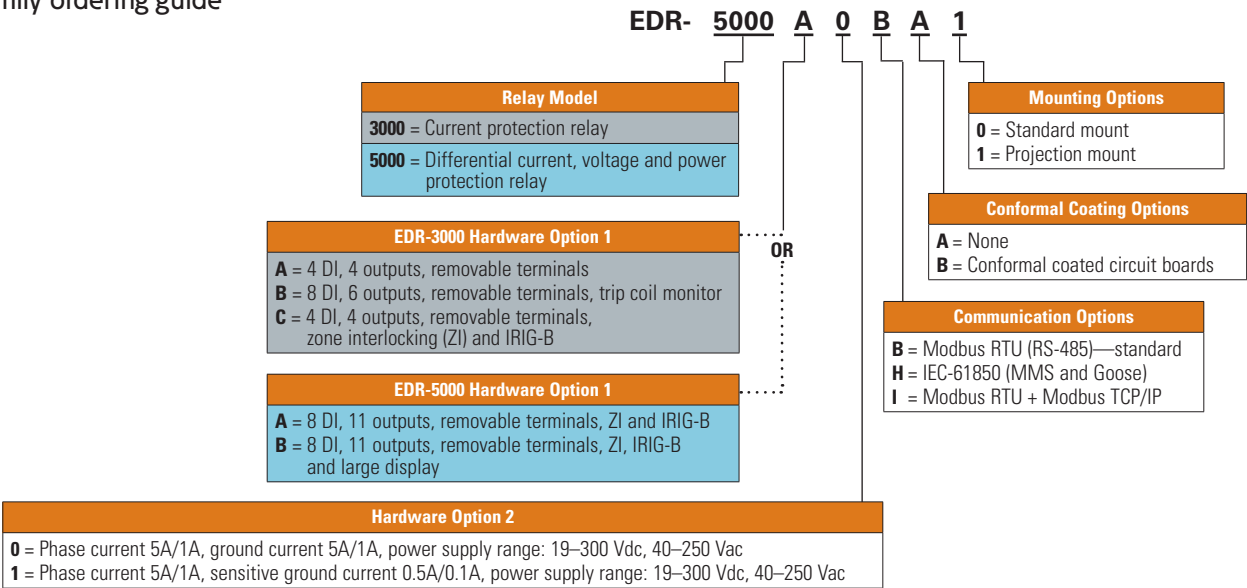
1 52—circuit breaker.

Protective elements key

- = Functions available on EDR-3000 and EDR-5000
- = Functions available on EDR-5000

See **Page 3** for metering features.

EDR family ordering guide

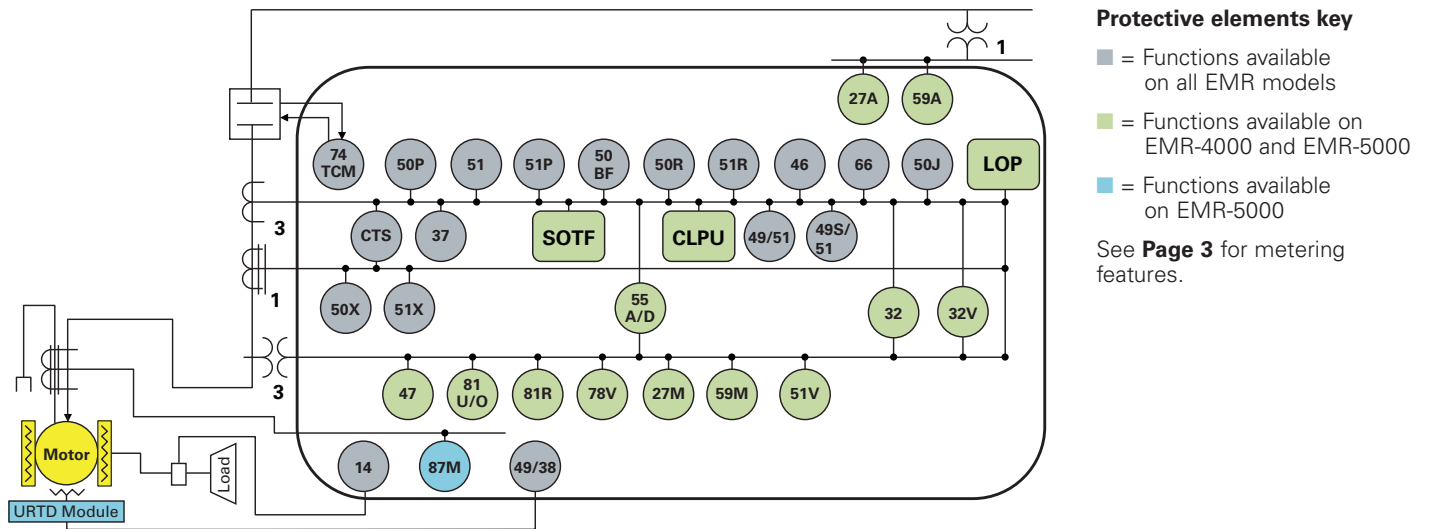


Eaton's motor relay family—EMR Series

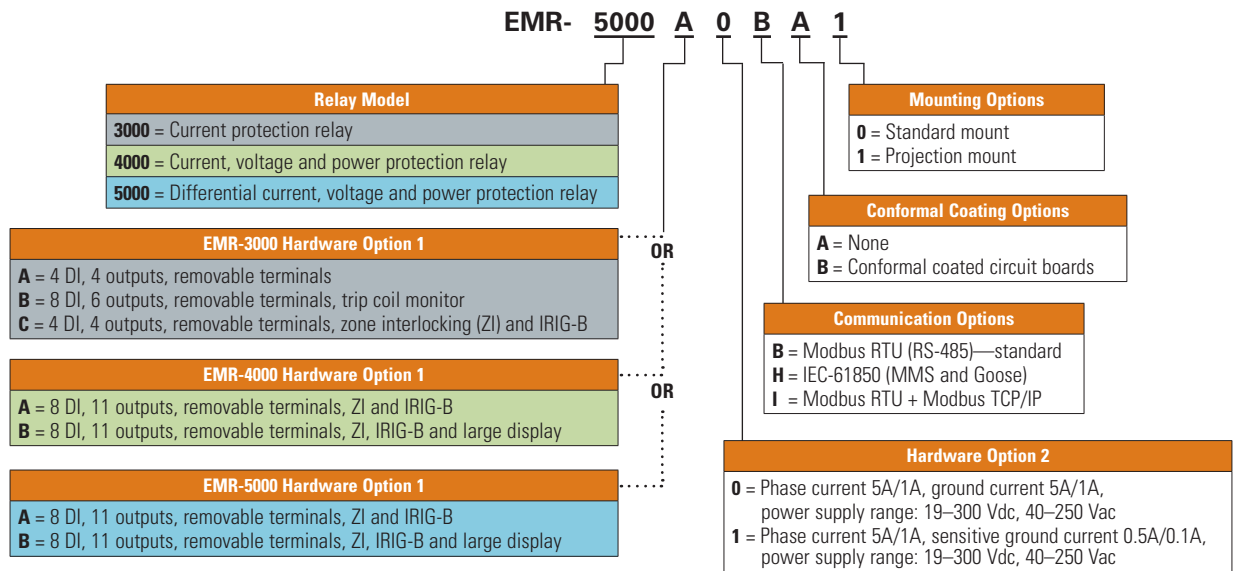
Model comparison guide—protective functions

EMR-3000	EMR-4000	EMR-5000
Protection functions 50BF—Breaker failure 50P—Phase instantaneous overcurrent elements 50R—Calculated ground or neutral instantaneous overcurrent elements 50X—Measured ground or neutral instantaneous overcurrent elements 51P—Phase overcurrent protection per time-current curve elements 51R—Calculated ground fault protection per time-current curve elements 51X—Measured ground or neutral fault protection per time-current curve elements 46—Phase unbalance negative sequence overcurrent elements 49/38—Thermal protection using optional URTD module 49/51—Thermal overload protection (I ² T) 49S/51—Locked rotor 50J—Jam or stall protection 37—Underload protection 66—Starts per time period 14—Underspeed CTS—Current transformer supervision 74TCM—Trip coil monitor (option) ZI—Zone selective interlocking (option) 86—Lockout protection	The EMR-4000 has all of the same protection functions as the EMR-3000 with additional features. Enhanced protection functions 27A/M—Auxiliary and main three-phase undervoltage elements 47—Phase voltage unbalance and sequence protection elements 55A/D—Apparent and displacement power factor elements 59A/M—Auxiliary and main three-phase overvoltage elements 59N—Ground fault overvoltage elements 32/32V—Forward and reverse watts and VARs elements 51V—Voltage restraint elements 78V—Vector surge element 81U/O/R—Under and over and rate of change frequency elements LOP—Loss of power CLPU—Cold load pickup SOTF—Switch on to fault	The EMR-5000 has all of the same protection functions as the EMR-4000 with additional features. Enhanced protection functions 87M—Differential current elements

Typical one-line example—ANSI protective elements guide



EMR family ordering guide

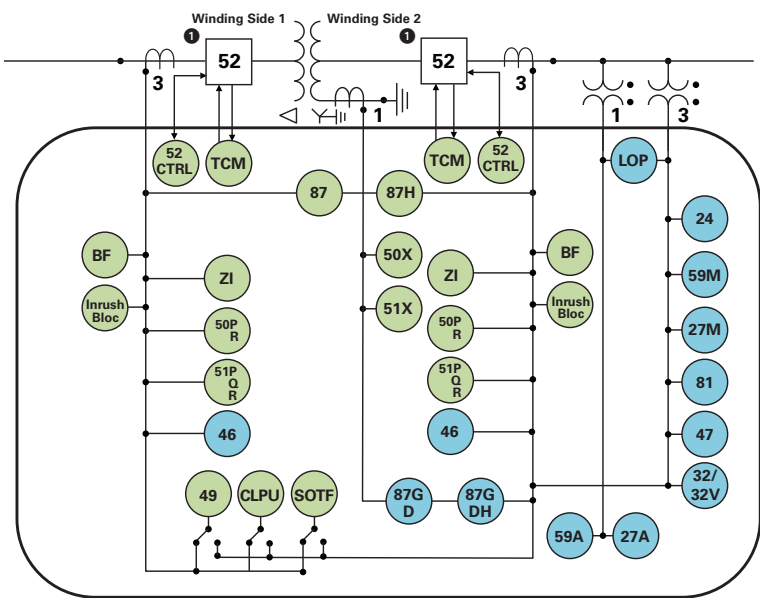


Eaton's transformer relay family—ETR Series

Model comparison guide—protective functions

ETR-4000	ETR-5000
Protection functions 87R —Dual-slope percentage restrained current differential with magnetizing inrush and over-excitation blocking 87H —Unrestrained current differential 87GD —Restricted ground fault / ground differential 50P —Instantaneous overcurrent elements with timers 50R —Instantaneous calculated elements with timers 50X —Instantaneous measured elements with timers 51P —Inverse time overcurrent elements 51Q —Negative sequence phase overcurrent elements 51R —Inverse time overcurrent calculated elements 51X —Inverse time overcurrent measured elements BF —Breaker failure elements 49 —Temperature protection SOTF —Switch onto fault protection CLPU —Cold load pickup 74TCM —Trip coil monitor ZI —Zone selective interlocking for bus protection BF —Breaker failure	The ETR-5000 has all of the same protection functions as the ETR-4000 with additional features. Enhanced protection functions 46 —Phase unbalance negative sequence overcurrent protection 47 —Phase voltage unbalance and sequence protection 27M/59M —Main three-phase under/overvoltage protection 27A/59A —Auxiliary single-phase under/overvoltage protection 81 —Frequency elements that can be assigned to: overfrequency, underfrequency, rate of change or vector surge 32 —Forward and reverse watts protection 32V —Forward and reverse VARs protection 24 —Over-excitation, volts-per-hertz protection 86 —Lockout protection

Typical one-line example—ANSI protective elements guide



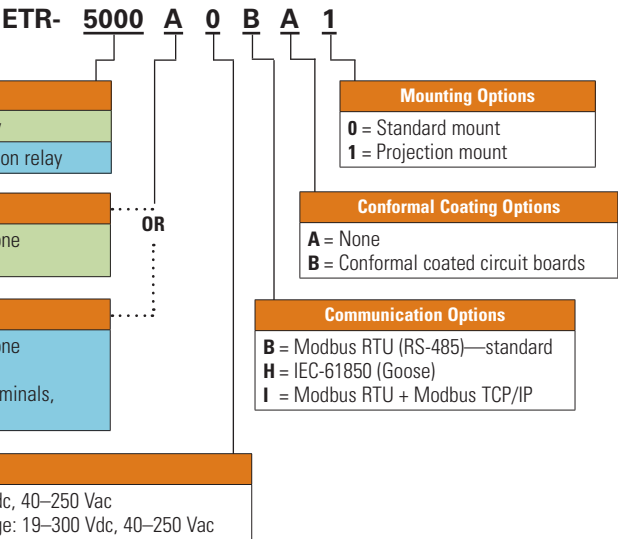
52—circuit breaker.

Protective elements key

- = Functions available on all ETR models
- = Functions available on ETR-5000

See **Page 3** for metering features.

ETR family ordering guide

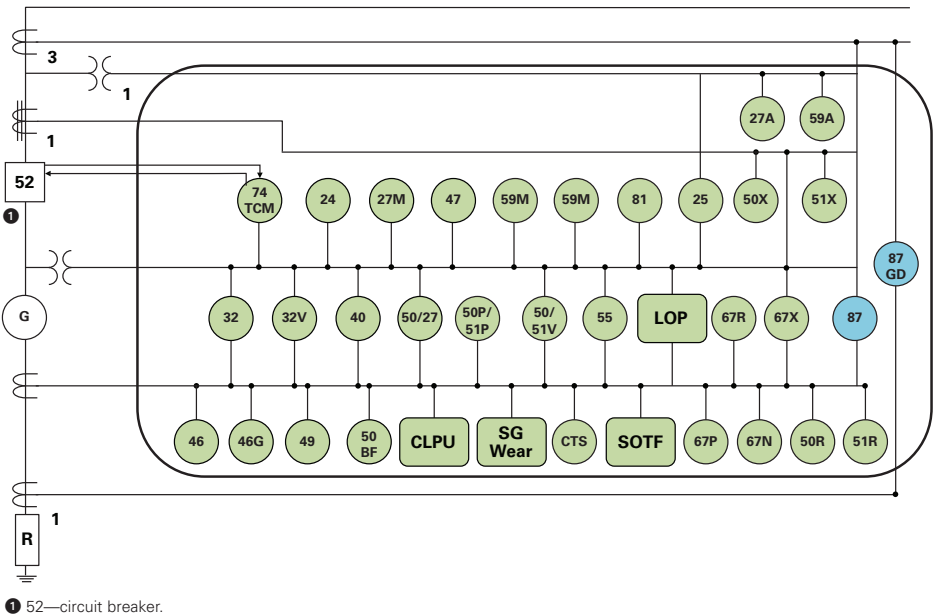


Eaton's generator relay family—EGR Series

Model comparison guide—protective functions

EGR-4000			EGR-5000
Protection functions			The EGR-5000 has all of the same protection functions as the EGR-4000 with additional features.
50BF —Breaker failure	67P/67R/67X/67N —	24 —Over-excitation, volts-per-hertz	Differential protection functions 87 —Phase current differential protection 87H —Unrestrained high-set differential current protection 87GD —Restricted ground fault protection 87GDH —High-set restricted ground fault protection 50/27 —Inadvertent energization
50P —Phase instantaneous overcurrent elements	Directional overcurrent elements	(64S) 27TN/59N —	
50R —Calculated ground or neutral instantaneous overcurrent elements	46 —Phase unbalance negative sequence overcurrent elements	Stator ground fault	
50X —Measured ground or neutral instantaneous overcurrent elements	47 —Phase voltage unbalance and sequence protection elements	46G —Generator unbalance	
51P —Phase overcurrent protection per time-current curve elements	27A/27M —Auxiliary and main three-phase undervoltage elements	40 —Loss of excitation	
51P(2) & 51P(3) have 51V —	59A/59M —Auxiliary and main three-phase overvoltage elements	25 —Sync check	
Voltage restraint	59N —Ground fault overvoltage element	79 —Auto-reclosing	
51R —Calculated ground fault protection per time-current curve elements	81U/O —Underfrequency and overfrequency elements	86 —Lockout	
51X —Measured ground or neutral fault protection per time-current curve elements	78V —Vector surge element	LOP —Loss of power	
49/51 —Thermal protection element	55A/55D —Apparent and displacement power factor elements	CLPU —Cold load pickup	
	32 —Forward and reverse watts elements	SG Wear —Switchgear wear	
	32V —Forward and reverse VARs elements	SOTF —Switch on to fault	
		CTS —Current transformer supervision	
		74TCM —Trip coil monitor (option)	
		ZI —Zone selective interlocking (option)	

Typical one-line example—ANSI protective elements guide

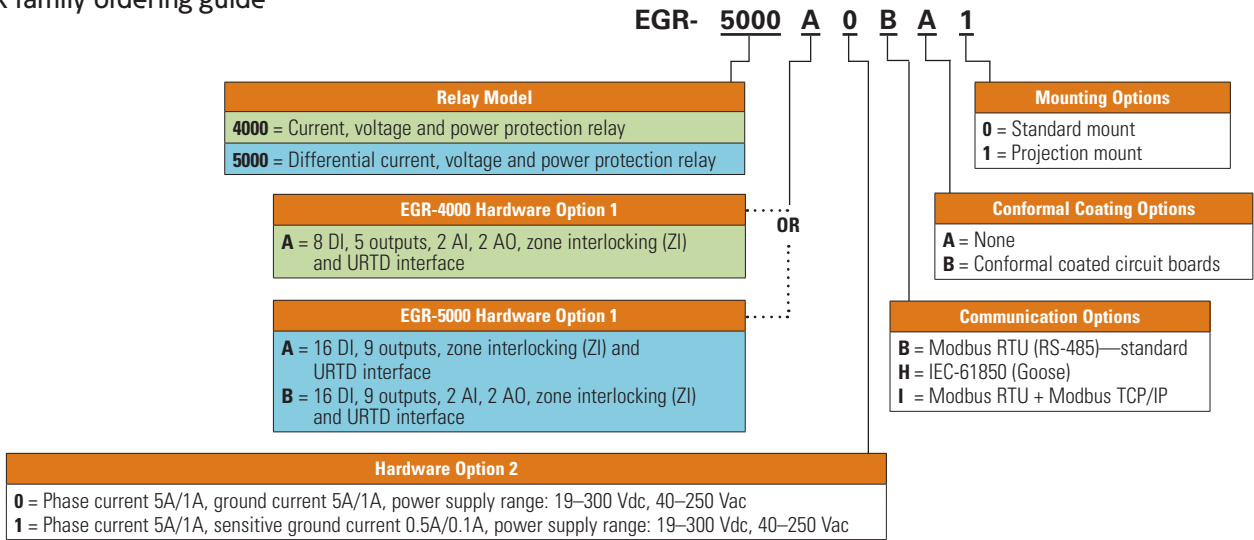


Protective elements key

- = Functions available on all EGR models
- = Functions available on EGR-5000

See **Page 3** for metering features.

EGR family ordering guide



E-Series Relay Family Standard Accessories

Description	Catalog Number
Universal RTD module with Modbus RTU 48–240 Vac / 48–250 Vdc	URTDII-01
Universal RTD module with Modbus RTU 24–48 Vdc	URTDII-02
1m fiber optic cable for relays / URTD communications	MPF0-1
5m fiber optic cable for relays / URTD communications	MPF0-5
10m fiber optic cable for relays / URTD communications	MPF0-10
25m fiber optic cable for relays / URTD communications	MPF0-25
E-Series RS-232 null modem cable	66B2214G01
E-Series USB to RS-232 converter	66B2214G02
E-Series RS-232 cable and USB to RS-232 converter	66B2214G03

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