

Key Features, Functions and Benefits

- Microprocessor-based protection with monitoring and control for medium voltage motors.
- Integral test function reduces maintenance time and expense.
- Zone selective interlocking improves coordination and tripping time, and saves money compared to a traditional bus differential scheme.
- Programmable logic control functions to accommodate different control schemes, simplify the wiring of the starter.
- Automatically detects direction of the motor and eliminates the need of switching current inputs into the relay.
- Reduce trouble shooting time and maintenance costs- Trip and event recording in non-volatile memory provides detailed information for analysis and system restoration. 6000 cycles of waveform capture aids in post fault analysis (viewable using Powerport-E software).
- Minimum replacement time- Removable terminal blocks ideal in industrial environments.
- Front RS-232 port and Powerport-E software provides local computer access and user-friendly windows based interface for relay settings, configuration, and data retrieval.
- Breaker open/close from relay faceplate or remotely via communications.
- Fast an easy troubleshooting, improved maintenance procedures, and increased device security. Provides detailed traceability for system configuration changes.
- Relays self-diagnostics and reporting improves uptime and troubleshooting.
- Breaker trip circuit monitoring improves the reliability of the breaker operation.

General Description

Eaton's EMR-5000 motor protection relay is a multifunctional microprocessor-based protective relay for the protection of any size motor at all voltage levels. It is most commonly applied on medium voltage or larger motors. The EMR-5000 relay is a current and voltage device with built in differential protection that provides complete and reliable motor protection, monitoring, diagnostics, metering, and starting control functions.

The EMR-5000 motor protection relay provides complete current, voltage, and frequency protection in a single compact case. The relay has eight current inputs rated for either 5 amperes or 1 ampere and four voltage inputs. Three of the voltage inputs are to be connected to the 3-phase power voltage for voltage protection and for metering. They can be connected in wye-ground or open delta configuration. The fourth voltage is for independent single-phase under-voltage/overvoltage protection. The unit is user programmable for 60 Hz or 50 Hz operation.

The maintenance mode password protected soft key, can be used for arc flash mitigation to change to an alternate settings group, set to have instantaneous elements only. The multiple setting groups can also be changed, via communications or a digital input. Flash memory is used for the programming and all settings are stored in nonvolatile memory.

An integral keypad and display is provided for direct user programming and retrieval of data without the need of a computer. 14 programmable LEDs provide quick indication of relay status.

A front port is provided for direct computer connection. An RS-485 and an Ethernet ports in the back are optional for local area networking using. Optional Modbus-RTU, Modbus-TCP, or IEC-61850 protocols are supported.

The EMR-5000 motor protection relay includes programmable logic functions. Logic gates and timers may be defined and arranged for customized applications. With the programmable logic control functions you can simplify the complexity of your starting schemes by eliminating timers and auxiliary relays. Flash memory is used for the programming and all settings are stored in nonvolatile memory. The relay allows for four preprogrammed setting groups which can be activated through software, manually, or contact input.

The EMR-5000 motor protection relay has mass memory for data storage and a real-time clock with 1 ms time resolution. The relay will log 300 sequence of event records, 20 detailed trip logs, minimum/maximum values, load profiles, the 5 latest start profiles, motor trending, breaker/contactors wear information and waveform data.

The EMR-5000 has either eight programmable binary inputs, 2 analog inputs, 2 analog outputs, or sixteen programmable binary inputs. It has 2 normally opened and 6 Form C heavy duty outputs and one form C signal alarm relay. The relay provides maximum user flexibility to configure the I/O. All inputs and outputs (except the healthy output) are user-programmable. The unit also counts with a test mode to force outputs and simulate currents, to facilitate the commissioning of the unit. It can be powered from 19 Vdc to 300 Vdc or 40 Vac to 250 Vac auxiliary power.

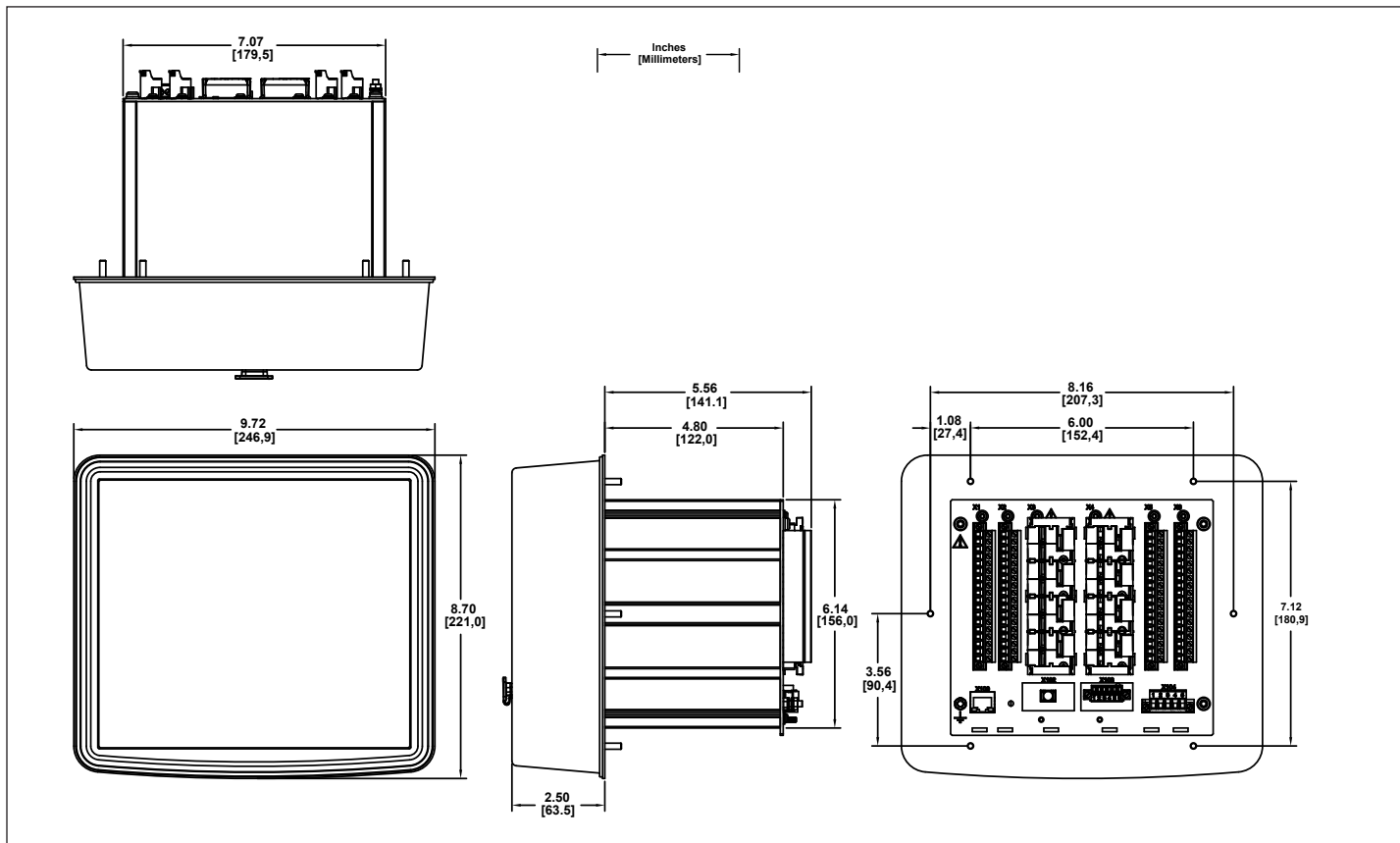


Figure 3. Projection Mount Front and Side Views.

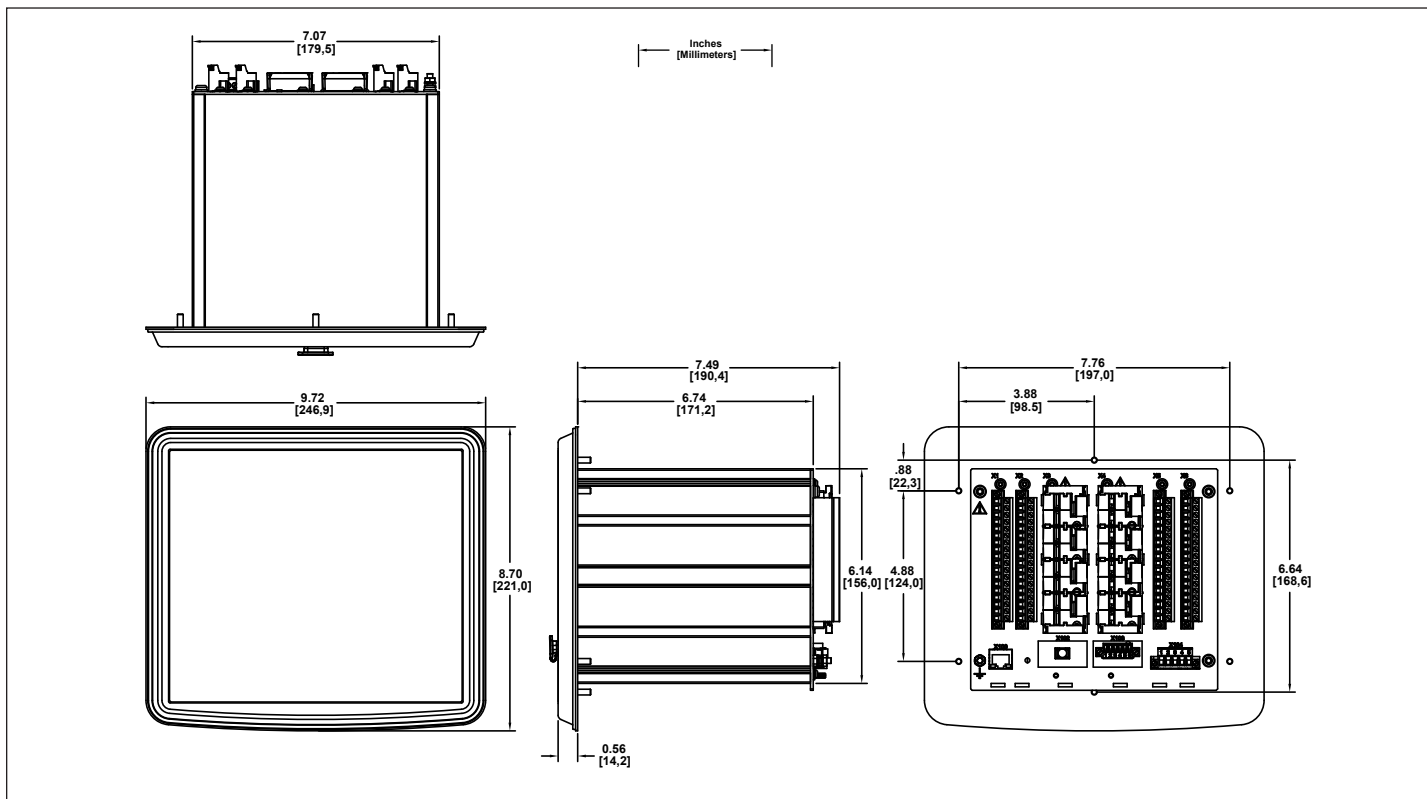


Figure 4. Standard Mount Front and Side Views.

Standards, Certifications and Ratings

NOTICE

**USE COPPER CONDUCTORS ONLY, 75°C (167°F).
CONDUCTOR SIZE AWG 14 [2.5 MM].**

Climatic Environmental Conditions

Storage Temperature:	-30°C to +70°C (-22°F to 158°F)
Operating Temperature:	-20°C to +60°C (-4°F to 140°F)
Permissible Humidity at Ann. Average:	<75% rel. (on 56d up to 95% rel.)
Permissible Installation Altitude:	<2,000 m (6,561.67 ft) above sea level If 4,000 m (13,123.35 ft) altitude applies, a changed classification of the operating and test voltages may be necessary.

Degree of Protection EN 60529

HMI Front Panel with Seal:	IP54
Rear Side Terminals:	IP20

Routine Test

Insulation Test Acc. to IEC60255-5:	All tests to be carried out against ground and other input and output circuits.
Aux. Voltage Supply, Digital Inputs, Current Measuring Inputs, Signal Relay Outputs:	2.5 kV (eff.) / 50 Hz
Voltage Measuring Inputs:	3.0 kV (eff.) / 50 Hz
All Wire-Bound Communication Interfaces:	1.5 kV DC

Housing

Housing B2: Height / Width	183 mm (7.205 in.) / 212.7 mm (8.374 in.)
Housing Depth (Incl. Terminals):	208 mm (8.189 in.)
Material, Housing:	Aluminum extruded section
Material, Front Panel:	Aluminum/Foil front
Mounting Position:	Horizontal (±45° around the X-axis must be permitted)
Weight:	Approx. 4.2 kg (9.259 lb)

Current and Ground Current Measurement

Plug-in Connector with Integrated Short-Circuiter (Conventional Current Inputs)

Phase and Ground Current Inputs:	
Nominal Currents:	1 A / 5 A
Max. Measuring Range:	Up to 40 x I _n (phase currents) Up to 25 x I _n (ground current standard)
Capacity:	4 x I _n /continuously
Overcurrent Proof:	30 x I _n / 10 s 100 x I _n / 1 s 250 x I _n / 10 ms (1 half-wave)
Power Consumption:	Phase current inputs At I _n = 1 A S=0.15 mVA At I _n = 5 A S=0.15 mVA Ground Current Input At I _n = 1 A S=0.35 mVA At I _n = 5 A S=0.35 mVA

Sensitive Ground Current Inputs:	
Nominal Currents:	1 A / 5 A with 50:0:025 core balance CT
Max. Measuring Range:	Up to 2.5 x I _n
Capacity:	2 x I _n /continuously
Overcurrent Proof:	10 x I _n / 10 s 25 x I _n / 1 s 100 x I _n / 10 ms (1 half-wave)
Power Consumption:	At I _n = 1 A S=0.35 mVA At I _n = 5 A S=0.35 mVA
Frequency Range:	50 Hz / 60 Hz ± 10%
Terminals:	Screw-type terminals with integrated short-circuiters (contacts)
Screws:	M4, captive type acc. to VDEW
Connection Cross Sections:	1 x or 2 x 2.5 mm ² (2 x AWG 14) with wire end ferrule 1 x or 2 x 4.0 mm ² (2 x AWG 12) with ring cable sleeve or cable sleeve 1 x or 2 x 6 mm ² (2 x AWG 10) with ring cable sleeve or cable sleeve The current measuring board's terminal blocks may be used as with 2 (double) conductors AWG 10,12,14 otherwise with single conductors only.

Voltage and Residual Voltage Measurement

Nominal Voltages:	60 - 520 V (can be configured)
Max. Measuring Range:	2 x nominal voltage or 800 V
Continuous Loading Capacity:	800 Vac
Power Consumption:	at V _n = 100 V S=0.1 mVA at V _n = 110 V S=0.1 mVA at V _n = 230 V S=0.4 mVA at V _n = 400 V S=1.0 mVA
Nominal Voltages:	60 - 520 V (can be configured)
Frequency Range:	50 Hz or 60 Hz ± 10%
Terminals:	Screw-type terminals

Frequency Measurement

Nominal Frequencies:	50 Hz / 60 Hz
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Voltage Supply

Aux. Voltage:	24 - 270 Vdc / 48 - 230 Vac (-20/+10%)
Buffer Time in case of Supply Failure:	>= 50 ms at minimal aux. voltage Interrupted communication is permitted.
Max. Permissible Making Current:	18 A peak value for <0.25 ms 12 A peak value for <1 ms
The voltage supply must be protected by a fuse of:	
2,5 A time-lag miniature fuse approx. 5 x 20 mm (0.2 x 0.8 in.) according to IEC 60127 3,5 A time-lag miniature fuse approx. 6,3 x 32 mm (0.25 x 1.25 in.) according to UL 248-14	

Power Consumption

Power Supply Range:	Power consumption in Idle Mode	Max. Power Consumption
24 - 270 Vdc:	Approx. 7 W	Approx. 13 W
48 - 230 Vac (For Frequencies of 50-60 Hz):	Approx. 7 VA	Approx. 13 VA

Display

Display Type:	LCD with LED background illumination
Resolution - Graphics Display:	128 x 128 pixel
LED - Type:	Two colored: red / green
Number of LEDs, Housing B2:	15

Front Interface RS232

Baud Rates:	115,200 Baud
Handshake:	RTS and CTS
Connection:	9-pole D-Sub plug

Real Time Clock

Running Reserve of the Real Time Clock:	1 year min.
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Digital Inputs

Max. Input Voltage:	300 Vdc / 259 Vac
Input Current:	<4 mA
Reaction Time:	<20 ms
Drop-out Time: Shorted Inputs Open Inputs	<30 ms <90 ms

Relay Output Contacts

Continuous Current:	5 A ac / dc
Max. Make Current:	25 A ac / 25 A dc for 4 s 30 A / 230 Vac according to ANSI IEEE Std C37.90-2005 30 A / 250 Vdc according to ANSI IEEE Std C37.90-2005
Max. Breaking Current:	5 A ac up to 240 Vac 5 A dc up to 30 V (resistive)
Continuous Current:	5 A ac/ dc
Contact Type:	Form C or normally open contact
Terminals:	Screw-type terminals

Supervision Contact (SC)

Continuous Current:	5 A ac / dc
Max. Switch-on Current:	15 A ac / 15 A dc for 4 s
Max. Breaking Current:	5 A ac up to 250 Vac 5 A dc up to 30 Vdc (resistive) 0,25 A at 250 Vdc (resistive)
Max. Switching Voltage:	250 V ac / 250 Vdc
Switching Capacity:	1,250 VA
Contact Type:	Form C
Terminals:	Screw-type terminals

Analog Outputs

The following technical data only apply to devices, which are equipped with analog outputs. Please refer to the order code of your device.

The mode of each output can be individually selected between current or voltage output. Shielded cable for the analog outputs is recommended. The terminals of the HF shield should be used, when connecting the shield to the ground on both sides of the cable is not possible. On one side of the cable the shield has to be directly connected to ground. In case of the use of unshielded twisted pair cables, the length must not exceed 10 m. All analog outputs have a common potential. Each output has an own common terminal.

Current Mode Range: Max. Load Resistance:	0-20 mA 1 k Ω
Voltage Mode Range:	0 - 10 V maximum output current 20 mA
Accuracy	0.5% of the nominal value 20 mA resp. 10 V
Influence of temperature to accuracy	<1% (within the range of 0°C to +60°C (+32°F to +140°F))
Test voltage of outputs (one group) against other electrical groups	2.5 kV
Test voltage of outputs (one group) against ground	1.0 kV

Time Synchronization IRIG-B00X

Nominal Input Voltage:	5 V
Connection:	Screw-type terminals (twisted pair)

Zone Interlocking

NOTICE

ONLY FOR ZONE INTERLOCK TRIPPING OUTPUTS (ZONE INTERLOCK, SEMI-CONDUCTOR OUTPUT): 5 VDC, <2MA FOR CONNECTION TO ELECTRONIC INPUTS ONLY.

Zone Out:	
Output voltage (High)	4.75 to 5.25 Vdc
Output voltage (Low)	0.0 to +0.5 Vdc
Zone In:	
Nominal input voltage	+5 Vdc
Max. input voltage	+5.5 Vdc
Switching threshold ON	min. 4.0 Vdc
Switching threshold OFF	max. 1.5 Vdc
Galvanic isolation:	2.5 kV ac (to ground and other IO)
Connection:	Screw-type terminals (twisted pair)

RS485*

Master/Slave:	Slave
Connection:	6 screw-clamping terminals RM 3.5 mm (138 MIL) (terminating resistors internal)

CAUTION

THE RS485 INTERFACE IS REALIZED VIA TERMINALS. THE COMMUNICATION CABLE HAS TO BE SHIELDED. THE SHIELDING HAS TO BE FIXED AT THE SCREW THAT IS MARKED WITH THE GROUND SYMBOL (REAR SIDE OF THE DEVICE).

Fiber Optic*

Master/Slave:	Slave
Connection:	ST-Plug

URTD-Interface*

Connection:	Versatile Link
*availability depends on device	

Boot Phase

After switching on the power supply, the protection will be available in approximately 19 seconds. After approximately 165 seconds, the boot phase is completed (HMI and Communication initialized).

Standards

Approvals

- UL-listed file: E217753

Design Standards

Generic Standard	EN 61000-6-2 EN 61000-6-3
Product Standard	IEC 60255-6 EN 50178 UL 508 (Industrial Control Equipment) CSA C22.2 No. 14-95 (Industrial Control Equipment) ANSI C37.90

High Voltage Tests (IEC 60255-6)

High Frequency Interference Test		
IEC 60255-22-1 Class 3	With one circuit Circuit to ground Circuit to circuit	1 kV/2 s 2.5 kV/2 s 2.5 kV/2 s
Insulation Voltage Test		
IEC 60255-5 EN 50178	All circuits to other circuits and exposed conductive parts Except interfaces Voltage measuring input	2.5 kV (eff.)/ 50Hz, 1 min. 1.5 kV DC, 1 min. 3 kV (eff.)/50 Hz, 1 min.
Impulse Voltage Test		
IEC 60255-5		5 kV/0.5J, 1.2/50 μs

EMC Immunity Tests

Fast Transient Disturbance Immunity Test (Burst)		
IEC 60255-22-4 IEC 61000-4-4 Class 4 ANSI C37.90.1	Power supply, mains inputs Other in- and outputs	± 4 kV, 2.5 kHz ± 2 kV, 5 kHz (coupling network) ± 4 kV, 2.5 kHz (coupling clamp)
Surge Immunity Test		
IEC 61000-4-5 Class 4 Class 3	Within one circuit Circuit to ground Communication cables to ground	2 kV 4 kV 2 kV
Electrical Discharge Immunity Test		
IEC 60255-22-2 IEC 61000-4-2 Class 3	Air Discharge Contact discharge	8 kV 6 kV
Radiated Radio Frequency Electromagnetic Field Immunity Test		
IEC 6100-4-3 ANSI C37.90.2	26 MHz - 80 MHz 80 MHz - 1 GHz 1 GHz - 3 GHz	10 V/m 35 V/m 10 V/m
Immunity to Conducted Disturbances Induced by Radio Frequency Fields		
IEC 61000-4-6 Class 3		10V
Power Frequency Magnetic Field Immunity Test		
IEC 61000-4-8 Class 4	Continuous 3 sec	30 A/m 300 A/m

EMC Emission Tests

Radio Interference Suppression Test		
IEC/CISPR11		Limit value class B
Radio Interference Radiation Test		
IEC/CISPR11		Limit value class B

Environmental Tests

Classification:		
IEC 60068-1	Climatic	20/060/56
Classification		
IEC 60721-3-1	Classification of ambient conditions (Storage)	1K5/1B1/1C1L/1S1/1M2 but min. -30°C (-22°F)
IEC 60721-3-2	Classification of ambient conditions (Transportation)	2K4/2B1/2C1/2S1/2M2 but min. -30°C (-22°F)
IEC 60721-3-3	Classification of ambient conditions (Stationary use at weather protected locations)	3K6/3B1/3C1/3S1/3M2 but min. -20°C (-4°F) / max 60°C (140°F)
Test Ad: Cold		
IEC 60068-2-1	Temperature Test duration	-20°C (-4°F) 16 h
Test Bd: Dry Heat		
IEC 60068-2-2	Temperature Relative humidity Test duration	60°C (140°F) <50% 72 h
Test Cab: Damp Heat (Steady State)		
IEC 60068-2-78	Temperature Relative humidity Test duration	40°C (104°F) 95% 2
Test Db: Damp Heat (Cyclic)		
IEC 60068-2-30	Temperature Relative humidity Cycles (12 + 12-hour)	60°C (140°F) 95% 2

Mechanical Tests

Test Fc: Vibration Response Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 59 Hz) Displacement (59 Hz – 150 Hz) Acceleration Number of cycles in each axis	0.0014 in. (0.035 mm) 0.5 gn 1
Test Fc: Vibration Endurance Test		
IEC 60068-2-6 IEC 60255-21-1 Class 1	(10 Hz – 150 Hz) Acceleration Number of cycles in each axis	 1.0 gn 20
Test Ea: Shock Test		
IEC 60068-2-27 IEC 60255-21-2 Class 1	Shock response test	5 gn, 11 ms, 3 impulses in each direction
	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction
Test Eb: Shock Endurance Test		
IEC 60068-2-29 IEC 60255-21-2 Class 1	Shock endurance test	10 gn, 16 ms, 1,000 impulses in each direction
Test Fe: Earthquake Test		
IEC 60068-3-3 KTA 3503 IEC 60255-21-3 Class 2	Single axis earthquake vibration test	3 – 7 Hz: Horizontal 0.394 in. (10 mm), 1 cycle each axis 7 – 35 Hz Horizontal: 2 gn, 1 cycle each axis

Specifications

Specifications of the Real Time Clock

Resolution:	1 ms
Tolerance:	<1 minute / month (+20°C [68°F]) <±1 ms if synchronized via IRIG-B

Time Synchronization Tolerances

The different protocols for time synchronization vary in their accuracy:

Used Protocol	Time drift over one month	Deviation to time generator
Without time synchronization	<1 min (20°C)	Time drifts
IRIG-B	Dependent on the time drift of the time generator	<±1 ms
SNTP	Dependent on the time drift of the time generator	±1 ms
Modbus TCP	Dependent on the time drift of the time generator	Dependent on the network label

Specifications of the Measured Value Acquisition

Phase and Ground Current Measuring

Nominal current (In):	1 A or 5 A (separate terminal inputs)
Max. Measuring Range:	40 A (25 A Ground or 2.5 A Ground sensitive)
Frequency Range:	50 Hz / 60 Hz ± 10%
Accuracy:	Class 0.5
Amplitude Error if I < 1 In:	±0.5% of the rated value *
Amplitude Error if I > 1 In:	±0.5% of the measured value *
Amplitude Error if I > 2 In:	±1.0% of the measured value *
Resolution:	0.01 A (0.001 A for earth current sensitive) *For earth current sensitive the precision does not depend on the nominal value but is referenced to 100 mA (with In = 1 A) respectively 500 mA (with In = 5 A)
Harmonics:	Up to 20% 3rd harmonic ±2% Up to 20% 5th harmonic ±2%
Frequency Influence:	<±2% / Hz in the range of ±5 Hz of the configured nominal frequency
Temperature Influence:	<±1% within the range of 0°C to +60°C (+32°F to +140°F)

Phase-to-Ground and Residual Voltage Measurement

Nominal voltage (Vn):	60 ... 600 V in 1 V steps
Max measuring range:	800 V
Frequency range:	50 Hz or 60 Hz ±10%
Precision:	Class 0,5
Amplitude error for V<Vn (measured):	±0.5% of the rated value
Amplitude error for V<Vn (calculated):	±1.0% of the rated value
Amplitude error for V>Vn (measured):	±0.5% of the measured value
Amplitude error for V>Vn (calculated):	±1.0% of the calculated value
Resolution:	0.1 V
Harmonics:	up to 20% 3rd harmonic ±1%, up to 20% 5th harmonic ±1%
Frequency Influence:	<±2% / Hz in the range of ±5 Hz of the configured nominal frequency
Temperature Influence:	<±1% within the range of 0°C up to +60°C

Frequency Measurement

Nominal frequency:	50 Hz / 60 Hz
Precision:	±0.05% of fn within the range of 40-70 Hz at voltages >50 V
Voltage dependency:	frequency acquisition of 5 V – 800 V

Energy Measurement*

Energy counter error for VAh < Sn* 1 h:	3% of Sn
Energy counter error for VAh > Sn* 1 h:	3% of measured energy

Power Measurement*

VA, W, VAR:	<±3% of the measured value or 0.1% x Sn
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Power Factor Measurement*

PF:	±0.01 of measured power factor or 1° I > 30% x In
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*Tolerance at 0.8 ... 1.2xVn (with Vn=100V) , |PF|>0.5, symmetrically fed. Units are selected automatically depending on CT and VT ratings for best fit. Sn=1.73 * VT rating * CT rating

Protection Elements Accuracy

NOTICE

THE TRIPPING DELAY RELATES TO THE TIME BETWEEN ALARM AND TRIP. THE ACCURACY OF THE OPERATING TIME RELATES TO THE TIME BETWEEN WHEN THE MEASURED VALUE HAS EXCEEDED THE THRESHOLD UNTIL THE PROTECTION ELEMENT IS PICKED-UP.

Overcurrent Protection Elements 50P[x]	Range	Step	Accuracy
Pickup	0.02 ... 20.00 x In	0.01 x In	±1.5% of the setting value resp. 1% x in.
Dropout Ratio			97% or 0.5% x In
t	0.00 ... 300.00 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>			<35 ms
Disengaging Time			<45 ms

Overcurrent Protection Elements 51P[x]	Range	Step	Accuracy
Pickup	0.02 ... 4.00 x In	0.01 x In	±1.5% of the setting value resp. 1% x in.
Dropout Ratio			97% or 0.5% x In
Operating Time Starting from I higher than 1.1 x I>			<35 ms
Disengaging Time			<45 ms
t-Multiplier	0.02 ... 2.00	0.01	±5% IEC NINV IEC VINV IEC EINV IEC LINV
	0.02 ... 20.00	0.01	±5% ANSI MINV ANSI VINV ANSI EINV Flat It I²t I³t

Reset Mode	Calculated, (Instantaneous, t-delay)		±5% IEC NINV IEC VINV IEC EINV IEC LINV IEC MINV IEC VINV IEC EINV Flat It I²t I³t
t-reset (Reset Mode = t-delay)	0.00 ... 60.00 s	0.01 s	±1% resp. ±10 ms

Ground Current Elements: 50X[x], 50R[x]	Range	Step	Accuracy
Pickup (measured ground current) Pickup (calculated ground current)	0.02 ... 4.00 x In	0.01 x In	±1.5% of the setting value Resp. 1% x In ±2.0% of the setting value Resp. 1.5% x In
Dropout Ratio			97% or 0.5% x In
t	0.00 ... 300.00 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from IE higher than 1.1 x IE>			<35 ms
Disengaging Time			<45 ms
t-reset (Reset Mode = t-delay)	0.00 ... 60.00 s	0.01 s	±1% resp. ±10 ms

Ground Current Elements: 51X[x], 51R[x]	Range	Step	Accuracy
Pickup (measured ground current) Pickup (calculated ground current)	0.02 ... 4.00 x In	0.01 x In	±1.5% of the setting value Resp. 1% x In ±2.0% of the setting value Resp. 1.5% x In
Dropout Ratio			97% or 0.5% x In
Operating Time Starting from IE higher than 1.1 x IE>			<35 ms
Disengaging Time			<45 ms
t-Multiplier	0.02 ... 2.00	0.01	±5% IEC NINV IEC VINV IEC EINV IEC LINV
	0.02 ... 20.00	0.01	±5% ANSI MINV ANSI VINV ANSI EINV Flat It I²t I³t
Reset Mode	Calculated, (Instantaneous, t-delay)		±5% IEC NINV IEC VINV IEC EINV IEC LINV ANSI MINV ANSI VINV ANSI EINV Flat It I²t I³t

EMR-5000 Motor Protection Relay

t-reset (Reset Mode = t-delay)	0.00 ... 60.00 s	0.01 s	±1% resp. ±10 ms
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Differential Current Protection: 87M[x]	Range	Step	Accuracy
Pickup (measured ground current)	0.01 ... 40.00 x In	0.01 x In	±1.5% of the setting value Resp. 1% x In
Dropout Ratio			97% or 0.5% x In
t	0.00 ... 300.00 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>			<35 ms
Disengaging Time			<45 ms

Voltage restraint: 51V[x]	Range	Step	Accuracy
Pickup	0.04 ... 2.00 x Vn	0.01 x Vn	±1.5% of the setting value Resp. 1% x In
Dropout Ratio			97% or 0.5% x In
Operating Time Starting from I higher than 1.1 x I>			<35 ms
Disengaging Time			<45 ms

Overcurrent Protection Elements: 49 Thermal Model	Range	Step	Accuracy
Trip Threshold	0.60 ... 0.99	0.01	±1.5% of the setting value Resp. 1% In
Trip Delay	0.0 ... 3600.0 s	0.1 s	DEFT ±1% resp. ±10 ms
Alarm Threshold	0.60 ... 0.99	0.01	±1.5% of the setting value Resp. 1% In
Alarm Delay	1 ... 360 x min	1 x min	DEFT ±1% resp. ±10 ms

Undervoltage and Overvoltage (Phase and Auxiliary) 27M[x] / 59M[x] 27A[x] / 59A[x]	Range	Step	Accuracy
Pickup	0.01 ... 1.30 x Vn	0.01 x Vn	±1.5% of the setting value Resp. 1% x Vn
Dropout Ratio			97% or 0.5% x Vn
t	0 ... 300 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from V higher/lower than 1.1 x V> or V<			<35 ms
Disengaging Time			<45 ms

Current unbalance: 46[x]	Range	Step	Accuracy
Threshold	0.01 ... 4.00 x In	0.01 x In	±2% of the setting value resp. 1% In
I2/I1 ≥ 0.1 ... 4.00 x In	2 ... 40%	1.00%	±1%
t	0 ... 300 s	0.01 s	DEFT ±1% resp. ±10 ms

Operating Time Starting from I2/I1 ≥ 1.1 x In			<60 ms
Disengaging Time			<40 ms

Voltage unbalance: 47[x]	Range	Step	Accuracy
Threshold	0.01 ... 1.30 x Vn	0.01 x Vn	±2% of the setting value resp. 1% Vn
V2/V1 ≥ 0.1 x Vn	2 ... 40%	1.00%	97% or 0.5% x Vn
t	0 ... 300 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from V2/V1 ≥ 1.1 x Vn			<60 ms
Disengaging Time			<40 ms

Over Frequency Protection: 810[x]	Range	Step	Accuracy
Threshold	40.00 ... 69.95 Hz	0.01 Hz	10 mHz at fn
Dropout Ratio			99.95% or 0.05% x fn
t	0.00 ... 3600.00 s	0.01 s	±1% resp. ±10 ms
Operating Time Starting from f higher than f>+0.02 Hz			40-50Hz <60 ms 50-70Hz <50 ms
Disengaging Time			40-50Hz <85 ms 50-70Hz <75 ms

Under Frequency Protection 81U[x]	Range	Step	Accuracy
Threshold	40.00 ... 69.95 Hz	0.01 Hz	10 mHz at fn
Dropout Ratio			±1% resp. ±10 ms
t	0.00 ... 3600.00 s	0.01 s	100.05% or 0.05% x fn
Operating Time Starting from f lower than f<-0.02 Hz			40-50Hz <60ms 50-70Hz <50ms
Release Time			40-50Hz <85 ms 50-70Hz <75 ms
V Block f			±1.5% of the setting value resp 1% x Vn
Dropout Ratio			103% or 0.5% x Vn

Rate of Change of Frequency df/dt	Range	Step	Accuracy
Threshold	0.01 ... 10 Hz/s	0.01 Hz/s	100 mHz per Second
t	0.00 ... 300.00 s	0.01 s	±1% resp. ±10 ms
Operating Time			<40 ms
Disengaging Time			<40 ms

Rate of Change of Frequency Df/Dt	Range	Step	Accuracy
Df	0.0 ... 10.0 Hz	0.1 Hz	100 mHz per Second
Dt	0.1 ... 10.0	0.1 s	±1% resp. ±10 ms
Operating Time			<40 ms
Disengaging Time			<40 ms

Vector surge 78V	Range	Step	Accuracy
Threshold	1 ... 30 degrees	1 degree	±0.5 [1-30°] at Vn and fn
Operating Time			<40 ms

PQ-protection: 32[x]/32V[x]	Range	Step	Accuracy
Threshold	0.02 ... 10.00 x VAn	0.01 x VAn	±3% or ±1.5% VAn
t	0.00 ... 1100.00 s	0.01 s	±1% resp. ±10 ms
Operating Time			75 ms
Disengaging Time			75 ms
Dropout Ratio			97% for P>/Q> and 103% for P</Q<

Power Factor PF-55D / PF-55A	Range	Step	Accuracy
Trigger-PF	0.50 ... 0.99	0.01	± 0.01 (absolute)
Reset-PF	0.50 ... 0.99	0.01	± 0.01 (absolute)
t-trip	0.00 ... 300.00 s	0.01 s	±1% resp. ±10 ms
T-Pickup Comp	0.00 ... 300.00 s	0.01 s	±1% resp. ±10 ms
T-Reset Comp	0.00 ... 300.00 s	0.01 s	±1% resp. ±10 ms
Operating Time			<120 ms

Switch On To Fault: SOTF	Range	Step	Accuracy
Operating Time			<35 ms
I<	0.01 ... 1.00 x In	0.01 x In	±1.5% of the setting value resp. 1% x In
t-enable	0.10 ... 10.00 s	0.01 s	±1% resp. ±10 ms

Breaker Failure Protection: 50BF	Range	Step	Accuracy
I-BF>	0.02 ... 0.10 x In	0.01 x In	±1.5% of the setting value resp. 1% x In
t-BF	0.00 ... 10.00 s	0.01 s	±1% resp. ±10 ms
Resetting Ratio			0.5% x In
Operating Time Starting from I Higher than 1.3 x I-BF>			<40 ms
Disengaging Time			<40 ms

Trip Circuit Monitoring: TCM	Range	Step	Accuracy
t-TCM	0.10 ... 10.00 s	0.01 s	±1% resp. ±10 ms

Loss of Potential: LOP	Range	Step	Accuracy
t-Pickup	0.0 ... 9999.0 s	0.1 s	±1% resp. ±10 ms

Current Transformer Supervision CTS	Range	Step	Accuracy
ΔI	0.10 ... 1.00 xIn	0.01 xIn	±2% of the setting value resp. 1.5% In
Pickup Delay	0.1 ... 9999.0 s	0.1 s	±1% resp. ±10 ms
Kd - Correction Factor	0.00 ... 0.99	0.01	
Dropout Ratio			94%

Jam-Stall Protection: 50J	Range	Step	Accuracy
Threshold	1.00 ... 12.00 x FLA	0.01 x FLA	±1.5% of the setting value resp. 1% In
Resetting Ratio	97% or 0.5% x In		
t	0.00 ... 1200.00 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>			< +35 ms
Disengaging Time			< +45 ms

Under Load Protection: 37[x]	Range	Step	Accuracy
Threshold	0.05 - .90 x FLA	0.01 x FLA	±1.5% of the setting value resp. 1% In
t	0.04 - 1200.0 s	0.01 s	DEFT ±1% resp. ±10 ms
Operating Time Starting from I higher than 1.1 x I>			< +35 ms
Disengaging Time			< +45 ms

Mechanical Load Shedding: MLS	Range	Step	Accuracy
Pickup Threshold	0.05 - 1.50 x FLA	0.01 x FLA	±1.5% of the setting value resp. 1% In
Pickup Delay	0.0 - 5.0 s	0.1 s	DEFT ±1% resp. ±10 ms
Dropout Threshold	0.05 - 1.50 x FLA	0.01 x FLA	±1.5% of the setting value resp. 1% In
Dropout Delay	0.0 - 5.0 s	0.1 s	DEFT ±1% resp. ±10 ms

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Motor Protection Relay

Motor Protection: 66 [x]	Range	Step	Accuracy
SPH Number of starts per hour.	1 - 10 per hr.	1	± 0
Reset Starts Per Hour Reset starts per hours timer from oldest start event.	1 hr.	N.A.	±1 min.
Stop Declaration Time period current must drop below threshold.	> 280 ms	Fixed	+ .016ms, - 0 ms
Anti Backspin Blocking time to allow for back spin.	1 -3600 sec.	1 sec.	±1 sec.
TBS Timer Time between repeated starts.	1 -240 min.	1 min.	+ 1 sec.

Temperature Protection Elements: 49/38 [x] RTD Trip w /URTD	Range	Step	Accuracy
Trip WDX, MBx, LBx	0 - 200°C (32 - 392°F)	1°C (1.8°F)	±1°C (1.8°F)
Alarm WDX, MBx, LBx	0 - 200°C (32 - 392°F)	1°C (1.8°F)	±1°C (1.8°F)
T-delay Alarm	0 ... 360 x min	1 x min	DEFT ±1% resp. ±10 ms
Reset Hysteresis	-2°C (-3.6°F) of threshold	Fixed	±1°C (1.8°F)

Start Delay Timers	Range	Step	Accuracy
IOC Start Delay	.03 - 1.00 sec.	.01 s	+ 32 ms
GOC Start Delay	.03 - 1.00 sec.	.01 s	+ 32 ms
Underload Start Delay	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
(I) Unbal. Start Delay	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Jam Start Delay	0.03 - 1200.00 sec.	0.01 s	+ 60ms, - 0 ms
Undervoltage Start Delay	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Overvoltage Start Delay	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Power Start Delay	0.03 - 1200.00 sec.	0.01 s	+ 60ms, - 0 ms
Power Factor Start Delay	0.03 - 1200.00 sec.	0.01 s	+ 60ms, - 0 ms
Frequency Start Delay	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Current Differential Start Delay	0.03 - 1.00 sec.	0.01 s	+ 60ms, - 0 ms
Generic 1	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Generic 2	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Generic 3	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Generic 4	0 - 1200 sec.	1 s	+ 60ms, - 0 ms
Generic 5	0 - 1200 sec.	1 s	+ 60ms, - 0 ms

Ordering Information

Sample Catalog Number

The catalog number identification chart defines the electrical characteristics and operation features included in the EMR-5000. For example, if the catalog number were EMR-5000A0BA1, the device would have the following:

EMR-5000

- (A) - 16 Digital Inputs, 9 Output Relays, Zone Interlocking, URTD Interface
- (0) - 5A/1A phase and ground CTs, Power Supply Range: 19-300 Vdc, 40-250 Vac
- (B) - Modbus-RTU (RS-485)
- (A) - Without Conformal Coating
- (1) - Projection Panel Mount

Table 1. Catalog Ordering Information for EMR-5000 Eaton Motor Relay

EMR-5000 Eaton Motor Relay Removable Terminals						
EMR-5000	A	0	B	A	1	
Choose from the following options.						
Hardware Option 1						
16 DI, 9 Outputs, Zone Interlocking, URTD Interface, IRIG-B, Large Display	A					
8 DI, 9 Outputs, 2 AI + 2AO, Zone Interlocking, URTD Interface, IRIG-B, Large Display	B					
Hardware Option 2						
Phase Current 5A/1A, Ground Current 5A/1A, Power Supply Range: 19-300 Vdc, 40-250 Vac		0 (Zero)				
Phase Current 5A/1A Sensitive Ground Current, 0.5A/0.1A, Power Supply Range: 19-300 Vdc, 40-250 Vac		1				
Communication Options						
Modbus-RTU (RS-485)			B			
IEC-61850 (Goose)			H			
Modbus-RTU (RS-485) + Modbus-TCP (RJ-45)			I			
Conformal Coating Options						
None				A		
Conformal Coated Circuit Boards				B		
Mounting Options						
Standard Mount						0 (Zero)
Projection Panel Mount						1

Table 2. Standard Accessories EMR-5000

Catalogue Number	Description
URTDII-01	UNVL RTD Mod with Modbus-RTU 48-240VAC/48-250VDC
URTDII-02	UNVL RTD Mod with Modbus-RTU 24-48VDC
MPFO-25	25 M FIBER OPTIC CABLE FOR RELAYS/URTD COMMUNICATIONS
MPFO-1	1 M FIBER OPTIC CABLE FOR RELAYS/URTD COMMUNICATIONS
MPFO-10	1 OM FIBER OPTIC CABLE FOR RELAYS/URTD COMMUNICATIONS
MPFO-5	5 M FIBER OPTIC CABLE FOR RELAYS/URTD COMMUNICATIONS
66B2214G01	E-Series RS-232 Null Modem Cable
66B2214G02	E-Series USB to RS-232 Converter
66B2214G03	E-Series RS-232 Cable & USB to RS-232 Converter