**Key features, functions and benefits**

- Microprocessor-based protection with monitoring, and control for medium voltage motors.
- Integral test function reduces maintenance time and expense.
- 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).
- Front USB port and Powerport-E software provides local computer access and user-friendly windows based interface for relay settings, configuration, and data retrieval.
- Fast and 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.

**General description**

Eaton’s EMR-3MP0 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-3MP0 relay is a current only device that provides complete and reliable motor protection, monitoring, and starting control functions. The EMR-3MP0 has been specially designed to simplify the settings and configuration providing a user experience very similar to the now obsolete Eaton MP-3000 motor relay. See pages 12–15 for information on the MP-3000 to EMR-3MP0 retrofit relay kit.

The EMR-3MP0 motor protection relay has removable terminal blocks, and multiple communications options.

The EMR-3MP0 motor protection relay has three-phase and one ground current inputs. It can be used with either a 5A or 1A CTs. The ground protection can be used with either a zero sequence ground CT or from the residual connection of the phase CTs. The zero sequence ground CT provides greater ground fault sensitivity than the residual connection. The unit is user programmable for 60 Hz or 50 Hz operation.

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 USB port is provided for direct computer connection. An RS-485 communication port on the back is standard for local area networking using Modbus-RTU or DNP3. An optional Ethernet port and various protocols are available.

The EMR-3MP0 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 wear information and oscillography data.

The EMR-3MP0 motor protection relay has four discrete inputs and 1 fiber optic input, 1 form C, and 2 NO programmable contacts, 1 form C healthy contact. It also has 4-20 mA analog output. The unit also comes 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.
Features

Protection features (trip and alarm elements)
- Thermal protection (49/51)
  - Locked rotor protection (49S/51)
- Phase overcurrent elements:
  - Two instantaneous elements with timers (50P[1], 50P[2])
- Ground overcurrent elements:
  - Two instantaneous measured elements with timers (50X[1], and 50X[2])
- Jam or stall protection (50J[1], 50J[2])
- Phase unbalance negative sequence overcurrent (46[1], 46[2]).
- Underload protection (37[1], 37[2]).
- Temperature protection with optional URTD (49/38).
  - Stars per hour (66)
  - Lockout protection (86).
  - Trip bypass (50BF).

Metering features
- Ampere: positive, negative and zero sequence.
- Ampere demand.
- % THD I.
- Magnitude THD I.
- Minimum/maximum recording
- Temperature with remote URTD module

Monitoring features
- Oscillography (6000 cycles total).
- Fault data logs (up to 20 events).
- Sequence of events report (up to 300 events).
- Trending (load profile over time)
- Motor history
- Records the last 5 motor start profiles.
- Motor start trending.
- CT supervision
- Clock (1 ms time stamping).

Control functions
- Transition for reduced voltage starts
- Incomplete sequence delay
- Permits numbers of cold starts
- Limits numbers of starts per hour
- Anti-backspin time delay
- Mechanical load shedding
- Zero speed switch for long acceleration motors
- Motor stop inputs
- Remote trip input
- Differential trip input
- Emergency override
- Remote open-close (stop-start)

Communication features
- Local HMI.
- Password protected.
- Addressable.
- Local communication port.
  - USB
- Remote communication port:
  - RS-485 terminals
  - Ethernet RJ45
  - Fiber optic ST
  - RS-485 D-SUB
  - LC duplex fiber optic
- Protocols:
  - Modbus-RTU
  - Modbus-TCP
  - IEC-61850
  - DNP3-RTU
  - DNP3-TCP/UDP
  - Profibus-DP
- Configuration software
  - Powerport-E
Protection and control functions

The Eaton’s EMR-3MP0 motor protection relay has been designed for maximum motor operation and protection. It permits running the motor close to its design limits while protecting it against excessive heating and damaging overload conditions. The EMR-3MP0 field proven protection algorithms were developed based on motor designs and operating parameters for optimum operation and protection while minimizing nuisance tripping. The EMR-3MP0 motor protection relay utilizes a patented protection algorithm and measurement technique based on proven positive and negative (unbalance) sequence current sampling and true RMS calculations.

Intel-I-Trip (I2t) overprotection

The EMR-3MP0 motor relay features the exclusive Eaton Intel-I-Trip intelligent overload protection system. Intel-I-Trip develops custom overload curves simply from motor nameplate data. Intel-I-Trip protects motors from potentially damaging overload and abnormal operating conditions. The Intel-I-Trip intelligent overload protection feature utilizes field proven measurement techniques and a patented motor thermal protection model. The EMR-3MP0 motor relay’s unique measurement technique samples the current waveforms 36 times per cycle, providing accurate measurements of the positive and negative sequence currents. The negative sequence current causes a greater heating effect on the rotor and has a greater impact on the thermal model in the relay. Intel-I-Trip utilizes these measurements in its motor model to safely protect the motor against the heating effects of these currents.

The motor thermal model is analogous to a bucket that is being filled and drained at the same time. The fill rate is dependent on the motor currents and the drain is based on motor design principles. The size of the bucket is equivalent to the thermal capacity associated with the mass of the motor. Intel-I-Trip integrates these rates and will issue a trip when the thermal capacity is filled.

Intel-I-Trip features adaptive trip characteristics that adjust the trip times based on measured motor temperature when RTDs are used.

Instantaneous overcurrent

The EMR-3MP0 motor protection relay provides an instantaneous phase overcurrent function to trip the motor for high fault current levels and save the fuses. This function can be disabled and has an adjustable time delay on starting to avoid nuisance tripping inrush.

Phase unbalance protection

Motor supply circuits are often fed through fuses and can be run with a single-phase fuse blown, referred to as single phasing the motor. The EMR-3MP0 motor protection relay measures the current unbalance and can be used to alarm or trip the motor before damage occurs. Pickup, start, and run timers and a second element for alarm purposes are provided.

Ground fault protection

A separate measuring circuit is used to measure ground current. A ground CT is recommended for more sensitive protection against winding insulation breakdown to ground. The relay ground circuit can be connected residually from the three-phase CTs. The ground fault protection has pickup and time delay set points or can be disabled.

Jam protection

The user-selectable jam function protects motors that are running against a sudden mechanical jam or stall condition. The common application is on motors used on crushers, chippers, or conveyors. It detects an increase of motor current to a level above full load. Pickup, start, and run timers and a second element for alarm purposes are provided.

Underload protection

The user selectable underload function is used to detect the loss of load on the motor. Coupling failure is a common cause for loss of load. Pickup, start, and run timers and a second element for alarm purposes are provided.

Reduced voltage starting

The EMR-3MP0 motor protection relay provides a transition and incomplete sequence function for reduced voltage starting. The user can select to transition based on the current level and/or on time.

Antibackspin

The stop function is programmable from 2–20%. For certain applications, such as pumping a fluid up a pipe, the motor may be driven backward for a period of time after it stops. The EMR-3MP0 relay provides an antibackspin timer to prevent starting the motor while it is spinning in the reverse direction. The timer begins counting from the moment a stop is declared by the relay.

Start control timers

Motors typically have limits to the number of cold starts, starts per hour period, or time between starts that are permitted without damage. The EMR-3MP0 motor protection relay incorporates these timers to prevent starting the motor beyond its capabilities.

Load shedding

The EMR-3MP0 motor protection relay provides a mechanical load shedding feature that can be used to control an upstream process. The load-shedding function closes a contact on an overload condition to control an upstream process from adding more load until the overload condition is gone.

Emergency override

The EMR-3MP0 motor protection relay has a user-programmable feature that will let the operator reset the start inhibitor timers and thermal overload bucket. This function is intended for use in emergency conditions only, and it may result in motor damage or failure.

Long acceleration motors

Large motors with a high inertia may experience starting currents that exceed the locked rotor current and time. The EMR-3MP0 motor protection relay has logic and provisions for a zero speed switch input to differentiate between a stall and start condition. If the motor is spinning, then the relay will not trip on the normal locked rotor-time allowing the motor to start.

Remote/differential trip

The digital inputs can be programmed to accept a contact input from a separate differential relay or other device to trip the motor. This provides local and remote target information and utilizes the trip contacts of the EMR-3MP0 motor protection relay. It will also record and log the motor information at the time of the trip.
EMR-3MP0 motor protection relay

Breaker failure or stuck contactor
The EMR-3MP0 motor protection relay includes a breaker failure (50BF, 62BF) or trip bypass function that can be initiated from either an internal or external trip signal. This is an independent element that can be used to operate a lockout relay or trip an upstream breaker. The timer must be longer than the breaker operating time and the protective function reset times.

Flexible phase rotation
The EMR-3MP0 motor protection relay can be applied on either an A-B-C or A-C-B phase rotation. A user setting permits correct operation and indication of the actual system configuration.

Monitoring and metering

Sequence of events records
The EMR-3MP0 protection relay records a maximum of 300 events associated with the relay. An event is classified as a change of state as detected by the relay. These include relay pickups, dropouts, trips, contact closure, alarms, setting changes and self-diagnostic failures. Each event is date and time stamped to a 1 ms resolution. The events are stored in a FIFO in chronological order.

Trip log
The EMR-3MP0 protection relay will store a maximum of 20 trip records in a FIFO trip log. Each trip record will be date and time stamped to a 1 ms resolution. The trip log record will include information on the type of fault, protection elements that operated, fault location and currents and voltages at the time of the fault.

Waveform capture
The EMR-3MP0 motor protection relay provides oscillography-recording capabilities. The relay will record all measured signals along with the binary signals of pickup, trip, logic and contact closures. The EMR-3MP0 relay can record up to 6000 cycles of data. The number of records is proportional to the size of each record; the maximum size per record is 600 cycles. The waveform capture is initiated by up to 8 different triggers; it can also be generated manually through the display or via communications.

Integral user interface
The front panel user interface has a 128 x 64 pixel LCD display with background illumination for wide angle viewing in all light conditions. 7 programmable LEDs provide quick and easy visual display of power on, mode of operation, alarm and trip indication. Soft keys are provided for operation mode selection, scrolling through data and settings. In addition, the relay settings and test functions are password protected.

Starting profiles
The EMR-3MP0 records the average current versus time for the last five starting cycles. This information is available via the communications port through Powerport-E.

Motor statistics
For each motor start, the EMR-3MP0 stores a motor start report and add this data to the motor statistics buffer. With the motor statistics you can track motor start data for the past eighteen 30-day periods. For each 30-day interval, the relay records the following information:

- The date the interval began
- The total number of starts in the interval
- The averages of the following quantities:
  - Motor start time
  - Start % rotor thermal capacity used
  - Maximum start current
Typical AC connection 5A CTs, and ground current measured by Zero Sequence CT.

3-phase, 3-wire IG measure standard 1/5A removable CT block

3-phase, 3-wire IG measure MP compatible 5A fixed CT block

Figure 1. Typical AC connections. 5A CTs, and ground current measured by Zero Sequence CT.
EMR-3MP0 motor protection relay

Functional overview

Figure 2. Functional overview.

Typical control diagram

Figure 3. Typical control diagram.

* This relay has to be a normally open to ensure that protection is enabled when motor is started.
Communication software

Eaton provides PowerPort-E configuration software. It runs on a PC or laptop for easy access to a single relay to change set points or configuration and to view metered values and stored data. PowerPort-E is free and can be downloaded from the Eaton web site at the following URL:

www.Eaton.com/pr

Figure 4. Powerport-E - EMR 3MP0 settings.
Load profiling/trending
The EMR-3MP0 relay automatically records selected quantities into non-volatile memory every 5, 10, 15, 30, or 60 minutes, depending on the trending report setting.

Programmable I/O
The EMR-3MP0 motor protection relay provides heavy-duty, trip-rated, 2 normally open and 2 form C contacts. One form C contact is dedicated to the relay failure alarm function and is operated in a normally energized (failsafe) mode. There are 4 discrete inputs that accept 120VAC inputs.

Drilling

![Drilling Plan]

Figure 5. Drilling plan.
Projection mount front and side views

Figure 6. Projection mount front and side views.
Standard mount front and side views

Figure 7. Standard mount front and side views.
MP-3000 replacement kit information

The MP-3000 replacement kit consists of 3 parts; EMR-3MP0 relay, cutout adapter panel and conversion box assembly. This kit is denoted by the -1 at the end of the EMR-3MP0 catalog number (see page 22). Please see the information below for details in installing the kit.

Standard MP-3000/retrofit cutout and drilling pattern

![Drilling pattern diagram](image_url)

**Figure 8. Drilling pattern.**
Basic installation steps for replacing MP-3000 with EMR-3MP0. See "MP-3000 to EMR-3MP0 installation instructions" at eaton.com/EMR under Resources > Installation instructions for more information.

**Step 1: Mount EWR-3MP0 into existing MP3000 cutout.**

![Figure 9. Mount EWR-3MP0 into existing MP3000 cutout.](image)

**Step 4: Slide the conversion box assembly down into the relay body.**

![Figure 10. Slide the conversion box assembly down into the relay body.](image)
Figure 11. Step 6 - Secure conversion box assembly ground wire to relay ground stud.

See "MP-3000 to EMR-3MP0 installation instructions" at eaton.com/EMR under Resources > Installation instructions for full installation instructions.
Conversion box internal wiring between MP3000 compatible terminals and EMR-3MP0 terminals.

**Figure 12.** Conversion box internal wiring between MP3000 compatible terminals and EMR-3MP0 terminals.
Figure 13. MP3000 wiring diagram.
Figure 14. EMR-3MP0 wiring diagram.
# MP-3000 settings pages and EMR-3MP0 translation

## Table 1. Page 1, SP motor settings for motor constants

<table>
<thead>
<tr>
<th>Line #</th>
<th>Display</th>
<th>Help message</th>
<th>EMR-3MP0 Parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FLA XXXX</td>
<td>Full load amps</td>
<td>FLA</td>
<td>Current in amps</td>
</tr>
<tr>
<td>2</td>
<td>LRC XXXX</td>
<td>Locked-rotor current % of FLA</td>
<td>LRC</td>
<td>*Multiples of FLA</td>
</tr>
<tr>
<td>3</td>
<td>LRT XXX</td>
<td>Maximum allowable stall time in seconds</td>
<td>LRTC</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>4</td>
<td>UTC XXX</td>
<td>Ultimate trip current in %FLA</td>
<td>UTC</td>
<td>*Multiples of FLA</td>
</tr>
<tr>
<td>5</td>
<td>PCT XXXX</td>
<td>Phase CT ratio numerator in primary amp</td>
<td>CT pri</td>
<td>Main CT primary rating</td>
</tr>
<tr>
<td>6</td>
<td>GCT XXXX</td>
<td>Ground CT ratio numerator in primary amp</td>
<td>XCT pri</td>
<td>Ground or aux CT primary rating</td>
</tr>
<tr>
<td>7</td>
<td>FREQ 50 or FREQ 60</td>
<td>50 - For 50 hertz 60 - for 60 hertz</td>
<td>f</td>
<td>50Hz or 60Hz</td>
</tr>
<tr>
<td>8</td>
<td>REV or NON REV</td>
<td>Reversing or nonreversing starter</td>
<td>Reversing</td>
<td>*Active or inactive</td>
</tr>
<tr>
<td>9</td>
<td>STOP X</td>
<td>Motor stop current level in % of phase CT ratio</td>
<td>STPC</td>
<td>*Multiples of FLA</td>
</tr>
</tbody>
</table>

## Table 2. Page 2, SP RTD settings for RTD inputs

<table>
<thead>
<tr>
<th>Line #</th>
<th>Display</th>
<th>Help message</th>
<th>EMR-3MP0 parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RTD IN °C or RTD in °F</td>
<td>Displayed in degrees °C or °F</td>
<td>Temperature unit</td>
<td>Celsius or Fahrenheit</td>
</tr>
<tr>
<td>2</td>
<td>WD T XXX</td>
<td>Winding temp trip</td>
<td>WD group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>3</td>
<td>WD A XXX</td>
<td>Winding temp alarm</td>
<td>WD group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>4</td>
<td>MB T XXX</td>
<td>Motor bearing trip</td>
<td>MB group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>5</td>
<td>MB A XXX</td>
<td>Motor bearing alarm</td>
<td>MB group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>6</td>
<td>LB T XXX</td>
<td>Load bearing trip</td>
<td>LB group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>7</td>
<td>LB A XXX</td>
<td>Load bearing alarm</td>
<td>LB group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>8</td>
<td>AX T XXX</td>
<td>Auxiliary trip</td>
<td>Aux group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>9</td>
<td>AX A XXX</td>
<td>Auxiliary alarm</td>
<td>Aux group</td>
<td>Activate then set temp</td>
</tr>
<tr>
<td>10</td>
<td>DIAG ON or DIAG OFF</td>
<td>Alarm on RTD failure diagnostic</td>
<td>(Always on)</td>
<td></td>
</tr>
</tbody>
</table>

## Table 3. Page 3, SP trip settings for trip events

<table>
<thead>
<tr>
<th>Line #</th>
<th>Display</th>
<th>Help message</th>
<th>EMR-3MP0 parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GFT XXX</td>
<td>Ground fault trip level in % of ground ct ratio</td>
<td>50X[1] - Meas. inst. OC/pickup</td>
<td>*Multiples of ground CT numerator</td>
</tr>
<tr>
<td>2</td>
<td>GFSD XX</td>
<td>Ground fault start delay in cycles</td>
<td>t-Blo-GOF</td>
<td>*Time in seconds</td>
</tr>
<tr>
<td>3</td>
<td>GFRD XX</td>
<td>Ground fault run delay in cycles</td>
<td>50X[1] - Meas. inst. OC/t</td>
<td>*Time in seconds</td>
</tr>
<tr>
<td>4</td>
<td>IOC XXX</td>
<td>Instantaneous overcurrent start delay in %FLA</td>
<td>50F[1] - Phase inst. OC/pickup</td>
<td>*Multiples of phase CT numerator</td>
</tr>
<tr>
<td>5</td>
<td>IOCSD XX</td>
<td>Instantaneous overcurrent start delay in cycles</td>
<td>t-Blo-IOC</td>
<td>*Time in seconds</td>
</tr>
<tr>
<td>6</td>
<td>JMT XXX</td>
<td>Jam trip level in % FLA</td>
<td>5G[1] - Jam-stall/pickup</td>
<td>*Multiples of FLA</td>
</tr>
<tr>
<td>7</td>
<td>JMSD XX</td>
<td>Jam trip and alarm delay in seconds</td>
<td>t-Blo-JAM</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>8</td>
<td>JMR XX</td>
<td>Jam trip delay in seconds</td>
<td>5G[1] - Jam-stall/t</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>9</td>
<td>ULT XXX</td>
<td>Underload trip level in % FLA</td>
<td>37[1] - Underload/pickup</td>
<td>*Multiples of FLA</td>
</tr>
<tr>
<td>10</td>
<td>ULSD XXX</td>
<td>Underload trip and alarm delay in seconds</td>
<td>t-Blo-Underload</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>11</td>
<td>ULTR XXX</td>
<td>Underload trip run delay in seconds</td>
<td>37[1] - Underload/t</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>12</td>
<td>UBT XXX</td>
<td>Phase unbalance trip level</td>
<td>46[1] - I Unbalance/%(I2/I1)</td>
<td>*Set threshold separately</td>
</tr>
<tr>
<td>13</td>
<td>UBSD XXX</td>
<td>Phase unbalance trip and alarm delay in seconds</td>
<td>t-Blo-Unbalance</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>14</td>
<td>UBTR XXX</td>
<td>Phase unbalance trip run delay in seconds</td>
<td>46[1] - I Unbalance/t</td>
<td>Time in seconds</td>
</tr>
</tbody>
</table>
Table 4. Page 5, SP start settings for start events

<table>
<thead>
<tr>
<th>Line #</th>
<th>Display</th>
<th>Help message</th>
<th>EMR-3MP0 parameter</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ST/T XXX</td>
<td>Starts per time allowed</td>
<td>SPH</td>
<td>Starts per hour</td>
</tr>
<tr>
<td>2</td>
<td>T/ST XXX</td>
<td>Time allowed for starts count in minutes</td>
<td>No setting - fixed at 1 hour</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TBS XXX</td>
<td>Time between starts in minutes</td>
<td>TBS timer</td>
<td>Time in minutes</td>
</tr>
<tr>
<td>4</td>
<td>NOCS X</td>
<td>Number of cold starts allowed</td>
<td>NOCS</td>
<td>1-5</td>
</tr>
<tr>
<td>5</td>
<td>TRNC XXX</td>
<td>Motor start transition current level in %FLA</td>
<td>Start control/TRNC</td>
<td>*Multiples of FLA</td>
</tr>
<tr>
<td>6</td>
<td>TRNT XXX</td>
<td>Motor start transition time in seconds</td>
<td>TRNT</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>7</td>
<td>TRN+T</td>
<td>Transition on event</td>
<td>TRN criteria</td>
<td>Default is TRN T and I</td>
</tr>
<tr>
<td>8</td>
<td>INSD XXX</td>
<td>Incomplete sequence report back time</td>
<td>INSQReportTime</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>9</td>
<td>INSD TRN or INSD ST</td>
<td>Incomplete sequence start time</td>
<td>INSQReportFrom</td>
<td>*InSq Start2Run or InSq Stop2Start</td>
</tr>
<tr>
<td>10</td>
<td>LAT XXX</td>
<td>Long acceleration time in seconds</td>
<td>LAT timer</td>
<td>Time in seconds</td>
</tr>
<tr>
<td>11</td>
<td>ZSW ON or ZSW OFF</td>
<td>Zero speed switch on discrete input 1 on or off</td>
<td>ZSS</td>
<td>*Active or Inactive</td>
</tr>
<tr>
<td>12</td>
<td>ABK XXXX</td>
<td>Anti-backspin delay time in seconds</td>
<td>ABK</td>
<td>Time in seconds</td>
</tr>
</tbody>
</table>

For full list of settings and E-Series software menu tree locations see document “MP-3000 to EMR-3MP0 settings sheet” at eaton.com/EMR under Resources > Installation instructions

Standards, certifications and ratings

Specifications

Climatic environmental conditions

- Storage temperature: -25°C up to +70°C (-13°F to 158°F)
- Operating temperature: -20°C up 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: IP30

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 B1: height / width 183 mm (7.205 in.)/ 141.5 mm (5.571 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 EMR-3000 housing B1: approx. 2.4 kg (5.291 lb)

Plug-in connector with integrated short-circuiting (conventional current inputs)

- Nominal current: 1 A and 5 A
- Continuous loading capacity: 4 x In / continuously
- Overcurrent withstand: 30 x In / 10 s
- 100 x In / 1 s
- 250 x In / 10 ms (1 half-wave)
- Screws: M4, captive type acc. to VDEW
- Connection cross sections:
  - 2 x 2.5 mm² (2 x AWG 14) with wire end ferrule.
  - 1 x or 2 x 4.0 mm² (2 x AWG 12) with ring cable sleeve or cable sleeve.
  - 1 x or 2 x 6mm² (2 x AWG 10) with ring cable sleeve or cable sleeve.

Voltage supply

- Aux. voltage: 19 - 300 Vdc / 40 – 250 Vac
- Buffer time in case of supply failure: > = 50 ms at minimal aux. voltage communication is permitted to be interrupted.
- 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 5 x 20 mm (approx. 0.2 x 0.8 in.) according to IEC 60127
  - 3.5 A time-lag miniature fuse 6.3 x 32 mm (approx. 0.25 x 1.25 in.) according to UL 248-14

Power consumption

- Power supply range:
  - 19 – 300 Vdc: 6 W idle mode/ 8 W max. power
  - 40 – 250 Vac 6 W idle mode/ 8 W max. power (For frequencies of 40-70 Hz)
Real time clock
- Running reserve of the real time clock: 1 year min.

Display
- Display type: LCD with LED background illumination
- Resolution - graphics display: 128 x 64 pixel
- LED - type: two colored: red / green
- Number of LEDs, housing B1: 8

Digital inputs
- Max. input voltage: 300 Vdc / 270 Vac
- Input current: <4 mA
- Reaction time: <20 ms
- Fallback time: <30 ms
- (Safe state of the digital inputs)
- Switching thresholds: Un = 24 Vdc, 48 Vdc, 60 Vdc,
  110 Vac / dc, 230 Vac / dc Un = 24 Vdc
- Switching threshold 1 ON:
- Switching threshold 1 OFF:
  - Min. 19.2 Vdc
- Max. 9.6 Vdc
  - Un = 48 V / 60Vdc
  - Switching threshold 2 ON:
  - Switching threshold 2 OFF:
    - Min. 42.6 Vdc
    - Max. 21.3 Vdc
    - Un = 110 / 120 Vac / dc
    - Switching threshold 3 ON:
    - Switching threshold 3 OFF:
      - Min. 88.0 Vdc / 88.0 Vac
      - Max. 44.0 Vdc / 44.0 Vac
      - Un = 230 / 240 Vac / dc
      - Switching threshold 4 ON:
      - Switching threshold 4 OFF:
        - Min. 184 Vdc / 184 Vac
        - Max. 92 Vdc / 92 Vac
        - Terminals: screw-type terminal
  
Current and ground current measurement
- Nominal currents: 1 A / 5 A
- Max. measuring range:
  - Up to 40 x In (phase currents)
  - Up to 25 x In (ground current standard)
  - Up to 2.5 x In (ground current sensitive)
- Continuous loading capacity: 4 x In/continuously
- Overcurrent proof:
  - 30 x In / 10 s
  - 100 x In / 1 s
  - 250 x In / 10 ms (1 half-wave)

  - Power consumption: phase current inputs
    - At In = 1A burden = 0.15 mVA
    - At In = 5A burden = 0.15 mVA
  - Ground current input
    - At In = 1A burden = 0.35 mVA
    - At In = 5A burden = 0.35 mVA
  - Frequency range: 50 Hz / 60 Hz ±10%
  - Terminals: screw-type terminals with integrated short-circuiters (contacts)

Binary output relays
- Continuous current: 5 A ac/dc
- Switch-on current: 25 A ac/dc for 4 s
- Max. breaking current: 5 A ac up to 125 V ac
- 5 A dc up to 50 V (resistive)
- 0.2 A dc at 300 V
- Max. switching voltage: 250 V ac/300 V dc
- Switching capacity: 2000 VA
- Contact type: 1 changeover contact
- Terminals: screw-type terminals

RS485
- Master/slave: slave
- Connection: 6 screw-clamping terminals RM 3.5 mm (138 MIL) (terminating resistors internal)

Design standards
- Generic standard EN 61000-6-2, EN 61000-6-3
- Product standard EC 60255-6, EN 50178
- UL 508 (industrial control equipment)
- CSA C22.2 No. 14-95 (industrial control equipment)
- ANSI C37.90

Tolerances of the real time clock
- Resolution: 1 ms
- Tolerance: < 1 minute / month (+20°C)

Measuring accuracy
- Max. measuring range: up to 40 x ln (phase currents)
- Up to 25 x ln (ground current standard)
- 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 > In: ±0.5% of the measured value
- Amplitude error if I > 2 In: ±1.0% of the measured value
- Resolution: 0.01 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 parametrized nominal frequency
- Temperature influence: ±1% within the range of 0°C up to +60°C
**Protection elements tolerances**

*Note:* The tripping delay relates to the time between pickup and trip. The tolerance of the operating time relates to the time between the measured value has exceeded the threshold until the protection stage is alarmed.

**Table 5. Protection stages tolerances**

<table>
<thead>
<tr>
<th>Protection elements</th>
<th>Range</th>
<th>Step</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overcurrent protection elements: 50P(x)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup</td>
<td>If the pick-up value is exceeded the module stage is started</td>
<td>0.01 x in</td>
<td>±1.5% of the setting value resp. 1% x In</td>
</tr>
<tr>
<td>Resetting ratio</td>
<td></td>
<td></td>
<td>97% or 0.5% x In</td>
</tr>
<tr>
<td>t</td>
<td>Tripping delay</td>
<td>0.00 x s</td>
<td>DEFT ±1% resp. ±10 ms</td>
</tr>
<tr>
<td>Operating time</td>
<td>Starting from I higher than 1.1 x I&gt;</td>
<td>&lt;35 ms</td>
<td></td>
</tr>
<tr>
<td>Disengaging time</td>
<td></td>
<td></td>
<td>&lt;45 ms</td>
</tr>
<tr>
<td><strong>Ground current stages: 50G (X), 50N(x)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pickup</td>
<td>If the pick-up value is exceeded the module stage is started</td>
<td>0.01 x in</td>
<td>±1.5% of the setting value resp. 1% x In</td>
</tr>
<tr>
<td>Resetting ratio</td>
<td></td>
<td></td>
<td>97% or 0.5% x In</td>
</tr>
<tr>
<td>t</td>
<td>Tripping delay</td>
<td>0.00 x s</td>
<td>DEFT ±1% resp. ±10 ms</td>
</tr>
<tr>
<td>Operating time</td>
<td>Starting from IG higher than 1.1 x IG&gt;</td>
<td>&lt;35 ms</td>
<td></td>
</tr>
<tr>
<td>Disengaging time</td>
<td></td>
<td></td>
<td>&lt;45 ms</td>
</tr>
<tr>
<td><strong>Circuit Breaker Failure Protection 50BF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-CBF&gt;</td>
<td>If the pick-up value is exceeded the module stage is started</td>
<td>0.0 x in</td>
<td>±1.5% of the setting value resp. 1% x In</td>
</tr>
<tr>
<td>Resetting ratio</td>
<td></td>
<td></td>
<td>0.5% x In</td>
</tr>
<tr>
<td>t-CBF</td>
<td>If the delay time is expired an CBF alarm is given out</td>
<td></td>
<td>&lt;40 ms</td>
</tr>
<tr>
<td>Operating time</td>
<td>Starting from I higher than 1.3 x ICBF&gt;</td>
<td></td>
<td>&lt;40 ms</td>
</tr>
<tr>
<td>Disengaging time</td>
<td></td>
<td></td>
<td>&lt;40 ms</td>
</tr>
</tbody>
</table>
# Ordering information

## Sample catalog number

The catalog number identification chart defines the electrical characteristics and operation features included in the EMR-3MP0. For example, if the catalog number were EMR-3MP0-2A0BB1-1, the device would have the following:

**EMR-3MP0-2**

(A) - four digital inputs, four output relays, 1 4-20 mA analog output, URTD interface

(0) - 5A phase and ground CTs, power supply range: 19-300 Vdc, 40-250 Vac

(B) - Modbus-RTU or DNP3 (RS-485)

(B) - With conformal coating

(1) - Projection panel mount

(-1) - MP mounting plate and terminal adapter

## Table 6. Catalog ordering information for EMR-3MP0 Eaton motor relay.

<table>
<thead>
<tr>
<th>EMR-3MP0 Eaton motor relay</th>
<th>EMR-3MP0-2</th>
<th>A</th>
<th>0</th>
<th>B</th>
<th>A</th>
<th>1</th>
<th>-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose from the following options.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Hardware option 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 DI, 4 outputs, removable terminals, 1 4-20mA analog output, URTD interface,</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hardware option 2</strong></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>(Zero)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard CT input terminals with shorting block: phase current 1 A / 5 A, ground current 1 A / 5 A, power supply range: 19…300 Vdc, 40…250 Vac.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>MP-3000- compatible CT input terminals: phase current 5 A, ground current 5 A, power supply range: 19…300 Vdc, 40…250 Vac.</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communication options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus/DNP3 RTU over RS485</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus/DNP3 TCP over Ethernet RJ45</td>
<td>C</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Profibus-DP over fiber optic ST</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profibus-DP over D-SUB / RS485</td>
<td>E</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Modbus RTU or DNP3 RTU over fiber optic ST</td>
<td>F</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Modbus/DNP3 RTU over D-SUB / RS485</td>
<td>G</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>IEC61850/Modbus/DNP3 TCP over Ethernet RJ45</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus/DNP3 RTU over RS485 or Modbus/DNP3 TCP over Ethernet RJ45</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IEC61850/Modbus/DNP3 TCP over LC duplex FO Ethernet</td>
<td>K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus/DNP3 TCP over LC duplex FO Ethernet</td>
<td>L</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Modbus RTU + DNP3.0 RTU (RS485 / terminals) + IEC 61850 + Modbus TCP + DNP3.0 TCP/UDP (Ethernet 100MB, RJ45)</td>
<td>T</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Conformal coating options</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Conformal coated circuit boards</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mounting options</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard mount</td>
<td></td>
<td></td>
<td>0 (Zero)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection panel mount</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special narrow projection bezel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP-3000 retrofit mounting plate and terminal adapter (requires projection panel mount option 1 or 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-1</td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Catalog ordering information for EMR-3MP0 Eaton motor relay (continued).

<table>
<thead>
<tr>
<th>Catalog number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>URTDI-01</td>
<td>UNVL RTD mod with Modbus-RTU 48-240VAC/48-250VDC</td>
</tr>
<tr>
<td>URTDI-02</td>
<td>UNVL RTD mod with Modbus-RTU 24-48VDC</td>
</tr>
<tr>
<td>ER-IQRETROKIT</td>
<td>E-Series 3000 IQ adapter kit projection mounted*</td>
</tr>
<tr>
<td>MPFO-1</td>
<td>1 M fiber optic cable for relays/URTD communications</td>
</tr>
<tr>
<td>MPFO-5</td>
<td>5 M fiber optic cable for relays/URTD communications</td>
</tr>
<tr>
<td>MPFO-10</td>
<td>10M fiber optic cable for relays/URTD communications</td>
</tr>
<tr>
<td>MPFO-25</td>
<td>25 M fiber optic cable for relays/URTD communications</td>
</tr>
<tr>
<td>ESERIESUSB6CB</td>
<td>E-Series mini USB cable 6 foot</td>
</tr>
</tbody>
</table>

*Mounting plate included in “-1” kit.
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