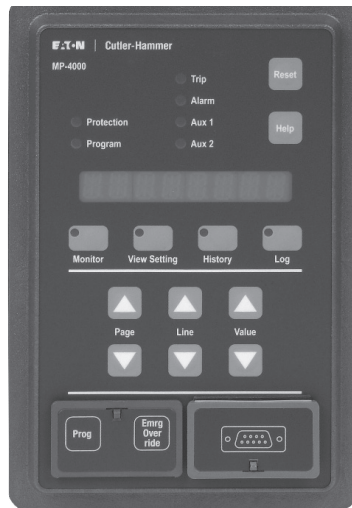


# MP-4000 motor protection



## Product description

- Microprocessor-based, multifunctional motor protection
- Intel-I-Trip overload protection based on motor data
- Event recording and operational logging
- Motor start profile
- Optional quick release drawout case
- Used on AMPGARD™ and medium voltage assemblies
- “Help” menu provides user operational assistance

## Application description

The Cutler-Hammer MP-4000 motor protection relay by Eaton Corporation is a multifunctional microprocessor-based protective relay for the

protection of three-phase AC motors. The MP-4000 motor relay may be applied to any size motor at any voltage level. It is most commonly used on large, medium voltage three-phase induction motors. It has also been widely used on important low voltage (480V) motor applications and synchronous motors.

The MP-4000 motor relay monitors three-phase and ground currents and three-phase voltages. It provides motor overload, stall, short circuit, phase unbalance, single phasing over/undervoltage, underpower, power factor, and ground fault motor protection.

It can also be used to provide protection for a load jam or loss of load condition.

The MP-4000 motor relay provides start control logic to protect the motor against excessive starts or starting the motor before it has had sufficient time to cool down. The MP-4000 motor relay may be applied to either across-the-line starters or reduced-voltage starters. On reduced-voltage starters, the MP-4000 relay can control the switch from reduced voltage to full voltage based on time and/or motor transition. The MP-4000 can protect the starter against failure to transition to full voltage through contact feedback and an incomplete sequence function.

## MP-4000 motor relay

The MP-4000 motor relay is generally used on a motor starter or a breaker used for a motor load. The MP-4000 motor relay provides the intelligence to protect and control the motor against abnormal operating conditions. It monitors the currents from either a 5A or a 1A secondary of a CT circuit. Ground current may be obtained from either a ground CT or from the residual connection of the phase CTs. It provides a Form C contact output for controlling the starter contacts or breaker operation.



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The protection functions are listed below:

- I<sup>2</sup>t overload protection (49/51)
- Locked rotor (49S/51)
- Ultimate trip current (51)
- Current unbalance (46)
- Instantaneous overcurrent (50)
- Ground fault protection (50G)
- Undervoltage (27)
- Overvoltage (59)
- Under power (32)
- Voltage unbalance (47)
- Power factor (55)
- RTD trip and alarm with URTD module (49/38)
- Underload trip (37)
- Starts per time (66)
- Jam or stall (51R)
- Auto or manual reset (86)
- Fail-safe or non-fail-safe trip modes

The metering functions are:

- Metering:
  - Average current (I Ave)
  - Amperes: magnitude and angle in primary values
  - Amperes: positive, negative, and zero sequence
  - Average voltage (V Ave)
  - Voltage: magnitude and angle
  - Voltage: positive, negative, and zero sequence
  - Percent of full load
  - Percent current unbalance
  - Percent voltage unbalance
  - Power, vars, and VA
  - Power factor
  - Frequency
  - Energy metering with time and date stamps
- RTD temperatures:
  - Individual winding
  - Motor bearing
  - Load
  - Auxiliary temperatures
- Motor conditions:
  - Percent of I<sup>2</sup>t thermal bucket
  - Time before start
  - Remaining starts allowed
  - Oldest start time

## Features, benefits, and functions

- Complete motor protection and control in a single compact case reduces panel space requirements and wiring costs
- Microprocessor design with self diagnostics eliminates calibration and reduces installation, commissioning, and maintenance

- Programmable stop 2–20% of PCT
- Intel-I-Trip overload protection develops customized curve from manufacturer's supplied motor data
- Intel-I-Trip overload protection provides adaptive trip characteristics based on motor temperature when motor RTDs are connected through an optional URTD module
- Meets UL® 1053 ground fault protection standards that eliminates the need for a separate ground relay saving cost, space, wiring, and time
- Voltage dip/loss ride through capability reduces unnecessary trips caused by poor power quality
- Motor currents, temperatures, and conditions are monitored and displayed either locally or remotely
- Event log provides motor operating records for the most recent 20 trip or alarm events with date and time stamping. This information can improve troubleshooting and reduce downtime
- Log book records the most recent 100 events such as motor START/STOP and set point changes to provide a log of motor operation with date and time stamping
- RTD diagnostics reduce unnecessary tripping caused by faulty RTD, RTD wiring, or communications
- Arm/disarm feature improves security for critical motor applications
- Motor start profile verifies protection and motor starting coordination. This feature can be used to develop protection settings on old motors where data is not available
- Optional communication module and Eaton's Cutler-Hammer software simplifies setting, configuration, monitoring, commissioning, and data retrieval either locally or remotely
- Optional quick release drawout case construction simplifies relay removal and replacement

## Standards and certifications

The MP-4000 motor protection was designed to meet the industry standards for protective relays. It is recognized under UL® 1053 Ground Fault Protection Standard.

- UL recognized (File No. E154862)
- UL 1053 recognized
- UL 508 recognized
- ANSI C37.90, C37.90.1
- cUL®
- CSA®

## Options and accessories

### Additional related Cutler-Hammer products by Eaton Corporation

The MP-4000 is available in either a fixed mount or quick release drawout case. Both mountings use the same panel cutout.

The Universal RTD module (URTD) is required when the motor is equipped with RTDs that you wish to monitor and use for protection. The URTD can be mounted near the motor to reduce RTD wiring and costs.

The MP-4000 motor protection is designed to operate from 120 Vac or 240 Vac auxiliary control power. The MP-4000 motor relay can be used with DC control power with the addition of the IQDCPS. The IQDCPS is an inverter from DC to AC.

## Product specifications

### Control power

- Nominal rating:
  - 120 Vac or 240 Vac
  - +10%, -25%
- Operating range:
  - 120 Vac: 90 132 Vac
  - 240 Vac: 180 264 Vac
- Frequency: 50 or 60 Hz
- Power use:
  - 20 VA maximum
  - UR TD: 6 VA maximum
  - IP ON I: 1 VA maximum
- Ride-through time: 30 cycles from nominal Vac

### Current inputs

- Nominal ( $I_n$ ): 1A or 5A
- CT rating:
  - $2 \times I_n$  continuous
  - $50 \times I_n$  for 1 second
- Burdens:
  - < 0.25 VA at 5A
  - < 0.05 VA at 1A

### Voltage inputs

- Nominal: 120 Vac
- Operating range: 69 to 150 Vac
- Burden: 2 VA

### Metering accuracy

- Phase current:  $\pm 1\%$  of  $I_n$  (5–100%)
- Ground current:  $\pm 1.5\%$  of  $I_n$  (0–55%)

### Discrete inputs

- Number of inputs: 2 programmable
- Ratings:
  - 1.2 VA at 120 Vac
  - Maximum off = 36 Vac
  - Minimum on = 86 Vac

### Output contacts

- Number of outputs: 4 Form C, programmable
- Momentary:
  - Make 30A AC/DC for 0.25 seconds
  - Break 0.25A at 250 Vdc (resistive)
  - Break 5A at 120/240 Vac
- Continuous:
  - 5A at 120/240 Vac
  - 5A at 30 Vdc

### Analog output

- Rating:  $\pm 4$ –20 mA programmable
- Maximum load: 1K ohm
- Accuracy: 1%

### Motor overload protection ( $I^2t$ )

- Full load amperes: 10–3000A
- Locked rotor current: 300–1200% FLA

- Locked rotor time: 1–120 seconds
- Ultimate trip current: 85–150% FLA
- Phase CT ratio: 10–4000 ( $I_n$ )
- Ground CT ratio: 10–4000 ( $I_n$ )
- Timing accuracy:  $\pm 2.5\%$  or  $\pm 30$  ms for  $I > 1.1 \times$  U.T.C

### Trip setting range

- Ground fault (GF): off, 2–55% CT ratio
- GF start time delay: 2–60 cycles
- GF run time delay: 0–60 cycles
- Timer accuracy:  $\pm 20$  ms
- Instantaneous O.C.: off, 300–1600% FLA
- IOC start time delay: 2–60 cycles
- Timer accuracy:  $\pm 20$  ms
- Jam trip: off, 100–1200% FLA
- Underload trip: off, 1–90% FLA
- Current unbalance trip: off, 4–40%  $I_{neg}/I_{pos}$
- Start delay timers:
  - 0–120 seconds (underload and phase unbalance)
  - 0–1200 seconds (jam)
- Run delay timers: 0–240 seconds
- Timer accuracy:  $\pm 5\% + 100$  ms
- Voltage unbalance: off, 1–100V
- Percent  $V_2/V_1$ : 4% + 40%
- Voltage unbalance time delay: 0–1200 seconds
- Under/overvoltage time delay: off, 10–150V
- Under/overvoltage time delay: 0–1200 seconds
- Under/overfrequency: 15–60 Hz
- Under/overfrequency time delay: 0–60 seconds
- Power protection: off, 0.06–0.90 + FLA VT
- Power time delay: 0–1200 seconds
- Power factor: off, 0.05 lag–0.99 lead
- Power factor time delay: 0–60 seconds

### Alarm setting range

- Ground fault: off, 2–55% CT ratio
- Overload  $I^2t$ : off, 60–99%  $I^2t$
- Jam: off, 100–1200% FLA
- Underload: off, 1–90% FLA
- Current unbalance: off, 4–40%  $I_{neg}/I_{pos}$
- Run delay timers: 0–240 seconds

### Start control functions

- Starts per time: 1–10 starts
- Time for starts per time: off, 1–240 minutes
- Time between starts: off, 1–240 minutes
- Number of cold starts: 1–5 starts
- Motor transition current: 10–300% FLA
- Time for transition: 0–1200 seconds
- Inc. sequence timer: off, 1–240 seconds
- Long acceleration timer: off, 1–1200 seconds
- Anti-backspin timer: off, 1–3600 minutes

**RTD inputs (requires URTD module)**

- Sensor types:
  - 10 ohm copper
  - 100 ohm nickel
  - 120 ohm nickel
  - 100 ohm platinum

**URTD module communications**

- Interface:
  - Electrical (3-wire)
  - Fiber optic (preferred)
- Fiber optic cable: Type HBFR-ERS or EUS

**Clock**

- Accuracy: ±1 minute/month at 25°C

**IPONI communications**

- Type: 2-wire, FSK
- Baud rate: 1200 or 9600 baud
- Protocol: INCOM™
- Functions:
  - Read/write set points
  - Read metered values
  - Read trip/alarms
  - Read events/history
  - View starting profile

**MPONI communications**

- Type: 5-wire, 485
- Baud rate: 1200 or 9600 baud
- Protocol: Modbus® RTU
- Functions:
  - Read metered values
  - Read trip/alarms

**DPONI communications**

- Type: J wire
- Baud rate: 500k, 250k, 125k
- Protocol: DeviceNet™
- Functions:
  - Read metered values
  - Read trip/alarms

**Logging**

- Log book: 100 events
- Log event: 20 trips and alarms
- Log start: last 4 starts
- Start profile: last 4 starts (communication only)
- History records: motor, trips, alarms, and total records

**Environmental conditions**

- Operating temperature: –20° to +60°C
- Storage temperature: 45° to +85°C
- Humidity: 0 to 95% noncondensing

**Dimensions in inches (mm)**

- Height: 10.25 (260.4)
- Width: 6.72 (170.7)
- Depth: 3.70 (94.0)

**Shipping weight lbs (kg)**

- 7 (3.2)

**Product selection**

**Table 1. MP-4000 ordering information**

Motor Protection Description	Catalog Number
MP-4000 drawout, 5A with RS232	MP4011
MP-4000 drawout, INCOM, 5A with RS232	MP4012
MP-4000 drawout, Modbus, 5A with RS232	MP4013
MP-4000 drawout, DeviceNet, 5A with RS232	MP4014
MP-4000 drawout, 1A with RS232	MP4111
MP-4000 drawout, INCOM, 1A with RS232	MP4112
MP-4000 drawout, Modbus, 1A with RS232	MP4113
MP-4000 drawout, DeviceNet, 1A with RS232	MP4114
MP-4000 fixed case, 5A with RS232	MP4010
MP-4000 fixed case, INCOM, 5A with RS232	MP4010INCOM
MP-4000 fixed case, Modbus, 5A with RS232	MP4010MODBUS
MP-4000 fixed case, DeviceNet, 5A with RS232	MP4010DEVICEN
MP-4000 fixed case, 1A with RS232	MP4110
MP-4000 fixed case, INCOM, 1A with RS232	MP4110INCOM
MP-4000 fixed case, Modbus, 1A with RS232	MP4110MODBUS
MP-4000 fixed case, DeviceNet, 1A with RS232	MP4110DEVICEN
MP-4000 fixed case, INCOM, 5A with RS232, URTD	MP4010VPI
MP-4000 fixed case, Modbus, 5A with RS232, URTD	MP4010VPM
MP-4000 fixed case, DeviceNet, 5A with RS232, URTD	MP4010VPD
MP-4000 fixed case, INCOM, 1A with RS232, URTD	MP4110VPI
MP-4000 fixed case, Modbus, 1A with RS232, URTD	MP4110VPM
MP-4000 fixed case, DeviceNet, 1A with RS232, URTD	MP4110VPD

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