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General description

MP-3000 is an advanced microprocessor-based motor protective device which is easy to mount and operate. MP-3000 can provide supervision and protection for motor overloads, rotor relaying or stator’s thermal damage, motor’s electrical faults, start’s over-frequency and failures caused by other devices. Due to its advanced algorithm and thermal model, MP-3000 protective device can operate safely in each kind of circumstances.

MP-3000 can be used to protect 3-phase 50/60Hz motors of any size or at all voltage levels; it can also protect asynchronous motors or synchronous motors with or without RTD.

Key features of MP-3000:
- In line with the strict requirements of UL1053 about grounding fault protection device.
- New power supply protective device can continuously operate only under 55% of voltage ratings. The device can still keep operating status within 30 cycles of reduced voltage or interruption.
- Drawout case (optional) makes easier and more convenient to dismantle and replace accessories and parts.
- With quick release drawout case and new functions of operating interruption/operating non-interruption, no tripping will be caused during the replacement of the device.
- Users can select tripping and alarm in the built-in detector on the device.
- Protective limits are attached to the new motor starting diagram.
- The device uses Intel-I-Trip intelligent overload protection which can automatically make adjustment of trip characteristics based on RTD readings and motor’s previous operating records.
- RTD fault diagnosis and inspection on communication failure further guarantee the smooth operation of the motor.
- “Mechanical processing load shedding” function can offer overload situation and control upstream processes to prevent motor from stopping due to overload or from tripping due to jam, and consequently to keep the continuity of the whole process.
- Flexible user-configurable input/output provide wider range of applications.
- Emergency override function can reset the starter inhibitor timers and remove thermal model’s storing bucket. It can restart the motor by using event logs with time marks. This function uses buttons and can be set as invalid.
- The motor can program the device during operation. After setting, the new settings will work immediately. In addition, users can set up to make programming function working only when the motor stops operating.
- Users can define that the device will trip immediately in case of negative phase sequence starting.
MP-3000 series microprocessor-based motor protective relay

Key features

Optimum motor protection

When using RTD, Intel-I-Trip overload protective curves is automatically programmable. The number of overload tripping depends on the effect on thermal model by internal temperature of the motor. Yet, it will trip directly when the stator temperature is too high.

The device samples the current waveform 36 time per cycle, providing accurate measurements of the positive and negative sequence current and contained harmonic component. The latter will strengthen the heating of rotor and stator. Comparing to balanced component or positive sequence component, the negative sequence contained in current plays a bigger role in rotor’s heating, and then causing bigger influence on relay’s thermal model.

Instantaneous overcurrent protection (50)
To trip the motor for high fault current levels. MP-3000 may replace fuse for medium sized current. This function can be disabled and has an adjustable time delay on starting to avoid nuisance tripping.

Phase unbalance protection (46)
MP-3000 measures the current unbalance and can be used to alarm or trip the motor before it gets heated and the thermal model trips.

Ground fault protection (50G)
MP-3000 uses a separate measuring circuit to measure ground current. A ground CT is recommended for more sensitive protection against winding insulation breakdown to ground. The relay ground CT’s input can be connected residually from the three phase CTs, which yet provides low protection sensitivity.

Jam protection (51R)
MP-3000 can provide jam function to protect motors that are running against a sudden mechanical jam or stall condition. The common application is on motors used on crushers, chippers, or conveyors. In case of jamming, MP-3000 can detect an increase of motor current to a level above full load.

Underload protection (37)
The underload function can detect the loss of load on the motor. Coupling failure is a common cause for loss of load.

Remote tripping / differential protection
One of the binary inputs can be programmed to accept outputs from a separate differential relay or other device to trip the motor. This provides local and remote target information by utilizing the trip contacts of the MP-3000 device. It will also record and log relevant motor information at the time of the trip.

Zero speed switch trip (14)
One of the binary inputs can be programmed to accept output from the zero speed switch. The switch is connected to motors’ axis. In this way, the motor will trip immediately if it does not operate when starting. This function provides optimum protection to motors with slow acceleration.
**Motor’s start and control**

Motors typically have limits to the number of cold starts, starts per time period and time between starts. MP-3000 incorporated this function to prevent starting the motor beyond its capacities.

**Start control timers**

MP-3000 device can detect motor’s transition and incomplete sequence for reduced voltage starting. The user can select one from four logical combinations of starting current and time sequence. The incomplete sequence function can also be used in process feedback, to trip the motor when the expected operation does not take place.

**Reduced voltage starting**

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 MP-3000 provides an antibackspin timer (the minimal time required between stop and restart) 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.

**Antibackspin**

MP-3000 provides a mechanical load shedding feature that can be used to control a driven process. The load shedding function closes a contact on an overload condition to prevent from adding more loads until the overload condition is gone, based on the setting values. Then when the contact is on, the loads on the motor are all back on.

**Load shedding**

MP-3000 has a user-programmable feature that will let the operator reset some tripping conditions such as start inhibitor timer and thermal model storing bucket. This function is intended for use in emergency conditions only, and it may result in motor damage or failure. Emergency override operation procedure is marked by time. The button is located behind the safety door and can be set as invalid.

**Emergency override**

Large motors with a high inertia, including motors of centrifugal machine and large air blower, their starting current exceeds full-load current greatly. Necessary time for starting also exceed locked rotor time. MP-3000 can make these motors not thermal tripping during long acceleration process. This function can be used with a zero speed switch.

**Long acceleration motors**

MP-3000 can measure the current unbalance and be used to alarm or trip the motor before it gets heated and the thermal model trips.

**Measurement and monitor functions**

MP-3000 can continuously measure a great number of electrical data, such as:

- Three-phase current, average: $I_{AVG}$
- Phase current, RMS: $I_A$ $I_B$ $I_C$
- Ground fault current: $I_G$
- Percentage of phase current in full load: $\frac{I_A}{I_B}$ $\frac{I_B}{I_C}$ $\frac{I_C}{I_A}$
- Phase unbalance(ratio of negative sequence current and positive sequence current): $\frac{I_B}{I_A}$

In order to provide more accurate information on motor operating status, MP-3000 will follow up below data:

- 6 temperatures of motor coils measured by URTD
- 2 temperatures of motor bearings measured by URTD
- 2 temperatures of load bearings measured by URTD
- Auxiliary temperature measure by URTD
- Percentage of $I^2T$ tripping current
- Time before next start
- Remaining starts allowed
- Oldest start time
Measuring and monitoring functions

**Analog output**
The device provides analog output on one circuit of 4-20mA. Some information, together with measurements such as 3-phase current, 12t tripping current and coil temperature will be feedbacked to PLC through current ring.

**Statistics of tripping reasons**
MP-3000 provides tripping statistics for each protective function. Users can follow tripping numbers and resetting time.

**Event logging**
MP-3000 can put the latest 100 status change logs into RAM. These logs cover all the status changes including logic input and output, changes of one or several parameters, alarm signals or actions of any output node.

**Fault logging**
MP-3000 records detailed information for the latest 20 faults. For each fault, the device records and indicates:
- Date and event at the moment of fault occurrence
- Effective setting group
- Fault phase
- Amplitude of magnitude causing tripping or alarming
- Parameters and ground current of fault phase
- Temperature measured by URTD at the moment of fault occurrence

**Start logging**
MP-3000 records detailed information of the last starts. For each start, the relay records and indicates:
- Date and time
- Maximum phase current, ground current and imbalance current during start
- Start current and start time
- Motor operating time

**Backup battery**
All parameters of the device such as protective function, logic control, communication, input and output can be programmed and changed by buttons on the operating panel.

A display screen can indicate all the data (setting value, measurements, information and etc)

The design of menu allows users to conveniently move and switch among each option, and be able to master and use it.

**Communication**
MP-3000 can communicate with IPowerNet system through power management communication. In this way, the device can transmit setting value, measurements, alarms and all the other records to host system. Users can make adjustments of communication parameters (such as communication address and Baut rate). Failure in communication function will not influence the protective function of MP-3000.
Technical specification

Control power
- Rated voltage: 120Vac or 240Vac (+10%, -25%)
- Operating range: 120Vac 90-132Vac
- 240Vac 180-264Vac
- Interruption time: Rated voltage, frequency: 60Hz, interruption of 20 cycles
  Frequency 50Hz, interruption of 6.5 cycles
- Frequency: 60Hz (ratings) 57-63Hz
  50Hz (ratings) 47-53Hz
- Power use: 20VA
- U RTD: 6VA, maximum
- IPONI: 1VA, maximum

Input
- Rating (ln) 1A or 5A
- CT rating: 2Xln (continuous)
- CT load: 50×ln (1 second)
  <0.25VA@5A (rating)
  <0.05VA@1A (rating)

Metering accuracy
- Phase current: ±1% ln (0-lnA)
  ±1% (ln-10ln)
- Ground current: ±1.5% ln (0-50ln)
  ±2% ln (55ln - 100ln)
  ±2% (ln-4ln)

Discrete input
- Quantity: 2, programmable
- Rating: Max (closed) = 36Vac
  Min (open) = 86Vac

Discrete output
- Quantity: 4 Form C, programmable
- Instantaneous: closed: 30Aac/dc, 0.25s
- Breaking: 0.25A 250Vdc (resistive load)
- Continuous: 5A@120Vac 240Vac
  5A@120Vac 240Vac
  5A@30Vdc

Analog output
- Rating: ±4-20mA programmable
- Maximum load: 1 kW
- Accuracy: 1%

Motor overload protection (I²T)
- Full load current: 10-3000A
- Locked rotor current: 300-1200% FLA, step 1% FLA
- Locked rotor time: time 1 second
- Ultimate trip current: 85-150 FLA, step 1% FLA
- Phase CT ratio: 10-4000ln, step 1
- Ground CT ratio: 10-4000ln, step 1
- Timing accuracy: ±2.50 or ±100ms (>1.1 x UTC)

Ground fault protection
- Current threshold: 2%-55% of primary CT ratio, step 1%
- Ground fault start delay: 2-60 cycles
- Ground fault operating delay: 0-60 cycles
- Timer accuracy: ±2.5 cycles - 1/2 cycles

Instantaneous overcurrent protection
- Current threshold: 300-1600% FLA, step 1%
- Start delay: 2-60 cycles, step 1 cycle
- Timer accuracy: ±2.5 cycles - 1/2 cycles

Jam protection
- Current threshold: 100-1200% FLA, step 1%
- Start delay: 0-1200 seconds, step 1 second
- Operating delay: 0-240 seconds, step 1 second

Underload protection
- Current threshold: 6-90% FLA, step 1%
- Start delay: 0-120 seconds (at setting=0) (1350mS), step 1 second
- Operating delay: 0-240 seconds, step 1 second
Mounting and wiring

Figure 2 Wiring terminal on the back panel and panel cutout dimensions (Unit [mm])

Figure 3 Typical control circuit and current transformer wiring diagram

MP-3000 series microprocessor-based motor protective relay
Mounting and wiring
### Ordering information

<table>
<thead>
<tr>
<th>Catalog number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP3000</td>
<td>5A CT input, fixed</td>
</tr>
<tr>
<td>MP3001</td>
<td>5A CT input, drawout, without communication</td>
</tr>
<tr>
<td>MP3002</td>
<td>5A CT input, drawout, with INCOM communication</td>
</tr>
<tr>
<td>MP3100</td>
<td>1A CT input, fixed</td>
</tr>
<tr>
<td>MP3101</td>
<td>1A CT input, drawout, without communication</td>
</tr>
<tr>
<td>MP3102</td>
<td>1A CT input, drawout, with INCOM communication</td>
</tr>
<tr>
<td>MP3000VPI</td>
<td>5A CT input, fixed, with URTD module, INCOM communication, fiber</td>
</tr>
<tr>
<td>MP3100VPI</td>
<td>1A CT input, fixed, with URTD module, INCOM communication, fiber</td>
</tr>
<tr>
<td>MP3000VPM</td>
<td>5A CT input, fixed, with URTD module, MODBUS communication, fiber</td>
</tr>
<tr>
<td>MP3100VPM</td>
<td>1A CT input, fixed, with URTD module, MODBUS communication, fiber</td>
</tr>
<tr>
<td>MP3000-INCOM</td>
<td>5A CT input, fixed, with IPONI, INCOM communication support</td>
</tr>
<tr>
<td>MP3100-INCOM</td>
<td>1A CT input, fixed, with IPONI, INCOM communication support</td>
</tr>
<tr>
<td>MP3000-MODBUS</td>
<td>5A CT input, fixed, with IPONI, MODBUS communication support</td>
</tr>
<tr>
<td>MP3100-MODBUS</td>
<td>1A CT input, fixed, with IPONI, MODBUS communication support</td>
</tr>
<tr>
<td>MPFO-1</td>
<td>1m cable (connecting MP-3000 and URTD)</td>
</tr>
<tr>
<td>MPFO-10</td>
<td>10m cable (connecting MP-3000 and URTD)</td>
</tr>
<tr>
<td>URTD</td>
<td>Universal RTD module</td>
</tr>
</tbody>
</table>
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