MM300 MOTOR MANAGEMENT SYSTEM

Integrated automation and protection for low voltage motors

KEY BENEFITS

- Full-featured protection for low voltage AC motors
- Advanced automation capabilities for providing customized protection and integrated process control
- Advanced FlexLogic™ reduces requirement for local PLC’s
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs and communication interfaces
- Application flexibility with multiple I/O options and programmable logic options (FlexLogic™)
- Enhanced troubleshooting tools including sequence of event records and waveform capture
- Powerful communications including Serial, Ethernet, Profibus, and DeviceNet protocols
- Small form factor and remote display options designed to fit in MCC buckets

APPLICATIONS

- Low Voltage three phase AC motors
- MCC or stand alone panel mount applications
- Reversing and Reduced Voltage applications
- Motor applications requiring advanced Automation or Control such as conveyor systems or well recovery pumps
- IEC or NEMA class motors

FEATURES

Protection and Control
- Enhanced Thermal Modeling
- Mechanical Jam / Stalled Rotor
- Undercurrent
- Underpower
- Acceleration Time
- Current Unbalance
- Ground Fault
- Sensitive Ground Fault
- Phase Overvoltage / Undervoltage
- Auxiliary Undervoltage
- Phase Reversal
- VT Fuse Failure
- Thermistor
- RTD Overtemperature

Automation
- Programmable Flexlogic™ option
- Starter Control
- Process Interlocks
- Programmable inputs and outputs
- Undervoltage Auto-restart

Metering & Monitoring
- Metering - current, voltage, power, energy, frequency, RTD, Thermistor
- Oscillography – analog values at 32 samples/cycle and digital states
- Event Recorder - Up to 256 time tagged events with 1ms res.
- Advanced device health diagnostics

Communications
- Networking Interfaces - Two Wire RS485, RJ45 Ethernet
- Multiple Protocols (Modbus RTU, Modbus TCP/IP, Internally powered Profibus, ODVA compliant DeviceNet)
- Programming Ports - USB, RS485
- Network Time Protocol (when ordered with Ethernet)

User Interface
- Control panel with 12 status LED’s, Motor Control and function keys
- Color HMI Display featuring a full color graphical display, Motor and system status LED’s, USB programming port and motor control keys.

EnerVista™ Software
- State of the art software for configuration and commissioning Multilin products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
**Protection and Control**

The MM300 is a digital motor protection and control system, designed for Low Voltage motor applications. Flexible and powerful, the MM300’s protection can be scaled to the specific requirements of your system.

**Motor Thermal Model**

To provide optimal protection and maximize run time, the MM300 employs an advanced thermal model, consisting of six key elements:

- Overload Curves
- Unbalance Biasing
- Hot/Cold Safe Stall Ratio
- Motor Cooling Time Constants
- Start Inhibit and Emergency Restart
- RTD Biasing (Optional)

**Overload Curves**

The MM300 thermal model can be programmed with one of 15 standard overload curves. When properly selected to match the motor manufactures thermal damage curves, the MM300 overload curve and Overload Pickup Level will determine the thermal capacity accumulated within the motor.

**Unbalance (Negative Sequence) Biasing**

Negative sequence current, which causes additional rotor heating, is not accounted for in the thermal limit curves provided by the manufacturer. The MM300 measures current unbalance as a ratio of negative to positive sequence current. The thermal model is then biased to reflect the additional rotor heating. A programmable K factor setting allows the amount of derating to be adjusted.

**Hot / Cold Safe Stall Ratio**

This ratio defines the steady state level of thermal capacity used (TCU) by the motor. This level corresponds to normal operating temperature of a fully loaded motor and will be adjusted proportionally if the motor load is lower then rated.

**Motor Cool Time Constants**

When the MM300 detects that the motor is running at a load lower then the overload pickup setpoint or the motor is stopped, it will start reducing the TCU value exponentially, based on the programmed cool time constants. As cooling occurs at different rates for stopped and running motors, two separate constants are used.

**RTD Biasing**

The Thermal Model relies solely on measured current to determine motor heating, assuming an ambient temperature of 40°C and normal motor cooling. The actual motor temperature will increase due to abnormally high ambient temperatures or if the motor cooling systems have failed. RTD Biasing enhances the motor thermal model by calculating the thermal capacity used based on available Stator RTD temperatures.

---

**Functional Block Diagram**

---

**ANSI Device Numbers & Functions**

<table>
<thead>
<tr>
<th>Device Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>27AUX</td>
<td>Undervoltage - Auxiliary Input</td>
</tr>
<tr>
<td>27</td>
<td>Undervoltage - Three Phase</td>
</tr>
<tr>
<td>37</td>
<td>Undercurrent/Underpower</td>
</tr>
<tr>
<td>38</td>
<td>Bearing Temperature RTD</td>
</tr>
<tr>
<td>46</td>
<td>Current Unbalance</td>
</tr>
<tr>
<td>47</td>
<td>Voltage Phase Reversal</td>
</tr>
<tr>
<td>49</td>
<td>Thermal Overload</td>
</tr>
<tr>
<td>50G</td>
<td>Ground Instantaneous Overcurrent</td>
</tr>
<tr>
<td>51G</td>
<td>Ground Time Overcurrent</td>
</tr>
<tr>
<td>51R</td>
<td>Locked/Stalled Rotor/Mechanical Jam</td>
</tr>
<tr>
<td>59</td>
<td>Overvoltage - Three Phase</td>
</tr>
<tr>
<td>66</td>
<td>Starts/Hour &amp; Time Between Starts</td>
</tr>
</tbody>
</table>
Voltage Protection
The MM300 comes standard with a single phase voltage input, providing single phase underpower, auxiliary undervoltage and optional undervoltage auto-restart functionality.
Optional 3 phase voltage inputs offer the additional following protection elements:
- Undervoltage
- Overvoltage
- Phase Reversal
- Three Phase Underpower
- VT Fuse Failure

Current Unbalance
In addition to Thermal model biasing, current unbalance is available in the MM300 relay as independent element with a built-in single phasing detection algorithm.

Thermistor
A single input from a motor winding thermistor is provided with the MM300. The MM300 can accept both positive temperature coefficient (PTC) and negative temperature coefficient (NTC) sensors. A thermistor level can be selected for both alarm and trip.

Advanced Automation
The MM300’s powerful I/O and programmable flexlogic options offer advanced automation control, reducing the need for additional programmable controllers or discrete control relays.

FlexLogic™
The MM300 optionally includes a control logic engine called FlexLogic™. This provides the ability of creating customized protection and control schemes thereby minimizing the need and the associated costs, of auxiliary components and wiring. Using FlexLogic™, the MM300 can be configured to specify what actions will be taken based on the status of protection or control elements, as well as inputs driven by connected sensors and equipment.

Scalable Hardware
The MM300 is available with a multitude of I/O configurations to suit most application needs. The expandable modular design allows for easy configuration and future upgrades.
- Up to 30 digital inputs (voltage rating up to 300V) and up to 18 digital outputs are available and can be used to monitor and control a wide range of auxiliary equipment
- Types of digital outputs include trip-rated Form-A and Form-C

Monitoring and Metering
The MM300 includes high accuracy metering for all AC signals. Voltage, current, power metering, and temperature all available options. Current and voltage parameters are available as total RMS magnitude and angle.

Fault and Disturbance Recording
The advanced disturbance diagnostic features within the MM300 can significantly reduce the time needed for troubleshooting power system events and reconstruction. Recording functions include:
- Sequence of Event Recorder (SOE)
  - 256 time stamped events
- Optional enhanced diagnostics with:
  - Waveform capture with up to 10 Analog Channels *
  - Data Logger with 10 channel RMS recorder

Advanced Device Health Diagnostics
The MM300 performs comprehensive device health diagnostic tests during startup and continuously at runtime to test its own major functions and critical hardware. These diagnostic tests monitor for conditions that could impact the MM300’s performance, evaluate the criticality of this impact and present device status via SCADA communications and front panel display. Providing continuous monitoring and early detection of possible issues helps improve system availability by employing predictive maintenance

RTD Biasing does not replace the TCU calculated using the motor current. It provides a second and independent measure of thermal capacity used. Based on a programmable curve, the MM300 will calculate the TCU at any given temperature. This TCU is then compared to that of the thermal model, and the larger of the two will be used.

To protect against faulty stator RTD’s, a TCU of 100% based on RTD Biasing will not cause a trip to be issued unless the motor current has exceeded the Overload Pickup Level.

Motor Start Supervision
Motor Start Supervision consists of the following features: Time-Between-Starts, Start-per-Hour, Restart Time. These elements guard the motor against excessive starting duty, which is normally defined by motor manufacturer in addition to the thermal damage curves.

Mechanical Jam and Acceleration Time
These two elements are used to prevent motor damage during abnormal operating conditions such as driven load jams and excessively long acceleration times.

Ground Fault
This function is designed to protect motors against phase to ground faults. The MM300 comes with two separate ground CT inputs intended for one of two different ground protection:
- Core balance (Zero sequence)
- Residual

RTD Biasing curve

Motor Protection
www.GEDigitalEnergy.com
Communications

The MM300 utilizes the most advanced communications technologies available today making it the easiest and most flexible motor protection relay to use and integrate into new and existing infrastructures. Multiple communication ports and protocols allow control and easy access to information from the MM300. All communication ports are capable of communication simultaneously.

The MM300 supports the most popular industry standard protocols enabling easy, direct integration into HMI and electrical SCADA systems. Modbus RTU is provided standard with a RS485 networking port. The following optional protocols and communication ports are available:

- Fieldbus Protocol with dedicated port.
  - ODVA Compliant DeviceNet
  - Internally powered Profibus
- Modbus TCP/IP with RJ45 10/100baseT Ethernet port

Profibus DP

Providing a high degree of communication flexibility, the MM300 supports both Profibus DP-V0 and DP-V1. Profibus DP-V0 provides high-speed cyclic data exchange between distributed field devices and the Profibus master. In addition to the high-speed cyclic data communication with DP-V0, DP-V1 provides communication of acyclic data information between the slaves and the engineering workstation, which allows for independent diagnosing and fine-tuning of each slave on the network.

Rapid Device Replacement

The MM300 supports Rapid Device Replacement, which is compatible with DeviceNet scanners that use Automatic Device Replacement (ADR) functionality. When Rapid Device Replacement is used in DeviceNet networks, this allows rapid change of MM300 devices with minimum process interruption.

When using Rapid Device Replacement, the MM300 can be replaced without the need to manually configure settings. The DeviceNet scanner will automatically recognize a new device and download the key protection, control and communication settings from the original MM300, reducing process downtime and manual setting file configuration.

EnerVista™ Software

The EnerVista™ Suite is an industry-leading set of software programs that simplifies every aspect of using the MM300 relay. The EnerVista™ suite provides all the tools to monitor the status of the protected asset, maintain the relay, and integrate information measured by the MM300 into DCS or SCADA monitoring systems. Convenient COMTRADE and Sequence of Events viewers are an integral part of the MM300 Setup software included with every MM300 to carry out postmortem event analysis to ensure proper protection system operation.

EnerVista™ Launchpad

EnerVista™ Launchpad is a powerful software package that provides users with all of the setup and support tools needed for configuring and maintaining Multilin products. The setup software within
Launchpad allows configuring devices in real-time by communicating using serial, Ethernet, or modem connections, or offline by creating setting files to be sent to devices at a later time.

Included in Launchpad is a document archiving and management system that ensures critical documentation is up-to-date and available when needed. Documents made available include:

- Manuals
- Application Notes
- Guideform Specifications
- Brochures
- Wiring Diagrams
- FAQs
- Service Bulletins

Viewpoint Monitoring
Viewpoint Monitoring is a simple-to-use and full-featured monitoring and data recording software package for small systems. Viewpoint Monitoring provides a complete HMI package with the following functionality:

- Plug & Play Device Monitoring
- System Single-Line Monitoring & Control
- Annunciator Alarm Screens
- Trending Reports
- Automatic Event Retrieval
- Automatic Waveform Retrieval

Viewpoint Engineer
Viewpoint Engineer is a set of powerful tools that will allow the configuration and testing of MM300 relays at a system level in an easy-to-use graphical drag-and-drop environment. Viewpoint Engineer provides the following configuration and commissioning utilities:

- Graphical Logic Designer
- Graphical Logic Monitor

Viewpoint Maintenance
Viewpoint Maintenance provides tools that will create reports on the operating status of the relay, simplify the steps to download fault and event data, and reduce the work required for cyber-security compliance audits. Tools available in Viewpoint Maintenance include:

- Settings Security Audit Report
- Device Health Report
- Single Click Fault Data Retrieval

EnerVista™ Integrator
EnerVista™ Integrator is a toolkit that allows seamless integration of Multilin devices into new or existing automation systems. Included in EnerVista™ Integrator is:

- OPC/DDE Server
- Multilin Drivers
- Automatic Event Retrieval
- Automatic Waveform Retrieval

User Interface
The MM300 can be ordered with or without a control panel or display. If local control or monitoring is required, there are two available options:

1) Control Panel
2) Color HMI Display

Power System Troubleshooting
The MM300 contains many tools and reports that simplify and reduce the amount of time required for troubleshooting power system events.

Analyze motor faults using both analog and digital power system quantities that are measured and recorded up to a rate of 32 samples per cycle.

Log motor operating parameters to allow for analyzing motor loading and performance over prolonged periods of time.
**Technical Specifications**

**INPUTS**

<table>
<thead>
<tr>
<th>Protection Type</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Undervoltage</td>
<td>100 to 300 V AC in steps of 1</td>
</tr>
<tr>
<td></td>
<td>Overvoltage</td>
<td>101 to 120% of rated voltage</td>
</tr>
<tr>
<td></td>
<td>Ground Fault</td>
<td>0.5 to 3 A</td>
</tr>
<tr>
<td></td>
<td>Overcurrent</td>
<td>10 A or 0.5 A to 3 A</td>
</tr>
<tr>
<td></td>
<td>Phase Imbalance</td>
<td>0.5 to 3 A</td>
</tr>
<tr>
<td></td>
<td>Phase Insufficiency</td>
<td>0.5 to 3 A</td>
</tr>
</tbody>
</table>

**OUTPUTS**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ground Fault</td>
<td>3 to 10 A</td>
</tr>
<tr>
<td></td>
<td>Overcurrent</td>
<td>10 A or 0.5 A to 3 A</td>
</tr>
<tr>
<td></td>
<td>Phase Imbalance</td>
<td>0.5 to 3 A</td>
</tr>
<tr>
<td></td>
<td>Phase Insufficiency</td>
<td>0.5 to 3 A</td>
</tr>
</tbody>
</table>

**OUTPUT RELAYS**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electromechanical form-A (IO_D)</td>
<td>5 mA</td>
</tr>
<tr>
<td></td>
<td>Silver-alloy</td>
<td>5 mA</td>
</tr>
<tr>
<td></td>
<td>Contact material</td>
<td>5 mA</td>
</tr>
<tr>
<td></td>
<td>Mechanical life</td>
<td>10 000 000 operations</td>
</tr>
</tbody>
</table>

**POWER SUPPLY**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal</td>
<td>240 V AC</td>
</tr>
<tr>
<td>Range</td>
<td>242 to 264 V AC</td>
</tr>
<tr>
<td></td>
<td>115 to 230 V AC</td>
</tr>
<tr>
<td>Power consumption</td>
<td>17 W</td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>IP20 (base unit)</td>
</tr>
<tr>
<td></td>
<td>RJ-45</td>
</tr>
<tr>
<td></td>
<td>Modbus TCP</td>
</tr>
<tr>
<td></td>
<td>Modbus RTU</td>
</tr>
<tr>
<td></td>
<td>USB PORT</td>
</tr>
</tbody>
</table>

**DIMENSIONS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>102 mm</td>
</tr>
<tr>
<td>Width</td>
<td>153 mm</td>
</tr>
<tr>
<td>Depth</td>
<td>113 mm</td>
</tr>
</tbody>
</table>

**ENVIRONMENTAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Operating: -20°C to +60°C*</td>
</tr>
<tr>
<td></td>
<td>Storage / Shipping: -40°C to +90°C*</td>
</tr>
<tr>
<td>Humidity</td>
<td>Operating: 20% to 80% (non-condensing)</td>
</tr>
<tr>
<td>Weight</td>
<td>0.75 kg</td>
</tr>
</tbody>
</table>

**POWER SUPPLY**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal</td>
<td>240 V AC</td>
</tr>
<tr>
<td>Range</td>
<td>242 to 264 V AC</td>
</tr>
<tr>
<td></td>
<td>115 to 230 V AC</td>
</tr>
</tbody>
</table>

**CERTIFICATION**

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL508, UL1053, C22.2.No 14</td>
<td></td>
</tr>
</tbody>
</table>
User Interface

**Graphical interface**
- Easy to use
- Wide viewing angle

**Navigation Keys**
- View actual values and status
- View and modify settings

**Color HMI Display**

**LED Indicator**
- Motor status
- Alarm indication
- System status
- Communication status
- Additional user LEDs

**Front USB Port**

**Secure device control**
- Revision control/history

**Soft key Navigation**
- View actual values and status
- View and modify settings

**Control Panel**

**Security**
- Revision control/history

**Expansion Module**
- to base unit with a single connector

**Optional 3-phase Voltage Module**
- RTD Module with three RTD inputs

**Profibus or DeviceNet**
- Optional fieldbus protocols

**RS485 Communications**
- and Thermistor input

**Expansion Module**
- to base unit with a single connector

**Switched Power Supply**
- Allows AC or DC control voltage

**I/O card includes:**
- 2 Contactor Outputs (Form A)
- 6 Programmable inputs
- Single Phase VT Input (60-300Vac)

**Optional TCP/IP Ethernet**

**Core Balance**
- Ground CT Input

**Core Balance**
- Ground CT Input

**Navigation Keys**
- View actual values and status
- View and modify settings

**LED Indicator**
- Motor status
- Alarm indication
- System status
- Communication status
- Additional user LEDs

**Dimensions**

**Dimensions**

**Motor Protection**

www.GEDigitalEnergy.com
Mounting

DIN Rail Mounting

Door Mounting

HandHeld Display (HHD)

The Hand Held Display (HHD) provides a rugged local interface for MM300 Motor Protection Systems where a local display is not used in the MCC.

The HHD provides a graphical color local interface to the MM300 Motor Protection Systems allowing local operators to view and change setting files and quickly access relay diagnostic information.

The HHD provides a clear and detailed view of all motor settings, diagnostic information and metering data available in the MM300 allowing local operators to make informed decisions on the motors operation.

Ordering

<table>
<thead>
<tr>
<th>MM300</th>
<th>Base I/O</th>
<th>Expansion Module 1</th>
<th>Expansion Module 2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Panel</td>
<td>X</td>
<td>B</td>
<td>G</td>
<td>None</td>
</tr>
<tr>
<td>Language</td>
<td>E</td>
<td>C</td>
<td></td>
<td>English (Standard)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>H</td>
<td></td>
<td></td>
<td>High (60-300 Vac/80-250Vdc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td></td>
<td>Low (24-48 Vdc)</td>
</tr>
<tr>
<td>Communication</td>
<td>S</td>
<td>D</td>
<td>P</td>
<td>RS485 Modbus RTU (Standard)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RS485 + DeviceNet Slave + 10/100 Modbus TCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RS485 + Profibus DP Slave + 10/100 Modbus TCP</td>
</tr>
<tr>
<td>Options</td>
<td>S</td>
<td>D</td>
<td>P</td>
<td>Standard Control and Event Recorder</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ Undervoltage Auto-restart</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ Waveform Capture, Data Logger</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+ FlexLogic</td>
</tr>
<tr>
<td>I/O Modules</td>
<td>A</td>
<td></td>
<td></td>
<td>3 Phase Current + Thermal O/L, Under Current, Single Phase Under Power</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 Phase Voltage Metering + 3 Phase Under Power, Under / Over Voltage, Phase reversal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 x RTD - 100PT - max 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 x 10A Relay Form A and 6 x Digital Input 60-300ac/ (Standard) - max 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 x 10A Relay Form C - max 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 x Digital Inputs 20-60 VDC, 2 x 10A Relay Form A (max 4)</td>
</tr>
</tbody>
</table>

Accessories for the MM300

- MM300 Basic Control Panel 18M9-0004
- MM300 Graphical Control Panel 18M9-0002
- HandHeld Display (HHD) 18M9-0052
- MM300 3ft. USB Cable 0804-0171
- MM300 1ft. RS232-RJ45 Cable 0804-0180
- MM300 3ft. RS232-RJ45 Cable 0804-0181
- MM300 3ft. Connector Cable 0804-0169
- MM300 6ft. Connector Cable 0804-0172
- USB-to-Serial Cable 0100-0001

Software for the MM300

- Viewpoint Engineer VPE-1
- Viewpoint Maintenance VPM-1
- Viewpoint Monitoring VP-1

Visit www.GEMultilin.com/MM300 to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a MM300 online
- View the MM300 brochure