KEY BENEFITS

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Follow technology evolution - Flash memory for product field upgrade
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated RS232 port

APPLICATIONS

- Small generators and motors
- Component for bigger generator packages
- Standby/critical power protection main unit
- Small motor protection
- Transformer protection

FEATURES

Protection and Control
- Phase, ground TOC
- Phase, ground IOC
- Thermal image protection
- Circuit breaker control (open and close)
- Negative Sequence Element
- Restricted Ground Differential Element
- Undercurrent
- Maximum number of starts
- Locked rotor
- Configurable I/O
- Six outputs: trip, service, 4 auxiliary
- 4 pre-configured overcurrent curves (ANSI, IEC)

Monitoring and Metering
- 24-event record
- Analog/digital oscillography
- Per phase current metering
- Monitoring of the last 5 trips information from the display

User Interfaces
- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps
- EnerVista™ Software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin devices
Overview

The MIG II, member of the MIll Family of protection relays, is a microprocessor based relay that provides basic protection for electrical machines. The primary application is for the protection of generator equipment however, it can also be used for motor protection. Basic protection features include thermal image protection, three phase time delayed overcurrent, phase instantaneous overcurrent, ground & neutral time delayed overcurrent, ground & neutral instantaneous overcurrent, negative sequence, undervoltage, starts/hour, and time between starts. Each protection element can be selectively enabled either via the front panel or via communication. Flexible settings, selectable ANSI or IEC curves, plus the choice of a user configurable overcurrent curve enable accurate coordination with other devices. The MIG II has two digital inputs and six configurable digital outputs. The MIG II has a total of six LEDs, four configurable in function and color. The front panel also features a 5 button keypad and a 16x2 LCD display that provides an easy to use user interface.

The front keypad allows the user to set the baud rate and relay address for communication. A front RS232 and a rear RS485 communication port are provided for computer access using ModBus® RTU protocol. The rear RS485 can be converted to an RS232 or fiber optic port (plastic or glass fiber optics) by means of using an external converter, such as GE Multilin DAC300 or F485. Windows® based EnerVista™ software is provided free of charge with the relay to allow setup and configuration of MIG II features. Computer access allows setting and configuration (inputs, outputs, LEDs and configurable logic) of the units, display of metering information and real time status of the unit. It also allows the display of event records and an oscillography record for the last fault. The MIG II has a drawout construction in 1/4 of a 19” rack case.

Protection

Thermal Image Element

A thermal image unit is included to protect equipment against overheating due to excessive load. Several operating curves can be set as a function of heating time constant T1 (adjustable between 3 to 600 minutes). Cool down time constant T2 is adjustable from 1 to 6 the heating constant. The algorithm of the thermal image takes into account the effect of the negative sequence components via the K1 constant. This K1 value protects the machine against side effects caused by the negative component, which causes overheating in the stator and rotor, with the same effect as overload.

Unbalance

The presence of negative sequence current can result in greatly increased rotor heating. The unit can be set either with a definite time (up to 255s) or with a $I^2t=K$ curve model where K is a value between 1 to 100.

Three Phase Time Overcurrent

The MIG II provides time overcurrent protection that can be set from 0.1 to 2.4 times FLC. Four separate ANSI or IEC time overcurrent curves can be selected in addition to a user configurable curve. ANSI and IEC curves include: definite time, normal inverse, very inverse, and extremely inverse. For each curve, different time multipliers may be set. This allows the
selection of the optimum curve for coordination with fuses, feeders, motors, transformers, etc.

Phase Instantaneous Overcurrent
The MIG II includes one adjustable phase instantaneous overcurrent unit. Settings allow the pickup setpoint to be set from 0.1 to 30 times FLC and a time delay from 0 to 100 seconds to be set.

Ground Time Overcurrent
The ground time overcurrent protection has the same curve selection choices and settings as the phase time overcurrent unit. The ground signal is normally derived as the residual sum of the three phase CTs eliminating the need for an additional ground sensor. Alternatively, for more sensitive detection, an additional core balance (zero sequence) ground sensor encircling the 3 phase conductors can be used. The MIG II can also be ordered with more sensitive ground inputs, capable of measuring current values as low as 0.005 A.

Ground Instantaneous Overcurrent
The ground instantaneous overcurrent protection has the same settings and features as the phase instantaneous overcurrent unit.

Restricted Ground Differential Element (MIG II P model only)
This unit detects ground faults in solidly grounded generators, through resistance and high impedance reactance. This feature calculates 3I, TERMINAL current from the measured phase currents, and measures the generator ground current 3I, NEUTRAL. The calculated difference between both values is the differential current Isdr. This value must exceed a user-programmable pick up value (setting) in order to activate the protection unit.

Negative Sequence Element
The MIG II relay incorporates a negative sequence protection element in order to detect system conditions that can cause unbalanced three-phase currents in the generator. As previously mentioned, these unbalances can be of higher magnitude than the load unbalance.

Undercurrent (MIG II Q model only)
The undercurrent function is mostly used in motor applications in order to detect a decrease in the machine current caused by a load decrease, and to prevent the pumps from working without load. The unit can be selected either as an alarm or as a trip.

Starts/hour & Time Between Starts. (MIG II Q model only)
This units counts the number of the machine starts and makes sure they do not exceed a number programmed by the user. The number of starts is controlled over a period of time called the Time Window. If the number of starts is exceeded then the unit blocks any new attempts and maintains the trip contact closed during the restart block time.

Locked Rotor (MIG II Q model only)
This unit protects the machine for excessive long starts that can damage the rotor due to excessive overcurrent conditions during the start-up. This is of major importance for those critical power applications where the motor drives the generator into service.

Multiple Setting Groups
Two separate settings groups are stored in MIG II non volatile memory, with only one group active at a given time. Switching between setting groups 1 and 2 can be done by means of a setting, a communication command or digital input activation. Settings are divided in 2 categories, main and advanced settings. This allows users to have access to main relay functionalities in an extremely simple, user friendly way by entering only main settings, while having access to complete functionality for more complex use through advanced settings.

Metering
MIG II provides metering values for phase and ground currents. The accuracy is 3% in the complete range, and 1% at the rated current.

Primary or Secondary Metering
The MIG II can monitor both the primary and secondary current metering values, by previous setting the corresponding CT ratio.

Event Recording
Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self test status. The MIG II stores up to 24 events time tagged to the nearest millisecond. This provides the information needed to determine sequence of events which facilitates diagnosis of relay operation. Each event is individually maskable in order to avoid the generation of undesired events, and includes the values of currents and status of all the protection elements at the moment of the event.

Use the oscillography feature as an accurate troubleshooting and diagnostics tool.
Oscillography

MIG II captures current waveforms and digital channels at 8 samples per cycle. One oscillography record with a maximum length of 24 cycles is stored in memory. Oscillography is triggered either by internal signals or an external contact.

Configurable I/O and LEDs

Two digital inputs are user configurable. Out of the six digital outputs incorporated, two have a fixed function (trip and service required), while the other four are user programmable. Those configurable outputs can be assigned either to a set of pre-configured values, or an OR/NOT combination of the same values. Each configurable output can be independently latched, and individually selected as NO or NC by means of a jumper. Outputs 1 and 2 can be isolated from outputs 2 and 3 by removing jumper JK.

Four of the 6 LED indicators can also be programmed by the user. The first LED has a fixed assignment (relay in service), the second is fixed for trip, and the remaining four LEDs are configurable in function, memory and color (red or green).

Configurable Logic

Up to a maximum of 4 configurable logic schemes can be implemented into the MIG II by means of using a set of 4 pre-configured logic gates and timer cells. A graphical user interface is provided for configuration of MIG II logic. The inputs of the MIG II configurable logic can be assigned to contact outputs and/or LEDs.

Circuit Breaker Control

The MIG II permits operation of the circuit breaker. Breaker opening and closing operations can be carried out by programming specific outputs, and digital inputs can be used for verifying the success of the operation.

User Interfaces

Display

Measurement data (actual values), fault reports for the last five trips, and settings are shown on the 16x2 characters LCD display.
Keypad
A five-button keypad allows user access for easy relay interrogation and change of settings. Access to events and oscillography records, and unit configuration is possible only through PC communication.

Self-Test Diagnostics
Comprehensive self-test diagnostics occur at power up and continuously during relay operation. Any problem found by self-tests causes an alarm and an event is logged.

Communication Ports
A front mounted RS232 and a rear RS485 port allow easy user interface via a PC. ModBus® RTU protocol is used for all ports. The relay supports baud rates from 300 to 19,200 bps. Up to 32 GE Multilin devices can be addressed on a single communications channel. A unique address must be assigned to each relay via a setting when multiple relays are connected.

MultiNet™ compatible
MultiNet is a communications module that provides GE Multilin serial ModBus IEDs with ModBus TCP/IP communications over Ethernet, allowing connection to fiber optic LAN and WAN network systems. MultiNet has the capability to connect up to 32 serial ModBus devices eliminating complex wiring and additional communications converters, and providing a streamlined and economical Ethernet hub. Unlike most communications converters that are designed for commercial use, MultiNet is environmentally hardened to withstand severe utility and industrial conditions.

EnerVista™ Software
The EnerVista™ Suite is an industry-leading set of software programs that simplifies every aspect of using the relay. The EnerVista™ suite provides all the tools to monitor the status of the protected asset, maintain the relay, and integrate information measured into DCS or SCADA monitoring systems. Convenient waveform and Sequence of Events viewers are an integral part of the MII Setup software included with every MIG II relay, 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 GE 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

Dimensions

![Dimensions Diagram]
Typical Wiring

Note: Only for reference. For particular connections for any MIG II model, please refer to its external connections drawing.

(*) Terminals B12, A12 and B11 are not to be tested for isolation under any circumstance.

(**) In the default configuration, inputs and outputs are programmed as follows:

**INPUTS**
- CC1: Emergency Reset
- CC2: External Trip

**OUTPUTS**
- OUT1: 49 Trip
- OUT2: Overcurrent Trip
- OUT3: 46 Trip
- OUT4: Pickup

WARNING: GROUND PC TO RELAY GROUND. OTHERWISE USE UNGROUNDED PC
### Technical Specifications

#### PROTECTION

**PHASE AND GROUND TIME OVERCURRENT (51P, 51G)**
- Current: Fundamental
- Pickup level: 0.1 - 2 A FLC in steps of 0.01
- Drop out level: 97% of the pickup level
- Accuracy: ±3% in the complete range
- Curves: IEC or ANSI inverse, very inverse, extremely inverse, user defined (depending on model). Definite time 0.00 to 600.00 s in steps of 0.01 s

**PHASE AND GROUND INSTANTANEOUS OVERCURRENT (50P, 50G)**
- Current: Fundamental
- Pickup level: 0.1 - 30 A FLC in steps of 0.01
- Drop out level: 97% of the pickup level
- Accuracy: ±3% in the complete range
- Timers:
  - Overreach: < 2%
  - Minimum: 3IILog

**Sensitivity (s):**
- Fundamental Current: 16 A
- Undercurrent (37): 1A or 5 A depending on the selected model
- Locked rotor (48): 0.2 s
- Operative Time: 8 ms

**TRIPPING CONTACTS**
- Max. Operating Voltage: 440 Vca
- Continuous current: 48 A
- Baud rate: 4000 VA

**Tripping time accuracy:**
- 0.00 to 600.00 s in steps of 0.1 s

**OUTPUT RELAYS**
- Configuration: 6 electromechanical, form C
- Time delay: 0.00 to 600.00 s in steps of 0.1 s
- Timing: 0.00 to 100 minutes in steps of 1 min.

**INPUTS**
- AC CURRENT
  - Relay Burden: 0.2 mA @ 57 Vdc
- Secondary Rated: 1A or 5A
- Definite time range: 0.00 to 600.00 s in steps of 0.01 s
- Tripping time accuracy: ±250 ms or 5%

**CURRENT UNBALANCE (46)**
- Current: Functional
- Pickup level: 0.05 to 0.99 FLC in steps of 0.01
- Curve: In accordance to k = I2 * t
- K Constant: ±50 ms or 3% of total time for timer set to 0 s
- Timers:
  - Definite time range: 1 to 100 in steps of 1
  - Heating constant t1: 3 to 600 minutes in steps of 1 min

**MECHANICAL CHARACTERISTICS**
- Packaging:
  - Approximate Weight: 2.7 kg (5.9 lbs)
  - Ship: 3.2 kg (7 lbs)

**INPUTS**
- Breaker: 48 A
- Make and Carry: 48 A
- Current Withstand: 4 x In continuously. 100 x In for 1 sec.
- Relay Burden: 2 mA @ 57 Vdc

**DIGITAL INPUTS**
- Voltage Threshold: 75 Vdc
- Maximum Voltage: 300 Vdc
- Low Range: 5 mA @ 300 Vdc
- Voltage Threshold: 12 Vdc
- Maximum Voltage: 57 Vdc
- Relay Burden: 2 mA @ 57 Vdc

**POWER SUPPLY**
- Rated DC Voltage: 24 to 48 Vdc
- Minimum/Max. DC Voltage: 19 / 58 Vdc
- Maximum/Min. Current: 8A / 300 Vdc
- Rated AC Voltage: 110 to 230 Vac @ 48 - 62 Hz
- Maximum/Min. AV Voltage: 88 / 264 Vac @ 48 - 62 Hz
- Power Consumption:
  - Max.: 10 W
  - Backup time:
    - (date, time and log memory) without power supply voltage: 1 week

**MEETING**
- Insulation Test Voltage:
  - IEC 60525-5: 2kV, 50/60 Hz 1 min
  - Surge Test Voltage: IEC 60525-5: 2kV, 50/60 Hz
  - 1 MHz interference: IEC 60525-22-1
  - Electrostatic Discharge: EN 61000-4-2
  - Radio interference:
    - IEC 60525-22-3: 40 MHz, 151 MHz
    - IEC 60525-22-4: 450 MHz and cellular phone
  - Radiated Electromagnetic fields with amplitude modulation:
    - IEC 60140: 10 V/m
  - Radiated Electromagnetic fields with frequency modulation:
    - IEC 50204: 10 V/m
  - Fast Transients:
    - IEC/IEEE C37.90.1
    - IEC 60525-22-1
  - Magnetic fields at industrial frequency:
    - 30 A/m

**APPROVALS**
- CE: Conforms to 89/336/CEE and 73/23/CEE
- ISO: Manufactured to an ISO9001 registered program

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* Specifications subject to change without notice

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**www.GEDigitalEnergy.com**
User Interface

Ordering

To order select the basic model and the desired features from the Selection Guide below:

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<th>MIG II</th>
<th>Application</th>
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<th>Q</th>
<th>E</th>
<th>0</th>
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<td>ANSI IEC IAC</td>
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<td>Generator protection elements Motor protection elements</td>
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<td>POWER SUPPLY</td>
<td>LO HI</td>
<td>24 - 48 Vdc (19.2 - 57.6 Vdc) 110 - 250 Vdc (88 - 300 Vdc) 110 - 230 Vac (88 - 264 Vac)</td>
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Visit www.GEMultilin.com/MIGII to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIG II online
- View the MIG II brochure