



# MIN II

## GROUND PROTECTION SYSTEM

Complete numerical ground directional protection

### 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
- Asset monitoring - Breaker health, and breaker failure protection
- 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

- Directional ground protection at any voltage level
- Backup/auxiliary protection for line schemes
- Component relay for transformers, generators and motors

### FEATURES

#### Protection and Control

- 2 ground IOC (high and low) units for grounded systems
- 2 ground TOC (high and low) units for grounded systems
- 2 directional units for grounded systems
- 2 directional overcurrent units for Petersen coil
- 2 directional overcurrent units for isolated ground
- Directional comparison: scheme logic
- 4 preconfigured overcurrent curves (ANSI or IEC)
- Configurable breaker failure protection
- Configurable I/O
- 6 outputs: trip, service, 4 auxiliary

#### Monitoring and Metering

- 32-event record, analog/digital oscillography
- Ground 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 MIN II, a member of the M II family of protection relays, is a microprocessor based relay that provides ground directional protection on distributed networks at any voltage level and backup/auxiliary ground directional protection for transformers, generators and motors. Additionally it can be used to create a separate directional comparison ground scheme in pilot channels used for distance relaying.

The MIN II relay can be used in systems where the neutral is rigidly connected to the ground, where the connection is done through a resistor or a Petersen coil, and also where the neutral is isolated from the ground (ungrounded systems). Two models are available: Models 'E' and 'S'. Basic protection features for the model 'E' (neutral rigidly or through resistor connected to ground) include ground directional time delayed overcurrent and ground instantaneous overcurrent (two levels each Hiset and Loset). Each unit can be selected to be directional or not. For the model 'S' (isolated ground or connection through Petersen Coil) the MIN II has two independent directional units.

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 MIN II has two fixed digital inputs and six fixed digital outputs. An option is

provided allowing the two inputs and four of the outputs to be user configurable.

The MIN II has six fixed status LEDs. An option is provided allowing four of these LEDs to be user configurable.

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 MIF II units.

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. An option is provided allowing the display of event records and an oscillography record for the last fault.

## Protection

### Ground Time Overcurrent

The MIN II provides ground time overcurrent protection that can be set from 0.1 to 2.4 times  $I_n$ . Three different curve types can be selected: ANSI, IEC/BS142 and one user configurable. This allows the selection of the optimum curve for coordination with

fuses, feeders, motor transformers etc. ANSI and IEC curves include: definite time, normal inverse, very inverse, and extremely inverse. For each curve, different time multipliers may be set.

Curve Types:

- ANSI IEC/BS142
- Normal inverse IEC A
- Very inverse IEC B
- Extremely inverse IEC C
- Definite time

### Ground Instantaneous Overcurrent units

The MIN II includes two separately adjustable ground instantaneous overcurrent units. Each one can be independently enabled. Settings allow the pickup setpoint to be set from 0.1 to 30 times  $I_n$  and a time delay from 0 to 600.00 seconds to be set.

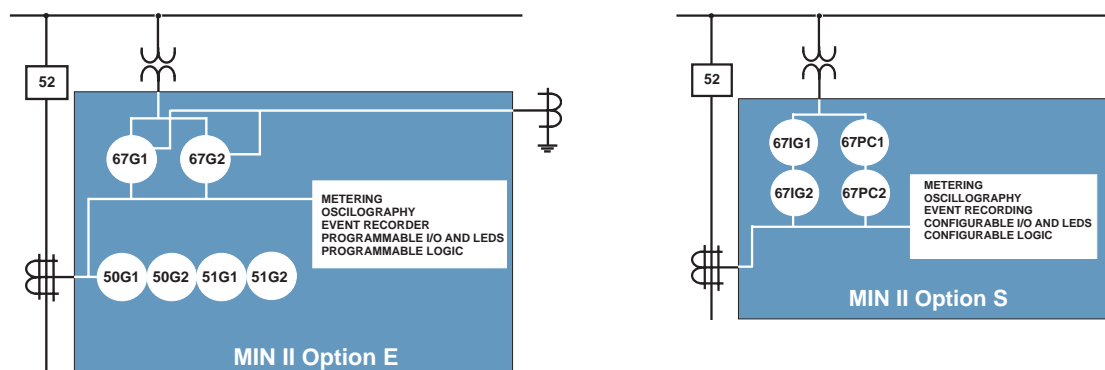
### Ground Directional Control

These units provide directional control to the units described above: 51G1, 51G2, 50G1, 50G2. The supervision is polarized by zero-sequence voltage with adjustable torque angle. The directional supervision is also adjustable independently for each overcurrent unit. Programmable performance logic for polarization voltage loss is included.

### Isolated Ground Directional Control

The MIN II provides directional protection for ungrounded systems. In this type of system the neutral is completely isolated from the ground, as a result of this the

## Functional Block Diagram





Use the oscillography feature as an accurate troubleshooting and diagnostics tool

ground fault current value is minimum and produced only by the line capacitive coupling.

The relay operation is based on the presence of this capacitive current plus the detection of an overvoltage condition.

### Petersen Coil Directional Control

The MIN II provides directional protection for systems where the connection to the ground is done through a Petersen coil. This scheme is known as ground resonant circuit or ground fault neutralizer. The relay operation is based on a real power directional protection unit, being intrinsically a ground directional function polarized by zero sequence voltage. The torque angle defines the operation zone and the three magnitudes (residual current, residual voltage and real power) define the pickup value.

### Multiple Setting Groups

Two separate settings groups are stored in MIN 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

MIN II provides metering values for ground current. The accuracy is 3% in the complete range.

### Event Recording

Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self test status. The MIN 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 voltages, and status of all the protection elements at the moment of the event.

### Oscillography

MIN 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.

The MIN II can be accessed with a PC using the M II EnerVista™ Setup Software via the RS232 communication port located in the relay front panel. If the relay was furnished with the appropriate option, use EnerVista™ to display last fault information such as event reports and an oscillography records. The MIN II has a drawout construction in 1/4 of a 19" rack case.

## 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 JX. 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 MIN 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 MIN II logic. The inputs of the MIN II configurable logic can be assigned to contact outputs and/or LEDs.

## User Interfaces

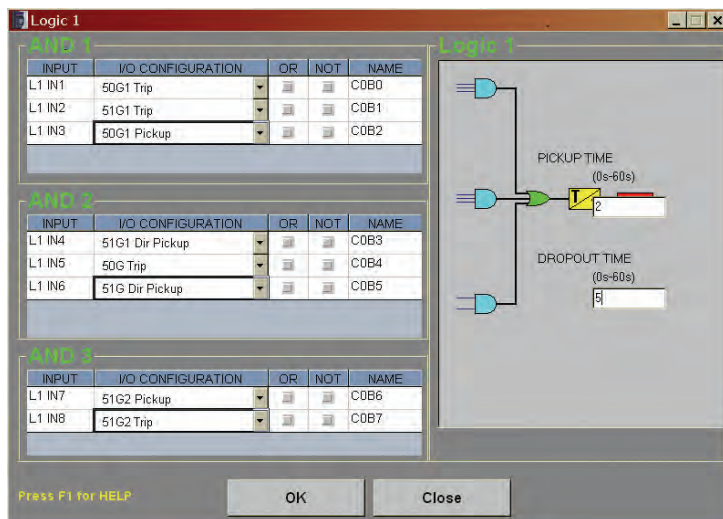
### Display

Measurement data (actual values), fault reports for the last five trips, and settings are shown on the 16x2 characters LCD display.

### Status LEDs

The MIN II incorporates 6 LED indicators in the front plate. The first one is a green LED identified as "READY", used to indicate the status of the protection elements. When "ON" it means the relay is energized and ready to protect, and at least one protection element has been enabled.

The second one is a red LED used for TRIP indication. It will be "ON" when a fault occurs and the relay energizes the trip outputs. Once energized, it will remain latched until the ESC/RESET key is pressed for three seconds to RESET the relay. Four additional LEDs are programmable in function and color. The factory default



Use Programmable Logic to set the MIV II to meet specific application needs

functions of the programmable LEDs are: Ground Trip, 50 Trip, and Pickup, while the color is set to RED, and the status memory as self-resetting. The user may change the function and status memory through the use of the EnerVista™ software.

The LED color can be modified using the relay keypad. The status memory may be programmed either self-resetting or latching. If programmed as self-resetting, when the associated function drops out the corresponding LEDs turn off. If programmed as latched, the LED will remain "ON" until the ESC/RESET key is pressed for three seconds to reset the relay.

In order to test LEDs, pressing the ESC/RESET key for three seconds will turn "ON" all LEDs. When the key is released, the LEDs will turn off (except if the function pickups are still active). This allows easy testing of the equipment.

### 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.

- Converts Modbus RTU over RS485 into Modbus TCP/IP over Ethernet
- Supports both 10BaseT and 10BaseF fiber connections
- Connect up to 32 RS485 serial devices to an Ethernet network
- Modbus TCP/IP provides multiple

SCADA masters allowing simultaneous communications to the same IED

- Flexible mounting options allow retrofit to existing devices
- Industrially hardened for utility and industrial applications
- Simple "plug & play" device setup with EnerVista™ software

MultiNet gives you the ability to connect M II serial devices to new or existing Ethernet networks. It has a 10Base-F fiber optic interface that provides high EMI/RFI immunity and inherent electrical isolation over long cable runs. MultiNet setup is simple, with a Windows® based EnerVista™ software program for installing and configuring the communication drivers.

## 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 or 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 MIN 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

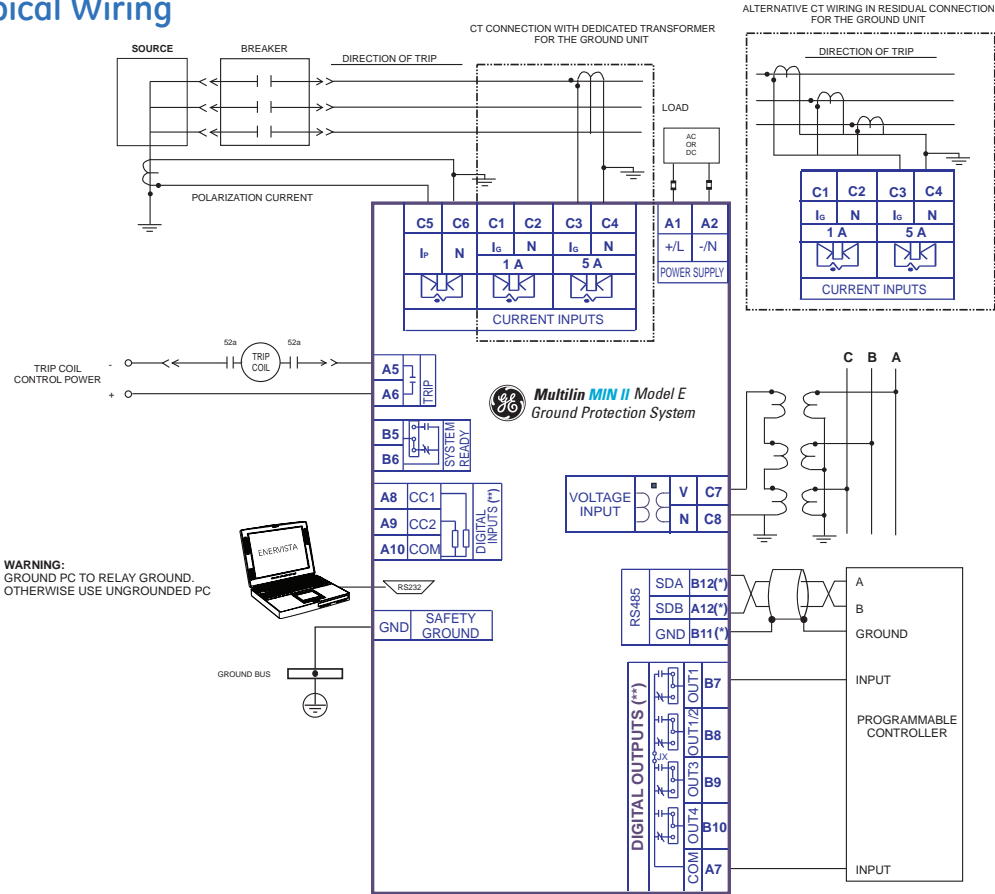
- Guideform Specifications
- Brochures
- Wiring Diagrams
- FAQs
- Service Bulletins

**Viewpoint Monitoring**

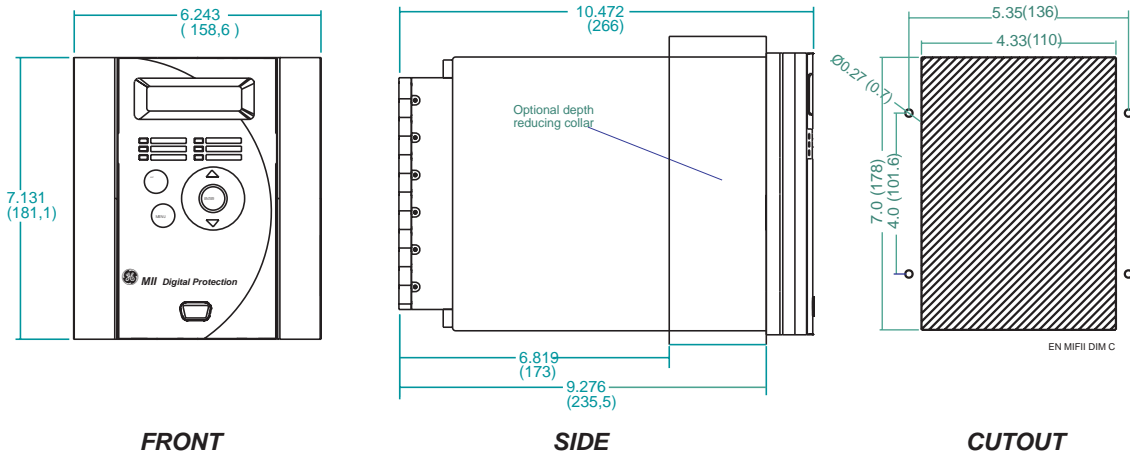
Viewpoint Monitoring is a simple-to-use and full-featured monitoring and data recording software package for small systems. Viewpoint Monitoring provides a complete HMI package with the following functionality:

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

**Typical Wiring**



**Dimensions**



Specialized Protection & Control

## Technical Specifications

### PROTECTION

#### GROUND TIME OVERCURRENT

**Pickup level:** 0.1 - 2.4 In in steps of 0.01  
**Curve Shapes:** Definite time, inverse, very inverse, extremely inverse, user defined.  
**Time multiplier:** 0.05 - 2.00 in steps of 0.01 for IEC curves  
 0.5 - 20.0 in steps of 0.01 for ANSI curves  
**Definite time:** 0.00 to 600.00 s in steps of 0.01 s  
**Accuracy:** 3% in the whole range. 1% typical at rated current.  
**Timing accuracy:** ± 5% + 50 ms of set time for 2 < I < 20 times the Actual Pickup Level for IEC/ANSI/definite time curves.

#### GROUND INSTANTANEOUS OVERCURRENT

**Current:** Fundamental  
**Pickup level:** 0.1 - 30 In in steps of 0.01  
**Definite time:** 0.00 to 600.00 s in steps of 0.01 s  
**Accuracy:** 3% in the whole range. 1% typical at rated current.  
**Timing accuracy:** ± 5% + 50 ms of set time for 2 < I < 20 times the Actual Pickup Level for IEC/ANSI/definite time curves.

#### GROUND DIRECTIONAL UNIT

**Torque angle:** -90° to +90° in steps of 1°.  
**Direction:** Forward / Reverse

#### GROUND TIME OVERCURRENT

**Pickup levels:** Current: 0.005 - 0.4 A in steps of 0.001 A  
 Voltage: 2 - 70 V in steps of 0.01 V  
**Definite time:** 0.00 to 600.00 s in steps of 0.01 s  
**Instantaneous trip deviation time:** 0 - 99.99 sec in steps of 100 ms

#### GROUND TIME OVERCURRENT FOR PETERSEN COIL

**Pickup level:** Current: 0.005 - 0.4 A in steps of 0.001 A  
 Voltage: 2 - 70 V in steps of 0.01 V  
 Power: 0.01 - 4.5 W  
**Definite time:** 0.00 to 600.00 s in steps of 0.01 s  
**Torque angle:** 0° to +180° in steps of 1°.

### METERING

#### THERMAL CAPACITY

**Current Circuits:**  
 Continuously: 4 x In  
 During 3 Sec: 50 x In  
 During 1 Sec: 100 x In

### COMMUNICATIONS

**Local Communication:** Alphanumeric display; 3 button frontal keypad

**Remote Communication:**  
 (local or remote PC and communications net):  
**Protocol:** ModBus® RTU  
**Baudrate:** 300 to 19200 bps  
 DB9 connector for RS232 ports on the front (1) and RS485 on the rear

### POWER SUPPLY

#### LOW RANGE

**Rated DC Voltage:** 24 to 48 Vdc  
**Min./Max. DC Voltage:** 19 / 58 Vdc

#### HIGH RANGE

**Rated DC Voltage:** 110 to 250 Vdc  
**Min./Max. DC Voltage:** 88 / 300 Vdc  
**Rated AC Voltage:** 110 to 230 Vac @ 48 - 62 Hz  
**Min./Max. AV Voltage:** 88 / 264 Vac @ 48 - 62 Hz  
**Power Consumption:** Max. = 15 W  
**Backup time:** (date, time and log memory) with out power supply voltage > 1 week

### INPUTS

#### AC CURRENT

**Secondary Rated Current:** 1A or 5 A depending on the selected model  
**Frequency:** 50 / 60 Hz ± 3 Hz (The unit can be set to 50 or 60 Hz)  
**Relay Burden:** < 0.1 VA @ In = 5A secondary  
 < 0.02 VA @ In = 1A secondary  
**Current Withstand:** 4 x In continuously  
 100 x In for 1 sec.

#### AC VOLTAGE

**Secondary Rated Voltage:** 50-240 Vac  
**Frequency:** 50 / 60 Hz ± 3 Hz (The unit can be set to 50 or 60 Hz)  
**Relay Burden:** < 0.2 VA @ 120 Vac  
**Voltage Withstand:** 440 Vac continuously

#### DIGITAL INPUTS

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

### OUTPUTS

#### TRIPPING CONTACTS

**Contact Capacity:**  
**Max. Operating Voltage:** 400 Vac  
**Continuous Current:** 16 A  
**Make and Carry:** 30 A  
**Breaking:** 4000 VA

#### OUTPUT RELAYS

**Configuration:** 6 Electro-Mechanical Form C  
**Contact Material:** Silver alloy suited for inductive loads  
**Operate Time:** 8 ms  
**Max Ratings for 100,000 operations:**

	Voltage	M/C	M/C cont.	Break 0.2 seg	Max Load
DC Resist	24 Vdc	16A	48A	16A	384W
	48 Vdc	16A	48A	2.6A	125W
	125 Vdc	16A	48A	0.6A	75W
	250 Vdc	16A	48A	0.5A	125W
DC Induct. (L/R=40ms)	24 Vdc	16A	48A	8A	192W
	48 Vdc	16A	48A	1.3A	62W
	125 Vdc	16A	48A	0.3A	37.5W
	250 Vdc	16A	48A	0.25A	62.5W
AC Resist	120Vdc	16A	48A	16A	720W
	250 Vdc	16A	48A	16A	4000W
AC Induct PF=0.4	120Vdc	16A	48A	16A	720W
	250 Vdc	16A	48A	16A	1250W

### MECHANICAL CHARACTERISTICS

- Metallic package in 1/4 19" rack and 4 units high
- Protection class IP52 (according to IEC 529)

### ENVIRONMENTAL

**Temperature:**  
**Storage:** -40°C to +80°C  
**Operation:** -20°C to +60°C  
**Humidity:** Up to 95% without condensing

### PACKAGING

**Approximate Weight:**  
**Net:** 8.8 lbs (4 kgs)  
**Ship:** 9.9 lbs (4.5 kgs)

### TYPE TESTS

TEST	STANDARD	CLASS
<b>Insulation Test Voltage:</b>	IEC 60255-5	2kV, 50/60Hz 1min
<b>Surge Test Voltage:</b>	IEC 60255-5	5 kV, 0.5 J (3 positive pulses and 3 negative.)
<b>1 MHz Interference:</b>	IEC 60255-22-1	III
<b>Electrostatic Discharge:</b>	IEC 60255-22-2 EN 61000-4-2	IV 8 kV in contact, 15 kV through air
<b>Radiointerference:</b>	IEC 60255-22-3: 40 MHz, 151 MHz, 450 MHz and cellular phone	III
<b>Radiated Electromagnetic fields with amplitude modulation</b>	ENV 50140	10 V/m
<b>Radiated Electromagnetic fields with amplitude modulation</b>	ENV 50141	10 V/m
<b>Common mode Radiated Electromagnetic fields with frequency modulation</b>	ENV 50204	10 V/m
<b>Fast Transients:</b>	ANSI/IEEE C37.90.1 IEC 60255-22-4 BS EN 61000-4-4	IV IV IV
<b>Magnetic fields at industrial frequency:</b>	EN 61000-4-8	30 AV/m
<b>Power Supply interruptions:</b>	IEC 60255-11	
<b>Temperature:</b>	IEC 57 (CO) 22	
<b>RF Emission:</b>	EN 55011	B
<b>Sinusoidal Vibration:</b>	IEC 60255-21-1 IEC 60255-21-2	II I
<b>Shock:</b>	IEC 255-5 (Tested on CTs, Power Supply terminals, Contact Inputs and Contact Outputs)	

### APPROVALS

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

\*Specifications subject to change without notice.

## Ordering

MINII	*	*	0	*	E	0	0	*	0	*	Description
Relay	N										Basic Model
Curve	L	A									With logic for teleprotection schemes (see Note 1) ANSI Curves IEC Curves (see Note 2)
Ground				E							Grounded system (In = 1 or 5 A) Isolated ground / Petersen Coil
Power Supply				S				LO			24-48 Vdc (Range: 19-58 Vdc) 110-250 Vdc (Range: 88-300 Vdc) - 110-240 Vac (Range: 88-264 Vac)
Conformal Coating										O	Without conformal coating
										H	Conformal coating

Visit [www.GEMultilin.com/MINII](http://www.GEMultilin.com/MINII) to:



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