



## MODULAR MICROPROCESSOR FAMILY

An economical choice for standard digital relaying applications

### KEY BENEFITS

- Ease of use and installation - same front panel programming, common cutout
- Follow technology evolution - Flash memory for product field upgrades
- Low priced scalable options - event reports, waveform capture, recloser, breaker fail
- Reduce troubleshooting and maintenance cost - Event reports, waveform capture
- Design flexibility - Easy to use programming logic
- Asset monitoring - Breaker health, and breaker failure protection
- Access to information - Modbus RTU™ communications
- AC/DC power supply
- Easy access via front panel keypad or communication links

### APPLICATIONS

- Feeder protection
- Main protection for small generators and motors
- Backup/Auxiliary protection for transformers, motors, generators and busbars
- Overload protection
- Automatic transfer equipment
- Load shedding and restoration schemes
- Backup directional overcurrent protection
- Reverse power protection
- Synchrocheck

### FEATURES

#### Features and Benefits

- Digital relay
- Incorporates protection, and control
- Local and remote user interfaces
- Internal memory
- Diagnostic features - event recording, and oscillography

#### User Interface and Programming

- Front Panel LEDs, key pad, and 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

#### Monitoring and Metering

- Current, voltage, frequency, thermal image
- Analog/digital oscillography (optional)
- Event recording up to 32 events
- Self-diagnostics

#### EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in MII relays into new or existing monitoring and control systems

## Protection

### Multiple Settings Groups

Two separate settings groups are stored in 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 contact input activation.

This allows users to have access to main relay functionalities in an extremely simple, user-friendly way by entering only main settings. Access to complete functionality for more complex use is available through advanced settings.

## Features and Benefits

### Event Recording

Events consist of a broad range of change of state occurrences, including pickups, trips, contact operations, alarms and self-test status. MII Family relays store up to 32 events, time tagged to the nearest millisecond. This information is invaluable in determining power system and relay operations. A user can inhibit the logging of selected events to aid in post-event analysis.

### Oscillography

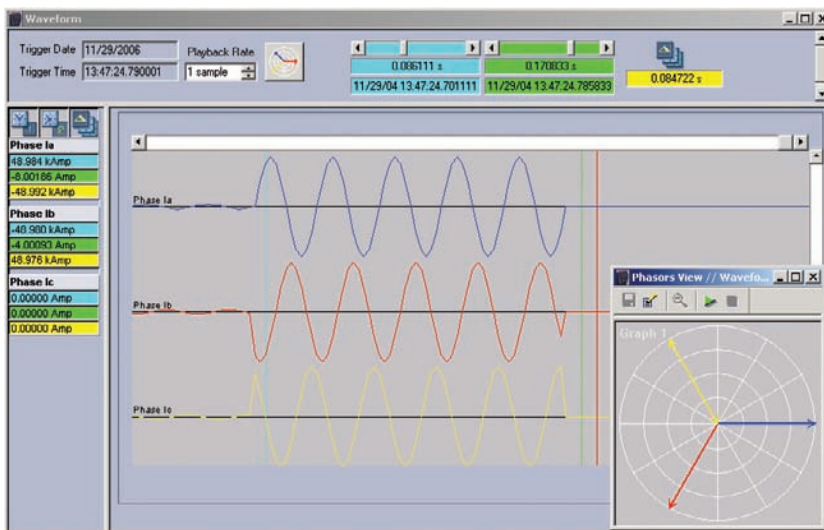
MII Family relays capture current waveforms and digital channels at eight samples per cycle. One oscillography record with a maximum length of 32 cycles is stored in memory. Oscillography is triggered either by internal signals or external contacts.

### Configurable I/Os

MII Family products have two configurable contact inputs and four configurable contact outputs. The configurable outputs can be latched. These units also have a fixed Trip and Service contact output.

### Breaker Failure Protection (optional)

A simple "breaker has not opened" feature is standard. A more complex breaker failure scheme can be easily implemented through the use of a digital input and configurable output logic (logic gates and timers).



Use the oscillography feature as an accurate troubleshooting and diagnostics tool

### Breaker Health (optional)

The breaker health threshold is set by the user to achieve "just in time" maintenance. When the cumulative I<sup>2</sup> value exceeds the threshold, an alarm occurs.

### Configurable Logic (optional)

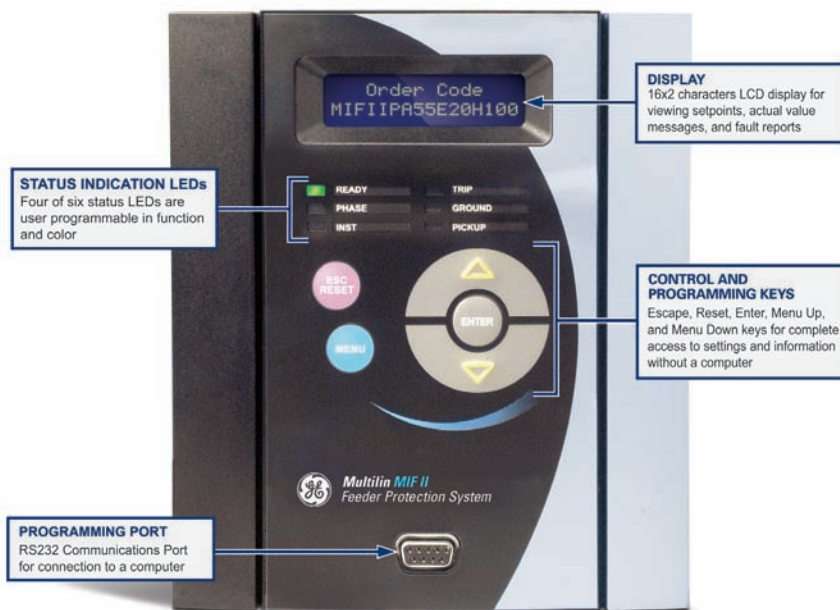
Up to four programmable logic schemes can be implemented by means of a set of four logic gates and timers, using the

graphical user interface provided. The outputs from programmable logic can operate contact outputs or faceplate LEDs.

### Metering

Phase and ground current, voltage, frequency and thermal image are measured with a maximum error of ±3% across the range.

## User Interface



## 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 MIF 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.

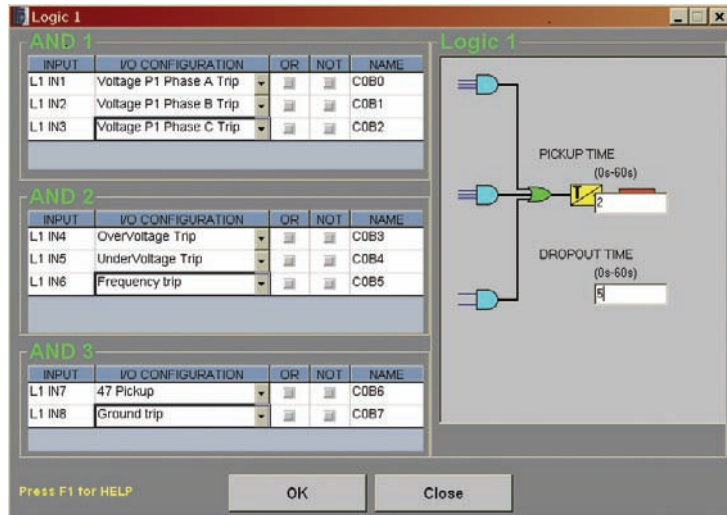
Four additional LEDs are programmable in function and color. The factory default functions of the programmable LEDs are: Phase Trip, Ground Trip, 50 Trip, and Pickup, while the color is set to RED, and the status memory as self-resetting. The user may change the function and status memory through the 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.



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

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



Connect up to 32 ModBus devices to your ethernet network including M II devices

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 MII 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

A single PC setup software package is required to access, configure, and monitor all the relays in the M II family, regardless of their model, application, or available options. The EnerVista™ M II Setup Software extracts the model number, version, and configuration parameters from the connected relay to display only the relevant data and options for the relay it is communicating with. This eliminates having to manually configure the relay within the software and provides a simple and easy to use operator user interface. All M II Family products are supplied with Windows® based EnerVista™ M II Setup Software. EnerVista™ is an easy to use tool that allows the communication with M II Family relays for monitoring, setting changes, and configuration. EnerVista™

software may be run on a PC with any Windows® based operating system. The program may be used locally on the RS232 front port or remotely on the RS485 port. It provides full access to the relay data with the following features:

- View relay status and actual values
- View/edit settings on-line/off-line
- View event recorder for troubleshooting
- Configure inputs, outputs and LEDs through configurable logic
- Utilize a configurable protection curve

- Relay firmware programming for upgrades

In addition, all status information such as target messages and digital input/output states may be viewed with EnerVista M II Setup Software.

## MII Family Feature comparison

	FEATURES	DEVICE	MIF II	MIG II	MIN II	MIV II	MIW II	MIB
PROTECTION	Phase Undervoltage	27P				■		
	Directional Low Forward Power	32L					■	
	Directional Reverse Power	32R					■	
	Loss of Excitation	40					■	
	Current Unbalance	46		■				
	Voltage Unbalance	47				■		
	Thermal Image Unit	49	■	■				
	Ground Overvoltage	59N				■		
	Ground IOC	50G	■	■	■			
	Phase IOC	50P	■	■				
	Ground TOC	51G	■	■	■			
	Phase TOC	51P	■	■				
	Phase Overvoltage	59P				■		
	Fuse Failure	VTFE						■
	Ground Directional	67G			■			
	Isolated Ground Directional	67N			■			
	Petersen Coil Ground Directional	67PC			■			
	Loss of Mains	78						
	Overfrequency	81O				■		
	Underfrequency	81U				■		
	Starts per Hour and Locked Rotor			■				
	Undercurrent	37		■				
	Differential Unit	87						■
	Restricted Earth Fault	87RGF		■				■
	Breaker Failure Protection	50BF	0					
	Programmable I/O and LEDs		0	■	■	■	■	■
Breaker Arcing Current		0						
Programmable Logic		0	■	■	■	■	■	
Multiple Settings Groups		■	■	■	■	■	■	
MONITORING AND METERING	Event Recorder	0	■	■	■	■	■	
	Oscillography	0	■	■	■	■	■	
	Thermal Capacity		■	■				
COMMUNICATIONS	Alphanumeric Display		■	■	■	■	■	
	Three-Button Keypad		■	■	■	■	■	
	ModBus® Communications		■	■	■	■	■	
	RS232 Serial Port		■	■	■	■	■	
	RS485 Serial Port		■	■	■	■	■	



# MII Family Common Technical Specifications

## PROTECTION

### PHASE TIME OVERCURRENT

**Pickup level:** 10 – 240% of CT rating  
**Curve shapes:** Definite time, inverse, very inverse, extremely inverse, custom  
**Time multiplier:** 0.05 – 2.00 in steps of 0.01  
**Definite time:** Up to 99.99 sec (10 msec steps)  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### GROUND TIME OVERCURRENT

**Pickup level:** 10 – 240% of CT rating  
**Curve shapes:** Definite time, inverse, very inverse, extremely inverse, custom  
**Time multiplier:** 0.05 – 2.00 in steps of 0.01  
**Definite time:** Up to 99.99 sec (10 msec steps)  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### PHASE INSTANTANEOUS

**Pickup level:** 10 – 3000% of CT rating  
**Definite time:** Up to 99.99 sec (10 msec steps)  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### GROUND INSTANTANEOUS

**Pickup level:** 10 – 3000% of CT rating  
**Definite time:** Up to 99.99 sec (10 msec steps)  
**Level:** ±3% in the complete range  
**Time:** Greater of ±3% or ±25 ms

### GROUND DIRECTIONAL

**Torque angle:** -90°, +90° (1° steps)  
**Direction:** Forward/back (rew)  
**Loss of voltage polarization logic:** Enable/disable

### ISOLATED GROUND DIRECTIONAL (MIN OPTION S)

**Voltage pickup levels:** V<sub>h</sub> 2 – 70 V in steps of 0.01 V  
 V<sub>i</sub> 2 – 70 V in steps of 0.01 V  
**Current pickup levels:** I<sub>low</sub> 5 – 400 mA in steps of 1 mA  
 I<sub>hi</sub> 5 – 400 mA in steps of 1 mA  
**Definite time:** 0 – 99.99 sec in steps of 10 msec  
**Instantaneous trip deviation time:** 0 – 99.99 sec in steps of 100 msec  
 -90°, +90° (1° steps)  
**Torque angle:** -90°, +90° (1° steps)

### PETERSEN COIL GROUND DIRECTIONAL

**Voltage pickup levels:** V<sub>h</sub> 2 – 45 V in steps of 0.1 V  
**Current pickup levels:** I<sub>low</sub> 5 – 100 mA in steps of 1 mA  
**Real power pickup levels:** 10 – 4500 mW in steps of 0.1 mW  
**Definite time:** 0.03 – 3 sec in steps of 10 msec  
**Instantaneous trip deviation time:** 1 – 10 sec in steps of 100 msec  
 -90°, +90° (0.01 steps)

### DIRECTIONAL REVERSE POWER

**Power pickup level:** 0.01 – 0.99 x Rated MW  
**Time delay:** 0.2 – 120 seconds in steps of 0.1  
**Block from online:** 0 – 5,000 sec.

### DIRECTIONAL LOW FORWARD POWER

**Power pickup level:** 0.01 – 0.99 x Rated MW  
**Time delay:** 0.2 – 120 seconds in steps of 0.1  
**Block from online:** 0 – 15,000 sec.

### LOSS OF EXCITATION

**Circle 1 diameter:** 2.5 – 300 ohm  
**Circle 1 offset:** 2.5 – 150 ohm  
**Circle 1 trip delay:** 0.1 – 10 sec  
**Circle 2 diameter:** 2.5 – 300 ohm  
**Circle 2 offset:** 2.5 – 150 ohm  
**Circle 2 trip delay:** 0.1 – 10 sec

### THERMAL IMAGE UNIT

**Tap current:** 10 – 240% of CT rating  
**Cool rate:**  
 T1: 3 – 600 min  
 T2: 1 – 6 x T1  
 K: 1 – 1.2  
**Alarm level:** 70 – 100%

### PHASE UNDERVOLTAGE

**Pickup level:** 2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)  
**Curve shapes:** Definite time  
**Time delay:** 0.0 to 600 sec in steps of 0.01  
**Accuracy:**  
 Level: ±3% over the complete range  
 Time: Greater of ±3% or ±25 ms

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**Accuracy:**  
 Level: ±3% over the complete range  
 Time: Greater of ±3% or ±25 ms

## HIGH IMPEDANCE

### DIFFERENTIAL UNIT

**Pickup Level:** 10mA to 400mA  
**Definite Time:** Up to 600 sec (10 msec steps)  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### ALARM UNIT

**Pickup Level:** 10mA to 400mA  
**Definite Time:** Up to 600 sec (10 msec steps)  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### VOLTAGE UNBALANCE

**Pickup level:** 2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)  
**Curve shapes:** Definite time  
**Time delay:** 0.0 to 600 sec in steps of 0.01  
**Accuracy:**  
 Level: ±3% over the complete range  
 Time: Greater of ±3% or ±25 ms

### OVERFREQUENCY

**Source:** Voltage (Phase B)  
**Pickup level:** 42.0 to 67.5 Hz in steps of 0.01 Hz  
**Time delay:** 0.0 to 600 sec in steps of 0.01  
**Voltage inhibit setting:** 30 to 250 V/10 to 60 V in steps of 0.01

### UNDERFREQUENCY

**Source:** Voltage (phase B)  
**Pickup level:** 42.0 to 67.5 Hz in steps of 0.01 Hz  
**Time delay:** 0.0 to 600 sec in steps of 0.01  
**Voltage inhibit setting:** 30 to 250 V/10 to 60 V in steps of 0.01

### CURRENT UNBALANCE

**Pickup level:** 5 – 99% of CT rating  
**Definite time:** Up to 99.99 sec (10 msec steps)  
**Curve shapes:** I<sub>2</sub> = K  
**Time multiplier:** K: 1 – 100  
**Accuracy:**  
 Level: ±3% in the complete range  
 Time: Greater of ±3% or ±25 ms

### STARTS/HOUR AND LOCKED ROTOR

**Pickup level:** 101 – 1000% of CT rating  
**Definite time:** 0.1 – 99.9 sec  
**Time window:** 10 – 100 min  
**Number of starts:** 1 – 10  
**Restart block time:** 10 – 100 min

### UNDERCURRENT

**Pickup level:** 10 – 99% of CT rating  
**Definite time:** 0 – 99.99 sec

### METERING

**Frequency:** ±5m Hz  
**Voltage/current:** ±3% over the complete range

### THERMAL CAPACITY

**Current circuits:**  
 Continuously: 4 x In  
 During 3 sec: 50 x In  
 During 1 sec: 100 x In

### MONITORING (OPTIONAL)

#### OSCILLOGRAPHY

**Records:** 1 x 24 cycles  
**Sampling rate:** 8 samples per power frequency cycle  
**Triggers:** Any element pickup or operate  
 Digital input change of state  
 Digital output change of state  
 Communication command  
**Data:** AC input channels  
 Digital input/output channels  
 Self-test events

#### EVENT RECORDER

**Capacity:** 24 events (32 in MIF)  
**Time-tag:** To 1 millisecond  
**Triggers:** Any element pickup, operate or reset  
 Digital input/output change of state  
 Self-test events

#### RANGES:

**Current:** 0.2 – 30 x In  
**Voltage:** Pickup level

## 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 electromechanical Form C  
**Contact material:** silver alloy suited for inductive loads  
**Operate time:** 8 ms  
**Max ratings for 100000 operations:**

	Voltage	M/C cont.	M/C 0.2 sec	Break	Max Load
DC Resistive	24 VDC	16 A	48 A	16 A	384 W
	48 VDC	16 A	48 A	2.6 A	125 W
	125 VDC	16 A	48 A	0.6 A	75 W
DC Inductive	250 VDC	16 A	48 A	0.5 A	125 W
	24 VDC	16 A	48 A	8 A	192 W
(L/R = 40 ms)	48 VDC	16 A	48 A	1.3 A	62 W
	125 VDC	16 A	48 A	0.3 A	37.5 W
AC Resistive	250 VAC	16 A	48 A	0.25 A	62.5 VA
	120 VAC	16 A	48 A	16 A	1920 VA
AC Inductive PF=0.4	250 VAC	16 A	48 A	16 A	4000 VA
	120 VAC	16 A	48 A	6 A	720 VA
	250 VAC	16 A	48 A	5 A	1250 VA

## INPUTS

### AC CURRENT

**Secondary Rated Current:** 1m 5 A depending on the selected model, or 50 mA for sensitive ground models  
**Frequency:** 50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)  
**Relay Burden:** < 0.2 VA @ In = 5A secondary  
 < 0.08 VA @ In = 1A secondary  
 < 0.08 VA @ In = 1A sensitive ground, secondary  
**Current Withstand:** 4 x In continuously  
 100 x In for 1 sec.

### AC VOLTAGE

**High Range**  
**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  
**Low Range**  
**Secondary Rated Voltage:** 20-60 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:** 250 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

**COMMUNICATIONS**

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

**Remote communication (local or remote PC and communications net):**

**Mode:** ModBus® RTU  
**Speed:** 300 to 19,200 bps

**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 @ 50 – 60 Hz

**Min./Max. AV Voltage:** 88 / 264 Vac @ 50 – 60 Hz

**Power Consumption:** Max. = 10 W

**Backup time:** (date, time and log memory) without power supply voltage > 1 week

**MECHANICAL CHARACTERISTICS**

- Metallic package in quarter 19" rack and four units high
- Frontal MMI with display and keypad
- DB9 connector for RS232 ports on the front (1) and RS485 on the rear
- 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

**TYPE TESTS**

Test	Standard	Class
<b>Insulation Test Voltage:</b>	IEC 60255-5	2kV, 50/60 Hz 1 min
<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>Radio interference:</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 Common mode</b>	ENV 50141	10 V/m
<b>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 IEC 57 (CO) 22	
<b>Temperature:</b>	IEC 57 (CO) 22	
<b>RF Emission:</b>	EN 55011	B
<b>Sinusoidal Vibration:</b>	IEC 60255-21-1	II
<b>Shock:</b>	IEC 60255-21-2	I
<b>Insulation Test:</b>	IEC255-5 (Tested on CTs, Power Supply terminals, Contact Inputs and Contact Outputs)	

**PACKAGING**

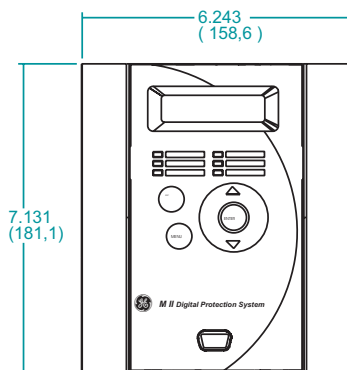
Approximate weight:	Two 4-rack	One 8-rack
<b>Net:</b>	8.8 lbs (4 kgs)	3.9 lbs (2.7 kg)
<b>Ship:</b>	9.9 lbs (4.5 kgs)	7 lbs (3.2 kg)

**APPROVALS**

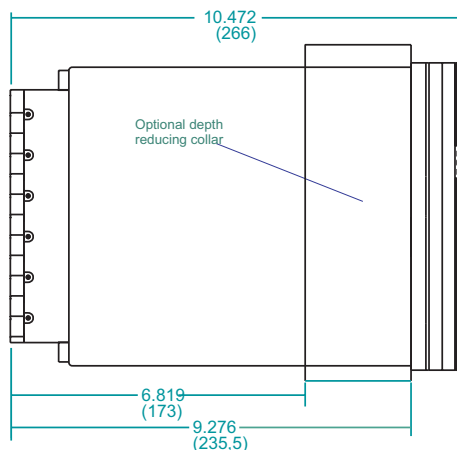
**ISO:** Manufactured under an ISO9001 registered system.  
**CE:** Conforms to EN 55011/CISPR 11, EN 50082-2, Conforms to IEC 947-1, 1010-1

\*Specifications subject to change without notice.

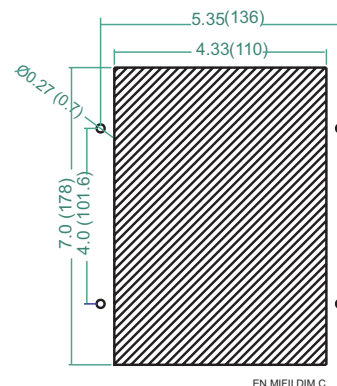
**Dimensions**



**FRONT**



**SIDE**



**CUTOUT**

The MII Family of products have a drawout construction in four-inch wide modules for relays including current channels or in two-inch wide modules for relays including only voltage channels. These drawout modules may be mounted in standard 19" racks, half racks, individual cases, or supplied with depth reducing collar for space efficiency.