



An economical choice for standard digital relaying applications.

Features and Benefits

- Advanced 16-bit microprocessor
- Configurable logic, curves, digital I/Os and LEDs
- Flash memory for field upgrades
- Two settings groups
- Modular construction for serviceability and reduced spare costs

Applications

- Feeder protection, any voltage level
- 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
- Directional power protection
- enerVista.com compatible (see page 275)

Monitoring and Metering

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

User Interfaces

- M+PC software for setting, monitoring
- RS232 port, faceplate accessible (19,200 bps, ModBus® RTU)
- RS485 rear port (19,200 bps, ModBus® RTU)
- LED dot matrix display and keypad
- Target LED indicators



Protection

Multiple Settings Groups

Two separate settings groups are stored in the nonvolatile 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. M 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

M 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

M 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.

I/O and LED configurations are programmed using M+PC software.



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).

Breaker Health (optional)

The breaker health threshold is set by the user to achieve "just in time" maintenance. When the cumulative I² 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 Interfaces

Faceplate LEDs

Six LEDs are provided on the relay faceplate. Two are assigned to indirect trip status and relay in service. Four LEDs are user-configurable, and can be assigned to various duties (trips, alarms, etc.) LEDs can be set to flash on-off and to be latched.

Keypad and Display

A three button keypad allows user access for easy relay interrogation and change of settings. Metering data, last trip information and settings are displayed through the LED dot matrix display. Note that full access to the event 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.

Communications

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 M Family relays 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.

M+PC Software

A single PC software package is required to access, configure, and monitor all relays in the M Family regardless of their model, application, or available options. The M+PC software extracts the model number, version, and configuration parameters from the connected relay to display only the relevant data and options for the relay with which it is communicating. This eliminates having to manually configure the relay within the software and provides a simple and easy to use operator user interface.

All M Family products are supplied with Windows®-based M+PC software. M+PC allows communication among M Family relays for monitoring, setting changes, information and configuration.

Keep track and react to all relay status data with ease.



The M+PC software program may be run on a PC with the Windows® 95/98/NT operating systems. The program may be used locally on the RS232 front serial port or remotely on the RS485 port. It provides full access to the relay data with the following features:

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

All status information such as target messages and digital I/O states may be viewed with the M+PC software.

Evaluation

M+PC software may be used off-line to simulate the connection to any M Family relay. This mode allows the user to:

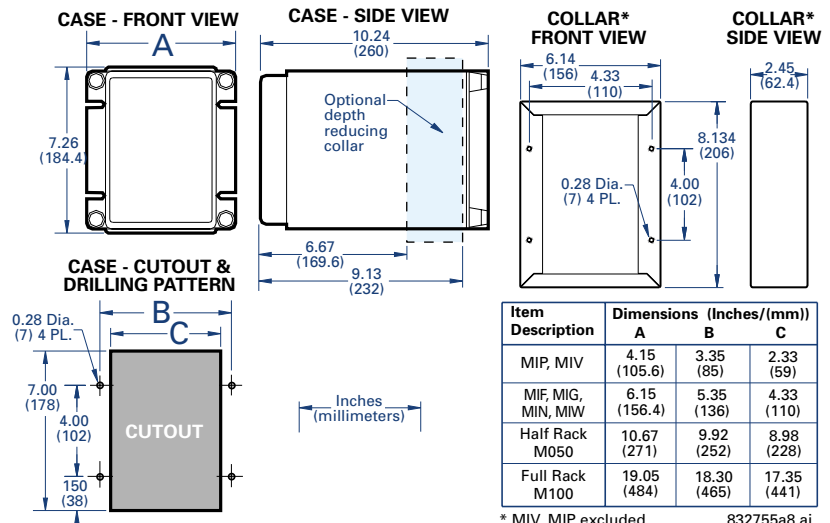
- View status, settings and protection units incorporated in the selected model
- Create setting files for future download to the physical relay

M Family Feature Comparison

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

Dimensions

The M 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.



M Family Common Technical Specifications

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PROTECTION	
PHASE TIME OVERCURRENT (51P)	
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 (51N)	
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 (50PH & 50PL)	
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 (50NH & 50NL)	
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 DIRECTIONAL (67N)	
Torque angle:	-90°, +90° (1° steps)
Direction:	Forward/back (rew)
Loss of voltage polarization logic:	Enable/disable
ISOLATED GROUND DIRECTIONAL (67IG) (MIN OPTION S)	
Voltage pickup levels:	Vh 2 – 70 V in steps of 0.01 V Vi 2 – 70 V in steps of 0.01 V
Current pickup levels:	l low 5 – 400 mA in steps of 1 mA hi 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
Torque angle:	-90°, +90° (1° steps)
PETERSEN COIL GROUND DIRECTIONAL (67PC)	
Voltage pickup levels:	Vh 2 – 45 V in steps of 0.1 V
Current pickup levels:	l low 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
Torque angle:	-90, +90 (0.01 steps)
DIRECTIONAL REVERSE POWER (32RP)	
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 (32LF)	
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 (40)	
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 (49)	
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 (27P)	
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
PHASE OVERVOLTAGE (59)	
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
GROUND OVERVOLTAGE (59N)	
Pickup level:	2.0 – 60 V or 10 – 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

PROTECTION	
VOLTAGE UNBALANCE (47)	
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 (81O)	
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 (81U)	
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 (46)	
Pickup level:	5 – 99% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Curve shapes:	I ² t = 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 (37)	
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 I _n
During 3 sec:	50 x I _n
During 1 sec:	100 x I _n

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 I _n
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	MAKE/CARRY CONTINUOUS	MAKE/CARRY 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	182 W
	48 VDC	16 A	48 A	1.3 A	62 W
(L/R = 40 ms)	125 VDC	16 A	48 A	0.3 A	37.5 W
	250 VDC	16 A	48 A	0.25 A	62.5 W
	AC Resistive	120 VAC	16 A	48 A	16 A
AC Inductive	250 VAC	16 A	48 A	16 A	4000 VA
	PF=0.4	120 VAC	16 A	48 A	6 A
	250 VAC	16 A	48 A	5 A	1250 VA

INPUTS	
BURDENS	
Voltage circuits:	0.2 VA
Current circuits:	0.1 VA for I _n = 5 A 0.02 VA for I _n = 1 A
DC burden:	
During operation:	10 W
Per each activated input:	8 mA/1 W, V _{aux} : 125

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	
Frequency:	50/60 Hz
Nominal phase current:	1 or 5 A (depending on model)
Nominal ground current:	1 or 5 A (depending on model)
Auxiliary voltage:	24 – 48 VDC, ±20% 110 – 250 VDC, 110 – 220 VAC ±20%

MECHANICAL CHARACTERISTICS	
<ul style="list-style-type: none"> • 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	
Isolation test voltage:	2 kV, 50/60 Hz, 1 min
Surge test voltage:	5 kV peak, 0.5 J
Interference:	Class III according to IEC60255-22-1
Electrostatic discharge:	Class IV according to IEC60255-22-2
Radio interference:	Class III according to IEC60255-22-3
Fast transient:	Class IV according to IEC60255-22-4
Sinusoidal vibration:	Class I according to IEC60255-21-1
Shock:	Class I according to IEC60255-21-2
Radiofrequency emission:	According to IEC 41B (Sec 81) and EN55022 Class B
Oscillatory/fast risetime transient:	ANSI/IEEE C 37.90.1
Electromagnetic interference withstand capability:	ANSI/IEEE C 37.90.2

PACKAGING		
Approximate weight:	Two 4-rack	One 8-rack
Net:	8.8 lbs (4 kgs)	3.9 lbs (2.7 kg)
Ship:	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, IEC 947-1, 1010-1
UL:	UL listed for USA and Canada

*Specifications subject to change without notice.

M Family Guideform Specifications

For an electronic version of the M Family guideform specifications, please visit: www.GEindustrial.com/Multilin/specs, fax your request to 905-201-2098 or email to literature.multilin@indsys.ge.com.



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