

# M FAMILY

## Modular Microprocessor Relays

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



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## 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  $I^2$  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  $\pm 3\%$  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.

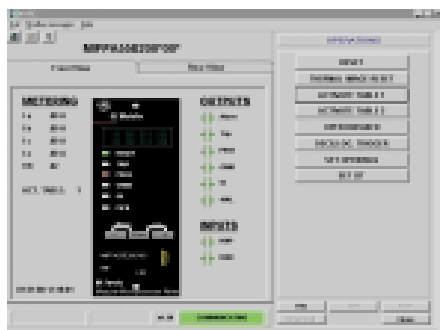
## Communications

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

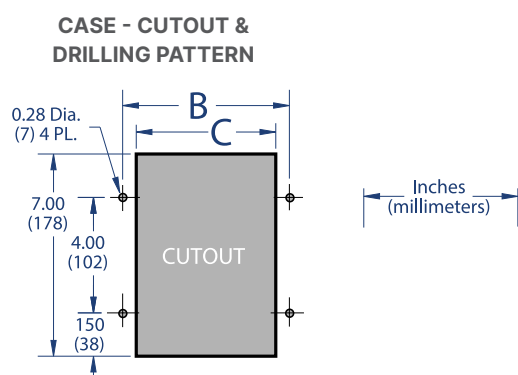
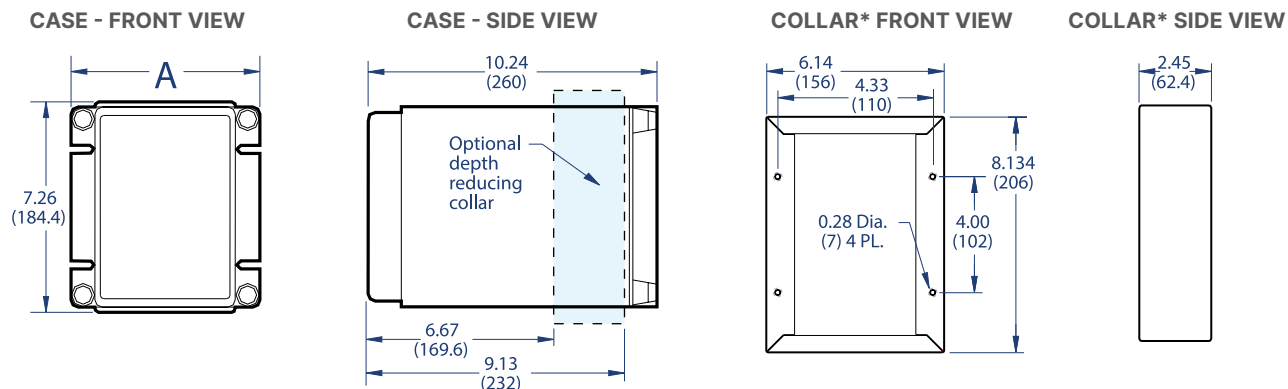
M+PC software may be used offline to simulate the connection to any M Family relay. This mode allows the user to:

- 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       |           | 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                |           | ■   | ■   | ■   | ■   | ■   | ■   |

## Dimensions



| ITEM DESCRIPTION   | DIMENSIONS (inches/mm) |             |             |
|--------------------|------------------------|-------------|-------------|
|                    | A                      | B           | C           |
| MIP, MIV           | 4.15 (105.6)           | 3.35 (85)   | 2.33 (59)   |
| MIF, MIG, MIN, MIW | 6.15 (156.4)           | 5.35 (136)  | 4.33 (110)  |
| Half Rack M050     | 10.67 (271)            | 9.92 (252)  | 8.98 (228)  |
| Full Rack M100     | 19.05 (484)            | 18.30 (465) | 17.35 (441) |

\* MIV, MIP excluded

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

| 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/                                                              |
| 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<br>Vi 2 – 70 V in steps of 0.01 V      |
| Current pickup levels:                            | I low 5 – 400 mA in steps of 1 mA<br>I 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:                            | I 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)                                                 |

| PROTECTION                           |                                                                 |
|--------------------------------------|-----------------------------------------------------------------|
| 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 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                                        |

| 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:                | I²t = 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 <sub>n</sub>          |
| During 3 sec:     | 50 x I <sub>n</sub>         |
| During 1 sec:     | 100 x I <sub>n</sub>        |

| MONITORING (OPTIONAL) |                                                                                                                           |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| OSCILLOGRAPHY         |                                                                                                                           |
| <b>Records:</b>       | 1 × 24 cycles                                                                                                             |
| <b>Sampling rate:</b> | 8 samples per power frequency cycle                                                                                       |
| <b>Triggers:</b>      | Any element pickup or operate<br>Digital input change of state<br>Digital output change of state<br>Communication command |
| <b>Data:</b>          | AC input channels<br>Digital input/output channels<br>Self-test events                                                    |

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

| RANGES:         |                           |
|-----------------|---------------------------|
| <b>Current:</b> | 0.2 – 30 × I <sub>n</sub> |
| <b>Voltage:</b> | Pickup level              |

## OUTPUTS

| TRIPPING CONTACTS        |         |
|--------------------------|---------|
| <b>Contact capacity:</b> |         |
| Max. operating voltage:  | 400 VAC |
| Continuous current:      | 16 A    |
| Make and carry:          | 30 A    |
| Breaking:                | 4000 VA |

| OUTPUT RELAYS                             |                                         |
|-------------------------------------------|-----------------------------------------|
| <b>Configuration:</b>                     | 6 electromechanical Form C              |
| <b>Contact material:</b>                  | silver alloy suited for inductive loads |
| <b>Operate time:</b>                      | 8 ms                                    |
| <b>Max ratings for 100000 operations:</b> |                                         |

| INPUTS                    |                                                                     |
|---------------------------|---------------------------------------------------------------------|
| BURDENS                   |                                                                     |
| <b>Voltage circuits:</b>  | 0.2 VA                                                              |
| <b>Current circuits:</b>  | 0.1 VA for I <sub>n</sub> = 5 A<br>0.02 VA for I <sub>n</sub> = 1 A |
| <b>DC burden:</b>         |                                                                     |
| During operation:         | 10 W                                                                |
| Per each activated input: | 8 mA/1 W, V <sub>aux</sub> : 125                                    |

| COMMUNICATIONS                                                           |                                                  |
|--------------------------------------------------------------------------|--------------------------------------------------|
| <b>Local communication:</b>                                              | Alphanumeric display;<br>3 button frontal keypad |
| <b>Remote communication (local or remote PC and communications net):</b> |                                                  |
| Mode:                                                                    | ModBus® RTU                                      |
| Speed:                                                                   | 300 to 19,200 bps                                |

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

| 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      |                              |
|--------------------|------------------------------|
| <b>Temperature</b> |                              |
| Storage:           | -40° C to +80° C             |
| Operation:         | -20° C to +60° C             |
| <b>Humidity:</b>   | Up to 95% without condensing |

| TYPE TESTS                                                |                                                   |
|-----------------------------------------------------------|---------------------------------------------------|
| <b>Isolation test voltage:</b>                            | 2 kV, 50/60 Hz, 1 min                             |
| <b>Surge test voltage:</b>                                | 5 kV peak, 0.5 J                                  |
| <b>Interference:</b>                                      | Class III according to IEC60255-22-1              |
| <b>Electrostatic discharge:</b>                           | Class IV according to IEC60255-22-2               |
| <b>Radio interference:</b>                                | Class III according to IEC60255-22-3              |
| <b>Fast transient:</b>                                    | Class IV according to IEC60255-22-4               |
| <b>Sinusoidal vibration:</b>                              | Class II according to IEC60255-21-1               |
| <b>Shock:</b>                                             | Class I according to IEC60255-21-2                |
| <b>Radiofrequency emission:</b>                           | According to IEC 41B (Sec 81) and EN55022 Class B |
| <b>Oscillatory/fast risetime transient:</b>               | ANSI/IEEE C 37.90.1                               |
| <b>Electromagnetic interference withstand capability:</b> | ANSI/IEEE C 37.90.2                               |

| 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                         |                                                              |
|-----------------------------------|--------------------------------------------------------------|
| <b>ISO:</b>                       | Manufactured under an ISO9001 registered system              |
| <b>CE:</b>                        | 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.

| 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     |
|                            | 250 VDC | 16 A                  | 48 A               | 0.5 A  | 125 W    |
| DC Inductive (L/R = 40 ms) | 24 VDC  | 16 A                  | 48 A               | 8 A    | 192 W    |
|                            | 48 VDC  | 16 A                  | 48 A               | 1.3 A  | 62 W     |
|                            | 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   | 1920 VA  |
|                            | 250 VAC | 16 A                  | 48 A               | 16 A   | 4000 VA  |
| AC Inductive PF=0.4        | 120 VAC | 16 A                  | 48 A               | 6 A    | 720 VA   |
|                            | 250 VAC | 16 A                  | 48 A               | 5 A    | 1250 VA  |

For more information, visit  
**gevernova.com/grid-solutions**



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GEA-N50176  
English  
250828