

# MGE UPS SYSTEMS POWER MANAGEMENT MODULE (PMM) 30-300 kVA

## GUIDE SPECIFICATIONS

### 1.0 GENERAL

#### 1.1 SUMMARY

This specification covers the electrical characteristics and general requirements for AC low voltage power distribution equipment, hereafter referred to as the PMM (Power Management Module). The PMM is designed primarily for distribution, monitoring and isolation of electrical power and will properly interface the building's AC power source with sensitive electronic loads in data center, telecom, office, or industrial environments.

#### 1.2 STANDARDS

The following standards and documents apply to the specified equipment to the extent defined herein:

- A. FCC Part 15 Class A (47 CFR 0-19)
- B. UL 60950 (while standard is applicable) & UL 1062 Safety of Information Technology Equipment, including Electrical Business Equipment (effective 12/1/00, replacing UL 1950) with the exception of 380 V units
- C. CSA Standard 60950.
- D. NEMA Standard ST-1
- E. NEMA ST20 - Dry-Type Transformers for General Applications
- F. NEMA AB1 - Molded Case Circuit Breakers
- G. NEMA PB1 - Panelboards
- H. NEC (NFPA70) Section 645Code
- I. ISO 9000 - International Organization for Standardization

#### 1.3 SUBMITTALS

Submittals shall contain the following documentation:

- A. **Installation Package:** Complete electrical characteristics and connection requirements. Provide detailed equipment outlines with cabinet dimensions and spacing requirements; location of conduit entry/exit paths; location of floor/seismic mounting; all cabinet weights; heat rejection and air flow requirements; single-line diagram; control and external wiring.
- B. **Product Data:** Provide catalog sheets and technical data sheets to indicate physical data and electrical performance, electrical characteristics, and connection requirements.
- C. **Manufacturer's Installation Instructions:** Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product. Include equipment installation outline, connection diagram for external cabling, internal wiring diagram, and written instruction for installation.

## 1.4 FINAL SUBMITTALS

Upon delivery of the PMM, the following submittals shall be included:

- A. A complete set of installation drawings showing all the information stated in section 1.3.
- B. An owner's manual showing safe and correct operation of all PMM functions.

## 1.5 QUALIFICATIONS & QUALITY ASSURANCE

- A. **Manufacturer's Certification:** The manufacturer shall specialize in manufacturing of Power Management Modules (PMM) specified in this document, with a nationwide first party service organization. The manufacturer shall be ISO 9001 certified and shall design to internationally accepted standards.
- B. **Factory Testing:** Prior to shipment the manufacturer shall complete a documented test procedure to test all functions of the PMM, and guarantee compliance with the specification. The factory test shall be performed in the presence of the customer providing the manufacturer receives adequate prior notice. The manufacturer shall provide a copy of the test report upon request.
- C. **Materials and Assemblies:** All materials and parts comprising the PMM shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. All active electronic devices shall be solid state and not exceed the manufacturer's recommended tolerances for temperature or current to ensure maximum reliability. All semiconductor devices shall be sealed. All relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies, and final products.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. All products shall be packaged in a manner to prevent penetration by debris and to allow safe delivery by all modes of ground transportation and air transportation where specified.
- B. Prior to shipping all products shall be inspected at the factory for damage.
- C. Equipment shall be protected against extreme temperature and humidity and shall be stored in a conditioned or protected environment.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. **Temperature:**
  - Operating:** -10°C to +40°C (14°F to 104°F)
  - Storage:** -40°C to +60°C (-40°F to 140°F)
- B. **Relative Humidity:**
  - Operating:** 10% to 90% non-condensing
  - Non-operating:** 10% to 70% condensing

- C. **Altitude:**  
**Operating:** 500 feet below to 7,000 feet above sea level  
**Non-operating:** 500 feet below to 25,000 feet above sea level
- D. **Audible Noise:** Typical, average noise level, 'A' weighted at three feet from the front of the cabinet  
at no load: 45dB: < 50 kVA  
50dB: 51 kVA to 150 kVA  
55dB: 151 kVA to 300 kVA

## 1.8 WARRANTY

The PMM shall be covered by a full parts and labor warranty from the manufacturer. The warranty period shall be for twelve (12) months from date of installation and start-up or eighteen (18) months from date of shipment from the manufacturer, whichever occurs first.

## 2.0 PRODUCT DESCRIPTION

### 2.1 APPROVED MANUFACTURERS & PRODUCT DESCRIPTION

- A. **Approved Manufacturer(s):** The specified equipment shall be manufactured by MGE UPS SYSTEMS or approved equal.
- B. **Product Description:** This specification covers the electrical characteristics and general requirements for AC low voltage power distribution equipment, hereafter referred to as the PMM (Power Management Module). The PMM is designed primarily for distribution, monitoring and isolation of electrical power and will properly interface the building's AC power source with sensitive electronic loads in data center, telecom, office, or industrial environments.

### 2.2 SYSTEM DESCRIPTION

#### A. PMM Design Requirements

1. The power rating of the PMM shall be [ ] kVA.

#### B. Input Characteristics

1. Voltage: 208, 480, 600 VAC,  $\pm 15\%$ , 3 phase, 3 wire plus ground when provided with an isolation transformer or 4 wire plus ground when no transformer is present (a non-standard option)
2. Frequency: 60 Hz,  $\pm 5$  Hz
3. Current: See Appendix

#### C. Output Characteristics

1. Voltage: 208, 480, 600 VAC,  $\pm 15\%$ , 3 phase, 4 wire plus ground
2. Frequency: 60 Hz,  $\pm 5$  Hz

3. Current: See Appendix
4. Load Power Factor: 60% lagging to 60% leading power factor
5. Harmonic Distortion, Voltage: < 1%
6. Efficiency at Full kW Load: > 96-97%

## 2.3 MODES OF OPERATION

- A. **Normal:** Under normal operation the input power is routed through the main input circuit breaker, which applies and disconnects AC power to the unit and protects the system in the event of a power overload. Power is directed to the isolation transformer (on standard models with an isolation transformer) where it will be electrically isolated on the output side of transformer. Depending on the transformer output voltage selected the voltage may be stepped down to the specified level. A monitoring system placed on the output of the transformer will monitor the output power and trigger an alarm in the event of a power quality deviation. Output power is fed to the respective panelboards and / or distribution breakers to distribute power to specific loads. Load circuits can be controlled manually from distribution panelboards.
- B. **Emergency:** An EPO (Emergency Power Off) switch shall be provided. This shall be a snap-action, momentary, rectangular, red push-button with a transparent, hinged cover to prevent accidental operation. It shall be illuminated by a red replaceable LED. When activated, the EPO will shunt trip the main input circuit breaker, illuminate the "EPO activated" LED and the "Alarm" LED, and energize the audible alarm at the control panel.

## 2.4 COMPONENT DESCRIPTION

- A. **Main Input Circuit Breaker:** The PMM shall be equipped with a main input circuit breaker (CB1) which, when closed and fed by a voltage source, energizes the PMM. The circuit breaker provides internal thermal overcurrent and instantaneous short circuit protection. The circuit breaker (CB1) includes a 24Vdc shunt trip to automatically open the circuit breaker and disconnect power to the entire unit when the Emergency Power Off (EPO) or remote EPO is activated, or when a designated alarm occurs.

The Main input circuit breaker is manually operated, automatic trip, rated for 600 VAC, 60 Hz, 3 Phase, and rated not less than 125% of the PMMs full load input current rating. It shall carry the manufacturer's standard interrupting capacity for that rating. High interrupting capacity ratings shall be available at 65KAIC for 480V systems. Higher ratings are also possible. The main input CB shall be vertically mounted for maximum reliability. The 'On (1)' and 'Off (0)' positions shall be clearly marked. The CB will provide internal thermal/magnetic overcurrent and instantaneous short circuit protection in each pole. Phase polarities shall be clearly marked.

- B. **Main Isolation Transformer:** The main isolation transformer is provided as a standard feature. The output rating of the transformer shall be the same as the continuous duty maximum full load rating of the PMM. The isolation transformer is a NEMA ST20, factory-assembled, dry type, double shielded isolation transformer with 200% rated neutral. Each phase of the transformer is a three-wire DELTA connected input winding and four-wire WYE connected 208Y/120 VAC output winding. The isolation transformer characteristics are described below:

K-Factor:	K-20
Windings:	
Aluminum:	30-150 kVA, standard
Copper:	200-300 kVA, standard, 30-150 kVA, optional
Harmonic Distortion:	less than 1%

Efficiency: greater than 97%  
 Insulation system: 220°C, with 150°C winding temperature rise  
 Impedance: 3% to 4.5% at rated load  
 Basic impulse level: 10kV  
 Common mode: -120db, 10Hz to 1Mhz  
 Normal mode: 20db per decade  
 Ventilation: Convection cooled.  
 Taps: Compensation taps are provided on the primary windings to allow field adjustment for either low or high source voltages as follows:

FCAN = Full capacity above normal (taps): 2.5%, 5.0%  
 FCBN = Full capacity below normal (taps): 2.5%, 5.0%, 7.5%, 10%

Temperature Sensors: Two thermal switches are wound into each coil 'hot spot'. The switches are normally-open contacts. The switches are wired to a terminal block mounted inside the cabinet. At 180°C the first contact closes and causes an LED to illuminate and an audible alarm to turn on at the status panel. At 195°C the second contact closes causing the main input circuit breaker to trip. An LED will illuminate and an audible alarm will turn on at the status panel.

- C. **Circuit Breakers and Panelboards:** The PMM is provided with output distribution panelboards, each with the following characteristics and/or features:

1. **Branch Circuit Panelboard:**

NEMA PB1, Square D type Universal (Plug-in or Bolt-on) NQOM442L225CUNLB.  
 Panelboard accepting QOB or QOB-VH bolt-on (standard), plug-in (QO) circuit breakers.

Pole Capacity: 42 poles, capable of accepting 1, 2, 3-pole circuit breakers  
 Bus Rating: 225 Amperes  
 Copper Ground Bus: 42 terminals  
 Copper Neutral Bus: Rated for 200% of nominal phase current (450 Amps)

The panelboard shall accommodate up to 100 Amp CBs and can be mounted based on available panelboard cable bending space.

2. **Panelboard Main Breaker:** The PMM has one panelboard main circuit breaker per 42 pole distribution panelboard (described below). The panelboard main CB provides thermal/magnetic overload and short-circuit protection for each panelboard, and allows manual on/off control.

Each panelboard is protected by a main circuit breaker:

Rating: 225 Amperes  
 Interrupting Capacity: 22,000 AIC ( 10,000 AIC for 380 V models)  
 Voltage Rating: 240 VAC maximum (415VAC maximum for 380 V models)  
 Model Type: Q2 (For 380V: SQL)

D. **Grounding**

1. **Construction:** A main grounding bus bar is provided and is effectively bonded to the unit frame. A ground bus bar is installed in all cabinets.
2. **Identification:** All ground connections use copper conductors with green insulation or green marking where required.

3. **Connections:** The following points are connected to ground:
  - a) Isolation transformer neutral
  - b) Isolation transformer shields and core
  - c) Primary input cable ground (when provided with jbox)
  
4. **Panelboard Ground Bus:** Ground bus located below (or above for top entry) the panelboard with wire connections for up to 42 wires. Lug range is 4 to 14AWG. Ground bus is provided for easy access.

### 3.0 SYSTEM CONTROLS AND INDICATORS

- A. **Monitoring:** The PMM shall have no monitoring capability except the EPO, LED indicators and audible alarm.

When advanced monitoring is selected, the PMM shall be equipped with advanced multi-function meter options that encompass additional metering and monitoring features (see section 4.0.Q).

- B. **Indicators:** The PMM provides audible and visual alarm indication of abnormal conditions. Upon activation of selected alarms, the PMM sounds an audible alarm and activates an alarm LED. The alarm sounds until an operator presses the "Audible Alarm Silence" button. The reset button silences all existing alarms. Upon activation of the same or a new alarm, the audible alarm will sound again. The audible alarm will be activated only by selected alarm conditions with thresholds factory programmable and stored in non-volatile memory. Factory setting shall be as follows:

Output Overvoltage:	+10%
Output Undervoltage:	-10%
Transformer Over temperature:	Alarm at 180°C: alarm shut down at 195°C
Overload (overcurrent):	
Each Phase:	110%
Phase Loss (output Voltage)	25% of nominal phase-to-neutral
kVA:	110% of nominal

The yellow 'TVSS Alarm LED' shall illuminate upon failure of the optional Transient Voltage Surge Suppression (TVSS) network.

The yellow "Transformer Overtemp" LED' shall illuminate upon a transformer over-temperature of 180° C.

### 3.1 MECHANICAL DESIGN AND VENTILATION

- A. **Enclosure:** The PMM is housed in a free standing NEMA-1 enclosure with dead front construction designed for installation on a raised or a flush floor. The PMM can accommodate bottom or top feed cables. The system monitor panel, input and output circuit breakers, and all customer power and control connection points are accessible from the front or side of the PMM. All circuit breakers are protected with "hinged dead front" panels to prevent access without a tool.

The cabinet is mounted on heavy-duty casters with leveling jacks.

Exterior Color and Finish - MGE light gray, Tiger Drylac 249/12170, designed to resist scratching

Exterior and interior sheet metal is 16 gauge or better. Exterior, use 10-32 Truss head S/S with locking patch screws mounted with x nylon washers. Interior, use rivets & monobolts where possible, all others use MGE's standard hardware

Outside painted panels are interlocked. Side and rear panels consist of a top and bottom panel requiring removal of the top panel prior to removal of the bottom panel.

Panelboard dead front covers are hinged on all cabinets to provide easy access when changing branch circuit breakers or performing infrared heat scans. Panelboard dead front covers are also adjustable for proper alignment.

- B. **Casters:** The main cabinet is mounted on four (4) 700 lb heavy duty casters from 30 to 300 kVA. The side cabinet is mounted on two casters and must be shipped attached to the main unit.

The casters rotate 360°. The casters are sized to support the maximum weight of the PMM without damage to surfaces or bearings. Casters will allow the PMM<sup>2</sup> to roll over normal surfaces without damage or hindrance. "Normal" surfaces include, but are not limited to, concrete slab, asphalt, wood, tile, etc. Rolling on carpet may require sheet metal plates over carpet to facilitate rolling. The PMM is designed to survive movement between loading docks and trucks, floors, elevators, and across reasonable obstacles such as cracks, thresholds, ramps, etc.

- C. **Leveling Jacks:** Four leveling jacks are typically provided to support the maximum weight of the PMM. Design allows the leveling jacks to be raised a minimum of one inch (1") to prevent damage during shipment. Nylon Thread Lock is used to prevent the jacks from vibrating down during shipment. Jacks are easily accessible with a crescent wrench or flat screwdriver when in the raised or lowered position. Leveling jacks are field replaceable using a forklift.
- D. **Center of Gravity:** The design allows the PMM<sup>2</sup> to be tilted and moved up a 15° incline without tipping over.
- E. **Access:** The system monitor panel, input and output circuit breakers, and all customer power and control connection points are accessible from the front of the PMM. Side access is required when panelboards are provided in a side facing orientation. Top access is required for TVSS. Rear access is not required for normal maintenance ('Normal' means routine maintenance such as circuit monitor service, distribution panelboard service, circuit breaker additions/deletions, etc. Transformer service, tap changes, and CT replacement are specifically excluded.) Output circuit breakers are protected with swinging, removable "dead front" panels. The doors are provided with a latched door lock (keyed lock optional).
- F. **Lifting:** The PMM is designed to allow lifting the unit using a forklift.
- G. **Maintenance:** Maintenance can be accomplished without the need for a special tool (other than a screw driver or crescent wrench) or fixture. Field replacement of any electrical component or assembly (other than the transformer) is achieved without lifting of more than 40 pounds (18 kilograms) of weight and without the use of hoists or jacks. The design allows for easy and safe replacement, adjustment or repair of all assemblies, subassemblies, modules, components, etc. A minimum of 36" may be required per local or national electrical codes in front of each panelboard.
- H. **Dimensions:** The overall size of the PMM is 72" high, 30" deep with a width of [ ] inches.
- I. **Weight:** The weight of the PMM shall be [ ] lbs.
- J. **Ventilation & Heat Rejection:** The PMM is convection cooled. Air access is from the bottom and exhausts from the top. The PMM has a six (6") inch recommended rear clearance.
- K. **Heat Rejection:** At full rated load the PMM heat rejection will be [ ] BTU /HR.
- L. **Conduit Landing:** The input conduit landing panel shall have three 1/2 inch knockouts located below the input circuit breaker. Each knockout can be punched to accept up to 3" conduits. The panelboard conduit landing panel shall have a combination of up to (32) 1/2", (12) concentric 1/2" & 3/4", (2) 1", and (1) 1-1/4" knockouts.

- M. **Termination:** All primary and secondary power wiring shall be suitably terminated using UL acceptable pressure (crimp) or screw-type lug assemblies. Belleville-type washers and lock washers shall be used on all associated studs or bolt-stacks. Control instrumentation, PC board, and interconnection wiring terminations shall conform to the UL standard.

Inductive Noise Coupling: Maximum separation shall be maintained between primary and secondary wiring and / or control/alarm wiring. To the extent possible, no primary or input wiring is permitted to share any area within the PMM<sup>2</sup> that is occupied by secondary wiring except within the main transformer compartment.

- N. **Power Wiring:** All internal wiring shall be stranded copper with PVC, Neoprene or Silicon insulation with a minimum operating voltage of 600 volts RMS. All wires shall be appropriately marked UL and CSA recognized as being suitable for the application. Minimum insulation temperature rating shall be no less than 105°C, and in no case is less than that required by the location/application of the wiring.
- O. **Control Wiring:** All control and instrumentation wiring used in this application shall be tinned, stranded copper with a temperature rating of at least 75° C. Insulation type is to be at least 125% of anticipated continuous load (3 hours or longer). Voltage rating is no less than required per UL and NEC. In areas where either primary or secondary AC voltages are present, PC board wiring and interconnect wiring will conform to the requirements of UL Standard 1950 for the application and location of the wiring.

#### 4.0 OPTIONAL ACCESSORIES

- A. **Input Power Junction Box with ten (10) feet of cable and Input Surge Suppressor:** An optional metal power junction box is provided for AC power input from a standard NEC-compliant, metallic conduit enclosed, multi-wire branch circuit.
1. **Termination** shall include insulated barrier-type terminal blocks for each phase, plus service ground. The terminal block shall use wrench-tightened, box-style compression terminals that do not require special termination of the branch circuit conductors of either copper or aluminum. Terminals shall be appropriately sized to connect the PMM's main input power cable. The largest single conductor used shall be 300 MCM per phase. Multiple conductors shall be used when amperage requirements exceed the capacity of 300 MCM per phase. When a neutral conductor is provided (i.e., PMM<sup>2</sup> without isolation transformer), the neutral conductor(s) amperage rating shall be 200% of one phase conductor.
  2. **Construction:** The minimum construction standard shall be NEMA 1. Whenever practical, a water-tight junction box shall be provided. All conduit connectors made to the J-box will use liquid-tight connectors. The power junction box shall be designed for permanent vertical installation on a wall or horizontal installation under a raised floor. The cover is removable by using a tool (screw-driver).
  3. **Code Compliance:** The junction box is separately listed by Underwriters Laboratories. It will serve as the demarcation between the premises wiring system and the beginning of the computer system.
  4. **Lightning Arrestor:** The Lightning Arrestor is included in the Power Junction Box with details specified in section 4.0.C.
- B. **Main Input Power Cable (Part of Junction Box)**

1. Conductors shall be UL listed type 1284, rated 105°C @ 600 VAC copper and sized in accordance with the NFPA 70 with all phase conductors and ground conductors the same size. Neutral conductors shall be sized 200% of phase conductors.
2. Conduit shall be heavy duty, liquid tight, flexible conduit with a self-extinguishing coating and shall be UL listed. Cable length shall be ten feet (10') from points of termination at the power junction box and at the PMM conduit landing panel. The input power cable shall be shipped separately from the PMM main input circuit breaker for installation at the site.

C. **A lightning surge arrester** is provided on the input power junction box. It shall protect the input of the PMM from extremely high and short duration voltage spikes impressed on the line by lightning strikes or similar abnormalities. Without any gap, the lightning surge arrest immediately conduct surges to ground and shall prevent lightning-induced surges from reaching the PMM transformer, monitor and controls. The lightning arrester shall meet the following electrical specifications:

Maximum voltage:	650 VAC	
Equivalent FOW Protective level:	2.2 kV crest	
Withstand Capabilities:	10,000 Amperes	
IR Discharge Voltage (kV crest) (8 x 20 microsecond current wave):	At 1,500 Amp	1.96
	At 5,000 Amp	2.62
	At 10,000 Amp	3.40
	At 20,000 Amp	4.23

D. **Transient Voltage Surge Suppression (TVSS) System:** The transient suppression system is a solid state filter system designed to clip voltages. If an input junction box is used it shall have an additional lightning arrester specified in section 4.0.C. The output transient voltage surge suppression (TVSS) system shall be mounted at the secondary (output) side of the transformer. It shall clip high voltage transients phase-to-phase, phase-to-ground, or phase-to-neutral. Its operation shall be the same whether the spike is line-generated or load-generated. Voltage shall be clipped to a maximum range of plus or minus 200 volts proportional to the sine wave. The TVSS shall include self diagnostics to sound an audible alarm and indicator lights when a critical element has failed and needs replacement. The TVSS shall be externally fused and UL1449 listed and have the following electrical characteristics:

Peak current handling:	100,000 Amp L-L, 50,000 Amps L-N, L-G or N-G
EMI/RFI noise rejection:	-40dB
Clamping level, LN:	420VAC, @ 200 Amp (ANSI/IEE C62.41 Category A3) 530VAC, @ 500 Amp (ANSI/IEE C62.41 Category B3) 650VAC, @ 3000 Amp (ANSI/IEE C62.41 Category C1)
Response Time:	<1 nano-second
Dimensions:	2.6" x 4.75" x 10.6"
Diagnostics:	Green Status LED, Dry Contacts, Audible Alarm
Connections:	#10 awg wire leads
Fuse Type & Rating:	VSP20, 20ka, 600V

E. **Transient Suppression Plate:** A Transient Suppression Plate supplied with the power junction box shall be provided to minimize the effects of high frequency electrical noise. It shall be mounted in direct contact with the masonry floor and act as one plate of a capacitor, with the reinforcement bars of the masonry acting as the other plate. The junction box and floor pedestals shall mount directly on top of it. The plate shall allow high frequency noise to be shunted to the rebar and to the earth ground.

F. **Manual Restart:** The Manual Restart system shall automatically trip the Main Input Circuit Breaker upon detecting a loss of one or more input phases for three cycles. When power is restored, the Main Input Circuit Breaker must be manually reset. The system shall include a key switch to activate and deactivate the manual restart feature.

- G. **Remote Emergency Power Off (REPO):** Activation of the REPO circuit shall disconnect power to all PMMs connected on the REPO circuit; whereas activation of a unit EPO switch disconnects power only to a specific PMM (see section 2.3.B). Each REPO shall include a normally open push button clearly marked and protected against accidental operation. The REPO shall be provided in the following configurations: Surface/Flush Mounted, Shallow (1N/O, 1 N/C); Surface/Flush Mounted, Deep (3 N/O, 1 N/C).
- H. **Output Cable:** Output Cables shall be fabricated using copper building wire and liquid-tight flexible metal conduit. Cables include appropriately sized circuit breakers for mounting on panelboards, receptacles, in-line connectors, and/or pig-tails, and are cut to length as specified. Cables are shipped detached from the PMM and coiled on a pallet.
- I. **Branch Circuit Breaker:** Optional molded case Square-D QO type, NEMA AB1 bolt thermal magnetic trip circuit breakers, with common trip handle.
- J. **Mainframe Circuit Breakers:** When circuit breaker ratings greater than those specified in paragraph 2.4.C are required, one panelboard is removed and replaced with up to four (4) Square D type KAL 225A circuit breakers (CB#1 to #4) in the specified panelboard position.
- K. **Isolated Ground:** An additional "isolated ground" bus bar shall be provided that is dedicated for termination of "isolated ground" receptacles with connections for up to 42 wires and a lug range of 4 to 14AWG. The isolated ground bus is bonded to the main grounding bus bar.
- L. **Floor Stands:** Floor stands shall provide stable support for the PMM when mounted on a raised floor installation. The floor stand is secured to the concrete slab floor with openings around it to allow input and output cable entry for the PMM with a 12" or 18" height as defined per specification.
- M. **Copper Transformer:** The main isolation transformer shall have copper winding optional from 30 kVA to 150 kVA (copper standard above 150 kVA). Transformer characteristics are described in section 3.0.B.
- N. **No Transformer:** The PMM shall be provided without an isolation transformer with a 4 wire 208/120 VAC input and output plus ground. All features associated with an isolation transformer, such as transformer over temperature and shutdown alarms are inactive.
- O. **Seismic Bracing:** The PMM shall include provisions to allow for securing to a slab floor with the bracing rated for UBC 97 seismic zone 4.
- P. **High KAIC Circuit Breaker Rating:** The PMM shall provide optional higher interrupt rating (65KAIC at 480 V) for the main input circuit breaker.
- Q. **Monitoring Options**
1. **Multi-Circuit Monitor (MCM):** The MCM can be configured to display the input (line side) or output (load side) voltage, current, kVA, kW and frequency and other parameters defined below. All measured values will be displayed on a large format LCD display mounted on the front of PMM. The meter shall also be equipped with LED alarm status indication.
- Metering:** All metered values will be in "true RMS" values with 0.35% accuracy. The monitor shall include a keypad allowing for the viewing of different selected values. The monitor shall display the following values and alarm conditions:

#### **Data Output**

- kWH Energy Consumption
- kW Real Power
- kVAR Reactive Power
- kVA Apparent Power
- Power Factor Total
- Voltage, L-L, average of 3 phases
- Voltage, L-N, average of 3 phases
- Current, average of 3 phases
- kW Real Power, phase A, B, C
- Power Factor, phase A, B, C
- Line to Line Voltage, phase A-B
- Line to Line Voltage, phase B-C
- Line to Line Voltage, phase A-C
- Line to Neutral Voltage, phase A-N
- Line to Neutral Voltage, phase B-N
- Line to Neutral Voltage, phase C-N
- Current, phase A, B, C
- KW Average
- KW Minimum
- Frequency (measured from phase A)

#### **Modbus Alarms**

- Overvoltage
- Undervoltage
- Overcurrent
- Over kVA
- Phase Loss

**Controls and Communications:** The user shall be able to control and communicate with the PMM via the following interfaces:

- a) Emergency Power Off (EPO and REPO) button that when activated shall trip the AC input circuit breaker with shunt trip
- b) Audible Alarm "Test/Silence" push-button
- c) Dry contact form C relay located on the MCM monitor and activated by any condition listed in section 3.0.B.
- d) RS485 serial communications interface
- e) Infrared communication with a Palm OS PDA (only when serial port is disabled)

2. **Input / Output Monitoring (optional with MCM meter only):** The MCM can be configured to monitor the power both on the input and output side of the transformer. When input monitoring is selected, all the parameters defined for the MCM (Multi-Circuit Monitor) shall be monitored for the line and the load side of the transformer and displayed on a single LCD large format display.
3. **PanelSubmain Breaker Monitoring (optional with MCM meter only):** The optional submain breaker monitoring displays the current of the submain breakers (panelboard main breakers or distribution breakers). In the event that the current approaches the trip rating of the breaker (threshold shall be factory set at 80% of breaker trip rating but shall have the ability to be customized) the monitor will alarm via the LCD display. Since the submain breakers are rated at 225A and panelboard breakers can potentially feed in excess of 600 A, submain monitoring shall prevent accidental tripping due to overloaded panelboards. The per phase current of each breaker shall also be displayed on the PMM's local LCD display.
4. **MGE Branch Circuit Current Monitoring (optional with MCM meter only):**

- Monitors current on individual branch circuit breakers
- Alarms when current exceeds a preset threshold
- To display on unit, must be used with the MGE Multi-Circuit Meter
- Optional split core CTs for retrofit applications

The MGE Branch Multi Circuit Monitor monitors the current individually on all 42 branch circuit breakers on a standard SQ-D NQ panelboard. In the event the current exceeds a threshold (custom programmable on every pole for pre-alarm/summary alarm and vital alarm thresholds), the alarm (audible and LED) will be activated to alert the operator to an overcurrent condition. Alarm parameters and currents are available via the MCM LCD display, serial output, or can be downloaded to a PDA via the IR port on the MCM display (serial port is disabled if IR port is enabled).

5. **Power Meter 800 (PM800):** The PM800 is a multifunction, digital instrumentation, data acquisition and control device. The PM800 can be configured to display the output (load side) voltage, current, kVA, kW and frequency and other parameters defined below. All measured values will be displayed on a large format LCD display mounted on the front of PMM. The meter shall also be equipped with alarm status indication.

**Metering:** All metered values will be in "true RMS" values with 0.075% accuracy. The monitor shall include a keypad allowing for the viewing of different selected values. The monitor shall display the following values and alarm conditions:

#### Data Output

- Current (per phase)
- Power Factor (per phase)
- Frequency
- THD (current/voltage)
- Voltage, L-L
- Voltage, L-N
- Real Power (per phase)
- Reactive Power (per phase)
- Apparent Power (per phase)
- Min/max values (voltage/current/power factor/real power/reactive power/apparent power/THD/frequency)
- *Plus* Energy Readings (consult PM810 Reference Manual)
- *Plus* Power Analysis (consult PM810 Reference Manual)
- *Plus* Demand Readings (consult PM810 Reference Manual)

#### Alarms

- Overvoltage
- Undervoltage
- Overcurrent
- Over kVA
- Phase Loss

**Controls and Communications:** The user shall be able to control and communicate with the PMM via the following interfaces:

- a) Emergency Power Off (EPO and REPO) button that when activated shall trip the AC input circuit breaker with shunt trip
- b) Audible Alarm "Test/Silence" push-button

- c) Dry contact form C relay located on the monitor and activated by any condition listed in section 3.0.B.
- d) RS485 serial communications interface

**R. Dual Zig-Zag Harmonic Cancellation Transformer:** The dual zig-zag main input isolation transformer shall have a single input and dual output windings with the two outputs having a 30 degree phase difference. The transformer shall function to limit and cancel harmonics. The triple harmonics shall be mitigated in the primary winding with the higher order harmonics (5,7,11,13 etc.) being reduced in the secondary windings. The loads on the output of the transformer are intended to be balanced between each corresponding opposite phase to ensure optimum harmonic cancellation. The output rating of the transformer shall be the same as the continuous duty maximum full load rating of the PMM. The isolation transformer is a NEMA ST20, factory-assembled, dry type, double shielded isolation transformer with 200% rated neutral. Each phase of the transformer is a three-wire DELTA connected input winding with two three phase, four wire connected 208Y/120 VAC output windings displaced 30 electrical degrees from each other, each designed to sustain 60% or greater of the nominal PMM load. The isolation transformer character characteristics are described below:

K-Factor:	K-20 (K-Factor Rating)
Windings:	30-150 kVA Aluminum, (Copper Optional) 00-300 kVA Copper, standard
Harmonic Distortion:	< 1% output voltage
Efficiency:	> 97%
Insulation System:	Class 220°C, with 150°C winding temperature rise
Winding Taps:	2.5% increments, (2) FCAN (5%), (4) FCBN (10%)
Sound Levels:	Maximum 50dB at 4 feet from enclosure
Impedance:	3% to 4.5% at rated load
Basic impulse Level:	10kV
Magnetic Field Strength:	< 0.1 gauss measured 1.5 feet from cabinet.
Temperature Sensor:	180°C and 195°C, Built into center windings
Common Mode:	-120 dB, 10Hz to 1 Mhz
Normal Mode:	20 Db

## 5.0 FIELD QUALITY CONTROL & SERVICE ORGANIZATION

### 5.1 FIELD SERVICE ENGINEER QUALIFICATIONS

The manufacturer must employ a 7 X 24 nation wide (international where applicable) field service organization with rapid access to all regions of the nation. The responding service professionals must be factory-trained engineers with an accredited and proven competence to service PMM equipment.

### 5.2 SPARE PARTS

Spare parts kits are designed to provide replacement spares which will solve: 50% of problems encountered (Level "50"), 75% of problems encountered (Level "75"), or 90% of problems encountered (Level "90").

### 5.3 MAINTENANCE TRAINING

The manufacturer shall make available to the customer various levels of training ranging from basic PMM operation to PMM maintenance.

#### **5.4 MAINTENANCE & SERVICE CONTRACTS**

The manufacturer shall offer additional preventative maintenance and service contracts covering the PMM. Accredited professional service engineers employed exclusively in the field of critical power systems service shall perform all maintenance and service. The manufacturer shall also offer extended warranty contracts.

**END OF SECTION**

PMM/PMR METER COMPARISON	<b>** All Meters Are Optional **</b>			
	PM810	MCM	CM4000	DMS300
True rms metering	✓	✓	✓	✓
Input metering	*	✓	.	
Output metering	✓	✓	✓	✓
Input AND Output metering		✓	.	
Branch Circuit Monitoring (Option)		✓	**	
Submain Breaker Monitoring (Option)		✓	.	
EGX/ECC Web Enabler (Option)		✓	✓	
Nonvolatile clock	✓	.	.	
Nonvolatile memory	✓	✓	✓	✓
Min/max readings of metered data	✓	.	✓	✓
Power quality readings – THD	✓	.	✓	✓
Setpoint-controlled alarm and relay functions	✓	✓	✓	✓
Onboard alarm	✓	✓	✓	✓
RS-485 Communications	✓	✓	✓	.
RS232 Communications		.	***	***
Modbus Protocol	.	✓	✓	✓

\* Ultra configuration only

\*\* Available remotely via the BCM's serial interface

\*\*\* Option

**Appendix:**

- 4.1 Power Ratings (kVA): 30 kVA, 50 kVA, 75 kVA, 100 kVA, 125 kVA, 150 kVA, 200 kVA, 225 kVA, 300 kVA
- 4.2.1 Input Voltage (VAC): 208,480, 600 VAC / 50 Hz @ 380 VAC 380 VAC (30-300 kVA), +/-15%, 3 Phase, 3 Wire plus Ground
- 4.2.2 Input Frequency: 60Hz, +/-5Hz @ 208,480, 600 VAC / 50 Hz @ 380 VAC
- 4.3.1 Output Voltage (VAC): 208,480, 600 VAC / 50 Hz @ 380 VAC VAC, +/-15%, 3 Phase, 4 Wire plus Ground
- 4.3.2 Output Frequency: 60Hz, +/-5Hz @ 208,480, 600 VAC / 50 Hz @ 380 VAC
- 6.8 PMM Dimensions: Consult installation drawings for specific configuration dimensions
- 6.9 Weights (See Chart Below)
- 6.11 Heat Rejection (See Chart Below)

<b>Transformer (kVA)</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>50</b>	<b>50</b>	<b>50</b>	<b>50</b>
Input Voltage (VAC)	208/120	208	480	208/120	208	480	600
Input Current (A)	83	83	38	139	139	63	48
Output Current (A) @ 208V	83	83	83	139	139	139	139
Heat Rejection ( BTUs / hr)	600(No Xfmr)	3200	3200	600(No Xfmr)	5300	5300	5300
Typical Weight (lbs) 42/84 pole	675(No Xfmr)	1075	1075	675(No Xfmr)	1200	1200	1200
126/168 pole add 250 lbs				210/252 pole add 500 lbs			

<b>Transformer (kVA)</b>	<b>75</b>	<b>75</b>	<b>75</b>	<b>75</b>	<b>75</b>	<b>100</b>	<b>100</b>
Input Voltage (VAC)	208/120	208	380	480	600	208/120	480
Input Current (A)	208	208	114	94	72	278	126
Output Current (A) @ 208V	208	208	208	208	208	278	278
Heat Rejection ( BTUs / hr)	600(No Xfmr)	8000	8000	8000	8000	600(No Xfmr)	8800
Typical Weight (lbs) 42/84 pole	675(No Xfmr)	1325	1525	1525	1525	675(No Xfmr)	1575
126/168 pole add 250 lbs				210/252 pole add 500 lbs			

<b>Transformer (kVA)</b>	<b>125</b>	<b>125</b>	<b>150</b>	<b>150</b>	<b>150</b>	<b>200</b>
Input Voltage (VAC)	480	600	380	480	600	480
Input Current (A)	157	120	228	188	144	251
Output Current (A) @ 208V	347	347	416	416	416	555
Heat Rejection ( BTUs / hr)	10900	10900	13100	13100	13100	13900
Typical Weight (lbs) 42/84 pole	1825	1825	2075	1900	1900	2250
126/168 pole add 250 lbs			210/252 pole add 500 lbs			

<b>Transformer (kVA)</b>	<b>225</b>	<b>225</b>	<b>225</b>	<b>300</b>
Input Voltage (VAC)	380	480	600	480
Input Current (A)	342	282	217	377
Output Current (A) @ 208V	625	625	625	833
Heat Rejection ( BTUs / hr)	15700	15700	15700	20900
Typical Weight (lbs) 42/84 pole	2450	2325	2325	3365
126/168 pole add 250 lbs / 210/252 pole add 500 lbs				