POWER INNOVATIONS INTERNATIONAL

LITEON GROUP

Q-MS Series UPQ 6 kVA

Installation and Operation Manual

MNL138

Rev 1.2

READ THIS MANUAL CAREFULLY
SAVE ALL INSTRUCTIONS

This manual contains important information needed to operate the Q-MS™ safely and efficiently. Please read all instructions carefully before installing or operating equipment.

Keep this manual handy for easy reference.

ELECTRICAL WARNING

Applying information contained in this manual to any other product, including customized Q-MS systems with nonstandard specifications, may cause injury.

Q-MS™, Q-MS Uninterruptible Power Quality™, UPQ™ are trademarks of Power Innovations International, Inc.

This manual may accompany other instructional addendums about additional customizations to standard Q-MS™ systems. Please contact Power Innovations if additional manuals are needed and have not been received.

Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies.

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Table of Contents

Figures

1—Introduction

The Q-MS 6 kVA Series UPQ™ system is an advanced, true on-line, uninterruptible power system, which is controlled by an intelligent microprocessor. The RS-232 and SNMP (Simple Network Management Protocol) advanced communication design make the UPQ system compatible with sophisticated monitoring software. All models offer advanced power security by providing redundant features and an available external SNMP - Web management option (NetAgent).

Figure 1—Q-MS 6kVA, no external battery attached

During an overload condition, an alarm will sound, and the UPQ system will automatically transfer to “Bypass” mode (if good power exists) within 4 milliseconds to ensure that the critical load (equipment) continues to operate. The Bypass function uses the AC supply power as its stand-by source. While in Bypass, the connected equipment is still protected by advanced EMI and suppression filters, but will not have isolation, regulation, or battery backup.

The UPQ system automatically transfers back to the inverter when an overload condition has been cleared.

For warranty and customer service information for this product, please refer to the Warranty section at the end of this manual.

1.1—Using This Manual

This manual explains how to safely receive, unpack, install, and operate the Power Innovations International, Inc. Q-MS Uninterruptible Power Quality (UPQ™) system.

Read and understand this manual to make installing and operating the system as easy as possible.

1.2—Conventions Used in This Manual

To make this manual easier to read, several formatting conventions have been adopted.

1.2.1—Additional Advice

This manual will occasionally provide additional advice. Some of the information is very important, while other information may be good to know. To show the importance of each piece of information, the following safety symbols are used:

ELECTRICAL WARNING

Denotes advice that, if not followed, could cause severe bodily harm or death due to electrical shock.

WARNING

Denotes advice that, if not followed, could cause severe bodily harm or death due to other types of injury.

Caution

Offers advice that, if not followed, may harm equipment or indirectly cause physical hazards.

Usually these symbols will be listed in order of importance. Other information is provided merely to be helpful.

Note

Offers practical advice that may be helpful but can be disregarded.

Manual Help

Provides references to other manual sections or drawings that accompany this manual.

Additional Manuals

Provides references to other manuals that may also be provided with this system.

1.2.2—Breaker Positions

Because some breakers on the front of the Q-MS share names with its subsystems or operation modes, breakers and their positions will be identified using all caps. Additionally, the words OPEN and CLOSED are always capitalized to stress which position is correct.

OPEN is used to identify a breaker that is in the OFF position. CLOSED is used to identify a breaker that is in the ON position.

1.2.3—System Key Identification

The first time a key located on the display is mentioned, both the name of the key and the symbol used on the key is included. In the following references, only the symbol for the key is used.

1.2.4—Type Conventions

Menu options will be placed in uppercase letters and formatted as they appear onscreen.

1.2.5—Cabinet vs. System

In this manual, the word cabinet refers to the actual Q-MS cabinet (or cabinets, for multi-cabinet systems).

The entire power quality system will be referred to as an uninterruptible power quality system (or UPQ), a Q-MS system, or a Q-MS. These terms do not refer to one cabinet or set of cabinets. They refer to the system and everything that supplies power to it, including the battery cabinet, the cabinet that controls the system, interconnecting cables, and other external controls.

2—System Features

2.1—Key Features

2.1.1—Input Surge Protection

The Q-MS system can protect the load from surges caused by lightning or neighboring loads.

2.1.2—Cold Start

The system can be started from battery power using a soft-start function in the event that input AC power is unavailable.

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3—Installing the System

3.1—Transporting the System

- Always keep the system right side up.
- Be careful to not bump or drop the system while it is being moved.

3.2—Site and Environment Considerations

The following precautions and recommendations should be taken into consideration before installing the system:

- The system should be located in an area with adequate ventilation.
- If the system is installed indoors, ensure proper ventilation for heat evacuation.
- Do not locate the system near:
  - Any heat source.
  - Pieces of machinery or equipment that produce metallic shavings, dust, or powder.
  - Anything that produces corrosive substances or vapor.
  - The shower of a fire extinguishing (sprinkler) system.
- The temperature and humidity values of the UPQ installation site must be within specified ranges. The system is capable of continuous operation within a temperature range of 0 ˚C (32 ˚F) to 40 ˚C (104 ˚F). For optimal performance and reliability, it is recommended that the temperature of the environment be kept below 25 ˚C (77 ˚F), and the humidity below 80%.
- If the UPQ system is installed outdoors, avoid direct exposure of the unit to the elements (sunlight, rain, snow, sand, dust, wind, etc.).
- The area surrounding the UPQ system should be kept clean. Trash, metallic powders, filings, and other foreign objects could be drawn into the unit and cause damage.
- Although the UPQ system has passed the international EMC tests, it is not recommended that it be installed near any equipment that is susceptible to electro-magnetic interference.

3.3—Connections

ELECTRICAL WARNING

Ensure the AC utility input is turned OFF before connecting all cables.

3.3.1—Connecting the INPUT

Do not use regular household or office outlets to connect the input. This Q-MS 6 requires an input power source between 208 and 240 VAC, single-phase.

When preparing to connect input cables, be sure to check and adhere to local electrical regulations.

Caution! System labels always take precedence over wire colors.

Manual Help: Refer to section **6.1—Q-MS Specifications** for additional power specifications.

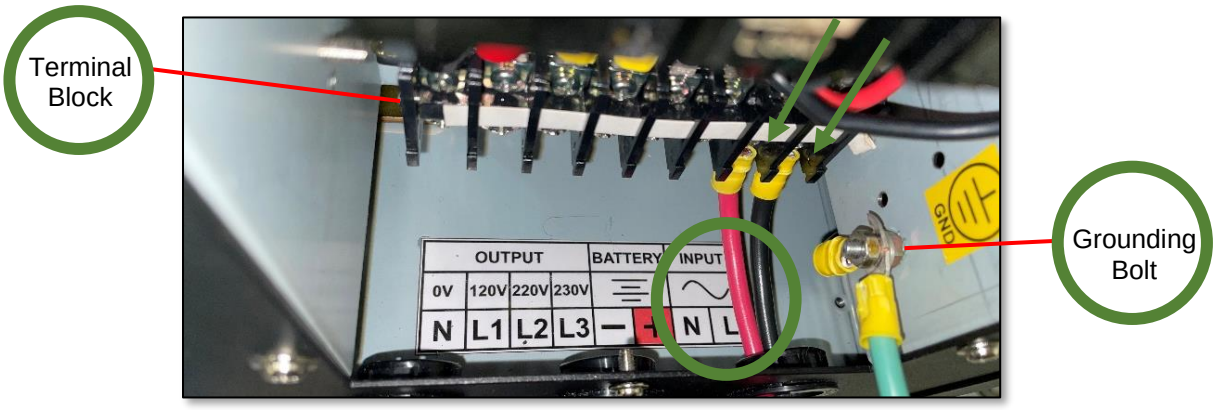


Figure 2—Terminal Block in Back of Q-MS 6 with AC Input cables and Ground connected

To make the input connections, do the following:

1. Detach the screws on the Q-MS rear panel with a screwdriver. Remove the panel to expose the terminal block (**Figure 2**).
2. Connect the INPUT N (NEUTRAL) and L (LINE) to their corresponding terminals on the bottom of the terminal block.
3. Connect the GROUND wire to the grounding bolt located to the right of the terminal block.

ELECTRICAL WARNING! Be sure to ground the system properly. Improper grounding can result in a risk of electric shock. Contact an electrician with any additional questions.

4. Confirm that INPUT power cables do not contact other conducting surfaces to prevent short-circuiting.

3.3.2—Connecting the OUTPUT

The Q-MS 6 supports three output voltages: 120, 220, and 230 VAC. To make the output connections:

1. In the bottom back of the Q-MS, connect N (NEUTRAL), L1, L2, and L3 cables to their corresponding terminals on the bottom of the terminal block (**Figure 3**).

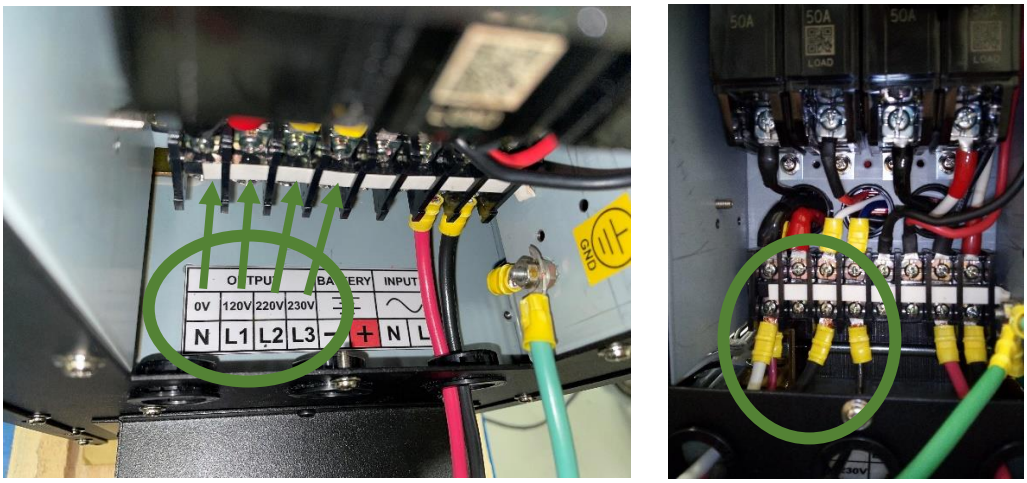


Figure 3—Terminal Block in back of Q-MS with Output Neutral and three Output Line termimals before & after connected

2. Confirm that the OUTPUT power cables do not contact other conducting surfaces to prevent a short-circuit.
3. Re-attach the rear panel to the back of the Q-MS using the original screws.

3.3.3—Connecting the Battery

ELECTRICAL WARNING

Ensure the battery breaker is OFF or the fuses on the battery cabinet are OPEN to avoid electrical shock.

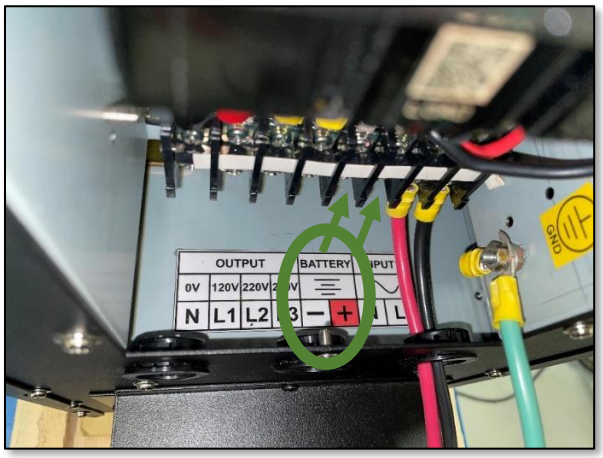


Figure 4—Terminal Block in back of Q-MS with Battery termimals indicated

1. **In the back of the Q-MS**, locate the labeled NEGATIVE (-) and POSITIVE (+) battery terminals (**Figure 4**)
2. Connect the NEGATIVE (-) and POSITIVE (+) cables to their corresponding terminal on the bottom of the terminal block.
3. Route the other end of the battery cables out cable port hole provided and to your battery cabinet.
4. **In your Battery Cabinet**, open cabinet doors and locate the terminal block at the bottom-right of the system OR, in some systems, remove the screws from the rear panel to access the battery terminal block.
5. Route the battery cables through the battery cabinet port holes as needed to the terminal block.

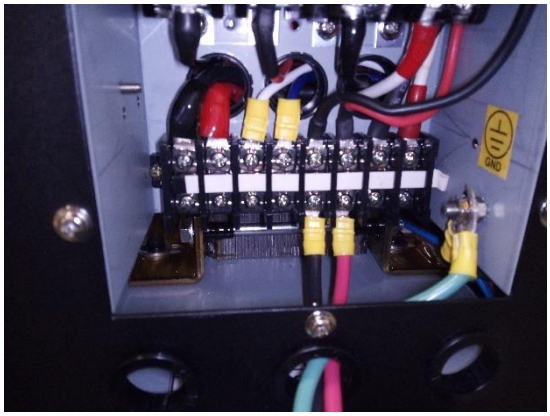


Figure 5—Terminal Block in back of Battery Cabinet with Positive and Negative cables connected

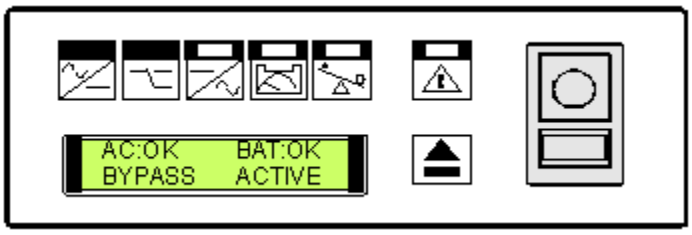
6. Connect the POSITIVE (+) and NEGATIVE (-) cables to their corresponding terminal on the bottom of the terminal block (**Figure 5**).
7. Connect the GROUND wire to the grounding bolt located beneath the battery breaker OR, in some systems the grounding bolt will be located to the right of the terminal block.

4—Operation

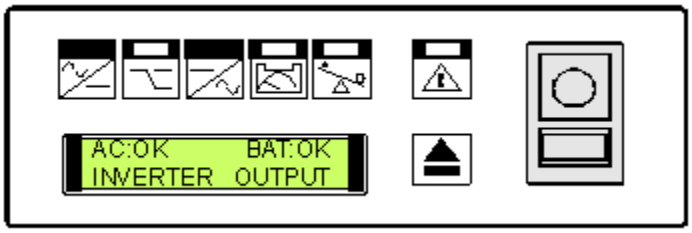
4.1—Startup Procedure

Once the system inputs and outputs have been properly connected and checked out, follow the instructions below to start the Q-MS:

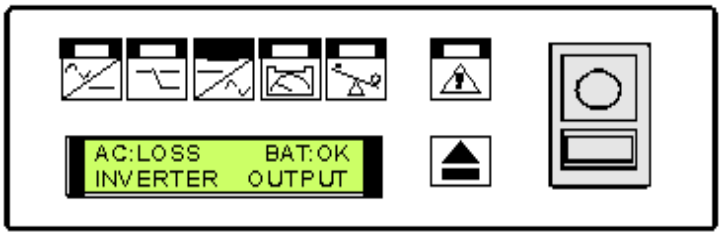
1. Prior to system start up, verify that the Input Breaker (located on the back of the Q-MS unit) and Battery Breaker are in the OFF position.
2. Switch both Input Breaker Switches, located on back of the Q-MS unit, to the ON position.
3. Switch the Battery Breaker Switches to the ON position.
4. Turn ON the Q-MS unit by pressing the power button located on the front of the unit. The Q-MS LCD display will light up immediately to indicate the AC utility power and batteries are normal and the output outlet is supplied via bypass.



5. After a 20-second delay, the Output LED will light up and the Bypass LED will turn OFF, indicating the Q-MS is operating correctly and that the Q-MS is ready to power the load.



6. To test the unit for blackout simulation, disconnect the AC input of the Q-MS by turning off the input breaker. The Q-MS will beep every 4 seconds to indicate AC power failure. This indicator means that the Q-MS is using battery power. The beep will stop automatically after 90 seconds. When approaching low battery level, the Q-MS will beep every second.



7. Resupply the AC utility power by turning the input breaker back ON. The Input LED will light up again. The initial setup is complete and the Q-MS is ready to have the load connected.

4.2—Q-MS Shutdown Procedure

ELECTRIC WARNING

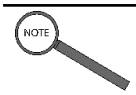
Prior to handing the Q-MS after shutdown, allow sufficient time (approximately 10 minutes) for the capacitors to fully discharge to avoid the risk of electric shock.

1. Turn OFF the Q-MS unit by pressing the power button.
2. Turn OFF the input power breakers located on the back of the Q-MS.
3. As an additional precaution, turn OFF the battery breakers to any affiliated battery.

4.3—Normal Operation Mode

Important notes about Q-MS Operation:

1. When operating the Q-MS, please contact Power Innovations immediately if anything different occurs from what has been outlined in the installation section of the manual. The Overload LED and beep indicate an overload condition. Turning OFF pieces of connected equipment (one at a time) will reduce the load until it can be determined what can be connected safely. If the Overload LED indicator is illuminated and the beep sounds continuously, switch OFF the least critical piece of equipment connected to the unit. Continue to switch OFF less critical items until the alarm stops.
2. During production and testing, the batteries are fully charged. After the initial startup, keep the power applied continuously to the Q-MS for at least 8 hours to ensure that the batteries are fully charged.
3. It is wise to test the operation of the Q-MS regularly to ensure the longevity of the batteries. Every 90 days, secure the load (i.e. if computers are being protected, close all open files and shutdown any other equipment which is sensitive to sudden power failure). Switch OFF the AC utility supply to the Q-MS and allow it to run from its batteries until the battery low alarm occurs. Restore AC supply and recharge batteries.



Note: For optimal battery life, check and recharge batteries as instructed above.

4.4—Routine Maintenance

1. The environment in which the Q-MS is located must be dry and relatively dust free.
2. Exterior panels can be cleaned with a mild cleaning solution.
3. All power connections at the input, battery, output terminals, and circuit breaker should be checked periodically.

ELECTRIC WARNING

Make sure all power to the Q-MS has been disconnected when these checks are performed. Failure to do so could be fatal.

4. The battery cells used are sealed and maintenance free. The factory adjusts both charging voltage and current according to battery specifications.

4.5—Storage Instructions

1. Following procedures listed under *Q-MS Shutdown Procedure*, turn off the Q-MS.
2. If the Q-MS has not been used for over 90 days, follow initial start-up procedure and supply power to the Q-MS for at least 24 hours to ensure that the battery is fully recharged.

5—Q-MS Operational Modes

5.1—Q-MS Block Diagram

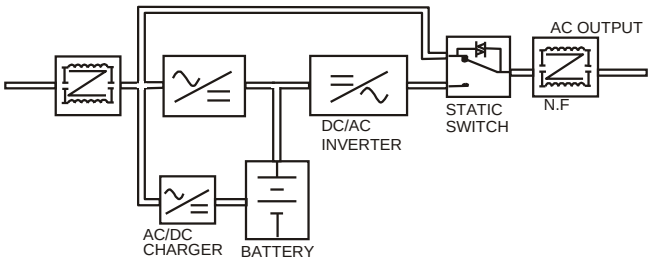


Figure 6—Q-MS Block Diagram

5.2—Normal Operation

There are two main loops when AC utility power is normal: the AC loop and the battery charging loop. The AC output power comes from the AC utility input and passes through the AC/DC rectifier, DC/DC booster, DC/AC inverter, and static switch to support power to the load. The battery charging voltage comes from the AC utility power input and is converted by the AC/DC charger to support battery-charging power.

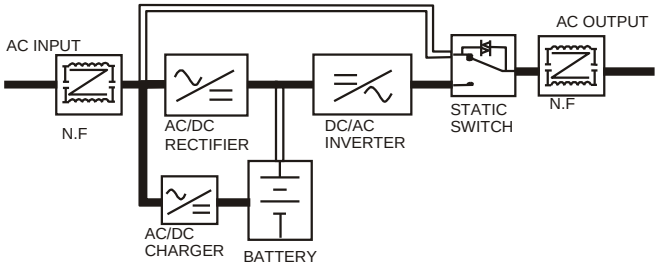


Figure 7—Q-MS Normal Operation topology

5.3—AC Utility Failure

The AC output comes from the battery, passes through the DC/DC converter, the DC/AC inverter, and the static switch within the battery backup time.

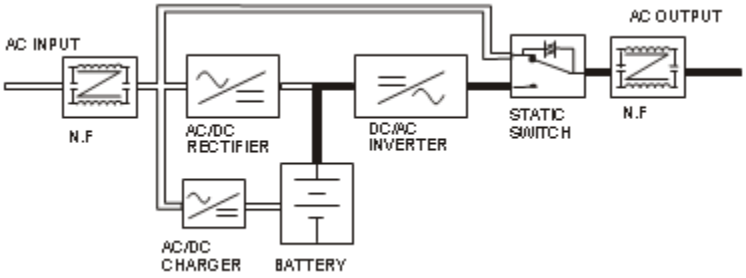


Figure 8—Q-MS AC Utility Topology

5.4—Bypass Enable

Under the following five conditions, the bypass will be enabled:

1. Overload.
2. Inverter failure.
3. Initial inverter startup (about 20 seconds).
4. SW4 has been turned OFF.
5. An over temperature condition.

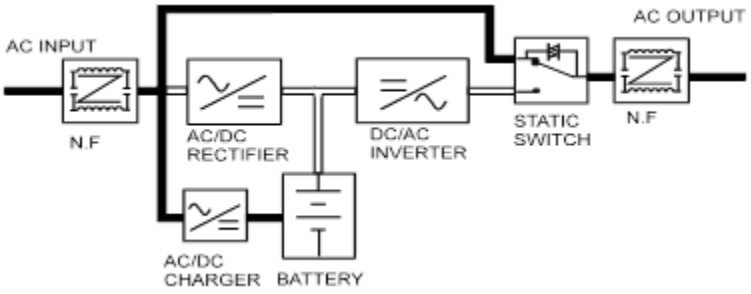


Figure 9—Q-MS Bypass topology

6—Q-MS Unit Overview

General	
Input current	43 Ah
Output power capacity	6,000 VA
Output power capacity	4,800 W
Current	29.09 Peak Amp
Nominal output voltage	120, 220, 230 VAC
Output frequency range	50 or 60 Hz ± 1%, factory set at 60 Hz
Input power factor	0.8
Output waveform	High resolution pure sine wave
Remote power management	Yes
Voltage Regulation & Frequency	
Input frequency	50 or 60 Hz ± 5%, factory set at 60 Hz
Input range: single phase	208 - 240 VAC
Output voltage regulation	± 1%
Isolation	
Common-mode noise rejection	Yes
Normal-mode noise rejection	Yes
Suppression	
IEEE 587/ANSI 62.41 (N. America)	Yes
IEEE 587/ANSI 62.41 (Intl.)	Yes
Joules (energy absorption)	2,000
Peak surge current	20,000 A
Multi-stage protection	Yes
CE approval	Yes
Conditioning	Yes
Output frequency regulation	50/60 Hz
Input frequency range	50/60 Hz ± 0.5% Hz
High Frequency On-Line Inverter	
Inverter driver frequency	± 0.5%
Overload capacity	>110% continuous
Crest factor	3:1
Transfer time	Zero
Efficiency	85% Min
UPQ to bypass/bypass to UPQ	Zero cross transfer, less than 4 ms (2 ms minimum)
Physical	
WxDxH	230 x 578 x 675 mm
WxDxH	9.06 x 22.76 x 26.6 in
Weight	88 kg
Weight	194.01 lb

6.1—Q-MS 6 kVA Specifications

6.2—Q-MS System Topology

The Q-MS provides perfect power quality through isolation of contaminated input, continual efficient regeneration of the output, and resource management and control.

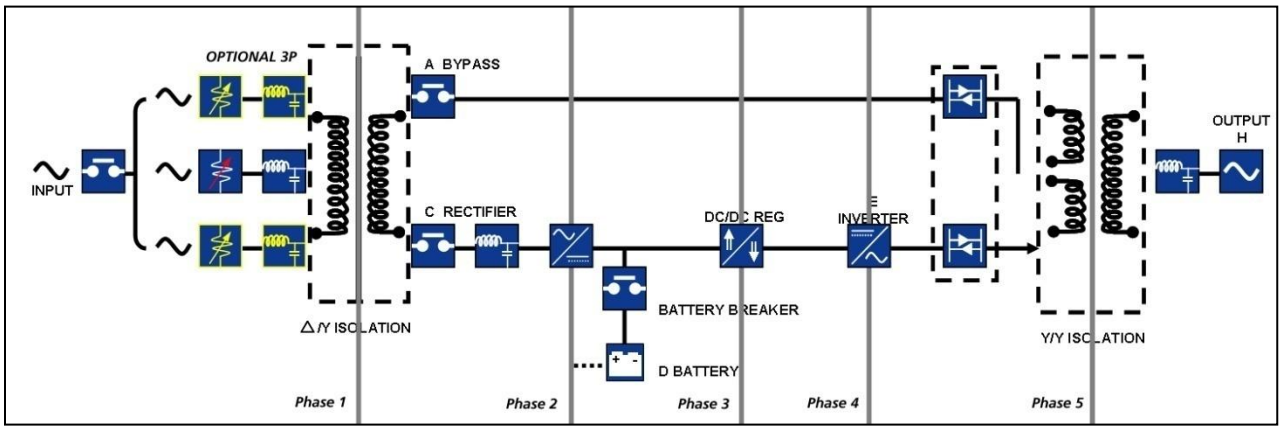


Figure 10—Q-MS Topology

6.3—Q-MS Status Indicators

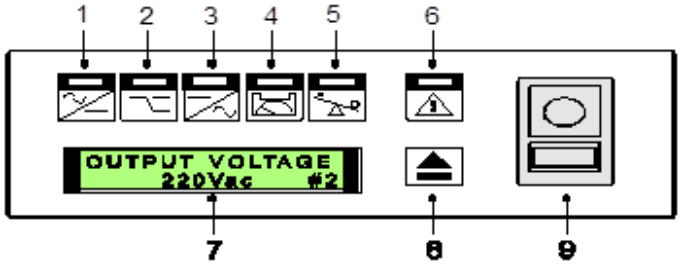


Figure 11—Front View LCD Indicators

1. **Input LED**: Indicates that AC power is available, and that the system is in “Online” mode. This LED should always be illuminated while the Q-MS is in normal operating mode.
2. **Bypass LED**: Indicates that the Q-MS is in bypass mode, and that the output power is supplied via the bypass line.
3. **Output LED**: Indicates the Q-MS power is being supplied from the inverter to the load.
4. **Battery Capacity LED**: Indicates that the batteries are low.
5. **Overload LED**: Indicates the load on the Q-MS exceeds it capabilities. A reduction of the load is required.
6. **Fault LED**: Indicates a fault condition. The system may need service, the connected load is too large, or there is a short circuit.
7. **LCD Display**:
   - Q-MS Status
   - AC: Loss (OK) BAT: OK (LOW)
   - No Output (Bypass, Output, Inverter Output)
   - Output Frequency
   - Battery Voltage
   - Input Voltage
   - Output Voltage
   - Input Frequency
   - Output Power
8. **LCD Switch**: This switch is pressed to select Q-MS status on the LCD Display.
9. **ON/OFF Switch (SW4)**: Turns the Q-MS ON or OFF.

6.4—Breakers

The Q-MS has an input breaker on the back of the unit.

6.5—Audible Beep/Alarm Status

1. If normal AC supply power fails, the beep/alarm sounds every 4 seconds.
2. When the battery voltage level is low, the beep/alarm beeps once every second.
3. When the UPQ system is in fault status, overloaded, or there is a short circuit condition on the output of the UPQ system, the beep will sound continuously.

6.6—Interface Specifications

The UPQ system provides communication signals for power failure, low battery, external shutdown, etc. via an RS-232 cable connection to the User's computer. The communication protocol is as follows:

Baud rate	: 2400
Data	: 8
Stop	: 1
Parity	: None

6.7—Final System Check

Daily operating procedure: Press the ON/OFF Switch (SW4) to turn ON or OFF the Q-MS.

Important points to note about operation of the Q-MS:

When operating the Q-MS, please contact Power Innovations immediately if anything different occurs from what has been outlined in the installation section of the manual. The Overload LED and beep indicate an overload condition. Turning OFF pieces of connected equipment (one at a time) will reduce the load until it can be determined what can be connected safely. If the Overload LED indicator is illuminated and the beep sounds continuously, switch OFF the least critical piece of equipment connected to the unit. Continue to switch OFF less critical items until the alarm stops and follow these precautions:

1. During production and testing, the batteries are fully charged. After the initial startup, keep the power applied continuously to the Q-MS for at least 8 hours to ensure that the batteries are fully charged.
2. It is wise to test the operation of the Q-MS regularly to ensure the longevity of the batteries. Secure the load every 90 days by closing all open files on the computer(s) being protected by the Q-MS and shutdown any other equipment which is sensitive to sudden power failure. Switch OFF the AC utility supply to the Q-MS and allow it to run from its batteries until the battery low alarm occurs. Restore AC supply and recharge batteries.

Note

For optimal battery life, check and recharge batteries as instructed above.

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7—Troubleshooting Guide

The following section provides troubleshooting information for the Q-MS unit. If problems persist or continue after performing standard troubleshooting protocol, please contact Power Innovations (back of this manual).

7.1—Symbol Reference

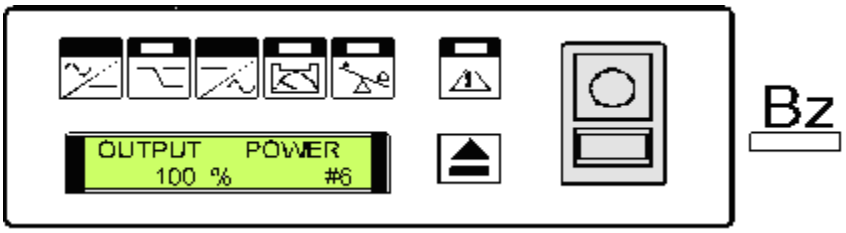
LIGHTS UP EXTINGUISH FLASH

Bz	Bz	Bz	Bz
Buzzer sounds continuously	Buzzer sounds every four (4) seconds	Buzzer sounds every second	Buzzer No sound

7.2—Q-MS Status and Action

The following screens show possible status situations of the Q-MS and what actions should be taken.

1. **100% Load (Normal Operation)**

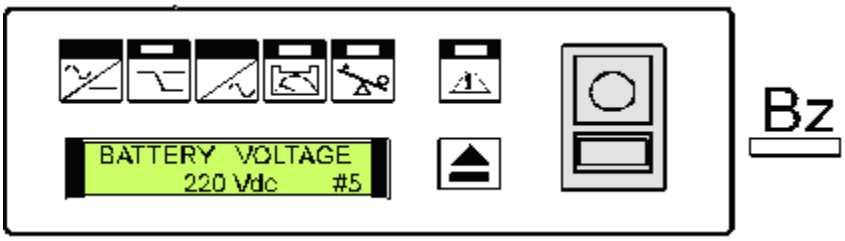


Q-MS STATUS:

AC utility power is normal. The Q-MS is running normally with a full load.

ACTION: None.

2. **Battery Charged to 90% (Normal Operation)**



Q-MS STATUS:

AC utility power is normal. The Q-MS is running normally. Batteries have been charged to 90% or more.

ACTION: None.

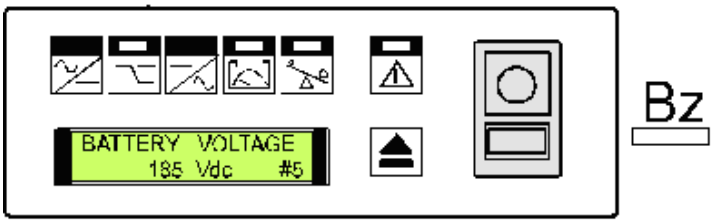
3. **208 VAC Input (Normal Operation)**

Q-MS STATUS:

AC utility power is 208 V. The Q-MS is running normally.

ACTION: None.

4. **Charger is not working**

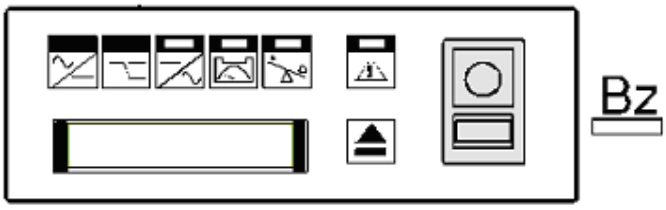


Q-MS STATUS:

AC utility power is normal. The Q-MS is running normally, but battery capacity is low.

ACTION: The battery is not charging. The charger board needs to be replaced. Contact Power Innovations Customer Support.

5. **System will not start**

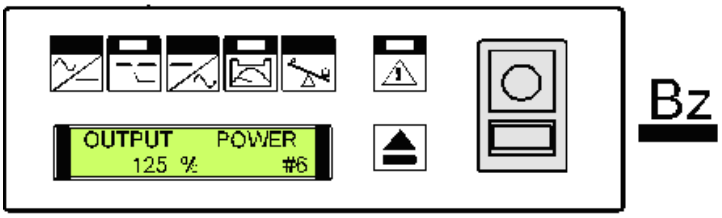


Q-MS STATUS:

AC utility power is normal. The output load is supplied by utility power. If the ON/OFF Switch is not ON, the Q-MS will not startup.

ACTION: Check all connections to the Q-MS. If unit still will not start, contact the Power Innovations Customer Support.

6. **Overload Condition**

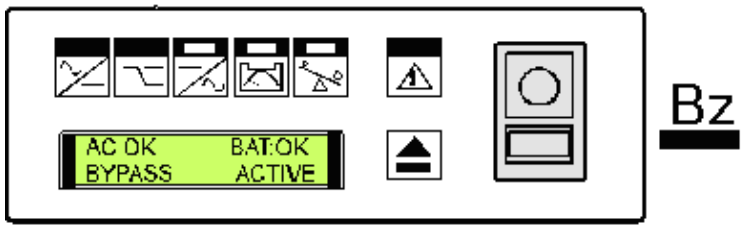


Q-MS STATUS:

AC utility power is normal, but the Q-MS is overloaded. The Overload LED will be lit and the buzzer will be beeping continuously.

ACTION: Reduce the critical load on the Q-MS until the system comes out of bypass.

7. **System Fault**

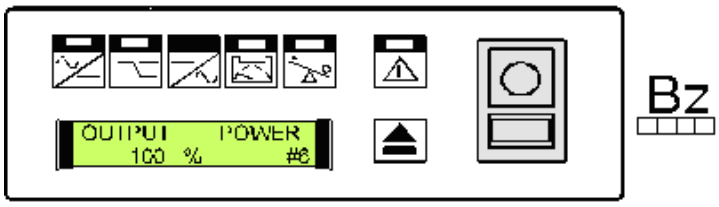


Q-MS STATUS:

AC utility power is normal, but the Q-MS is abnormal. The load is supplied by AC utility power via bypass.

ACTION: Power OFF the Q-MS and restart the system according to the startup procedure. If problem continues, contact the Power Innovations Customer Support.

8. **System is in backup mode (Normal Operation)**

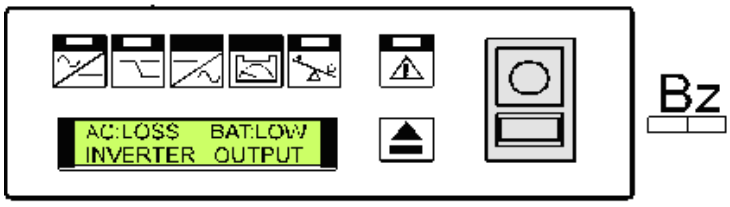


Q-MS STATUS:

There is AC utility power failure. The load is being supplied by battery power in the Q-MS. The Q-MS is connected with a full load. A buzzer sounds every 4 seconds.

ACTION: When AC utility power fails, reduce the less critical load in order to extend backup time. If there is no power failure, check all connections and fuses. If the problem continues, contact the Power Innovations Customer Support.

9. **Low Battery Detected**

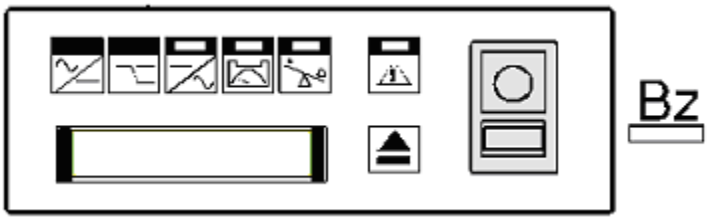


Q-MS STATUS:

There is AC utility power failure. The load is supplied by the Q-MS and battery power is running out. The buzzer beeps every second.

ACTION: Q-MS will shut down automatically. Any critical data should be saved immediately.

10. **System is in sleep mode**



Q-MS STATUS:

There is AC utility power failure and battery power has been exhausted. The Q-MS has shut down automatically.

ACTION: The Q-MS will restart when AC utility power is restored. If AC utility power failure is more than 6 hours, please follow storage instructions.

8—Warranty

Limited Warranty

Power Innovations International, Inc. (hereinafter “Power Innovations”), warrants this product to be free from defects in material and workmanship for a period of one year from the date of purchase. The warranty also includes twelve-month coverage on parts only.

Repair or Replacement

If any part or portion of the Power Innovations product fails to conform to the Warranty within the Warranty period, Power Innovations, at its option, will furnish new or factory remanufactured products for repair or replacement of that portion or part. Replacement parts or unit may be new or refurbished and will meet specifications of the original parts or unit.

Legal Rights and Restrictions

This warranty gives you specific legal rights. You may also have other rights which vary from state to state. This warranty is limited to the original end user of the product and is not transferable. This warranty covers only Power Innovations supplied components. Service required as a result of third-party components is not covered under this warranty.

Proof of Purchase

Proof of purchase will be required by Power Innovations to substantiate date of purchase. Such proof of purchase must be an original bill of sale or receipt containing name and address of seller, purchaser, and the serial number of the product.

Limitation of Remedies

Power Innovations’ entire liability and the User’s exclusive remedy will be repair or replacement of the unit if all conditions described under “Limited Warranty” have been met.

Incidental Damages

In no event will Power Innovations be liable for indirect, special, incidental, consequential, or exemplary damages of any kind whatsoever arising out of the use of this unit, including without limitation, lost profits, business interruption, or loss of data, whether any claim is based upon theories of contract, negligence, strict liability, tort, or otherwise.

Warranty Claims

Customer Support

Questions concerning the operation, repair, or maintenance of this equipment should be directed to the Service Department of Power Innovations International. When making such an inquiry, provide the Service Department with the model number, serial number, and approximate date of receipt of the equipment.

Making a Claim

Within a reasonable time, but in no case to exceed 30 days, after discovery of a defect, the purchaser shall contact Power Innovations at 801-785-4123. It is the obligation of the purchaser to have the product shipped, freight prepaid, or delivered to the authorized reseller from whom it was purchased, or other facility authorized by Power Innovations to render the services provided hereunder in the original package. All products returned to Power Innovations for service MUST have prior approval, which should be obtained by calling 801-785-4123.

Claim Restrictions

The product must not have been previously altered, repaired, or serviced by anyone other than a service facility authorized by Power Innovations to render such service, and the serial number of the product must not have been altered or removed. To be covered by this warranty, the product will not have been subjected to accident, misuse or abuse, or operated contrary to the instructions contained in the User's Manual. Any such conditions will void this warranty.

Prior to Any Return

If it is deemed necessary to return this equipment to the factory for servicing, contact the Customer Support Department for authorization and an RMA number.

Contacting Power Innovations

If there are any questions or comments about this product, please feel free to contact us at:

Power Innovations International, Inc.
Tel: (801) 785-4123
Fax: (801) 785-6999
Email: support@power-innovations.com