



Power Innovations
International, Inc.

MatrixEMM™

(Battery Monitoring Module)



Master Monitor



Detecting Module

User's Manual

*The Matrix Series
of power perfection from
Power Innovations International*

The standard for perfect, dependable power.

MatrixEMM User's Manual

WARRANTY AND COPYRIGHT

LIMITED WARRANTY

Power Innovations International, Inc. (hereinafter “Power Innovations”), warrants this product to be free from defects in material and workmanship and, subject to the conditions set forth below, agrees to repair or replace (at Power Innovations’ sole option) any part of the enclosed unit which proves defective for a period of one (1) year from the date of purchase. Spare parts are warranted for ninety (90) days. Replacements parts or units may be new or refurbished and will meet specifications of the original parts or unit.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. This warranty is limited to the original purchaser 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 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.

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 may be obtained by calling 801-785-4123. The product will not have been previously altered, repaired, or serviced by anyone other than a

service facility authorized by Power Innovations to render such service, the serial number of the product shall not have been altered or removed. In order 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.

LIMITATION OF REMEDIES

Power Innovations International, Inc.'s entire liability and the user's exclusive remedy shall be replacement of the unit if all conditions described under "Limited Warranty" have been met. In no event will Power Innovations International Inc. be liable for any other damages arising out of the use of this unit.

TECHNICAL SUPPORT

The MatrixEMM Series is developed by Power Innovations International, Inc. If there is any question or comment about this product, please feel free to contact us.

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Safety

Warnings



- Read this manual carefully before operating.
- Follow all operating instructions.
- For safety, obey all warnings on the product and in this manual. (Failure to do so may void the warranty.)
- Install Master Monule of the MatrixEMM near an AC outlet to ensure easy access.
- The MatrixEMM is intended for installation in a controlled environment.
- DO NOT open the cover, as there are no user serviceable parts inside.
- DO NOT insert any object into any of the ventilation holes or any other opening on the MatrixEMM units.
- Use only the AC power cable that is provided.
- Do not leave the MatrixEMM modules connected to monitored batteries for an extended period of time if the battery being monitored is not connected to an automatic charging system

1. Description

The MatrixEMM is an intelligent module capable of monitoring each individual battery in a battery bank. The unit can identify batteries below specification limits and initiate recharging or auto-repair procedures, therefore prolonging battery life. One module can monitor up to 64 individual 12V batteries. The MatrixEMM will report abnormal situations, such as total battery failure, incorrect cable connections, or battery charge less than preset values.

2. Module Overview & Contents

2.1 Master Monitor



There are three keys (UP↑/DOWN↓/ENTER↵) and two LEDs on the front panel of the MASTER MONITOR, as seen in the above photo. The green LED illuminates when power is connected. The red LED illuminates, and an audible alarm

sounds, when an abnormal situation occurs. Such anomalies include battery failure, incorrect cable connections, or battery charge less than preset values.

To make the display more legible, the LCD is backlit by LEDs. To prolong the life of LEDs, power to the LEDs is cut off 15 seconds after the last key was pressed. Backlighting will resume when any key is pressed.

2.2 Detecting Module



There are two LEDs on the front cover of the DETECTING MODULE, as seen in the above photo. The green LED illuminates for power ON, and the red LED illuminates for battery failure or abnormal battery connections.

3. Installation

3.1 Factory Settings

The MatrixEMM comes with one MASTER MONITOR (MM) and a variable number of Detecting Modules (DM). One Master Monitor can support up to 64 individual Detecting Modules. Each Detecting Module comes preset with an individual dip switch setting that provides an address for communication with the Master Monitor. On the bottom of each DM the factory preset values are noted along with the corresponding number in the DM sequence. These values can be changed or added to after installation; however, caution must be taken to insure that duplicate addresses do not exist in the string.

3.2 Connecting the Units

The DMs are installed by connecting the positive and negative leads to the corresponding contacts on the battery to be monitored. No other power source is needed for operation of the DMs. **CAUTION:** Do not leave the DM attached to a battery for an extended period of time if that battery is not attached to an automatic charging system. When the green LED is lit on the DM, a good connection has been made with the battery and the DM is ready to communicate.

Once each DM is connected to the battery, connect all DMs to each other and to the MM using the cables provided. The order in which the DMs are connected will not affect the performance of the system. The DM and MM also have no designated input or output ports for communication, thus they are universal in function, and it is not important which communication cable goes into which port.

Note: Cable length between DMs and the MM should not exceed 100 feet.

3.3 Troubleshooting Installation

A “connect error” displayed on the MM after connecting the power could be due to one of the following:

- (a) A bad connection in the communication line
- (b) A DM is disconnected from one of the batteries
- (c) The number of DMs attached is not equal to the number of DMs pre-programmed into the MM.

3.4 Changing Dip Switch Settings

If for any reason the dip switch settings of an individual DM must be changed, the DM must be reset after the changes are made by either disconnecting it from the battery being monitored or by pressing the “reset” button located between the red and green LEDs on the top of the DM.

4. LCD Screen Display

The Home Menu is displayed once power is connected to the MASTER MONITOR.

Home Menu					G	R	E	E	T	I	N	G				
					T	E	X	T								

The LCD displays a greeting that can be changed by the user (refer to menu 6). Pressing the ↓ key will change the LCD to Menu 1.

Menu 1	→	B	A	T	T	E	R	Y		F	A	U	L	T		
		B	A	T	T	E	R	Y		V	O	L	T	A	G	E
		S	E	T	T	I	N	G		D	I	S	P	L	A	Y
		T	O	T	A	L		V	O	L	T	A	G	E		
		E	X	I	T											

Menu 1 is a menu for selecting BATTERY FAULT, BATTERY VOLTAGE, SETTING DISPLAY, TOTAL VOLTAGE, and EXIT. Pressing the ↑ or ↓ keys allows the user to scroll through the selections indicated by the cursor (→). Pressing the ↵ key confirms the selection and changes the display to the menu corresponding to the selection. If EXIT is selected, the LCD returns to the Home Menu.

Menu 2

	B	A	T	T	E	R	Y		F	A	U	L	T		
0	2		0	4											

Menu 2 appears when BATTERY FAULT is selected, showing the identity number (ID) of the faulty battery.

Menu 3

0	1	:	1	2	.	5		0	2	:	1	1	.	6	
0	3	:	1	2	.	5		0	4	:	1	0	.	5	

Battery ID No. Battery Vdc

Menu 3 appears when BATTERY VOLTAGE is selected, showing the voltage status of each individual battery.

Menu 4

A	M	O	U	N	T	:		1	6		P	C	S	# of Batteries
		V	O	L	T	:	2	2	0		V	d	c	Charge Voltage
	C	Y	C	L	E	:	0	1			D	A	Y	Auto-battery Discharge Cycle
		F	I	X	:	O	N							Auto-fix Function

Menu 4 appears when SETTING DISPLAY is selected, displaying all the parameters that have been set.

Menu 5

	T	O	T	A	L		V	O	L	T	A	G	E		
				2	2	0		V	d	c					

Menu 5 appears when TOTAL VOLTAGE is selected, displaying the total voltage value of all the connected batteries.

The following Menus, 6 through 11, are parameter setting screens, such as greeting text, the number of batteries to be monitored, charge voltage, auto-discharge cycle and auto-repair function. Connect the power while holding down the ⌵ key on the Master Monitor to go to Menu 6.

Menu 6

→	G	R	E	E	T	I	N	G										
	B	A	T	T	E	R	Y		A	M	O	U	N	T				
	D	E	T	E	C	T		V	O	L	T	A	G	E				
	D	I	S	C	H	A	R	G	E		C	Y	C	L	E			
	R	E	P	A	I	R		F	U	N	C	T	I	O	N			
	C	E	L	L		E	R	R	O	R		S	E	T				
	E	X	I	T														

Menu 6 is used to select GREETING, BATTERY AMOUNT, CHARGE VLOTAGE, DISCHARGE CYCLE, REPAIR FUNCTION, and EXIT. Pressing the ↑ or ↓ keys allows the user to scroll through the selections, indicted by the cursor (→). Pressing the ⌵ key confirms the selection and changes the display to the menu corresponding to the selection.

Menu 7

Menu 7 is displayed when GREETING is selected from Menu 6. Here the user is permitted to edit the welcome greeting. The ↑ or ↓ keys are used to choose the alphanumeric characters. Pressing the

↵ key confirms the entry. The total should not be more than 16 figures for each row. The display will return to Menu 6 once the figure '#' is selected.

Menu 8

	B	A	T	T	E	R	Y		A	M	O	U	N	T	
							0	5							

Menu 8 is displayed when BATTERY AMOUNT is selected from Menu 6. Here the user inputs the number of batteries to be monitored (maximum 64). The ↑ or ↓ keys are used to choose the first number. Press the ↵ key to confirm the entry. 2 digits are required in the input, e.g., 35 or 07. The ↑ or ↓ keys are used to choose the second number. After the number is selected, press the ↵ key to select and return to Menu 6.

Menu 9

	C	H	A	R	G	E		V	O	L	T	A	G	E	
							2	2	0						

Menu 9 is displayed when CHARGE VOLTAGE is selected from Menu 6. Here the user enters the charging voltage for a battery charger. The ↑ or ↓ keys are used to choose the first number. Press the ↵ key to confirm the entry. 3 digits are required in the input, e.g., 230. The ↑ or ↓ keys are used to choose the second number. After the number is selected, press the ↵ key to confirm the entry. The ↑ or ↓ keys are used to choose the third number. After the number is selected, press the ↵ key to confirm the entry and return to Menu 6.

Menu 10

	D	I	S	C	H	A	R	G	E		C	Y	C	L	E
--	---	---	---	---	---	---	---	---	---	--	---	---	---	---	---

5. LED Display

5.1 System Status Indications

Both the Master Monitor (MM) and the Detecting Modules (DMs) have green and red LEDs for easy display of system status. Different sequences of LED lighting and flashing represent different status conditions for the MM and the DM.

If only the green LED is lit on the MM, the system status is normal. If the green and red LEDs are lit simultaneously, there is a system error, and a more precise report may be found on the LCD display of the MM.

On the DM, if only the solid green LED is lit, there is power present; however, no communication is taking place. This status is reached only when the communication cable is disconnected or a menu has been entered on the MM.

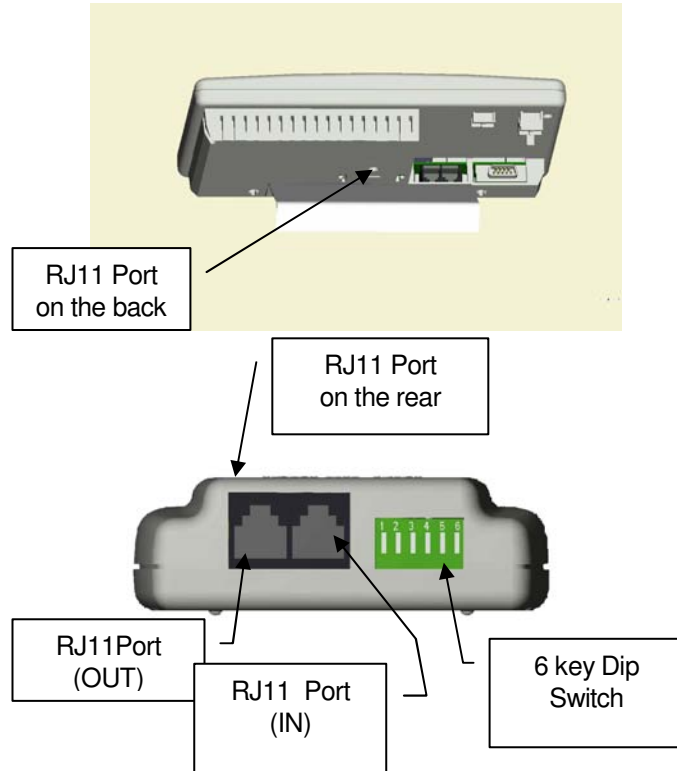
Solid green and flashing red indicates that the DM is functioning normally and communication is taking place between the DM and the MM.

Intermittent flashing of red and green LEDs indicates that a repair cycle has been entered.

6. Module Installation / ID Number Setting

6.1 Master Monitor

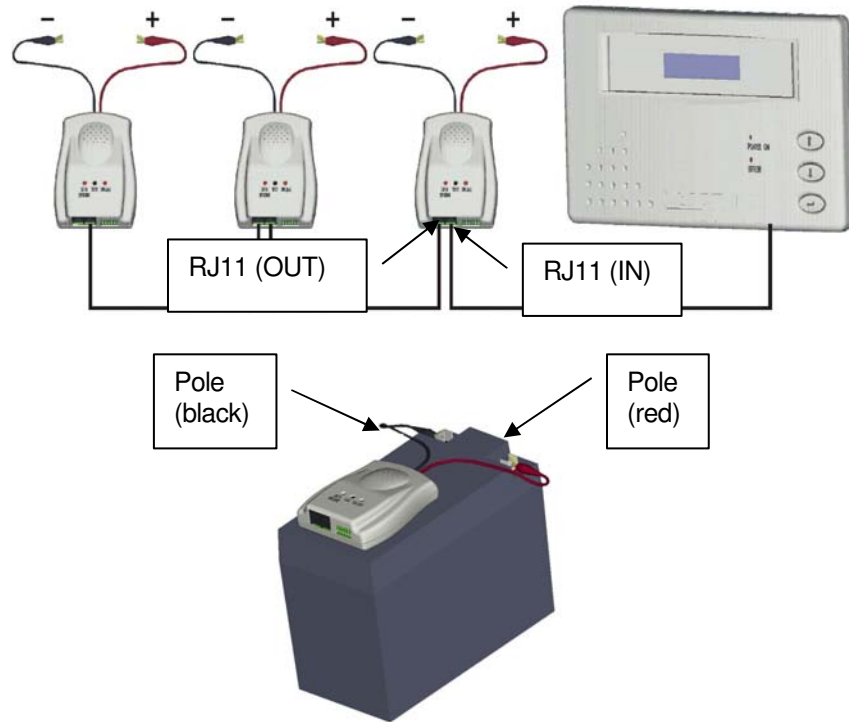
The MASTER MONITOR can be connected to as many as 64 DETECTING MODULES. Either RJ11 port of the MASTER MONITOR is connected to the RJ11 input port of the first DETECTING MODULE, using standard telephone wire w/connectors.



RJ11
Port

6.2 Detecting Module

The RJ11 output port of the first DETECTING MODULE is connected to the RJ11 input port of the second DETECTING MODULE, using standard telephone wire w/connectors. Similarly, additional DETECTING MODULES are linked. Each DETECTING MODULE has two battery connectors, red and black. The red is connected to the (+) pole of the battery to be monitored and the black to the (-).



Each DETECTING MODULE is given a unique ID number to clearly identify the incoming signal. Please refer to the following Binary System Table. The ID number should be from 1 to 63, converted into binary. The digital '0' is used to stand for ID number '64'.

The key position in the 6 key Dip Switch is set according to the binary digit 0 or 1. 1 is the ON position of the Dip switch.

Each DETECTING MODULE is thus given a unique ID. As an example, if the ID number of a battery is 17, the binary number will be as 100010 (see the table on the following page). Therefore, the first and the fifth key of Dip Switch should be switched to 'ON'.



Binary System Table for 6 key Dip Switch																											
		Switch							Switch							Switch							Switch				
ID	1	2	3	4	5	6	ID	1	2	3	4	5	6	ID	1	2	3	4	5	6	ID	1	2	3	4	5	6
1	1	0	0	0	0	0	17	1	0	0	0	1	0	33	1	0	0	0	0	1	49	1	0	0	0	0	1
2	0	1	0	0	0	0	18	0	1	0	0	1	0	34	0	1	0	0	0	1	50	0	1	0	0	0	1
3	1	1	0	0	0	0	19	1	1	0	0	1	0	35	1	1	0	0	0	1	51	1	1	0	0	1	1
4	0	0	1	0	0	0	20	0	0	1	0	1	0	36	0	0	1	0	0	1	52	0	0	1	0	1	1
5	1	0	1	0	0	0	21	1	0	1	0	1	0	37	1	0	1	0	0	1	53	1	0	1	0	1	1
6	0	1	1	0	0	0	22	0	1	1	0	1	0	38	0	1	1	0	0	1	54	0	1	1	0	1	1
7	1	1	1	0	0	0	23	1	1	1	0	1	0	39	1	1	1	0	0	1	55	1	1	1	0	1	1
8	0	0	0	1	0	0	24	0	0	0	1	1	0	40	0	0	0	1	0	1	56	0	0	0	1	1	1
9	1	0	0	1	0	0	25	1	0	0	1	1	0	41	1	0	0	1	0	1	57	1	0	0	1	1	1
10	0	1	0	1	0	0	26	0	1	0	1	1	0	42	0	1	0	1	0	1	58	0	1	0	1	1	1
11	1	1	0	1	0	0	27	1	1	0	1	1	0	43	1	1	0	1	0	1	59	1	1	0	1	1	1
12	0	0	1	1	0	0	28	0	0	1	1	1	0	44	0	0	1	1	0	1	60	0	0	1	1	1	1
13	1	0	1	1	0	0	29	1	0	1	1	1	0	45	1	0	1	1	0	1	61	1	0	1	1	1	1
14	0	1	1	1	0	0	30	0	1	1	1	1	0	46	0	1	1	1	0	1	62	0	1	1	1	1	1
15	1	1	1	1	0	0	31	1	1	1	1	1	0	47	1	1	1	1	0	1	63	1	1	1	1	1	1
16	0	0	0	0	1	0	32	0	0	0	0	0	1	48	0	0	0	0	1	1	64	0	0	0	0	0	0

7. Customer Service

There are no user serviceable parts inside. DO NOT remove the cover or attempt to service either module of the MatrixEMM unit. Unauthorized service will VOID the warranty.

7.1 Maintenance

The MatrixEMM is designed for maintenance-free operation, thus requiring very little attention from the User. The minimal service requirements to ensure trouble free operation is to keep the units clean by wiping the covers with a damp cloth.

7.2 Troubleshooting

Due to its unique design, the unit must be serviced by authorized personnel only. If the MatrixEMM fails to operate properly, contact Power Innovations' Customer Service (see front of this manual for contact information). Be prepared to answer the following questions before asking for assistance:

1. Are all communications cables connected?
2. Are all DETECTING MODULES properly connected to the batteries?
3. Are all DETECTING MODULES CONNECTED TO THE MASTER MONITOR?
4. Are there any duplicate dip switch addresses?