

**Installation and
Operation Manual**

Digital Monitor Mark III

ALL SPECIALTY CONCEPTS, INC. PRODUCTS, INCLUDING THIS ONE,
CARRY A FIVE (5) YEAR LIMITED WARRANTY.

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THANK YOU...

....for purchasing this Specialty Concepts product. As the world leader in electronics for the photovoltaic solar industry, we have put much time and effort into bringing you the best possible product at a reasonable price.

We hope that you are extremely pleased with your new DM3, and with all of your Specialty Concepts products.

PRODUCT DESCRIPTION

The Specialty Concepts Digital Monitor Mark III (DM3) is a flush-mounted digital meter for monitoring the performance of an alternative energy system. The DM3 uses a large, easy to read, liquid crystal display, a rotary switch for selection of voltage and currents, and indicator lights for "HIGH VOLTAGE ALARM" and "LOW VOLTAGE ALARM". The standard DM3 measures the battery voltage and a single current reading of up to 30 amps. With a separate (optional) remote shunt, an additional 100 or 500 amp current reading is available. The internal 30 amp shunt can be cut and replaced with a remote shunt allowing two current readings to be made using remote shunts. The two current readings allow the DM3 to monitor a charging circuit and a load circuit that may be a power distribution box or an inverter. An auxiliary input allows the monitoring of a second system voltage or a third current.

An optional knock-out box (4x7 BOX) is available for wall mounting, or to protect the DM3 for in-wall flush mounting.

Many of the features of the DM3 are user programmable and can be easily changed in the field.

This unit operates in nominal 12 to 48 volt systems. Electrical connections are easy to make to the back of the unit with bare wire or with terminal lugs.

FEATURES

- Operates in 12 volt to 48 volt systems
- Digital display of battery voltage and system current(s)
- One 30 amp current reading standard
- Up to three 100 or 500 amp readings with optional remote shunts
- Adjustable field-programmable high- and low-voltage alarms with indicator lights
- Function select switch with 4 positions to choose display reading:
 - BATTERY VOLTAGE
 - AUX. INPUT
 - CURRENT 1
 - CURRENT 2
- Low power consumption
- User installable alarm relay or alarm beeper modules

PRECAUTIONS, WARNINGS, AND NOTES

DANGER: Hydrogen gas is **VERY** explosive. Where there are batteries, there may be hydrogen. Work only in a well vented area. Make sure that no hydrogen is present when making or removing any electrical connections or when equipment is operating normally. Wires should have no power applied to them when making or removing connections to equipment in the presence of batteries.

DANGER: Electricity, even low voltage electricity, can be dangerous. Installation should be performed by a licensed electrical contractor or other qualified personnel only. It is recommended that the requirements of all applicable local electrical codes (or U.S. National Electrical Code in the absence of local codes) be followed.

WARNING: Follow all safety precautions of the battery manufacturer and the National Electrical Code. Proper ventilation must be provided for vented batteries. Most vented batteries produce hydrogen gas when charging, which is extremely explosive. **DO NOT** expose the battery to open flame, matches, cigarettes or sparks.

CAUTION: **DO NOT** exceed the voltage and current ratings of the DM3 as stated in the specifications.

DO NOT cut the internal shunt unless you plan to use a remote shunt for both current readings. Once this shunt is cut, you will not be able to repair it.

QUICK HELP

IF YOU....

- Want to perform a **quick setup**..... go to page 3
- Want to install an **external shunt**..... go to page 4, 13
- Want to use the **internal shunt**..... go to page 13
- Do not know **what a shunt is**..... go to page 6
- Want to **mount your DM3**..... go to page 5, 12
- Want to **wire your DM3**..... go to page 5, 13
- Want to **re-program your DM3**..... go to page 10
- Want to **re-calibrate the alarms**..... go to page 10
- Want to install the **Alarm Relay Module**..... See instructions with module
- Are **having problems** getting the DM3 to work..... go to page 9
- Need to select **wire sizes**..... go to page 6
- Need to **replace the fuse** or **remove the back**..... See back panel of DM3
- Want to **learn** about options for your DM3..... go to page 4.

QUICK SETUP

IF YOU READ NO OTHER PAGE IN THIS MANUAL...**READ THIS ONE!**

Page numbers after headings refer to the location in this manual where further details about the topic can be found.

PLEASE READ ALL CAUTIONS AND WARNINGS ON PAGE 2 BEFORE PROCEEDING

1. Choose a location for the DM3 (Page 5):

- This location must be indoors, or outdoors in a suitable enclosure, and protected from dirt, bugs, and moisture.
- You will be running wires to this location from your solar panels, batteries and (possibly) your loads.

2. Decide on the method for mounting it (Page 5, 12):

- If you wish to flush mount the DM3, you must cut a hole for it in the mounting surface. Go to page 12 for flush mount instructions. Use the mounting template on page 16.
- If you wish to mount the DM3 in the optional metal enclosure, first secure the enclosure to the mounting surface with the proper hardware. Then, after connecting the DM3 (see below), you will secure the DM3 to the enclosure.

3. Determine if you will be using the DM3's internal shunt or if you need to install an external shunt. (Page 5, 13). If you do not know what a shunt is, refer to page 6.

NOTE: Shunts MUST be installed in the negative legs of the device whose current you wish to measure.

- For one current of 30 amps or less, use the internal shunt.
- For one current of more than 30 amps, use an external shunt.
- For a second current of any value, use an external shunt.

4. Install the optional alarm relay module or the alarm beeper module (Page 4, 11):

- If installing this option, mount it to the rear of the DM3 per the instructions included with the module.

5. Set the programming jumpers (Page 5, 7, 10):

- Determine which shunts you will be using. If using the internal 30 amp shunt or any external 100 amp shunts, you do not need to modify the decimal point programming. If using any 500 amp shunts, the programming will have to be altered
- Determine what the "AUX" input will be used for. Set the two jumpers accordingly.
- If you wish to alter the factory preset alarm set-points (they are set for a 12 volt system), this must be done after the DM3 has power applied to it (see steps 6 and 7 below) and before it is mounted.

6. Connect wires to the DM3 (Page 5, 6, 13):

CAUTION: FOR SAFETY, REMOVE POWER FROM WIRES BEFORE CONNECTING THEM TO THE DM3.

- Using the label on the back of the DM3 as a guide, connect the wires to the DM3. Observe polarity.

7. Apply power to and test the DM3 (Page 5, 7):

- Apply battery power to the DM3.
- Set the front panel switch to the "BATTERY VOLTS" position. The display should show your normal battery voltage.

If measuring current, set the front panel selector switch to the appropriate position. The display should show the current being produced (or consumed) by the device connected to the shunt .

UNPACKING YOUR DM3

You will find the following items in the package:

- The DM3 itself
- This instruction manual
- A small plastic bag containing the following items:
 - 4 mounting screws
 - 1 spare fuse
 - 2 spare programming jumpers

OPTIONAL ACCESSORIES

THE FOLLOWING ITEMS ARE OPTIONAL AND ARE AVAILABLE FROM YOUR DEALER:

Alarm relay module:

This plug-in module allows the connection of equipment that will provide additional “hi” and “lo” alarm warnings. Examples of such warnings are lights, bells or sirens, radio transmitters, etc.

Alarm beeper module:

This plug in module produces a loud tone to indicate that a hi or lo battery voltage condition has occurred.

NOTE: Only one of the above modules may be installed on the DM3.

Metal box (4x7 BOX):

Protects the DM3 electronics. Provides a means for mounting the DM3 to a wall without making a large cutout (such a cutout is required for flush mounting). The enclosure can also be used for flush-mount installations to protect the DM3 and to allow cable clamps to secure wires.

External shunts:

If you wish to measure more than one current, or if you wish to measure a current greater than 30 amps, you will need external shunts. One is required for EACH such current measurement. The shunts are specified as follows:

- For currents up to 100 amps: 100A/100mv
- For currents up to 500 amps: 500A/50mv

ADDITIONAL ITEMS AND TOOLS THAT YOU WILL NEED FOR INSTALLATION OF THE DM3

TO FLUSH MOUNT THE DM3:

- Wire strippers
- Drill with 3/8" bit
- Keyhole saw or saber saw
- Awl or punch
- Slotted screwdriver
- 2-conductor wire from DM3 to battery
- 2-conductor wire (16-26 AWG) from remote shunts to DM3 location (optional)
- Mounting fasteners of appropriate type for the wall material

TO WALL MOUNT THE DM3:

- Optional wall mount enclosure
- Wire strippers
- Awl or punch
- Slotted screwdriver
- 2-3 each 1/2 inch Romex cable clamps
- 2-conductor wire from DM3 to battery
- 2-conductor wire (16-26 AWG) from the remote shunt to DM3 location (optional)
- Mounting fasteners of appropriate type for the wall material

TO INSTALL OPTIONAL REMOTE SHUNTS:

- Wire strippers
- Heavy duty diagonal cutters (for cutting the internal shunt on the DM3)
- 7/16 end wrench (for 100 amp/100 mv shunt)
- 9/16 end wrench (for 500 amp/50 mv shunt)
- Slotted screwdriver
- Remote shunts (100 amp/100 mv or 500 amp/50 mv)
- Wire lugs, 2 per shunt (1/4" hole for 100 amp, 3/8" hole for 500 amp)
- Mounting fasteners of appropriate type for the wall material
- Small gauge wire (16-26) for shunt sense wires

TO INSTALL OPTIONAL ALARM MODULE:

- Wire strippers
- 5/16 inch nut driver or long nose pliers
- Appropriate gauge wire (16-20) for connection to alarm device

TO INSTALL OPTIONAL BEEPER MODULE:

- 5/16 inch nut driver or long nose pliers

INSTALLATION INSTRUCTIONS

- 1. LOCATE A SUITABLE LOCATION.** Page 12. This location must be protected from moisture, dust, dirt, and bugs. The DM3 **MUST NOT** be mounted out-of-doors unless it is installed in a suitable, **COMPLETELY SEALED** enclosure (available from your dealer). The DM3 may be mounted where other system components (batteries, inverters, etc.) are located or it may be mounted in a remote location many hundreds of feet from other equipment.
- 2. DECIDE ON WHAT WILL BE MEASURED.** Page 13. You will probably want to monitor **AT LEAST** the battery voltage and the charging current from the solar panels. You might want to **ALSO** monitor load current and load voltage. Measuring battery voltage will automatically provide operating power to the DM3.
- 3. DECIDE ON INTERNAL OR EXTERNAL SHUNT(S).** Page 13. If any current that you decide to measure is less than 30 amps, **AND** you can properly run heavy enough wires to carry this current to the DM3, then it would be easiest to use the internal shunt. If you are measuring more than 30 amps, or if you cannot run heavy enough wire to the DM3, then you must use an external shunt. If you are going to measure 2 currents, you **MUST** use an external shunt for the second current.

DO NOT PERFORM THE FOLLOWING PROCEDURE UNLESS YOU ARE SURE THAT YOU WILL BE USING AN EXTERNAL SHUNT FOR CURRENT 1. DO NOT PERFORM THE PROCEDURE WITH ANY POWER APPLIED TO THE UNIT.

To use an external shunt for Current 1, you must cut out the internal shunt. To do so, use a heavy-duty wire cutter with a narrow point to cut the internal shunt. The shunt is the gold-colored loop of wire between the DM3 chassis and circuit board, just below the CURRENT 1 terminal block.

- 4. MOUNT THE DM3.** Page 12. You have 2 basic choices; surface or flush mount. For surface mount (which is the easiest method), you will need a small enclosure. The enclosure is mounted to a wall and the DM3 is then mounted into the enclosure. To flush mount the unit (this is more difficult, but looks better), use the template on page 16 of this manual for further flush-mount details. You will have to cut a hole in your wall and run wires in the wall. **REFER TO THE APPROPRIATE SECTION OF THE NATIONAL ELECTRICAL CODE FOR PROPER AND SAFE METHODS FOR INSTALLATION. IF IN DOUBT ABOUT INSTALLATION, SEEK ASSISTANCE FROM A QUALIFIED EXPERT.**

- 5. SET OPTIONS.** Page 10. The DM3 comes factory programmed for a 12 volt system as follows:

HI ALARM: 15.5 volts

LO ALARM: 11.5 volts

CURRENT 1 DECIMAL POINT: on (Does not need to be changed for ext. shunts less than or equal to 100 amps).

CURRENT 2 DECIMAL POINT: on (Does not need to be changed for ext. shunts less than or equal to 100 amps).

ALARM PROGRAMMING: off

AUX. INPUT: set for normal voltage reading with respect to system ground.

If these program options suit your needs, you do not need to alter any settings and you may proceed with the installation. You may change these settings at any time as you may require.

- 6. WIRE DM3.** Page 13. For appropriate wire sizes, refer to Page 6.

NOTE: If you are using the optional enclosure on the back of the DM3, you may find it easier to wire the unit if the knock-outs in the box are placed towards the top of the unit. When wiring the DM3, run the wires through these knock-outs (and through a cable clamp) and then down over the label on the back of the DM3 and then into the back of the terminal blocks.

- **BATT+ and BATT-**. You must connect the BATT+ and BATT- positions on the DM3 to a source of DC voltage. In a solar system, this is normally the batteries. It is recommended that 18 gauge wire be used for typical installations. If your DM3 is located more than 100 feet from the batteries, then a larger size wire should be used. Using wire that is too small will cause no damage and is not dangerous. It will, however, result in slightly inaccurate voltage readings.
- **AUX+ and AUX-**. Connect these 2 positions to a second source of voltage that you wish to monitor. Some examples are: a second set of batteries, the voltage from the solar panels, the voltage at a load, or any other DC voltage in the system. Any wire size may be used. This input can also be used as a digital meter for general system testing. To measure a third current with an external shunt, remove the AUX. SCALE SELECT jumper and connect the external shunt to the AUX. inputs.
- **CURR1+ and CURR1-**. Use this position to measure any current (up to 30 amps) using the internal shunt or any current with an external shunt. When using the internal shunt, you must use wire of sufficient size to carry the measured current with a minimum of loss. With an external shunt, any size wire may be used to connect the shunt to the DM3.
- **CURR2+ and CURR2-**. Use this position to measure any current using an external shunt. When connecting a shunt to this input, first remove the jumper shorting the screw terminals together. This jumper is no longer needed if the shunt remains wired to the DM3.

- 7. TEST DM3.** With power applied to the DM3, you should be able to measure the battery voltage by placing the Measurement Selection Knob to the first position. If you have shunts (internal or external) installed in the system to measure current, you should be able to measure these currents by turning the knob to the appropriate position. If you encounter problems with the DM3, refer to the trouble-shooting section, page 9.

SELECTING WIRE SIZES

Use the following information to determine what wire size you should use for various functions:

TO CONNECT BATTERY POWER CONNECTIONS: You may use any size wire (16 to 20 AWG is best) that you find convenient. If the DM3 is more than 50 feet from the system's batteries, use wire greater than 18 gauge. The larger the wire, the more accurate will be the voltage readings made by the DM3.

TO CONNECT AUX. INPUT: You may use any size wire for this input.

TO CONNECT CURRENT 1 (INTERNAL SHUNT): Use the following chart to determine wire size:

<u>ROUND-TRIP DISTANCE TO LOAD, BATTERY, OR ARRAY</u>	<u>CURRENT TO BE MEASURED</u>	<u>RECOMMENDED WIRE SIZE*</u>
20 FEET	UP TO 30 AMPS	USE #10 WIRE
50 FEET	UP TO 30 AMPS	USE #6 WIRE**
100 FEET	UP TO 30 AMPS	USE #2 WIRE**

* A smaller wire size may be used for lower currents. An external shunt MUST be used if current exceeds 30 amps. It is suggested that an external shunt be used for wire runs greater than 100 feet round trip.

** The terminal block on the DM3 will not accept wires this large. It is suggested that the wires be terminated with a suitable spade lug that will fit.

TO CONNECT CURRENT 1 AND OR 2 (EXTERNAL SHUNT): You may use any size wire from the shunt output to the DM3 for this input.

TERMINOLOGY / GLOSSARY

SHUNT: A small electronic device that will produce a small voltage when a current passes through it. This voltage can then be measured by a voltage meter. EXAMPLE: You may have 100 amps coming from your solar system; this is VERY difficult to measure. A shunt with 100 amps passing through it will produce 100 mv (millivolts, or thousandth of a volt); this is VERY easy to measure.

SPADE CONNECTOR: A "U" shaped connector that will accept a bare wire in one end and can be fastened under the head of a screw on the other end. Allows for a very clean method of connecting wires to terminal blocks that are not designed for bare wires.*

LOAD: The device(s) in your solar system that use power. Some examples of loads might be lights, electric refrigerators, inverters, water pumps, etc.

NEGATIVE LEG(S): The wires that connect the negative sides of the batteries, solar panels, and loads. Usually (but not always) in D.C. systems, these wires are black. The shunts for the DM3 must be placed in the negative legs for proper operation.

PROGRAMMING JUMPERS: The small black devices used on the DM3 to turn various functions on or off. They consist of a small black handle that contains a strip of gold-plated metal that shorts adjacent programming pins on the DM3 circuit board.

AMPS: A measure of current, or the AMOUNT of electricity that flows in a circuit. The higher the number of amps delivered from the solar panels, the faster the batteries will charge.

VOLTS: A measure of the PRESSURE of electricity that flows in a circuit. The higher the voltage, the greater is the amount of electricity that can be forced through a circuit. Typical voltages for photovoltaic systems are 6, 12, 24, 36, and 48 volts.

WATTS: A measure of the POWER available in a solar system. The larger that this number is, the more work can be done. You can figure out the watts in your system by multiplying the system voltage by its current rating. For example, a 12 volt system producing 10 amps is a 120 watt system.

REMOTE (or EXTERNAL) SHUNT: A shunt that is not on the DM3. A remote shunt would be used when the current being measured exceeds 30 amps. A remote shunt can also be placed near the batteries in the system allowing small wires to be run to the DM3.

SURFACE MOUNT: An installation method where the DM3 is mounted into a box (4x7 BOX) and the box is then mounted to the surface of the wall. The unit will protrude from the wall by several inches.

FLUSH MOUNT: An installation method where the DM3 is mounted into a cutout in a wall. This allows the unit to be flush with the wall surface.

ALARM RELAY MODULE: An option for the DM3 that provides for the connection of alarm devices to indicate when battery voltage becomes too high or low. The relay contacts can drive various alarm devices, such as an audible alarm, a remote warning light, or a radio transmitter.

ALARM BEEPER MODULE: An option for the DM3 that provides an audible warning should the battery voltage become too high or low.

TRIMPOT: A small screw-adjust device that is used to set the Hi and Lo Alarms.

AWG: American Wire Gauge. Used to identify the size of wire. The smaller the AWG, the bigger the wire size.

D.C. SYSTEM: Direct Current. The kind of power that comes out of batteries and solar panels. Only equipment rated for use with D.C. should be run directly from the batteries.

A.C. SYSTEM: Alternating current. The kind of power that comes out of standard wall sockets. D.C. can be converted to A.C. by an inverter. Only equipment rated for use with A.C. should be run from the output of an inverter.

INVERTER: An electronic device that converts D.C. to A.C.

* All of the terminal blocks on SCinc products are designed to accept bare wire. Spade connectors may still be used, if desired.

OPERATING INSTRUCTIONS

- 1. TURNING ON THE DM3:** Once connected to a source of power (the batteries), the DM3 will always be on. Power consumption is very low, so no impact will be experienced to the capacity of the system. To turn off the DM3, you must remove battery power or remove the fuse.
- 2. SELECTING A FUNCTION:** Set the FUNCTION SELECT knob to the item you wish to measure. Currents 1 and 2 will measure whatever current is generated (by the solar panels) or consumed (by the loads) depending on how you have installed the shunts. You may write the item being measured in the box above the switch position.
- 3. RESPONDING TO AN ALARM:** If you notice an alarm indication from the DM3 (Hi Alarm Light or Lo Alarm Light on) this indicates that your battery voltage is either too high or too low. For a high alarm, this may indicate that the batteries are overcharging due to a regulator failure or the need to install a regulator if none is being used, or that the Hi Alarm Setting is too low and should be re-adjusted. For a low alarm, this may indicate a discharged battery (perhaps due to inclement weather, a faulty regulator or solar panel, or too much power consumption for the size of the system), or that the Lo Alarm Setting is too high.

If you believe that there is a problem with your solar system, you may use the DM3 to verify operating parameters, such as actual battery voltage, and charging or load currents. If you believe that the alarm settings are in error, please refer to Page 10 for alarm programming instructions.

THE NEXT ITEM IS NECESSARY ONLY IF YOU WISH TO RESET THE ALARM SET-POINTS.

- 4. RE-PROGRAMMING THE ALARMS:** Page 10. You do not need any additional equipment to re-program the alarms. Proceed as follows:
 - Disconnect any wires to the CURRENT 2 inputs.
 - Put the DM3 into Program Mode by installing the Programming Jumper across PROG MODE pins.
 - Set the Measurement Selection Knob to the CURRENT 2 position.
 - Place a Programming Jumper across LO ALARM (to set the Lo Alarm) or HI ALARM (to set the Hi Alarm). Only one alarm can be adjusted at a time.
 - Adjust the appropriate "trimpot". Read the alarm setting on the DM3's display.
 - When finished, place the Programming Jumpers back into their storage positions and reconnect Current 2.

THE NEXT STEP IS NECESSARY ONLY IF YOU WILL BE USING SHUNTS THAT ARE FOR CURRENTS GREATER THAN 100 AMPS. YOU DO NOT NEED TO RE-PROGRAM THE DECIMAL POINTS IF YOU ARE USING THE INTERNAL 30 AMP SHUNT OR EXTERNAL 100 AMP SHUNTS.

- 5. RE-PROGRAMMING THE DECIMAL POINTS:** Page 10. If you will be measuring currents greater than 100 amps (using external shunts), the decimal point must be turned off for each such current. Proceed as follows:
 - If CURRENT 1 will be measuring currents greater than 100 amps, place the Programming Jumper that is across CURR 1 into the storage position.
 - If CURRENT 2 will be measuring currents greater than 100 amps, place the Programming Jumper that is across CURR 2 into the storage position.

SPECIFICATIONS

PARAMETER	VALUE
Operating voltage range.....	9 volts to 65 volts continuous, 85 volts for 1 minute.
Current measurement, internal shunt (NOTE 1)	30 amps
Current measurement, external shunt (NOTE 2)	Up to 999 amps
Operating temperature range.....	32° F to 122° F (0° C to 50° C)
Current consumption	
1. No options installed, no alarms activated	@12 volts: 13ma @48 volts: 17ma
2. No options installed, one alarm activated	@12 volts: 17ma @48 volts: 21ma
Accuracy	
1. DC voltage.....	+/- 1%
2. DC current.....	+/- 2%
Alarm settings.....	User adjustable over operating voltage range. Factory set to: Lo Alarm - 11.5 v, Hi Alarm - 15.5 v
Alarm delay.....	Up to 5 seconds
Alarm calibration readout accuracy.....	+/- 2%
Alarm hysteresis.....	Approximately 3% of setting
Optional alarm relay contact ratings.....	Up to 28 volts: 1 amp. From 28 to 65 volts: 100ma. Non-inductive load.
Size	
1. No options, no enclosure.....	7.5 in. W X 4.2 in. H X 2.5 in. D
2. With enclosure.....	7.5 in. W X 4.2 in. H X 3.0 in. D

NOTES:

1. Internal shunt can be removed to allow current measurements with an external shunt.
2. Use 100 amp/100 mv , 500 amp/50mv, or 1000 amp/100mv shunts.

FREQUENTLY ASKED QUESTIONS

- 1. WHY DO I NEED EXTERNAL SHUNTS ?** - The internal shunt on the DM3 can only handle 30 amps, so if you want to measure a current greater than 30 amps, you must use an external shunt. This external shunt would normally be located near where the current is flowing so that only the small wires carrying the shunt's signal need be run to the DM3. Also, if you wish to measure a second current, you must use an external shunt.
- 2. CAN I DAMAGE THE DM3 BY HOOKING IT UP WRONG ?** - The DM3 has circuitry to protect itself from incorrect hookup. If hooked up wrong, the unit will not work until it is hooked up correctly.
- 3. WHAT ARE SOME OF THE THINGS I MIGHT WANT TO MEASURE WITH THE DM3 ?** - The basic things to measure would be battery voltage and array current. This information is the minimum that you will need to know to determine how your system is operating. You may also wish to measure the current consumed by your inverter or load(s), so you will know if you are taking out too much energy from the system.
- 4. WHAT DO I NEED TO DO IF I CHANGE MY SYSTEM VOLTAGE ?** - The DM3 will work in any system rated from 12 to 48 volts nominal. If you change your system voltage, the only thing that you will have to do is to recalibrate the alarms, if you wish (see page 10).
- 5. WHAT DOES THE OPTIONAL ALARM RELAY OR BEEPER MODULE DO ?** - If you would like some type of warning that something is wrong with your system (other than from the red lights on the front of the unit), one of these modules will help. The RELAY MODULE can be used to power a warning light or audible alarm at a location removed from the DM3. The BEEPER MODULE will provide a very loud warning in the vicinity of the DM3. Both modules monitor high- and low- voltage alarms.
- 6. WHAT CAN I USE THE AUX. INPUT FOR ?** - This input can be used to measure a second system voltage (for instance, voltage at the solar panels or at a particular load), or it may be used with a third external shunt to measure a third system current. It may also be used with an insolation monitor to measure the amount of sunlight striking the solar panels.. See page 10 for AUX. INPUT programming instructions.

TROUBLE SHOOTING

DISPLAY BLANK, ALARMS DO NOT FUNCTION, NO POWER TO UNIT

- 1) Re-check system wiring to insure proper installation and battery polarity .
- 2) Check all system fuses and circuit breakers. Before replacing a blown fuse, locate and correct the cause of the blown fuse.
- 3) Check the fuse on the DM3. If it is blown, it indicates that the DM3 probably needs service.
- 4) Confirm that all system connections are clean and tight. Particularly check crimp connections that have been crimped but not soldered as these connections tend to deteriorate over time.
- 5) Check the connection from the monitor to the battery. If possible, check the input voltage to the monitor with a hand held multi-meter on the "BATTERY" terminals of the monitor.

TO REPLACE THE FUSE ON THE DM3

The fuse is located under the back panel on the DM3. To remove this panel, remove the two screws securing the back to the DM3. Lift off the back and you will see the fuse (refer to page 11 for location). If blown, replace with a new 1 amp type agc fuse. If it blows again, the DM3 needs service.

ALARMS DO NOT FUNCTION PROPERLY

- 1) Check alarm calibration. Refer to Page 10.
- 2) If using the display on the DM3 to calibrate the alarms, make sure that all wires are temporarily removed from the CURRENT 2 positions on the terminal block.

INCORRECT CURRENT READINGS

- 1) Check to be sure that the shunts (internal, and external, if used) are wired in the negative legs of the system components.
- 2) Using a digital multimeter, measure the millivolt reading at the shunt and then at the DM3 terminal block to which it is connected. Compare this value with the expected current reading and the displayed value.
- 3) Check to be sure that the shunts are installed in the proper location to monitor the desired reading.
- 4) Check to be sure that there are no alternative paths around the shunts.
- 5) If the polarity of the current reading is wrong, reverse the wires to the internal shunt or the wires going from any external shunts to the DM3.

RANDOM READINGS ON "CURRENT 2" POSITION

- 1) Check the connections to the "Shunt" terminals on the monitor.
- 2) Electronic "noise" from inverters or other loads can sometimes influence the readings. Some types of loads (fluorescent lights, inverters) can generate electronic "noise" that sometimes interferes with the monitor reading, particularly when sense wires from remote shunts run close to wiring to the load. Check to see if strange behavior can be traced to the operation of a certain appliance.

RANDOM READINGS ON "CURRENT 1" POSITION

- 1) Check the connections to the "Shunt" terminals on the monitor.
- 2) Electronic "noise" from inverters or other loads can sometimes influence the readings.

CURRENT READINGS INCREASE WHEN THEY SHOULD DECREASE, OR DECREASE WHEN THEY SHOULD INCREASE

- 1) Check the location of the shunts in the circuit. Depending upon their location, they might be reading net current (current in minus current out) instead of only current in.

CHARGE CURRENT INCREASES WHEN CHARGING STOPS

- 1) Check the location of the shunt measuring charge current from the solar panel(s). For correct monitoring, the shunt should be installed in the negative leg, between the regulator and the battery, not between the solar panel(s) and the regulator.

CURRENT READINGS LESS THAN EXPECTED

- 1) Check to see that modules and batteries are in the correct series-parallel configuration for proper system voltage and current.
- 2) Check for an alternative path to ground around the shunt. .
- 3) Make sure that the correct shunt is installed.
- 4) Check output from the solar panel(s), and that they are not partially shaded or dirty.

INCORRECT VOLTAGE READINGS

- 1) If you have an accurate digital volt meter, check voltage readings at the battery and at the monitor, to see if they agree. Voltage drops occur between the regulator and the battery occasionally during maximum charging. Drops often occur through old fuses, fuse holders or circuit breaker boxes and at loose or corroded connections.

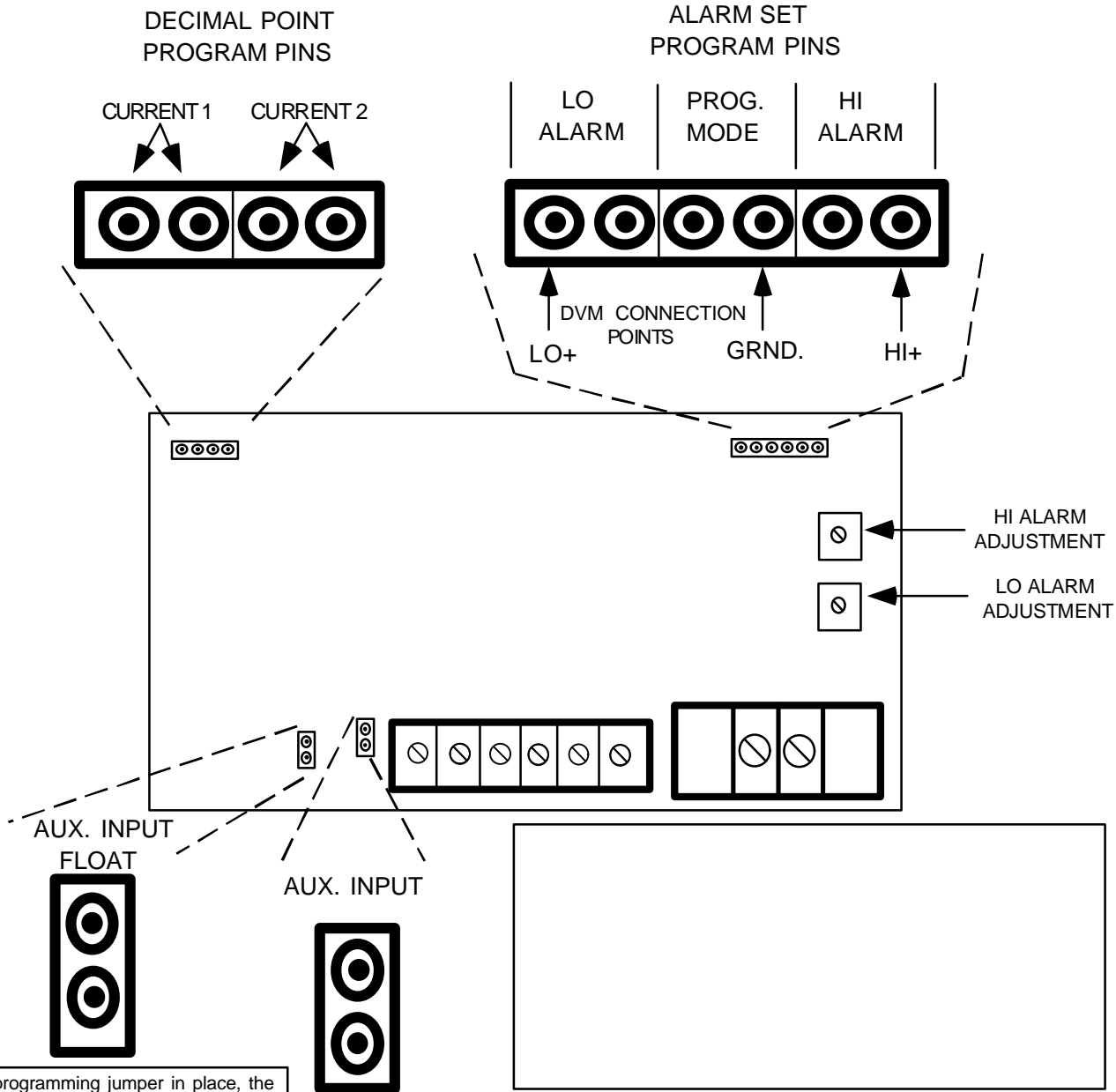
If, after reviewing all of the above troubleshooting information, you cannot get the DM3 to operate properly, it is possible that it may have been damaged. High voltage from nearby lightning strikes or unregulated charging sources can damage the monitor. The built-in lightning protection provides substantial protection, but it is sometimes overwhelmed. Contact your installer/dealer to obtain assistance in the troubleshooting of your system. You may also opt to return the unit to Specialty Concepts for a thorough check-out.

PROGRAMMING PIN INSTRUCTIONS

The decimal point programming pins are factory set for the internal 30 amp shunt or for use with the external 100 amp shunts. You only need to reprogram the decimal point if you are using the 500 or 1000 amp external shunt. To perform this reprogramming, remove the programming jumper from the set of pins that correspond to the input that the shunt is connected to. If you are using two shunts, remove both programming pins.

IF YOU HAVE AN ACCURATE DIGITAL VOLTMETER (DVM)...
Connect your DVM (set to the 200mv range) to the appropriate pins for HI or LO alarms. The reading you get on the DVM is the setting of that alarm. Change this setpoint by turning the appropriate adjustment screw.

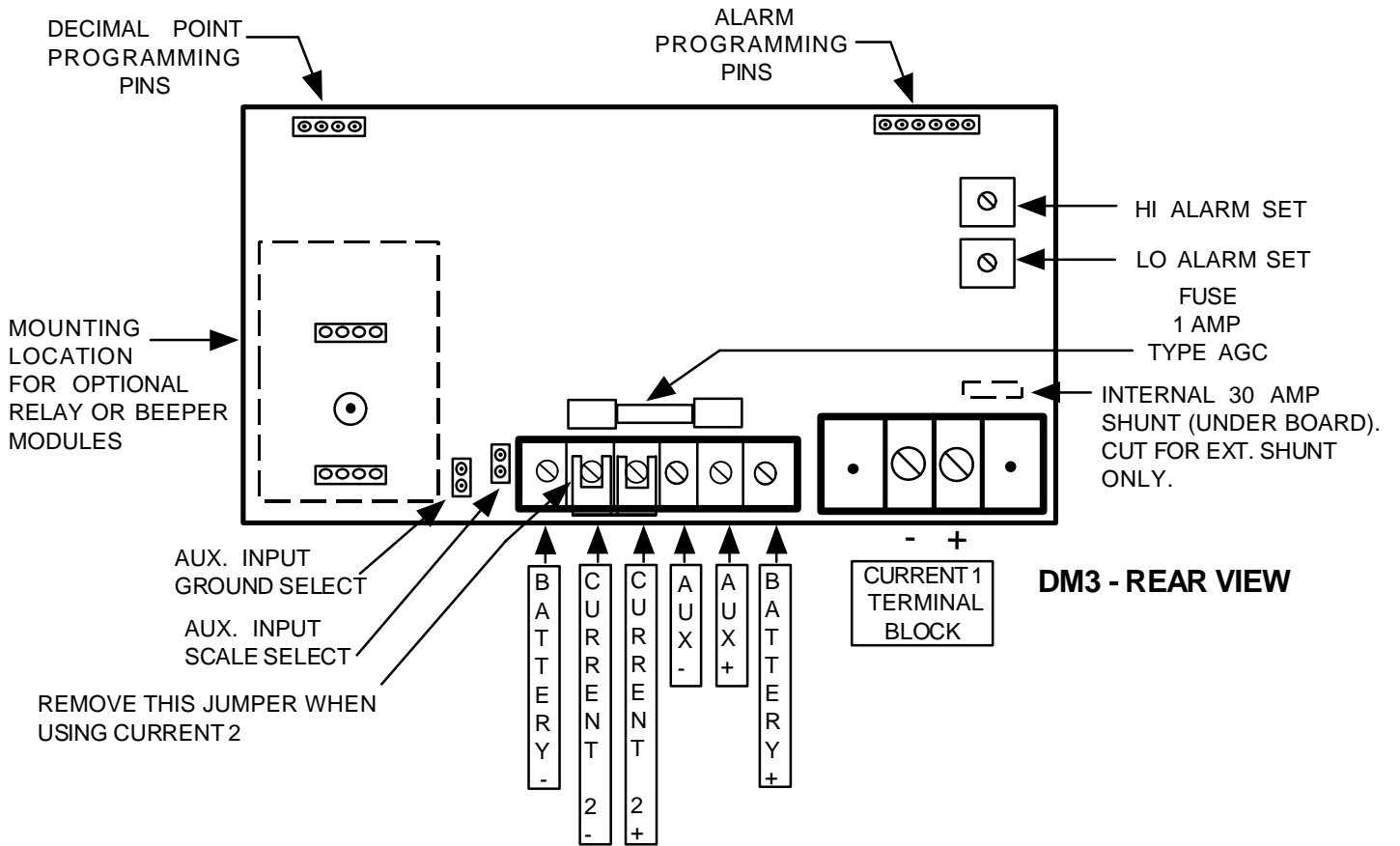
IF YOU DO NOT HAVE AN ACCURATE DIGITAL VOLTMETER ...
use a programming jumper to short PROG. MODE pins together. If you have any wires connected to the CURRENT 2 input, disconnect them. Use a programming jumper to short the appropriate HI or LO alarm pins together. Set the DM3's function switch to position "CURRENT 2". The reading you get on the DM3 display is the setting of that alarm. Change this set-point by turning the appropriate adjustment screw.



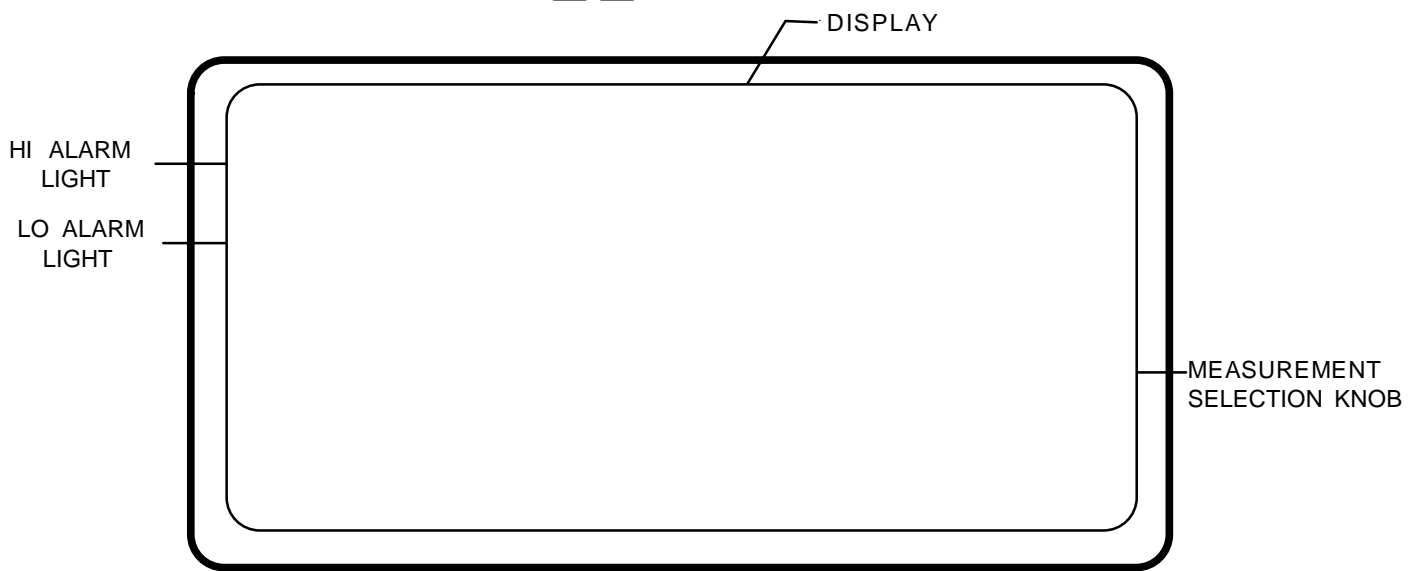
With this programming jumper in place, the negative side of the AUX input is connected to system ground. If you would like this input to float (not be connected to ground) then remove this jumper.

The AUX input comes factory preset to measure a system voltage. This input will divide whatever voltage is connected to it by 1000. If you wish to connect this input up to a shunt, or to use this input as a meter with a full scale range of 200mv, remove this programming jumper.

DM 3 COMPONENT LOCATIONS AND FUNCTIONS



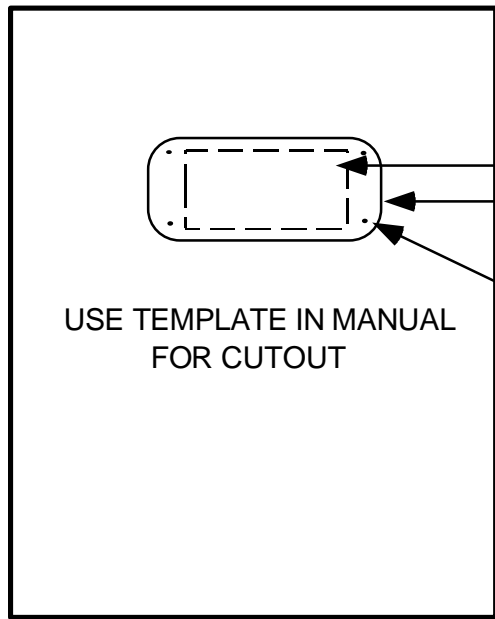
DM3 - REAR VIEW



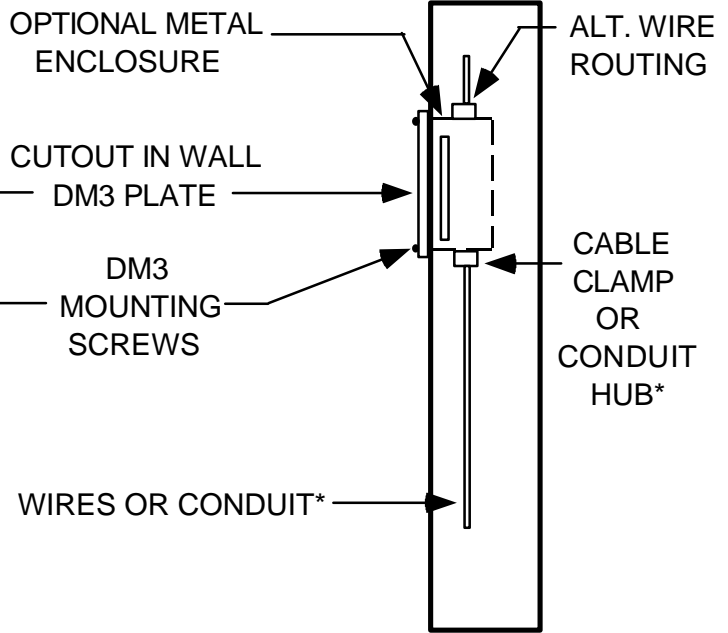
DM3 - FRONT VIEW



FLUSH MOUNT

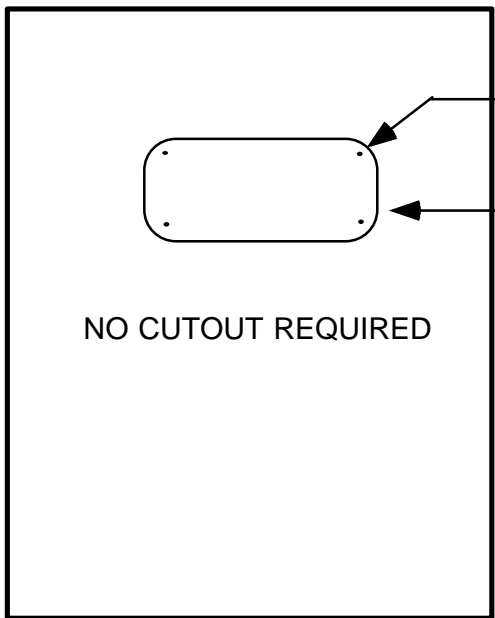


WALL - FRONT VIEW

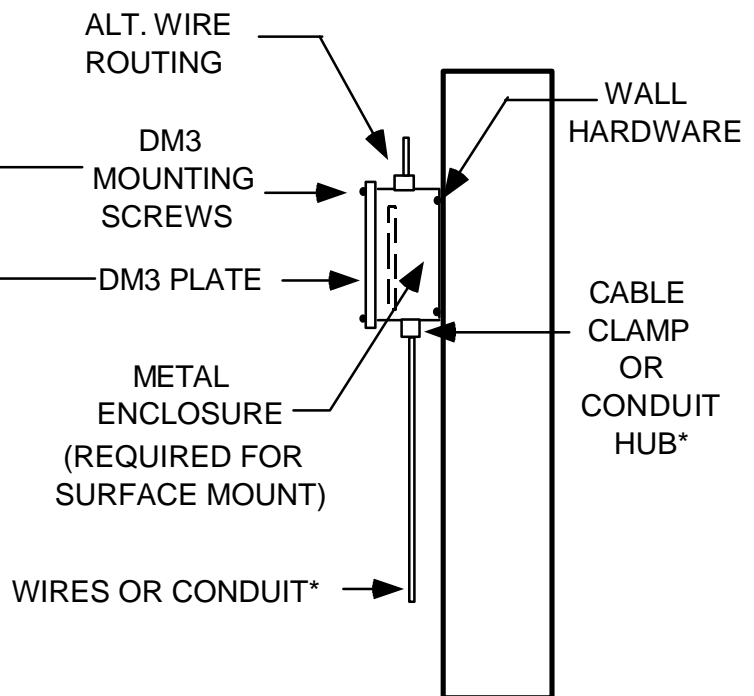


WALL - END VIEW

SURFACE MOUNT

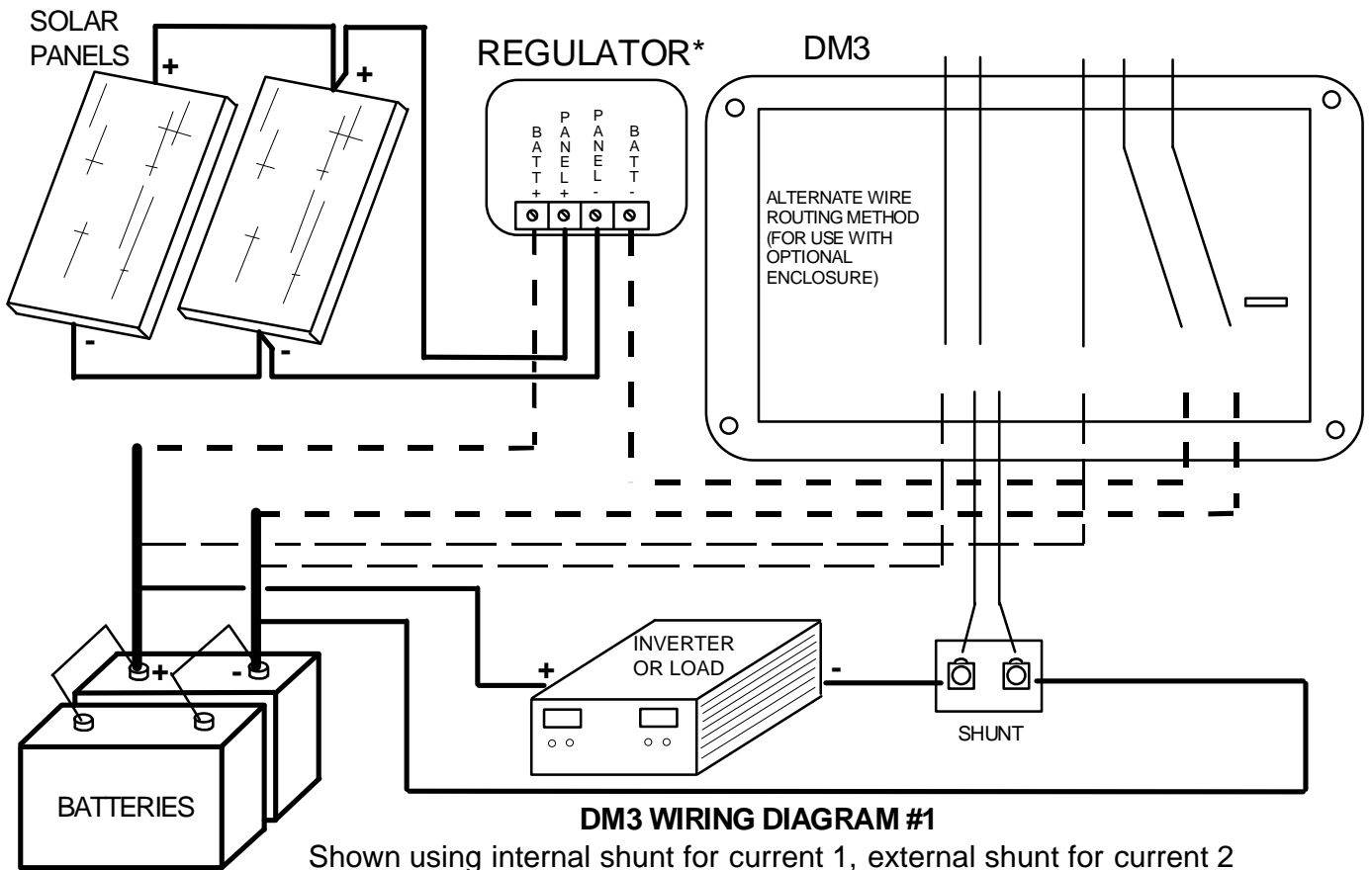


WALL - FRONT VIEW

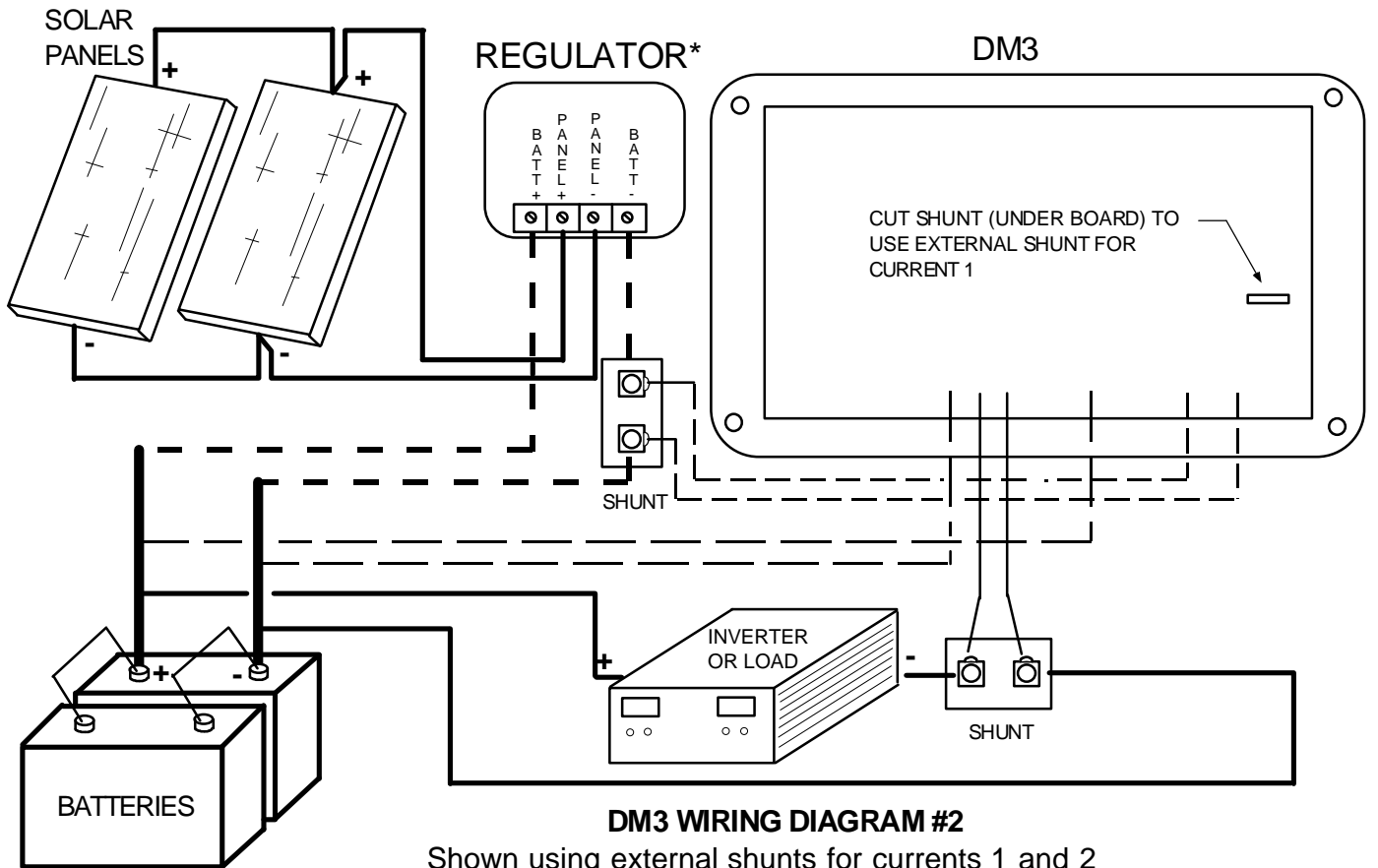


WALL - END VIEW

* METHOD DEPENDS UPON CODE REQUIREMENTS AND TYPE OF CONSTRUCTION



* Suggested hookup with SCinc ASC regulator shown. Other regulators may be used.



* Suggested hookup with SCinc ASC regulator shown. Other regulators may be used.

LIMITED FIVE YEAR WARRANTY
SPECIALTY CONCEPTS, INC.

1. Specialty Concepts, Inc. warrants all its products for a period of five (5) years from the date of shipment from its factory. This warranty is valid against defects in materials and workmanship for the five (5) year warranty period. It is not valid against defects resulting from, but not limited to:
 - A. Misuse and/or abuse, neglect or accident.
 - B. Exceeding the unit's design limits.
 - C. Improper installation, including, but not limited to, improper environmental protection and improper hook-up.
 - D. Acts of God, including lightning, floods, earthquakes, fire and high winds.
 - E. Damage in handling, including damage encountered during shipment.
2. This warranty shall be considered void if the warranted product is in anyway opened or altered. The warranty will be void if any eyelets, rivets, or other fasteners used to seal the unit are removed or altered, or if the unit's serial number is in any way removed, altered, replaced, defaced or rendered illegible.
3. The five (5) year term of this warranty does not apply to equipment where another manufacturers' warranty is available. An example of such equipment may be, but is not limited to, an electronic enclosure. The time limit for this warranty may be for less than the Specialty Concepts limited warranty. Specialty Concepts will assist the claimant in attempts to seek warranty claims for such equipment, where appropriate.
4. Specialty Concepts cannot assume responsibility for any damages to any system components used in conjunction with Specialty Concepts products nor for claims for personal injury or property damage resulting from the use of Specialty Concepts' products or the improper operation thereof or consequential damages arising from the products or use of the products.
5. Specialty Concepts cannot guaranty compatibility of its products with other components used in conjunction with Specialty Concepts products, including, but not limited to, solar modules, batteries, and system interconnects, and such loads as inverters, transmitters, and other loads which produce "noise" or electromagnetic interference, in excess of the levels to which Specialty Concepts products are compatible.
6. Warranty repair and/or evaluation will be provided only at Chatsworth, California facility of Specialty Concepts. Units for such repair and/or evaluation must be returned freight prepaid to Specialty Concepts with a written description of any apparent defects. Specialty Concepts will not be required at any time to visit the installation site wherein Specialty Concepts' products are subject to warranty repair and/or evaluation.
7. Only Specialty Concepts is authorized to repair any of its products, and they reserve the right to repair or replace any unit returned for warranty repair. The party returning a unit for repair is responsible for proper packaging and for shipping and insurance charges, as well as any other charges encountered, in shipping to and from Specialty Concepts.
8. This warranty supersedes all other warranties and may only be modified by statement in writing, signed by Specialty Concepts.

Warranty terms effective as of April 1, 1993

REPAIR INFORMATION

Directions for returning units needing repair.

1. Write up a note with the following information:
 - Name / Company Name
 - Return Address : (For USA/Canada: UPS Deliverable. Avoid PO Boxes)
 - Daytime Phone
 - Description the failure
 - Specify amount of repair charges preapproved (we will contact you if repair charges are larger than this amount.)
2. Box up unit with copy of sales receipt (if available).
3. Send by UPS or Parcel Post to :

Specialty Concepts, Inc.
Attn : Repair Dept.
8954 Mason Ave
Chatsworth, CA 91311 USA

If the Repair is not covered under warranty, the repair charges will not exceed 30% of the value of a new unit. (shipping and handling not included) Domestic charges are collected via UPS-COD. For non-warranty repairs, repaired portion features an additional one-year warranty.

SPECIALTY CONCEPTS, INC.

8954 MASON AVE., CHATSWORTH, CA 91311 USA PH: (818) 998-5238, FAX: (818) 998-5253

