

MidNite Solar Classic Owner's Manual



**This Manual covers models Classic 150, 200, 250
&250KS**

The MidNite Solar Classic charge controller conforms to *UL 1741, Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, Second Edition, May 7, 1999 with revisions through January 28, 2010 and CAN/CSA C22.2 No. 107.1: 2001/09/01 Ed: 3 (R2006)*

Note: The Classic KS has not been evaluated by ETL.

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MidNite Solar's Classic charge controller User's Manual
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Contact Information

Telephone: 360.403.7207

Fax: 360.691.6862

Email: customerservice@midnitesolar.com

Web: www.midnitesolar.com

Contents

Scope.....	5
Introduction.....	5
Classic Power Curves.....	8
Unpacking the Classic.....	10
Removing and installing the front cover on the Classic	11
Mounting the Classic	12
Alternative Mounting.....	14
Dimensions.....	14
Sealed or Vented.....	14
Network Cable Routing and Installation Guidelines.....	15
Battery Temperature Sensor Installation.....	17
Chassis Grounding.....	19
DC System Grounding.....	19
DC GFP (Ground Fault Protection)	20
Disabling GFP.....	20
Wiring the Classic	21
DC Terminal Connector	23
Over Current Protection and Wire Size Requirements.....	23
Current Rating.....	23
Over Current Protection.....	24
Long Distance Wire Runs	24
Connecting the Classic to the Clipper.....	25
Maximum and Minimum Wire Size.....	25
Commissioning the Classic.....	25
Using the Classic Setup Screen's.....	25
Setting Nominal Battery voltage.....	26
Battery Charge Stages and Meanings	26
Bulk MPPT	26
Absorb.....	26
Float	27
Equalize.....	27
Adjusting Absorb, Equalize and Float Voltages.....	27
Battery Size and Chemistry.....	27
Battery Temperature Compensation.....	27
Calibrating Battery and PV Voltage.....	27
Configuring DC Input Source.....	28
Configuring the Classic for Wind Input Source.....	30
Wind.....	30
Setting the Date and Time	30
Setting Longitude and Latitude	30
Configuring Auxiliary Input/Output.....	31
Aux 1 Function.....	35
Aux 2 Function. Output/Input.....	36
Setting the MNGP features, Access the Version of software and Restore factory defaults	36
Operating the Classic.....	37
Navigating the Menu's	37
Viewing Other MidNite Products on the Display.....	38
Connecting Classic to Two MNGPs/Network cable.....	38
Arc Fault	39

View Faults and Warning's	40
View Logged Data	40
Uploading New Firmware to the Classic.....	40
Updating Classic Firmware (Windows XP).....	40
Connecting the Classic to the Internet	56
Networking.....	56
Network Setup Through the MNGP	58
DHCP	58
Static IP	59
IP Address	59
Subnet.....	59
Gateway	59
DNS 1 & 2.....	59
Web Access	60
Local Network.....	60
Advanced	60
MODBUS (Preliminary).....	60
DISCLAIMER	60
Conventions:	61
Dealer Information Screen	86
Positive Ground systems.....	86
HyperVOC™	86
HyperVOC™ Origins	87
Troubleshooting.....	87
Technical information	88
Specifications Electrical.....	88
Specifications Mechanical	89
Default Battery charge set points	90
Optional accessories	90
Regulatory Approval.....	90
Warranty.....	91
End of Warranty tune up	91
Aux 1 and Aux 2 Graphs/Jumpers	92
Aux 1 Voltage-Time Relation (Relay/12v)	93
Aux 2 Voltage-Time Relation (PWM)	93
Classic Breaker sizing	94
Classic Menu Map.....	95

Scope

This Manual provides safety guidelines and installation information for the Classic charge controller. It does not provide brand specific information about photovoltaic panels, batteries etc. Contact the manufacturer of other components in the system for relevant technical data.

Introduction

The MidNite Classic charge controller is unique in its ability to be used for a great variety of DC input sources. The Classic is designed to regulate DC input from PV, Hydro, Wind and other DC sources.. The Classic 150, 200 and 250 are designed to work with 12, 24, 36, 48, 60 and 72 volt battery banks. The Classic250KS is designed to charge up to a 120V nominal battery bank. The Classic can be installed stand alone or as a multi-unit networked installation.

Standard features of the Classic charge controller include:

- *3 input operating voltage ranges 150, 200 and 250 VDC
- *Multiple DC input options (example Solar, Wind or Hydro)
- *Wizard driven setup interface including voice and help screens
- *Graphical display
- *Previous 180 days of operational data logged
- *Internet ready

This Manual covers *Classic 150, Classic 200 Classic 250 and the Classic 250KS*. It covers the installation, wiring and use of the Classic charge controller.



WARNING Warnings signs identify conditions or practices that could result in personal injury or loss of life.



CAUTION Cautions identify conditions or practices that could result in damage to the unit or other equipment.

MIDNITE SOLAR CHARGE CONTROLLER INSTALLATION GUIDELINES AND SAFETY INSTRUCTIONS

This product is intended to be installed as part of a permanently grounded electrical system as shown in the system configuration sections. The following important restrictions apply *unless superseded by local or national codes*:

- The System's DC Negative conductor must not be bonded to earth ground. The Classic does this with its internal Ground Fault Protection circuitry. The battery negative and ground are not bonded together directly but are connected together by the Classic's internal GFP device. All negative conductor connections must be kept separate from the grounding conductor connections. The equipment ground terminal inside the Classic must be connected to Earth Ground for the internal DC-GFP to work. *Continue*
- With the exception of certain telecom applications, the Charge Controller should *never* be positive grounded.



- The Charge Controller equipment ground is marked with this symbol:
- If damaged or malfunctioning, the Charge Controller should only be disassembled and repaired by a qualified service center. Please contact your renewable energy dealer/installer for assistance. Incorrect reassembly risks malfunction, electric shock or fire.
- The Charge Controller is designed for indoor installation or installation inside a weatherproof enclosure. It must not be exposed to rain and should be installed out of direct sunlight.

For routine, user-approved maintenance:

- Turn off all circuit breakers, including those to the solar modules, batteries and related electrical connections before performing any maintenance.

Standards and Requirements

All installations must comply with national and local electrical codes; professional installation is recommended. The NEC in the USA requires a DC ground fault interrupter for all residential PV installations. NEC2011 requires an ARC FAULT detector on all charge controllers and inverters operating above 80VDC. Both of these devices are built into the Classic.

DC and Battery-Related Installation Requirements:

- ❖ All DC cables must meet local and national codes.
- ❖ Shut off all DC breakers before connecting any wiring.
- ❖ Torque all the Charge Controller's wire lugs and ground terminals to the specs found on page 19.
- ❖ Copper wiring must be rated at 75° C or higher.
- ❖ Keep cables close together (e.g., using a tie-wrap) as much as possible to reduce inductance.
- ❖ Ensure both cables pass through the same knockout and conduit to allow the inductive currents to cancel.
- ❖ DC battery over-current protection must be used as part of the installation on the input and output.
- ❖ Breakers between the battery and the Classic must meet UL489 standards.
- ❖ Breakers between the DC source and the Classic must meet UL1077 or UL489 standards.

Design the battery enclosure to prevent accumulation of hydrogen gas at the top of the enclosure. Vent the battery compartment from the highest point to the outside. A sloped lid can also be used to direct the flow of hydrogen to the vent opening. Sealed (AGM, Gel etc) batteries do not normally require ventilation. Consult your battery manufacturer for details.



WARNING: PERSONAL PRECAUTIONS DURING INSTALLATION
WARNING BATTERIES PRESENT RISK OF
ELECTRICAL SHOCK, BURN FROM HIGH SHORT CIRCUIT CURRENT, FIRE OR
EXPLOSION FROM VENTED GASES. FOLLOW PROPER PRECAUTIONS.

- ❖ Someone should be within range of your voice to come to your aid if needed.
- ❖ Keep plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
- ❖ Wear complete eye protection. Avoid touching eyes while working near batteries. Wash your hands with soap and warm water when done.

- ❖ If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters an eye, flood the eye with running cool water at once for at least 15 minutes and get medical attention immediately following.
- ❖ Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.
- ❖ NEVER smoke or allow a spark or flame in vicinity of a battery or generator.
- ❖ Be cautious to reduce the risk of dropping a metal tool onto batteries. It could short the batteries or other electrical parts that can result in fire or explosion.
- ❖ Never wear metal items such as rings, bracelets, necklaces, and watches when working with a battery or other electrical circuits. A battery can produce a short circuit current high enough to weld a ring or the like to metal, causing severe burns.

Classic Power Curves

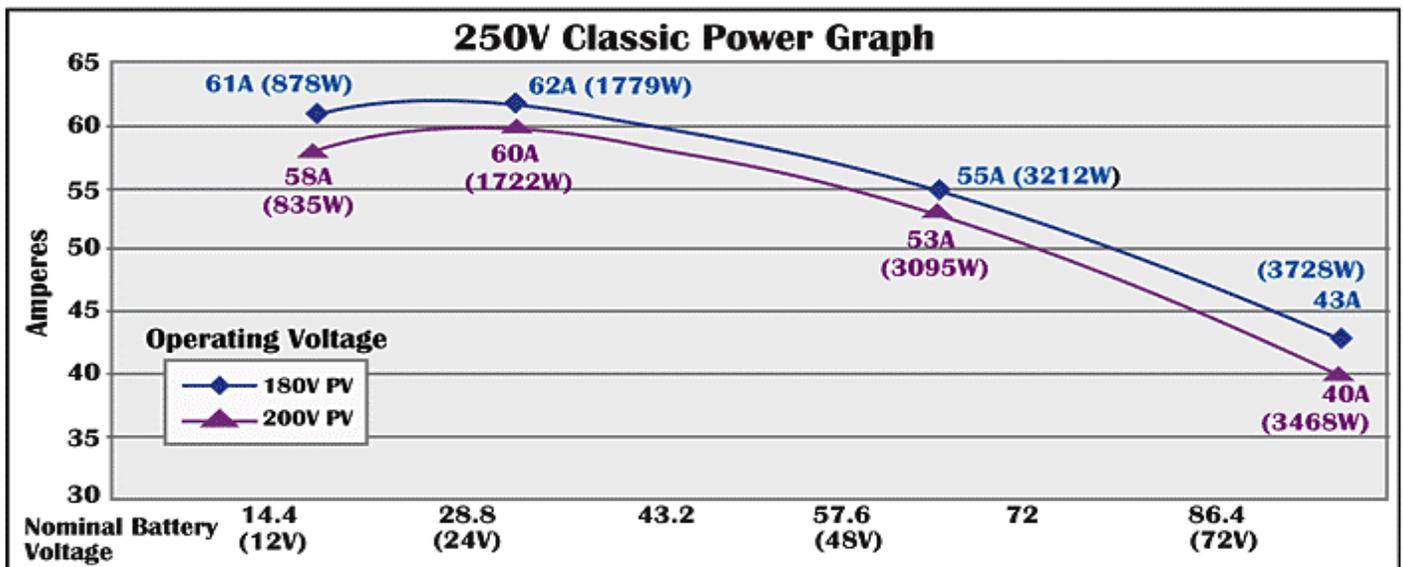
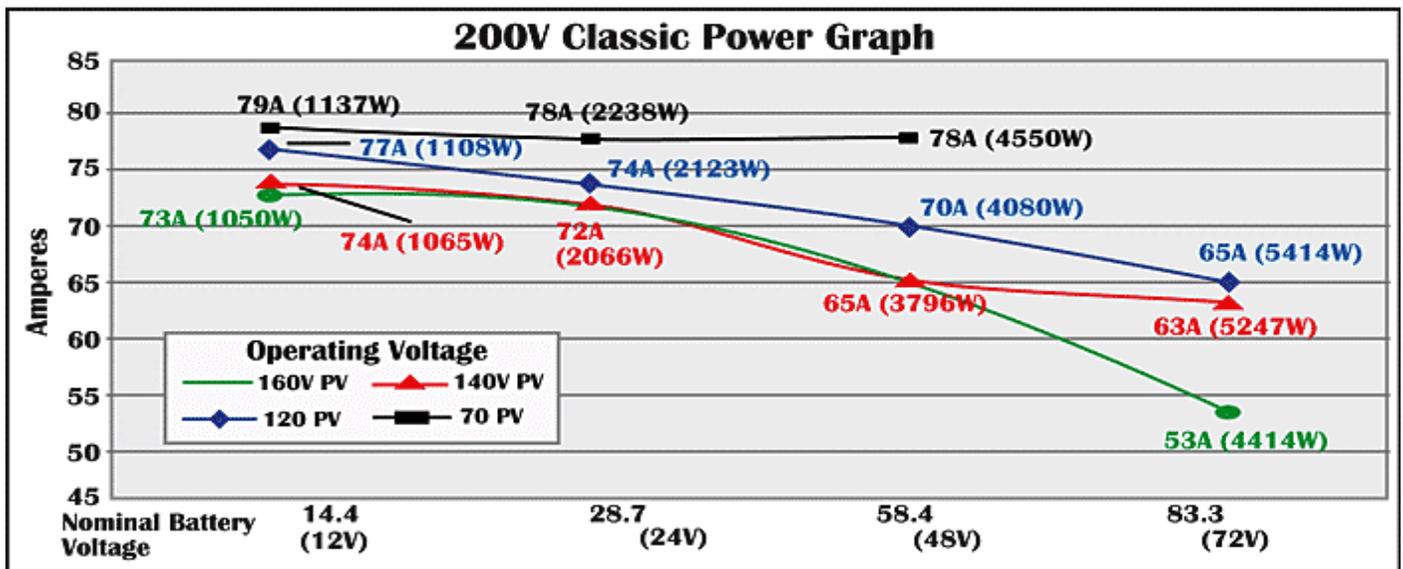
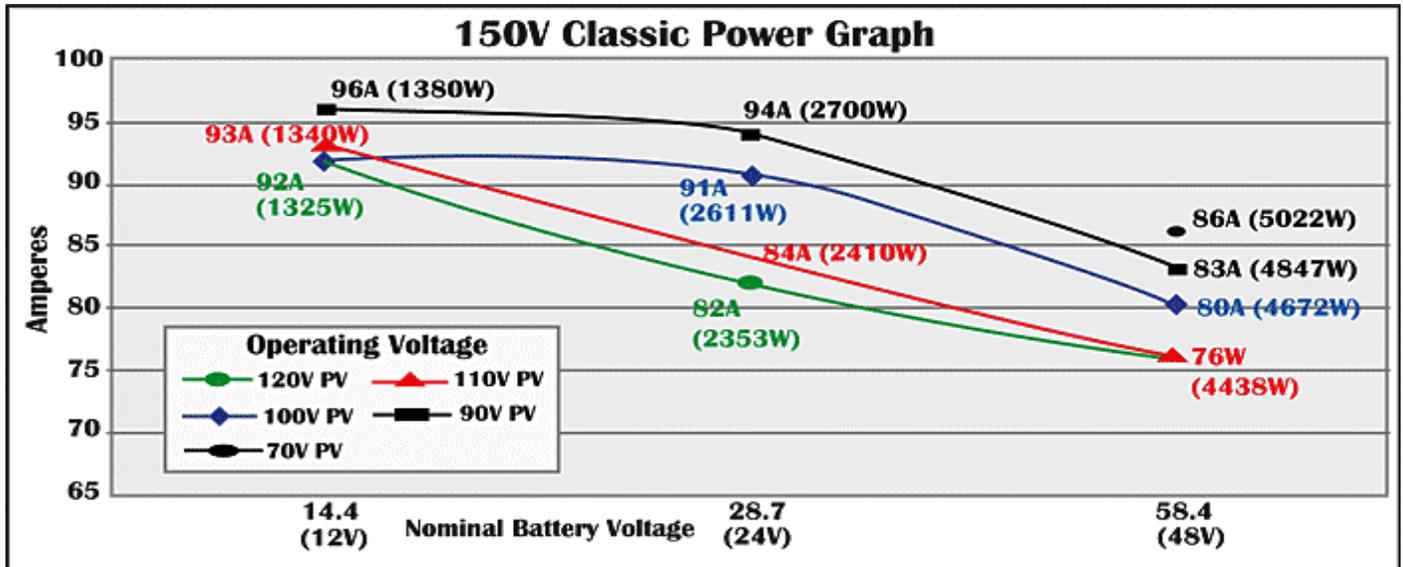
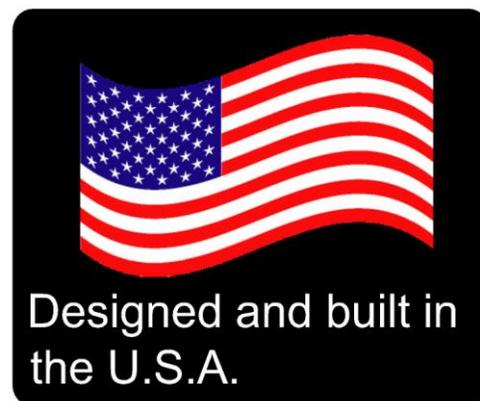


Figure 2.1

The graphs above represent the max power output for a given input for each Classic. Using and understanding these power graphs will help maximize Classic's output power and aid in selecting wire and breaker/disconnects. The built in set up wizard also helps select breakers and wire sizes. Notice that lower battery voltages and lower PV input voltages result in higher continuous output power. The PV voltages listed are for reference and are not intended to be the only PV voltages supported. The battery voltages listed show the most used battery bank configurations. Other voltages are also supported. The Classic battery voltage parameters are fully user adjustable.

For example: if you are using a Classic 250 and 48v battery bank, the maximum continuous output power based on 25 degree C ambient is 55 amps when using a PV array that yields a Maximum Power Voltage of 180 volts. The same set up using a bit higher voltage modules that result in a 200V Maximum Power voltage will result in only 53 amps. Although 55 to 53 amps is not a significant change, it does give you the idea that all things being equal, lower voltages are a bit more efficient.

Below are the labels present on the Classic.



MIDNITE SOLAR CLASSIC 150

MPPT SOLAR, WIND, HYDRO, BUCK, BOOST CHARGE CONTROLLER

NOMINAL OPERATING ENVIRONMENT 25°C (40°C DE-RATED SEE MANUAL)

CONFORMS TO UL STANDARD 1741



Intertek
3084883

2ND EDITION MAY 7, 1999
WITH REVISIONS THROUGH
JANUARY 28, 2010

CERT. TO CAN/CSA
STD. C22.2
No. 107.1 2001/09/01

MAX PV VOLTAGE (OPERATING) 150V

MAX PV CURRENT (OPERATING) 96A

MAX PV VOC 150V + BATTERY VOLTAGE

MAX PV SHORT CIRCUIT CURRENT 96A

MAX BATTERY CHARGE CURRENT 96A

MAX BATTERY CHARGE VOLTAGE 93V

NOMINAL BAT VOLTAGES 12-72V

MAX OUTPUT FAULT CURRENT 436A

MIDNITE SOLAR CLASSIC 250

MPPT SOLAR, WIND, HYDRO, BUCK, BOOST CHARGE CONTROLLER

NOMINAL OPERATING ENVIRONMENT 25°C (40°C DE-RATED SEE MANUAL)

CONFORMS TO UL STANDARD 1741



Intertek
3084883

2ND EDITION MAY 7, 1999
WITH REVISIONS THROUGH
JANUARY 28, 2010

CERT. TO CAN/CSA
STD. C22.2
No. 107.1 2001/09/01

MAX PV VOLTAGE (OPERATING) 15-250V

MAX PV CURRENT (OPERATING) 62A

MAX PV VOC 250V + BATTERY VOLTAGE

MAX PV SHORT CIRCUIT CURRENT 62A

MAX BATTERY CHARGE CURRENT 62A

MAX BATTERY CHARGE VOLTAGE 93V

NOMINAL BAT VOLTAGES 12-72V

MAX OUTPUT FAULT CURRENT 436A



Q1 Q2 Q3 Q4 10 11 12 13 14

AUX OUTPUT 1: 13VDC 200mA - RECONFIGURABLE AS 3.3VDC AUX **INPUT**

AUX OUTPUT 2: 500mA RELAY DRY CONTACT- RECONFIGURABLE AS 13VDC 200mA OUTPUT

MINIMUM INTERRUPT RATING: 4000 AMPS DC FOR OVERCURRENT PROTECTION DEVICE

TORQUE TERMINAL BLOCK AND GND TERMINAL TO 35 IN-LBS (4Nm). SUITABLE FOR USE WITH 75°C MINIMUM RATED COPPER CONDUCTORS.

THIS DEVICE IS PROVIDED WITH AN INTEGRAL PV DC GROUND FAULT INTERRUPTER. IF THE PV GROUND FAULT-PROTECTION IS TRIPPED, THE NEGATIVE CONDUCTOR MAY BE ENERGIZED.

⚠ DANGER CAUTION

⚠ ATTENTION CAUTION



ELECTRICAL SHOCK AND BURN HAZARD. SOLAR PANELS WILL CONTINUE TO PRODUCE VOLTAGE EVEN WHEN DISCONNECTED. ENSURE THAT PV MODULES ARE COVERED. TURN OFF PV ARRAY AND CHARGE CONTROLLER OUTPUT PRIOR TO SERVICE. RISK OF ELECTRIC SHOCK. DO NOT REMOVE COVER. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

DANGER DE CHOC ÉLECTRIQUE ET DE RISQUE DE BRÛLURE. LES PANNEAUX SOLAIRES CONTINUERONT DE PRODUIRE L'ÉLECTRICITÉ MÊME S'ils SONT DÉBRANCHÉS. S'ASSURER QUE LES PANNEAUX SOLAIRES SONT COUVERTS PENDANT L'ENTRETIEN. POUR TOUTE ACTION D'ENTRETIEN, LA SORTIE DES PANNEAUX SOLAIRES ET DU CONTRÔLEUR DE CHARGE DOIVENT ÊTRE DÉCONNECTÉES. RIEN À DÉPANNER À L'INTÉRIEUR DU É-PANNEAU. NE PAS OUVRIR LE COUVER. POUR TOUTE RÉPARATION OU SERVICE D'ENTRETIEN, CONSULTER UN AGENT SPÉCIALISÉ.

10-625-1

ATTENTION
SURFACES CHAUDES



CAUTION
HOT SURFACES

CL00001



MIDNITE SOLAR, INC.
17722 87TH AVE NE UNIT C
ARLINGTON, WA. 98223 USA
WWW.MIDNITESOLAR.COM

Unpacking the Classic

When you receive your Classic you will want to unpack it and make sure everything is there and in good shape. Refer to Figure 1.1. Included in the Classic package should be:

- *Classic charge controller
- *Battery temperature sensor
- **Snap on upper vent cover
- *Knock out covers 4 screened
- **Knock out covers 4 solid
- *User's manual DVD, printed installation instructions

*1 ten foot custom USB cable

**Note. These items are optional email customerservice@midnitesolar.com for more information
If anything is missing or damaged please refer to Page 2 for details on contacting us.

Figure 1.1



Removing and installing the front cover on the Classic

Removing the front art deco cover is required to gain access to the wiring compartment.

Be aware there is a cable connecting the cover to the electronics. Do not pull hard or fast as damage could occur.

To remove the front cover of the Classic in preparation for installation, remove the 4 Phillips head screws with a #2 Phillips screwdriver. Lift the front half of the Classic casting off. You will need to unplug the display cable. It works the same as any phone cable.

To re-install the front cover of the Classic you will need to plug in the display cable and carefully route it around the components on the circuit board as you set the cover in place. See Figure 1.2 Do not force the cover if it does not seat into place easily stop and look for any cables or wires that may be interfering. With the cover seated in place install the four Phillips screws with a #2 Phillips screwdriver.

Figure 1.2



Mounting the Classic

The following section covers typical mounting arrangements. If you require additional details that are not covered here please contact our technical support team. The Classic is designed to be directly mounted onto the MidNite Solar E-Panel. The Classic can also accommodate other installation methods as well. Mount in an upright position out of direct sunlight when possible. For your convenience the

Classic has four one inch knock outs that are pre cast. The Classic has mounting locations and conduit locations are similar to other brands of charge controllers to facilitate ease of upgrading older technologies.

Mounting the Classic directly to the E Panel:

- *Remove the front cover of the Classic.
- *Install the mounting bracket on the E Panel and start the upper mounting screw into the bracket leaving it about half way out so you can hang the Classic on this screw.
- *Install the 1 inch close nipple into the E Panel as shown in the E-Panel directions. The 1” close nipple, 3 locknuts and 2 plastic bushings are included with each E-Panel. One locknut acts as a spacer.
- *Carefully hang the Classic on the screw in the bracket and slide it over the close nipple see figure 1.3.
- *Install the lock nut and bushing on the close nipple and tighten the screw in the mounting bracket.
- *Don't install the front cover until you complete the wiring of the Classic.

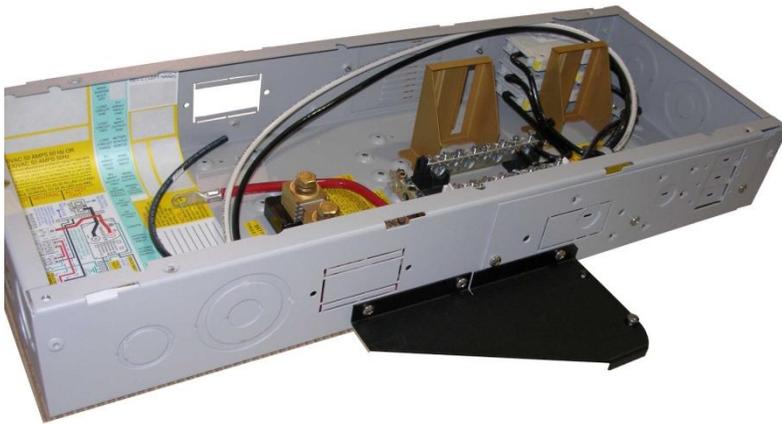


Figure 1.3A Charge controller bracket mounted to the E-Panel. The bracket comes with every E-Panel

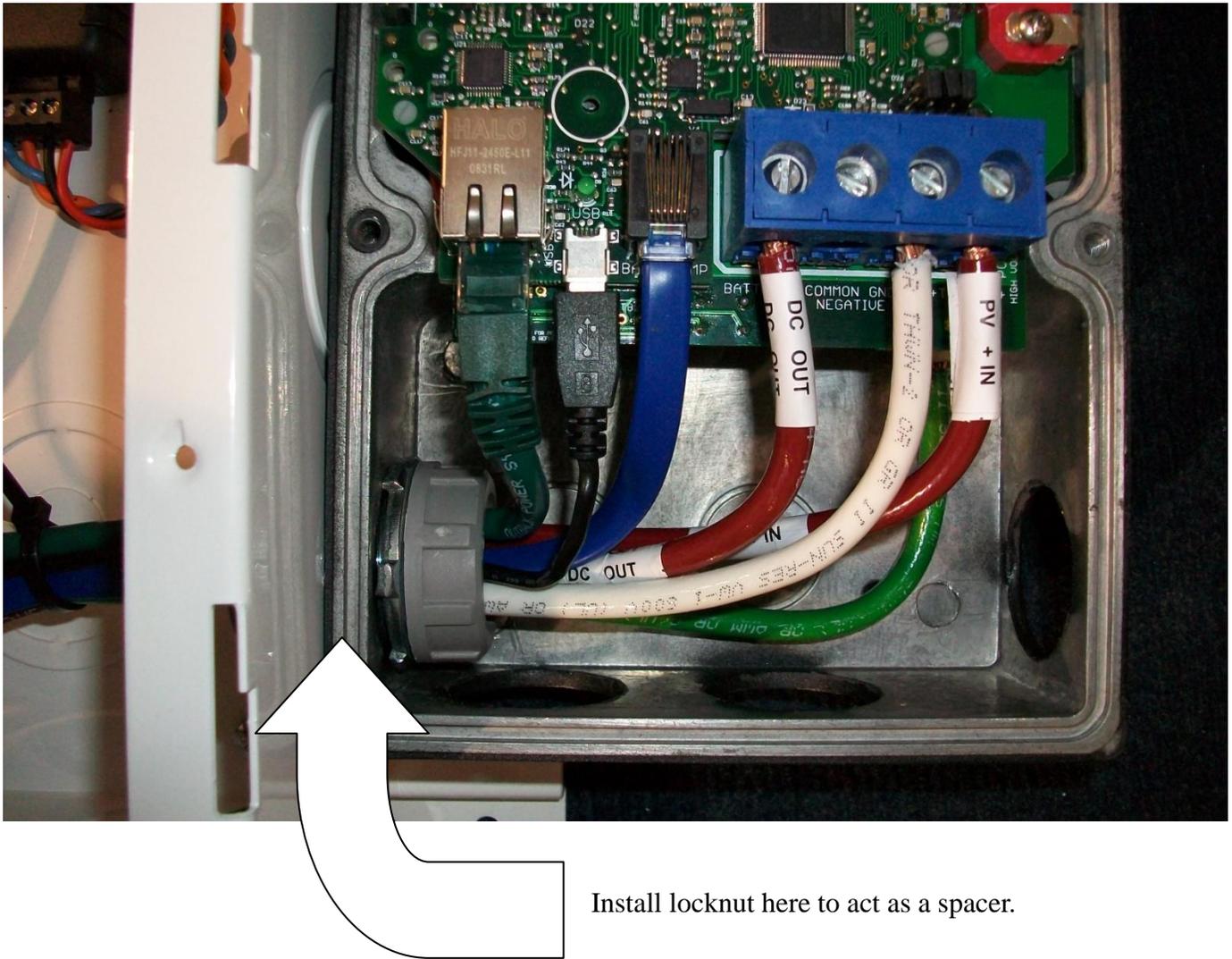
Figure 1.3B Classic Mounted to side of E-Panel



Figure 1.3C Nipple, locknuts and bushings that come with every E-Panel



Figure 1.3D Classic mounted to the side of a MidNite Solar E-Panel



Install locknut here to act as a spacer.

Alternative Mounting

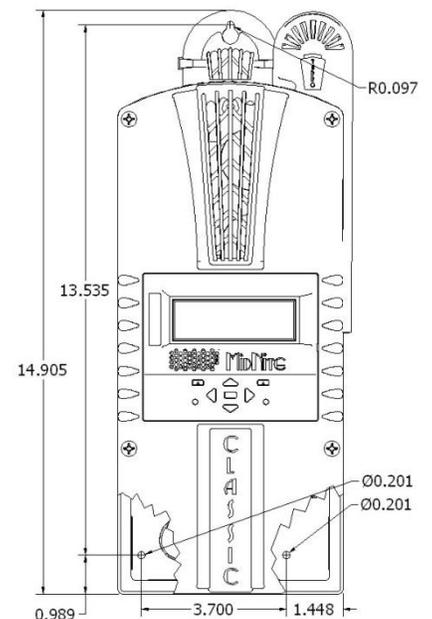
To mount the Classic to a plywood surface use 1 1/2" wood screws in the top key hole slot hole and the holes in the wiring compartment. Taking care to make sure the Classic is Plumb and Level.

Dimensions

See page 40 for more details.

Sealed or Vented

The Classic has the ability to be sealed for protection from salt air or dust. It comes from the factory Vented. If you live in a dusty or salt air environment you may wish to seal the Classic. Sealing the Classic does not make the unit water resistant. To seal the Classic install the solid



plastic knock out covers into any unused knock outs and snap the upper vent cover onto the Classic as seen in the photo below. Note that the Classic will be slightly de-rated (puts out less power) by sealing it. Refer to the specifications page of the owner's manual for the ratings in the sealed mode. To obtain the parts necessary to seal the Classic please contact our Technical Support Team. Refer to Figure 1.4 and 1.5

Figure 1.4



Figure 1.5



Network Cable Routing and Installation Guidelines

The Classic uses a 4 conductor phone cable to communicate with other Classic's or other MidNite products. This cable is a standard 4 conductor phone cable and simply plugs into the jack on the Classic labeled slave. Plug the other end into the master jack on the second device. There is a plastic clamp located on the circuit board for routing the network cables above the USB jack so they stay tied down and out of the way. Refer to figure 1.7A and 1.7B

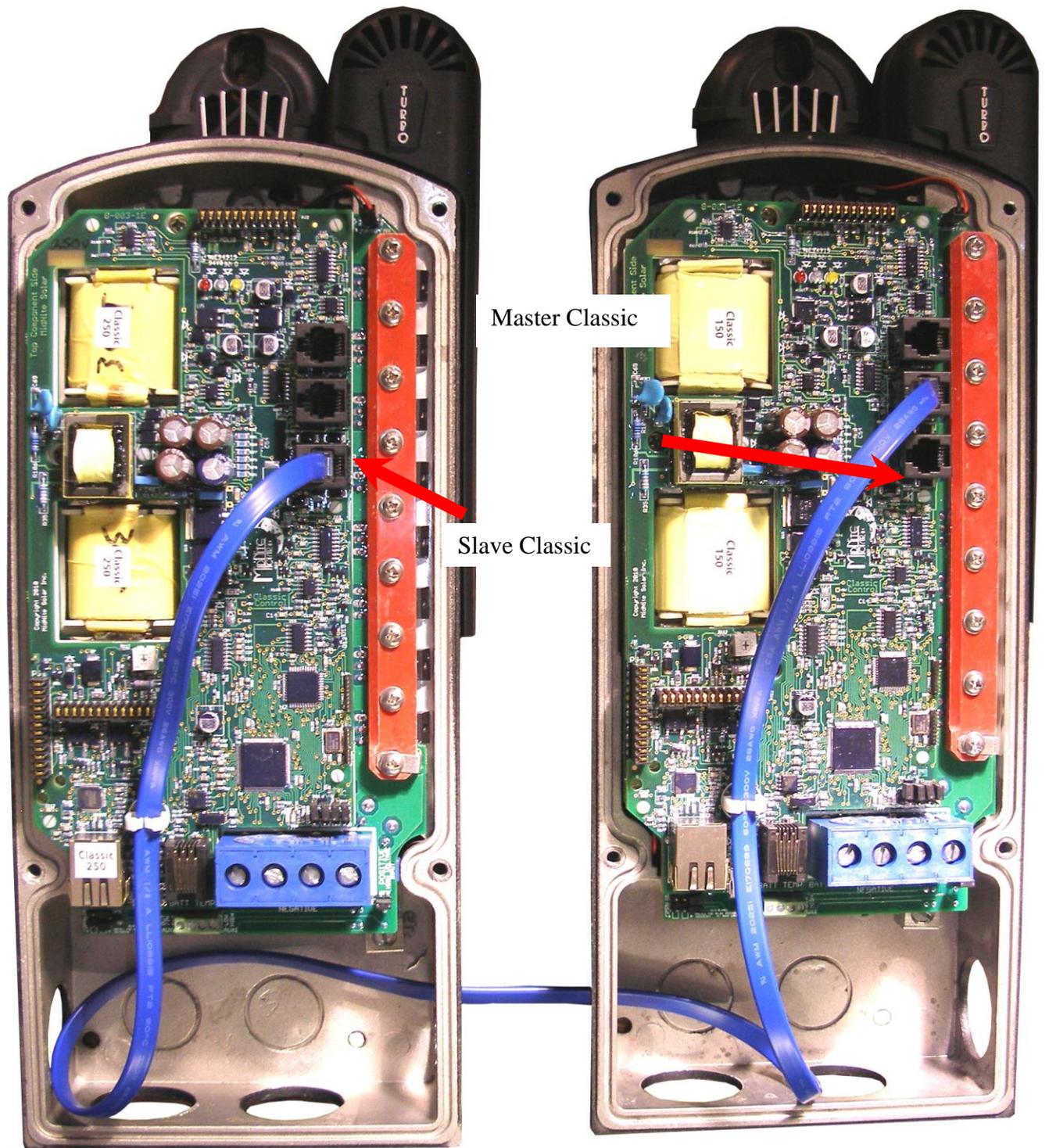


Figure 1.7A Master / Slave methods of hook up

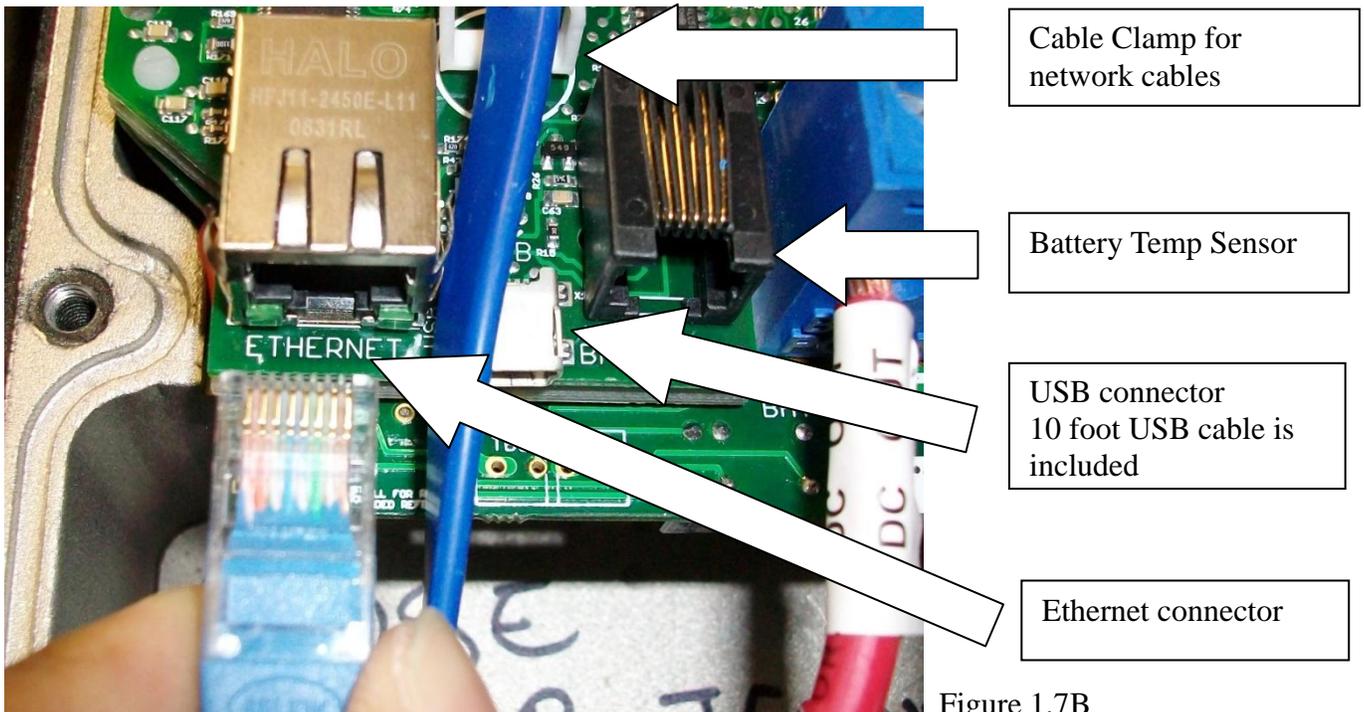


Figure 1.7B

Battery Temperature Sensor Installation



CAUTION - To reduce risk of injury, charge only deep-cycle lead acid, lead antimony, lead calcium, gel cell or absorbed glass mat type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage. Never charge a frozen battery.



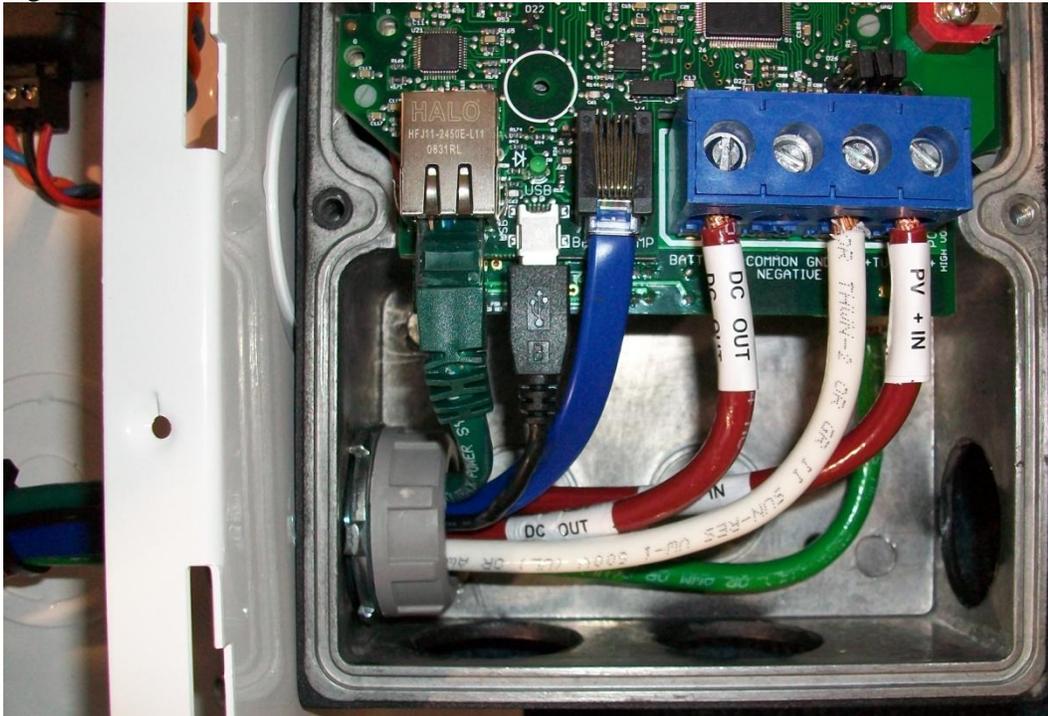
WARNING: RISK OF INJURY. To reduce the risk of injury, charge only properly rated (such as 6 V 12 V and 24 V) lead-acid (GEL, AGM, Flooded, or Nickel Cadmium) rechargeable batteries. Other battery types may burst, causing personal injury and damage.



WARNING: Explosion hazard during equalization, the battery generates explosive gases. Follow all the battery safety precautions listed in this guide. Ventilate the area around the battery using ventilators with brushless motors thoroughly and ensure that there are no sources of flame or sparks in the Vicinity.

The Classic comes with a Battery temperature sensor which plugs into the jack beside the DC Terminal connector labeled “Battery Temp”. Refer to Figure 1.8 Route the cable through the E-panel into the battery box. Pick a battery in the middle of the bank and about half way up the side of the battery thoroughly clean a spot off on the case. Then remove the protective tape from the sensor and adhere the temperature sensor to the battery. Some manufacturers use a double wall case on the battery. For mounting a temp sensor to them please refer to the battery manufacturer's recommended procedure.

Figure 1.8



Insert BTS to the jack labeled BATTERY TEMP on the control board.

Figure 1.9



Chassis Grounding

In all installations the Classic chassis should be connected to ground. For systems with a battery breaker sized 60 amps and smaller 10 AWG (6 mm²) copper is generally sufficient. For systems with a battery breaker sized 100 amps and smaller 8 AWG (10 mm²) copper is required. For grounding conductor requirements on your specific installation please consult your local electrical code. The chassis grounding terminal is in the upper right corner of the electrical connection compartment see Figure 2.0

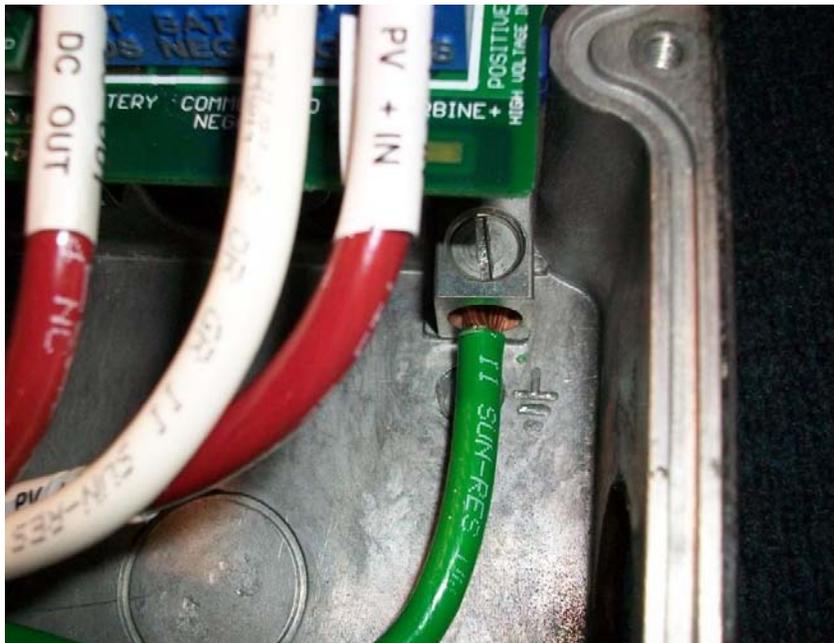


Figure 2.0

DC System Grounding

The Classic charge controller is designed to work with Negative Ground, Positive Ground or Ungrounded power systems. In grounded systems, dc negative may be connected to ground either externally or by using the Classic's internal grounding jumper, shown on figure 2.1. The internal grounding jumper should only be installed when the Classic's GFP is enabled. In a system with multiple charge controllers the grounding jumper should be installed on every charge controller. In Positive ground or Ungrounded systems the GFP jumper must be removed. See Figure 2.1 Also note that with Positive ground there will be items still referenced to battery negative that can complete a short circuit of the battery bank. These items include but are not limited to the USB Cable and the Ethernet jack. Please contact Technical support for assistance on Positive ground systems.

DC GFP (Ground Fault Protection)

The Classic has internal ground fault protection (GFP) built in. Since 2008 the NEC requires a DC-GFP on all PV systems in the USA. The built in DC-GFP eliminates the need to purchase and install an external DC-GFP. If the internal grounding jumper is installed in a Classic, the battery negative and DC source negative must not be connected to the system grounding conductor anywhere in the system. Grounding of these circuits will defeat the GFP function. In a network with multiple Classics, all Classics must have the internal grounding jumper installed and GFP enabled. The factory setting will make a DC negative to System Ground connection in the Classic charge controller. The GFP function will need to be disabled for Positive ground or an ungrounded DC system.

Figure 2.1



The Ground fault device is simple to understand and use. The Classic DC-GFP works a bit different than others. It detects a fault between battery/PV negative and earth ground just like the breaker DC-GFP system. The difference with the Classic is that it simply turns off when a ground fault is detected. This is different than disconnecting the PV plus circuit. This trick of turning off was first pioneered by another charge control company as an alternative to a \$100 external circuit breaker assembly. The Classic's system consists of a PTC that is between the

Negative and Ground internally in the Classic. A PTC is basically a type of resistor with a 1 ohm value that when loaded to three quarters of an amp will heat up and go to a very high resistance looking like an open circuit. One of the 3 Classic microprocessors watches the PTC and when it sees a high resistance it will disable the Classic. The ground fault device will then require a manual reset. The PTC is self-healing though so there are no fuses to change. This method meets the requirement for DC ground fault protection in the National Electric Code.

To disable the internal Ground Fault Protection function, the jumper labeled GFP needs to be removed, and the GFP function must be disabled in the TWEAKS menu. See section below for instructions.

To reset the internal GFP function after detection has occurred, fix the actual ground fault, then turn OFF the Classic and turn it back ON. Do this by turning the external battery breaker to OFF position and then to ON position.

Disabling GFP

The GFP feature should only be disabled to operate the Classic in an ungrounded power system or in systems where GFP is not required.

- Press Main Menu
- Scroll to the right or left until TWEAKS is highlighted and press ENTER
- In TWEAKS press the right soft key to get to the MORE menu
- In MORE scroll until GFP is highlighted
- Use the up and down arrow keys to toggle between on and off
- Press ENTER to save

Wiring the Classic



WARNING: Shock hazard. Disconnect the batteries and input power before opening the Classic front cover

When two or more Classics are paralleled onto one DC Source a blocking diode must be used between each Classic and the input source to isolate each Classic from the other ones.

The Classic should be wired by a qualified professional and needs to meet all applicable electrical codes. Always make sure all source and battery circuits are de energized and wait 5 minutes before working on the wiring in the Classic. The Classic has 2 common neutral (negative) terminals. Therefore, only one neutral conductor is required to run from the E-Panel and terminate on either (or both) common neutral terminal. The Positive DC source wire goes to the PV+ Turbine+ screw. The Positive Battery DC wire goes to battery + terminal. Torque the terminal screws to the specs below.

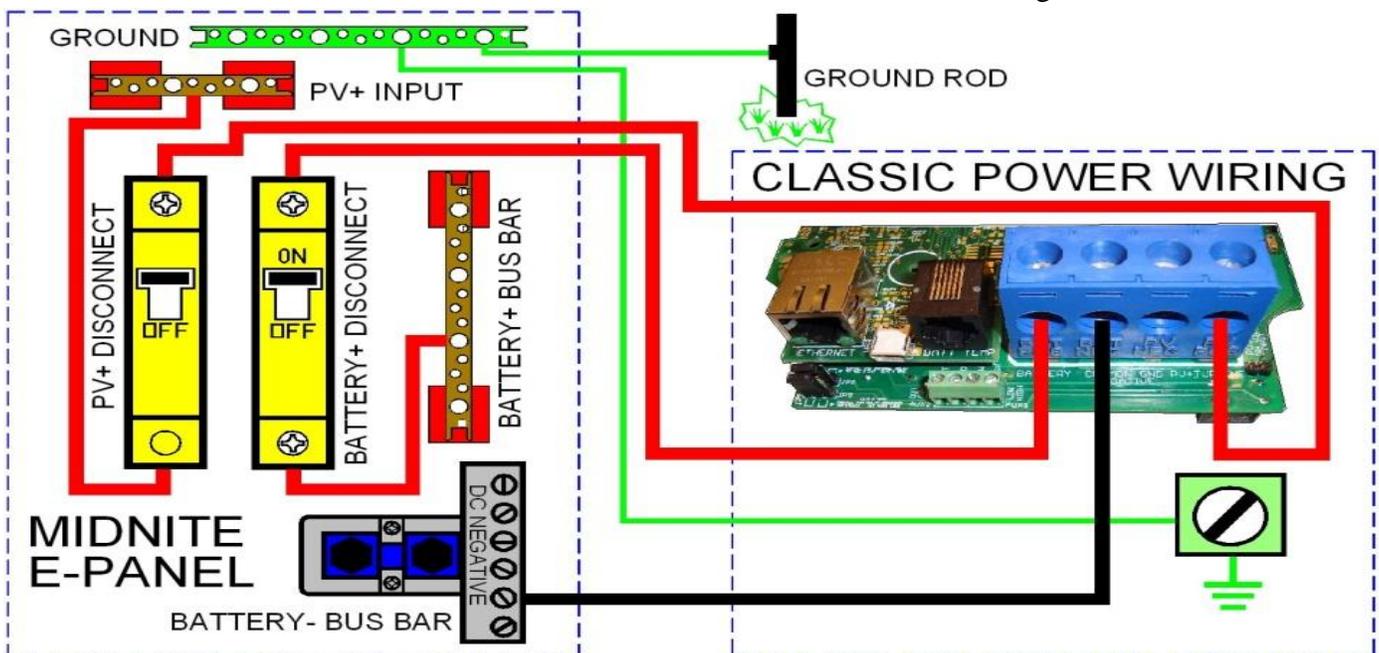
To connect the wiring to the Classic:

- ❖ Ensure the DC source and Battery are disconnected
- ❖ Connect a grounding conductor between the Classic and system ground
- ❖ Ensure the breaker between the battery and Classic meets UL489 standards.
- ❖ Ensure the breaker between the dc source and Classic meets UL1077 standards.
- ❖ Connect the DC source and Battery wire to the Classic
- ❖ Connect any communications cables or auxiliary input/output wires
- ❖ Torque terminal connector screws to the following specs

The Torque specs on the DC terminal connector (big blue terminal connector) are:

- ❖ Up to #10 AWG torque to 25-35 inch pounds.
- ❖ #8 AWG torque to 30-40 inch pounds.
- ❖ #6 AWG or above. Torque to 40-50 inch pounds.

Figure 2.1



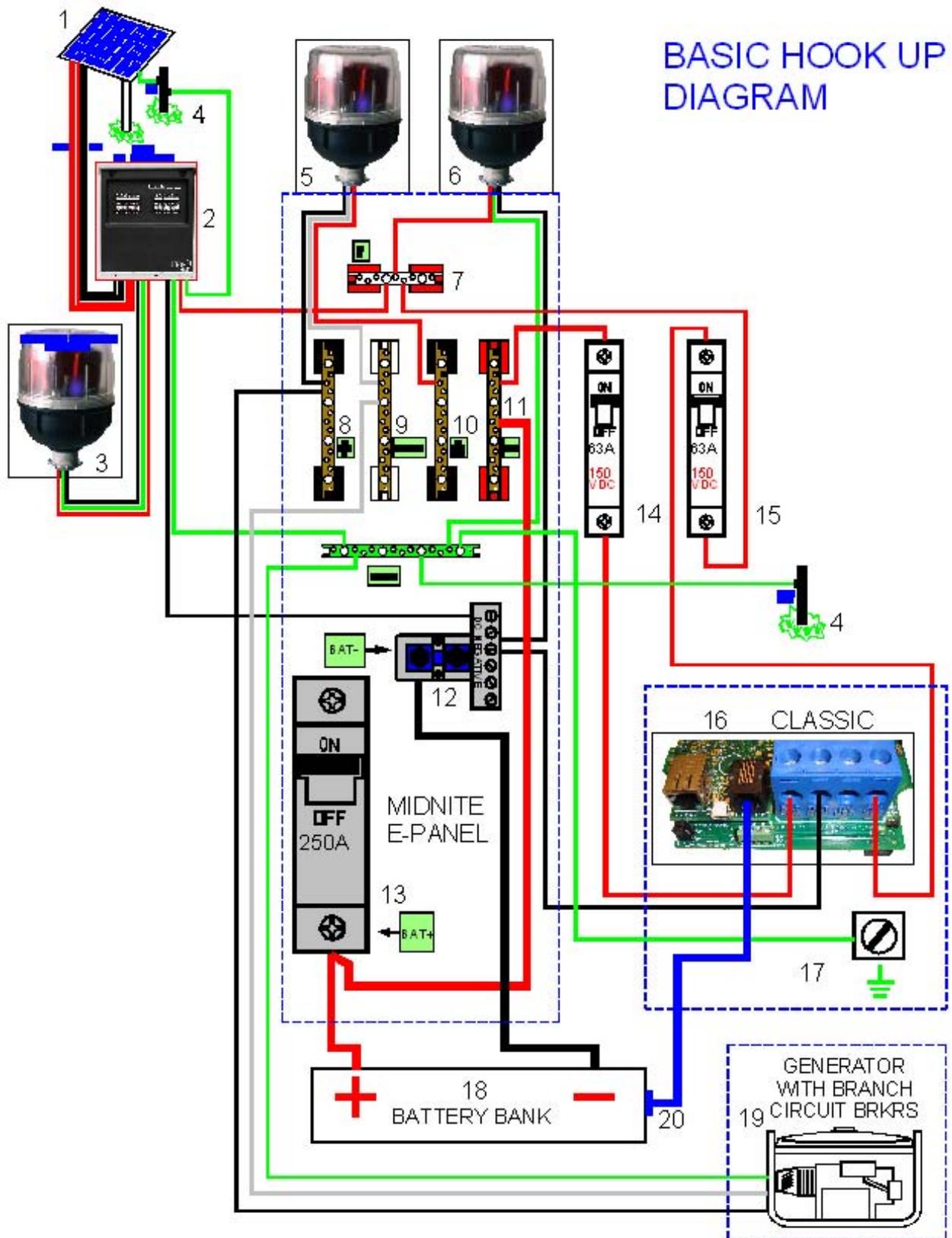


Figure 2.2

DC Terminal Connector



Figure 2.4

The Classic's DC terminal connector is located on the circuit board as shown in. The connector will take up to a #4 AWG. #4 AWG THHN when installed in the Classic and MidNite E-Panel is rated for over 100 amps and is therefore suitable for the highest power available from the Classic 150.

Over Current Protection and Wire Size Requirements

The over current devices, wiring, and installation methods used must conform to all electrical codes applicable to the location of installation. Wiring needs to be protected with proper strain relief clamps and or conduit. See page 49 for a breaker and wire size chart.

The network cables, USB cable, BTS cable and auxiliary input/output cables should run in a different conduit to preserve their signal. When installing the Classic in a MidNite E-Panel, it is acceptable to run all wiring through the same knockout hole. It is legal to run signal and power wires together as long as all wiring is listed for the highest voltage to be encountered.

Current Rating

The Classic limits the output current based on the model you have.

The Classic current ratings are:
Classic 150v - 96 amps maximum
Classic 200v - 79 amps maximum
Classic 250v - 62 amps maximum

Temperature Current Limit

The Classic has a current limit component which interacts with the temperature of the charge controller. If the Classic is exposed to extremely hot ambient conditions the output current will be reduced automatically to keep the charge controller safe, if the orange LED comes on, on the MNGP it means that the Classic is in current limit mode. If you believe the Classic is not hot and the orange LED is on, most likely the current limit set point is too low. To check this follow steps bellow.

- Press Main Menu
- Highlight the CHARGE menu and press the Enter Button
- Scroll to LIMITS and press the Enter Button
- Press the right arrow key to highlight Out Amps column
- Use the up and down arrow keys to change the current limit then press the Enter Button to save this data

Over Current Protection

The Classic must have over current protection to protect wiring from over current events. A means of disconnect must be installed on the DC in and DC out of the Classic. Consult your local codes to determine over current ratings. The breaker between the battery bank and the Classic must conform to UL489. The breaker between the DC source and the Classic must conform to UL1077 or UL489. The NEC requires 1.56 times short circuit current for PV over current protection. This is reduced to 1.25 times when using a breaker rated for continuous duty. All MidNite Solar breakers are hydraulic/magnetic and are rated for continuous duty. No de-rating is required for the output breaker when using MidNite Solar breakers.

PV in particular will be capable of producing more current than its name plate rating in extreme situations so the safe minimum wire size should be selected for the PV array maximum short circuit current. Please consult PV manufacturer for specifications. The US National Electrical Code requires 1.56 times the PV short circuit current for wire size on the PV input. Output wire size follows the NEC guidelines. Typical wire size for output is 6AWG for the Classic250 and 4AWG for the Classic200 and 150 but check all de-ratings for your wire type and installation method.

Long Distance Wire Runs

The Classic offers some unique opportunities if you are faced with longer than normal wire runs between the DC source and the Classic. The Classic comes in 3 input voltage ranges letting you design a DC source at a higher voltage if it is beneficial. For example let's say you have a 300 ft run from a PV array to the Classic you could wire for an open circuit voltage close to 250vdc accounting for the coldest temperature you will encounter. This will allow you to run a smaller gauge wire than with a lower voltage charge controller. The efficiency of a high voltage Classic is less than the lower voltage versions, so you need to weigh the benefit. If this sounds too complicated use this rule of thumb in selecting the proper Classic. PV runs up to 100 feet, use the Classic 150. Runs up to 180 feet, use the Classic 200. Above 180 feet use the Classic 250.

If the wire size between the DC source and the Classic is larger than the Classic's DC terminal connector you can use a splicer block or similar connector to reduce down to #4 AWG close to the Classic. The MidNite E-panels are supplied with a PV input busbar that accepts up to 1/0 wire.

Connecting the Classic to the Clipper

Not Yet Available Please email customerservice@midnitesolar for status updates on the Clipper.

Maximum and Minimum Wire Size

The Classic DC terminal connector will accept wire from #14-#4 AWG

Commissioning the Classic

The Classic will enter into the setup wizard upon initial power up. If the Classic does not enter into the setup wizard or you want to enter the wizard at any time follow these steps to get into the setup wizard.

- ❖ Press the Main Menu button.
- ❖ Scroll Left or Right until Wizard is highlighted and press the Enter button.
- ❖ Follow the on screen instructions through to the end.

Using the Classic Setup Screen's

The Classic setup wizard will walk you through the set up process. Below is a description of the steps.

DO YOU WANT PASSWORD ENABLED? PASSWORD WILL BE 142 YES NO	Sets the password On Classic Settings
CONNECTED TO CLASSIC 150	Tells you which classic model it is
IS THIS A GRID TIED SYSTEM (BATTERY BACKUP) YES NO	This menu will determine how to treat batteries differently. sealed batteries lower voltage for grid tied
TIME DATE 24:00:00 01/10/2010	Set time and date, this is important because Classic will automatically know at what time to wake up and go to sleep mode (Sunrise/sunset using Astronomical formulas)
BATTERY CHEMISTRY FLOODED LEAD ACID ENTER	Sets up battery temp compensation and absolute maximum charge voltages regardless of temp
BATTERY BANK VOLTAGE 48	Selects between different voltage configurations on the system, increments of 12 volts (12v, 24v, 36v, 48v, 60v, 72v)

DO YOU KNOW THE BATTERY BANK AMP HR CAPACITY YES NO	Helps set Absorption time and EQ defaults
WHAT IS THE VOLTAGE OF AN INDIVIDUAL BATTERY 6	This is necessary for the set up software to help figure out battery capacity
SET CURRENT LIMIT 80 ENTER TO CONTINUE	Sets classic's max output current
CONTROLLER MODE SOLAR WIND HYDRO SCROLL < > TO SELECT THEN PUSH ENTER	Selects classic's mode. This can be changed in the mode menu
STC MODULE POWER 210 ^ WATTS	Photovoltaic module power rating
STC VOC RATING 44.3^ VOLTS	Photovoltaic module voltage rating
STC ISC RATING	Photovoltaic module current rating

Setting Nominal Battery voltage

Upon initialization the Classic will display battery

To set up the Classic to a preset battery voltages (e.g. 12v, 24v... 48v) follow the steps below.

- ❖ Press Main Menu
- ❖ Scroll to the left until Charge is highlighted and push the Enter button
- ❖ Highlight Volts and press the Enter button
- ❖ Press the Right soft key
- ❖ Scroll up and down to select the desirable battery voltage

Battery Charge Stages and Meanings

Bulk MPPT

This stage of the Classic means; that the Classic will be putting out as much current as it can trying to charge the batteries to the absorb voltage set point. This is also known as constant current mode.

Absorb

This stage means that the Classic will maintain the absorb set point voltage until the batteries are charged or it reach Float stage. At this stage the classic is not putting out maximum current, as that would increase the battery voltage over the Absorb set point. This is also referred to as constant voltage mode.

The absorb time is proportional to the bulk time. (i.e. the time bulk takes to reach the absorb voltage.) The battery it's considered "full" at the end of the absorb charge cycle.

Float

A *Float* cycle follows after the *Absorb* cycle is completed; *Float* is displayed on the screen. Battery voltage is held at the float voltage set point, float time can be changed by the user.

Equalize

Equalization function has to be enabled by the user, refer to page 25. The intent of an equalization charge is to bring all battery cells to an equal voltage by a deliberate overcharge. The goal is to return each battery cell to its optimum condition through a series of voltage controlled chemical reactions inside the batteries.

Adjusting Absorb, Equalize and Float Voltages

Setting the Classic up through the wizard will set Absorb, Float and EQ to the factory default set voltage to the specified battery type. (E.g. Flooded Lead, Gel...) These voltages are fully adjustable, just follow the steps below.

- ❖ Press Main Menu
- ❖ Scroll to the left until Charge is highlighted and push the Enter button
- ❖ Highlight Volts and press the Enter button
- ❖ Use left and right arrows keys to highlight the set point voltage to adjust
- ❖ Use up and down arrow keys to lower or raise the voltage
- ❖ Press the Enter button to save the new voltages.

Battery Size and Chemistry

The Classic supports a variety of battery chemistries including; Flooded lead acid, sealed – AGM, gel cell and Nickel Cadmium. These different types of batteries have different charging parameters. These parameters are crucial for long- time battery life. Go through the WIZARD to select the battery type of your system. If you replace the batteries for a different type make sure you change the type on the WIZARD. That is the only place where the battery type can be changed.

Battery Temperature Compensation

The Classic comes with a battery temperature sensor (BTS). This sensor raises or lowers charge voltage based on temperature. Connect BTS to the BATT TEMP jack. (Refer to fig 1.7B and 1.9) Battery temperature menu appears as **T-Comp** in the BATTERY MENU. In this menu you can change the voltage compensation as needed. If the BTS is disconnected or shorted the Classic will automatically use the default charge voltages non-compensated.

Calibrating Battery and PV Voltage

To calibrate the Classic battery and PV voltage reading, you will need a Volt meter to check the actual battery bank voltage or input PV voltage. Using the volt meter measure the voltage on the DC terminal connector of the Classic (refer to Figure 2.4) compare this reading to the reading on the Status screen in the Classic,(press Status if not in this screen) to adjust the reading of the Classic to the one in the volt meter follow these steps:

- ❖ Press Main Menu, scroll to TWEAKS and press Enter
- ❖ Highlight VBatt and use the up and down arrow keys to match both of the readings
- ❖ Press the Enter button to save

Note. Use the description below to help complete the calibration of the Classic voltages.
TWEAKS screen

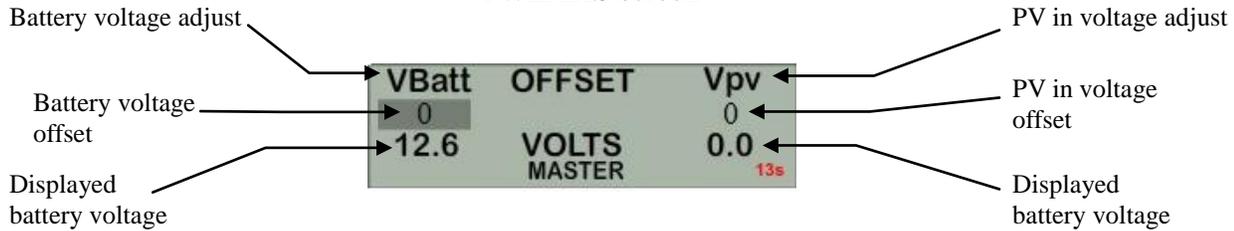


Figure 2.7

Configuring DC Input Source

To select the Mode the Classic will run in, follow the steps below.

- ❖ Push the Main Menu button.
- ❖ Scroll left or right until Mode is highlighted and then push the Enter button.
- ❖ Scroll to the right and highlight the current Mode than use the up and down arrows to set the mode you want.
- ❖ Take note of the Right soft key most modes have some set points that can be adjusted.
- ❖ Press the Main Menu button until you get back to the Mode Menu
- ❖ Set the ON/OFF to ON and press Enter

The following Modes will appear in this order in the MODE Menu.

Micro Hydro

This mode is intended for use with hydro systems but can be used with other sources as well. When the Classic first turns on after the input voltage goes above battery voltage, it will sweep from that open circuit voltage down to battery voltage, finding the maximum power point voltage (MPP V). Then return the input to that newly found voltage. After the original turn on sweep, the Classic will do mini sweeps at user adjustable time intervals. If the time interval is set to 0, the Classic will not do any mini sweeps but will stay on this first found MPP V until the user goes to the mode menu and turns it off and back on again.

Micro Hydro mode sweeps slightly slower than Solar mode and has 2 user adjustable settings. Sweep Interval is the time between mini-sweeps, in minutes, and sweeps around the present (i.e. the last found), MPP Voltage. The range of this sweep is determined by the Sweep Depth user adjustment and is expressed as a percentage of Watts that the sweep started from. For example, if in Micro Hydro mode, the Classic was outputting 1000 Watts and the Sweep Depth percentage was set for 20%, (200 Watts), the sweep will bring the input voltage DOWN until the output power drops down to 800 Watts, then will sweep UP in voltage until the power drops again down to 800 Watts and then go back to the newly found MPP Voltage, waiting for the next sweep.

This mode will NOT go to resting even when the input has been disconnected and will always stay awake so the turbine has the least chance of over-spinning.

Solar

This is the default mode for PV systems and has a very fast sweep (typically 1/2 second or less) that will re-sweep at user adjustable sweep intervals, unless the Classic finds that it needs to do a sweep on its own because of changing conditions. The timed sweep interval is user adjustable and is in units of minutes. SOLAR mode is typically best for PV systems, especially if there is partial shading at times during the day. The Classic will show a message of "PV SHADE" if it thinks the PV array is partially

shaded (if this feature is enabled).

SOLAR mode is best suited for shaded or un-shaded PV arrays that are at least one nominal voltage above the battery voltage. For severe partial shading or PV arrays with nominal voltage equal to battery voltage, you may also want to try Legacy P&O (Perturb and Observe) MPPT mode.

Legacy P&O

Legacy P&O (Perturb and Observe) mode is a slow tracking mode similar to the Micro Hydro mode but with the difference that it is slightly faster and will shut off if the power source goes off.

It has 2 settings that are user adjustable. Sweep Interval is the time between mini-sweeps, in minutes, and sweeps around the present (i.e. the last found), MPP Voltage. The range of this sweep is determined by the Sweep Depth user adjustment and is expressed as a percentage of Watts that the sweep started from. For example, if in Legacy P&O mode, the Classic was outputting 500 Watts and the Sweep Depth percentage was set for 10%, (50 Watts), the sweep will bring the input voltage DOWN until the output power drops down to 450 Watts, then will sweep UP in voltage until the power drops again down to 450 Watts and then go back to the newly found MPP Voltage, waiting for the next sweep.

This mode is also useful for such items as DC generators or rectified ac alternators being driven by a fossil fuel engine. An Example would be a Lister diesel with an Other Power 3 phase alternator. The AC output would be rectified and run into a Classic set for legacy P&O.

NOTE ON HIGH VOLTAGE-HIGH POWER INPUT SOURCES... When using an unlimited power source, it is recommended that the input voltage not be much higher than 4 or 5 times the output (battery) voltage. i.e. Don't try to charge a 12V battery from an unlimited input power source sitting at, say, 200 Volts. The Classic is able to work with high power-high voltage sources but will usually require an input voltage dropping power resistor in series with the input voltage source. Please call a MidNite technical representative for advice on what size input resistor to add to the input for these special cases if you are unsure what to place in-line and we will try to help.

Wind Track

This mode uses a power curve that is either built by the user or one of the pre-installed graphs. The power curve consists of 16 set points that consist of output amperage and input voltage, allowing the user to custom build a curve for their Wind turbine. Please refer to the Wind section of the manual for full details on programming the curve as well as our video that will help in understanding how to adjust these curves using the wind graph editor.

Dynamic

This is typically used for PV (solar) input sources and tries to follow, on a slow dynamic basis, the changing conditions of the input source. This mode has one user adjustment which is a forced sweep perturb trigger interval for times when the input condition changes do not trigger a dynamic sweep. The interval is in units of minutes.

U-Set VOC%

This is a fully manual mode based on a percentage of VOC. The Classic will sweep based on the user set time in minutes and then park at a user set % of the VOC the Classic found on that sweep. This mode is

useful for testing or constant voltage sources.

The ON/OFF has to be set to OFF in order to change the operational mode. Scroll to the right to highlight the word ON or OFF and use the up and down keys to change it to OFF. Push the Enter button to save this change. Now you can scroll to the right and highlight the mode under Function. Scrolling up or down changes the modes. Once a mode is selected push the Enter button to save this change. Then you can use the right soft key to select “setup”. This would be where you will manually set up any parameters specific to the mode you selected.

Configuring the Classic for Wind Input Source

Wind

If you selected “Wind” you will need to select a power curve from the list of pre-loaded curves or build your own. To access the list of power curves follow the steps below.

- ❖ Push the Main Menu button.
- ❖ Scroll left or right until “Mode” is highlighted and push the Enter button.
- ❖ Set the status to OFF and then use the right soft key to select “Graph”.

Using the left soft key select “MEM”. Now you can scroll up and down through the menu and select from the curve that was designed for your turbine. Once you find the correct power curve use the right soft key to select “RECALL”. Now push the Enter button to save this power curve to the Classics memory.

There are also 9 memory spaces for you to save a custom power curve. To build custom power curves select a memory location between 1 and 9 and hit “RECALL”. Use the right and left arrow buttons to scroll through the 16 steps in the custom curve. On each step you can set the amperage by using the up and down buttons. When you have the power curve the way you want it select “MEM”. Use the up and down buttons to select a location 1 through 9 to save it in and select “SAVE”. Now push the Enter button to save it to the Classic's memory.

For more information consult the videos contained in this DVD as well as the MidNite Solar web site.
Classic-Wind-Graph-Editor-1.mpg

Setting the Date and Time

To set the date and time manually on the Classic follow the steps below.

- ❖ Push the Main Menu button.
- ❖ Scroll left or right to highlight “TIME” and push the Enter button

Now scroll left or right to highlight the data you want to manually change. Use the up and down buttons to change the data. When you have all the data changed push the Enter button to save the changes. The Classic includes a battery in the MNGP portion, to keep the time running even when the power is disconnected. To replace the battery refer to the Installation Manual

Setting Longitude and Latitude

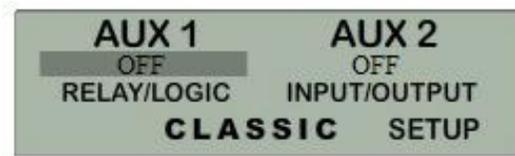
With the built in virtual map, you are able to select where you are in the world. For a more precise setting you can manually enter the longitude and latitude coordinates, geographic location is important because it

helps determine when the Classic wakes up and when it goes to sleep. This setting tells the Classic when sunrise and sunset are to happen. The Classic will use this information on future features also. To set longitude and latitude coordinates you need to go through the WIZARD that is the only way to gain access of this feature

Configuring Auxiliary Input/Output

The Classic includes two auxiliary ports which can be configured to become inputs or outputs. These aux ports can be used as a secondary power supply to be used for accessories such as vent-fan, anemometer and generator starter or even an anemometer. The Aux output is limited to 200ma or less per channel. These aux ports if used correctly could extend the system life. Here is an explanation of how they work.

- An internal, re-settable Positive Temperature Co-efficient (PTC) fuse protects the AUX internal components from overcurrent or a short circuit.
- AUX 1 consists of either RELAY or LOGIC operation depending on the user selection function.
- AUX 2 could be set to become an INPUT or OUTPUT. One at a time this port could be reading the state of a device connected and takes an action from there.



To configure the Classic's Aux ports:

- ❖ Push the Main Menu button
- ❖ Scroll left or right to highlight "AUX" and push the Enter button.

Scroll left or right to highlight the relay you wish to change. Push the right soft key labeled "SETUP". Scroll up or down to change the function of the relay. Select the right soft key to set the parameters of the function. When finished push the ENTER button to save the changes.

Main Aux Screen shows both Aux1 and Aux2 functions

Table 2.0

Off -	Places output to Low state (0 Volts)
Auto -	Selects the assigned function to the Aux output or input
On -	Sets output for Low state (12 Volts or Relay On)

The Following is a list of the Aux 1 and 2 functions with brief descriptions of their function.

Aux 1

Vent Fan Lo

This mode will turn Aux 1 off above the voltage set point you program. It allows you to run a vent fan for a battery bank based on battery voltage. There is a voltage set point that you set and Aux 1 will turn off when the battery reaches that set point. The voltage has to fall 2 tenths of a volt below the set point for 30 seconds before Aux 1 will turn back on.

Vent Fan High

This mode will turn Aux 1 on above the voltage set point you program. It allows you to run a vent fan for a battery bank based on battery voltage. There is a voltage set point that you set and Aux 1 will turn on when the battery reaches that set point. The voltage has to fall 2 tenths of a volt below the set point for 30 seconds before Aux 1 will turn off.

Float Low

This mode will turn Aux 1 off whenever the Classic is in Float. Aux 1 will stay off until the Classic falls 3 tenths of a volt below the float voltage set point.

Float High

This mode will turn Aux 1 on whenever the Classic is in Float. Aux 1 will stay on until the Classic falls 3 tenths of a volt below the float voltage set point.

Clipper Control

This mode was intended to control the MidNite Clipper. It will send out a PWM signal whenever the controller is unloading the turbine because the battery is full or close to it. There are no adjustment in this mode the Classic is preprogrammed with the best parameters to control turbine RPM.

Day Light

This mode will turn Aux 1 on at sunrise and turn it off at sunset based on the PV input voltage.

Nite Light

This mode will turn Aux 1 on at sunset and turn it off at sunrise based on the pv input voltage.

Toggle Test

This mode will cycle Aux 1 for 1 second off and 1 second on repeatedly. This mode is mostly for testing purposes.

Pv V on Low

This Mode will turn Aux 1 off above a user set voltage based on the input voltage to the Classic (V High) and turn Aux 1 on when it hits a low voltage set point (V Low). It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 off after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 on after reaching the V Low set point. This mode can be useful for controlling a failsafe stopping system for Hydro or Wind.

Pv V on High

This Mode will turn Aux 1 on above a user set voltage based on the input voltage to the Classic (V High) and turn Aux 1 off when it hits a low voltage set point (V Low). It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 on after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 off after reaching the V Low set point. This mode can be useful for controlling a failsafe stopping system for Hydro or Wind.

Opportunity Lo

This mode will turn Aux 1 off when the Classic gets within a certain range of the voltage set points for each charging stage (V High) and turn Aux 1 on when it gets to a low set point (V Low). These set points are user adjustable and will allow the Absorb, Float and EQ timers to continue to run. You will adjust these set points to negative numbers and the numbers are an offset from the voltage set point. For example a -.2 would turn Aux 1 off 2 tenths of a volt below your set points. This mode will allow you maximum diversion while maintaining your 3 stage charging. It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 off after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 on after reaching the V Low set point.

Opportunity Hi

This mode will turn Aux 1 on when the Classic gets within a certain range of the voltage set points for each charging stage (V High) and turn Aux 1 off when it gets to a low set point (V Low). These set points are user adjustable and will allow the Absorb, Float and EQ timers to continue to run. You will adjust these set points to negative numbers and the numbers are an offset from the voltage set point. For example a -.2 would turn Aux 1 on 2 tenths of a volt below your set points. This mode will allow you maximum diversion while maintaining your 3 stage charging. It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 on after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 off after reaching the V Low set point.

Low bat disc

This mode will turn Aux 1 off when it reaches a set point based on battery voltage (V High) and turn it on at another set point based on battery voltage (V Low). It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 off after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 on after reaching the V Low set point. This can be used with a NC relay when the battery gets to the set point the Classic will send 12vdc to the relay holding it open and disconnecting the load.

Diversion

This mode will turn Aux 1 on when it reaches a set point based on battery voltage (V High) and turn it off at another set point based on battery voltage (V Low). It also allows you to set a delay time in seconds the Classic will wait before turning Aux 1 on after reaching the V High set point. It also allows you to set a hold time in seconds the Classic will wait before turning Aux 1 off after reaching the V Low set point.

Aux 2

Float Low

This mode will turn Aux 2 off whenever the Classic is in Float. Aux 2 will stay off until the Classic falls 3 tenths of a volt below the float voltage set point.

Float High

This mode will turn Aux 2 on whenever the Classic is in Float. Aux 2 will stay on until the Classic falls 3 tenths of a volt below the float voltage set point.

Day Light

This mode will turn on Aux 2 at sunrise and turn it off at sunset based on the PV input voltage.

Nite Light

This mode will turn on Aux 2 at sunset and turn it off at sunrise based on the pv input voltage.

Clipper Control

This mode was intended to control the MidNite Clipper. It will send out a PWM signal whenever the controller is unloading the turbine because the battery is full or close to it. There are no adjustment in this mode the Classic is preprogrammed with the best parameters to control turbine RPM.

Pv V on Low

This mode is PWM based and is just reverse logic of Pv V High. It would be comparable to using the NC contacts of the relay used in Pv V High. It can be used that way with a solid state relay with NC contacts for a failsafe load.

Pv V on High

This mode is PWM based and will PWM Aux 2 above a user set voltage (V High) based on the input voltage to the Classic and stop when it hits a low voltage set point (V Low).

Toggle Test

This mode will cycle Aux 2 for 1 second off and 1 second on repeatedly. This mode is mostly for testing purposes.

Opportunity Lo

This mode is PWM based and is just reverse logic of Opportunity Hi. It would be comparable to using the NC contacts of the relay used in Opportunity Hi. It can be used that way with a solid state relay and NC contacts to do diversion above a set voltage.

Opportunity Hi

This mode is PWM based and will PWM Aux 2 when the Classic gets within a certain range of the voltage set points for each charging stage (V High) and stop when it gets to a low set point (V Low). These set points are user adjustable and will allow the Absorb, Float and EQ timers to continue to run. You will adjust these set points to negative numbers and the numbers are an offset from the voltage set point. For example a -.2 would turn Aux 2 on 2 tenths of a volt below your set points. This mode will allow you maximum diversion while maintaining your 3 stage charging.

Diversion Lo

This mode is PWM based and is just reverse logic of Diversion Hi. It would be comparable to using the NC contacts of the relay used in Diversion Hi. It can be used that way with a solid state relay and NC contacts to do diversion above a set voltage.

Diversion Hi

This mode is PWM based and will PWM Aux 2 at a set point based on battery voltage (V High) and stop it at another set point based on battery voltage (V Low).

Aux 1 Function

OUTPUT = Relay or 12V/0V Signal jumper selectable

Aux 1 has the relay so Diversion functions must operate slowly

VENT FAN LOW	Aux1 on below setpoint
VENT FAN HIGH	Aux1 on above setpoint
FLOAT LOW	Aux1 off when in Float
FLOAT HIGH	Aux1 on when in Float
CLIPPER CONTROL	PWM Control for Clipper
DAY LIGHT	Aux1 on at dawn off at dusk
NITE LIGHT	Aux1 on at dusk off at dawn
TOGGLE TEST	Aux1 cycled 1 sec interval
Pv V ON LOW	Aux1 on below Pv in setpoint
Pv V ON HIGH	Aux1 on above Pv in setpoint
OPPORTUNITY LO	Divrt based on chrg state lo
OPPURTUNITY HI	Divrt based on chrg state hi
LOW BAT DISC	Disc load based on bat volt
DIVERSION	Slow Diversion control

Aux 2 Function. Output/Input

OUTPUT = 12V/0V Signal

FLOAT LOW	Aux2 off when in Float
FLOAT HIGH	Aux2 on when in Float
DAY LIGHT	Aux2 on at dawn off at dusk
NITE LIGHT	Aux2 on at dusk off at dawn
CLIPPER CONTROL	PWM Control for Clipper
P _v V ON LOW	PWM sig below P _v in setpoint
P _v V ON HIGH	PWM sig above P _v in setpoint
TOGGLE TEST	Aux2 cycled 1 sec interval
OPPORTUNITY LO	PWM divert rltv chg state lo
OPPORTUNITY HI	PWM divert rltv chg state hi
DIVERSION LO	PWM Divert on Bat voltage lo
DIVERSION HI	PWM Divert on bat voltage hi

To set/ change threshold voltage as well as time do the following:

- When in the function you wish to use press the right soft button
- This will take you to the VOLTS menu here is where you set your threshold voltage
- Use the left and right arrow keys to navigate through the options
- Use the up and down arrow keys to raise or lower the threshold voltage
- To change the time press again the right soft button to get to the TIME menu
- In this menu do the same as you did in the VOLTS menu, until desired adjustments are made
- Press ENTER to save

Setting the MNGP features, Access the Version of software and Restore factory defaults

The Classic comes with an integrated “MidNite Graphics Panel” (MNGP), which is the primary interface to the Classic. Setting up contrast, backlight and volume its simple just follow the steps below.

- ❖ Push the Main Menu button.
- ❖ Scroll left or right to highlight “Misc” and push the Enter button.
- ❖ Use the left and right arrow keys to select the feature to set and press the Enter button
- ❖ Press the up and down buttons to adjust
- ❖ Press Enter to save

Use diagram below for MNGP reference. Figure 2.8

Figure 2.8



Operating the Classic

Once the parameters have been set via the set up wizard or from manual set up, there are no further requirements to make the Classic function. It is all automatic.

Navigating the Menu's

- ❖ Push MAIN MENU
- ❖ Push right and left buttons to see the different menus
- ❖ To return to the status screen push STATUS button

* To navigate from one end of the main menus to the other end push the top right and left buttons

When the Classic first turns on it will take you through the WIZARD setup. After all of these parameters are set **and saved**, you will be placed in the MAIN MENU screen with WIZARD highlighted. Below the name of the menu is a description of the menu. Pushing the left and right buttons will enable you to see all the main menus provided. Inside some of these main menus will be sub-menus to adjust the parameters of the selected feature.

Here is an overview of these menus:

<<WIZARD— CHARGE —MODE—AUX—MISC—LOGS—TWEAKS—TEMPS—NET>>

Below each of the menu names is a row with a description of the menu inside. To enter a menu, the name of the menu has to be highlighted. Pushing ENTER will show the submenus. The up and down arrow keys are enabled for easier navigation. Highlighting a sub menu and pushing ENTER will take you inside

the submenu where you will be able to change the parameters of the unit. To get out of the submenus push MAIN MENU, this will take you out of the submenus one at a time every time you push it. See page 44 for entire Menu Map.

Viewing Other MidNite Products on the Display

The Classic is able to view other products or Classics connected to the network. For example: the MidNite Solar Clipper. To view other products or Classics connected to the Classic network, go to the Status screen and press the UP and DOWN arrows to scroll between the addresses of the different items. The Classic is address 10 and labeled. CLASSIC

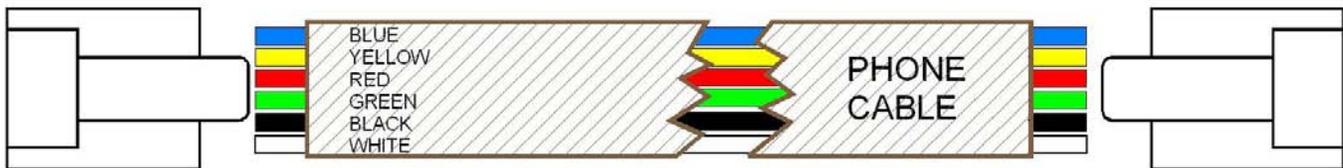
Connecting Classic to Two MNGPs/Network cable

The Classic can be controlled with two MNGPs at the same time. This will help when the Classic is in a shop and there is a considerable distance between the Classic and the controlling point (office, inside house, garage etc.). Instead of going to the Classic to check status or to change a setting, the user can run a cable to the controlling point and see the Classic in a second MNGP. The cable is a six wire phone cable. Connect one side of the extension cable to the jack in the Classic labeled SLAVE/OUT and the other end to the second MNGP. Since the Classic transmits power and data signals through the phone cable to the MNGP the length of the cable is limited to 100ft.

MidNite Solar only offers a 3ft as an optional accessory. If you are making your own cable be sure to insert cable end all the way into the phone terminal to get a good contact. Use the phone crimping pliers to crimp both ends of the cable.

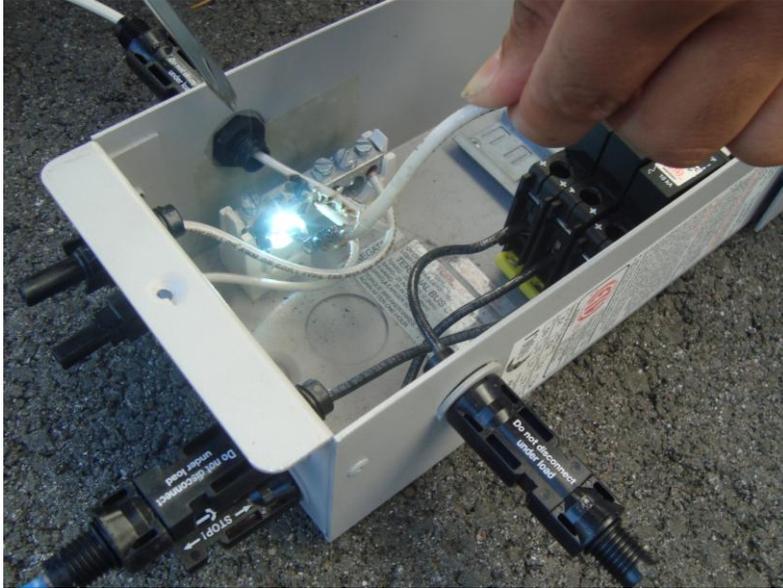


We recommend using flat phone cable for extension, just because it is easier to work with. Use the two pictures above as reference. Make sure the color and position of the wires are as shown in the diagram below. Use terminal connector tab as reference.



Arc Fault

The Arc Fault Detector is a unique safety component included in every Classic, because safety is not an option, the engineers at MidNite take action as the 2011 NEC code requires.



The Classic is the first charge controller in the world to successfully stop a series arc. The Classic can detect an arc in less than 100mSec. From low power arcing to devastating high power arcing, the Classic will detect and shut down with an audible and visible alert to announce that there is a problem in the PV side of the system. When an arc is detected the Classic has to be manually cleared.

Resetting the Arc Fault Detector after detection has occurred: The First thing to do is find and fix the actual arcing wire, terminal, splice etc. The Classic needs to be powered down completely for 15

seconds and then powered back up. Do this by turning the DC source (PV, Wind or hydro etc.) breaker off. Then turn off the external battery breaker. Then simply turn the 2 breakers back on starting with the battery breaker.

The arc fault module has three adjustable parameters consisting of: **MODE**, **TIME** & **SENSITVY**
MODE: Is assigned as a 1 from factory default and it should stay that way unless instructed by MidNite Solar.

TIME: This sets the length of the arc the Classic has to monitor before tripping the Arc fault detection. This parameter is set to 4 from the factory.

SENSITIVITY: This parameter determines how sensitive the Arc fault detector will be 1 being the most sensitive and 15 the least. This parameter is set to 10 from the factory.

If you experience nuisance tripping you can raise the sensitivity one digit at a time. Follow the instructions below to make adjustments or disable Arc fault. As a last resort, you may disable Arc fault if your system cannot work with the arc fault detector.

To change the parameters of the Arc Fault, follow the steps below:

- ❖ Press Main Menu
- ❖ Scroll to the right or left until TWEAKS is highlighted and press ENTER
- ❖ In TWEAKS press the right soft key to get to the BITS menu
- ❖ In BITS press the right soft key to get to ARC ADJ
- ❖ In this menu use the left and right keys to select the feature to adjust
- ❖ Use the up and down arrow keys to change the parameters

In order for the Classic to read the new settings you must power cycle the Classic. Do this by turning the DC source (PV, Wind or hydro etc.) breaker off. Then turn off the external battery breaker. Than simply turn the 2 breakers back on starting with the battery breaker.

View Faults and Warning's

The Classic has some helpful safety features including the GFP (Ground Fault Protection) and AFD (Arc Fault Detector). When one or more faults are detected the Classic will stop outputting power and display a fault message in the bottom right corner of the home screen (STATUS). To clear the fault refer to Page 19 and page 33; Arc Fault section.

View Logged Data

The Classic can log the power produced by your system. Shown in Total kilo Watt hours (kWh), you can view daily logged data or accumulated throughout the life time of the Classic. Daily logged data is displayed in the bottom left corner of the Status screen; the daily logged data will get reset to 0 kWh every 24hrs. The total logged data is displayed in a menu screen called LOGS. Total logged data is an accumulation of all of the power that has been produced by the system; this data cannot be reset back to 0 kWh. To view total kWh produced by you system:

- ❖ Press Main Menu,
- ❖ Scroll to LOGS and
- ❖ Press the Enter button.

Uploading New Firmware to the Classic

There is also an Ethernet method for updating software in the Classic itself (Ethernet for MNGP Remote coming soon).

Updating Classic Firmware (Windows XP)

Requirements:

PC with Windows XP
One available USB port
Internet Connection

WARNING ! The Classic's USB port is NOT isolated from battery negative. This is typically only an issue on positive ground systems or systems with a tripped ground fault protection device. Care must be taken that a computer connected to the Classic's USB port is either isolated from ground and the Classic's negative or that the computer's USB negative is common with the Classic's negative and ground.

1. To retrieve the firmware, go to www.midnitesolar.com, then click on the link labeled "Firmware" in the top menu bar of the web site.

Robin's Corner

The engineers at MidNite Solar have been designing renewable energy disconnect boxes for twenty years. The majority of the existing disconnect boxes were designed by us. We think we have finally got it right. People in the industry have spent years teaching us what is important to them. Our E-Panels take care of the over current and disconnect requirements. This allows you to devote more of your hard earned money to the performance components such as PV panels, power electronics and batteries.

Robin



- Fill out the registration form with the required fields and click Submit.

Name: *

First:	<input type="text"/>
Last:	<input type="text"/>

Email *

Email:	<input type="text"/>
Verify Email:	<input type="text"/>

Select Classic Model *

150:	<input type="radio"/>
200:	<input type="radio"/>
250:	<input type="radio"/>
250 KS:	<input type="radio"/>

Message:

- An email will be sent to you with a link to the firmware. Click the link to start the download.
If the download does not start, copy the link, paste it in the URL address bar and then press enter.

MidNite Solar Firmware Download

midni9@sadar.lunarpages.com

Sent: Fri 3/11/2011 5:57 PM

To: rob@midnitesolar.com; rob@midnitesolar.com; From: info@midnitesolar.com



MidNite Solar Inc.

Ph. 360.403.7207

Fax 360.691.6862

17722 - 67th Ave NE

Arlington, WA 98223

www.midnitesolar.com

Click the link below to start the download.

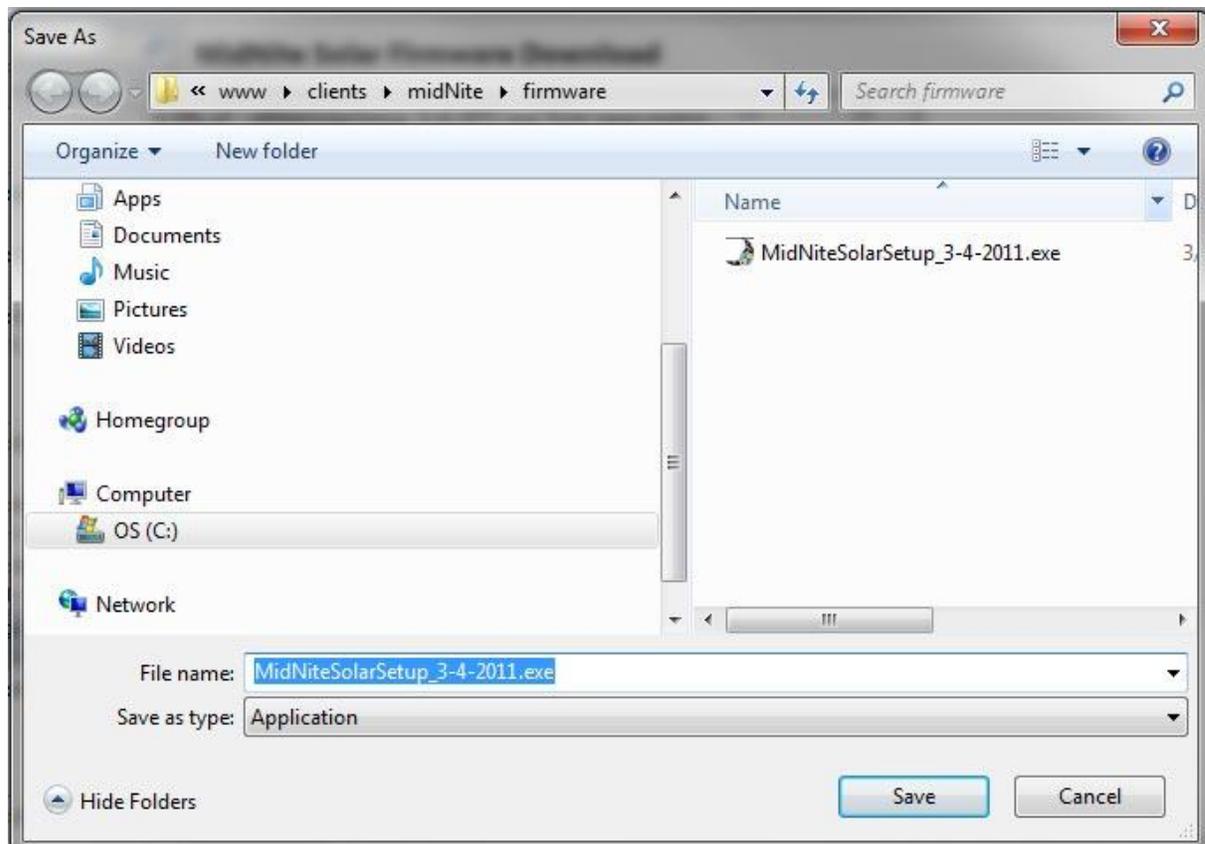
http://www.midnitesolar.com/firmware/MidNiteSolarSetup_3-4-2011.exe

If the download does not start, copy the link, paste it in the URL address bar and then press enter.

Thank you!

MidNite Solar Inc.

4. Select "Save" to save the file on your computer.

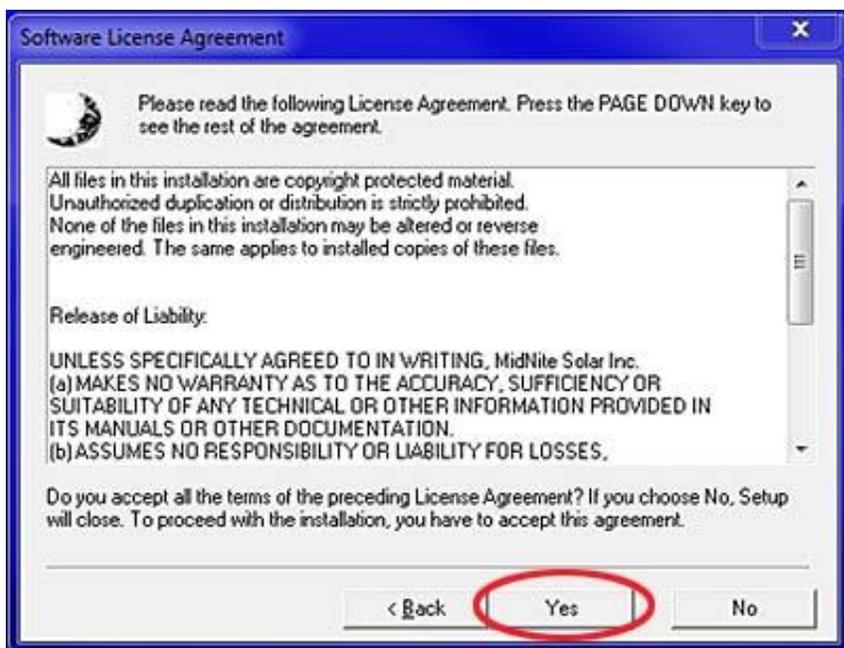


If your antivirus sees the MidNite Update.exe as a threat, temporarily disable your antivirus. When the install is complete enable your antivirus.

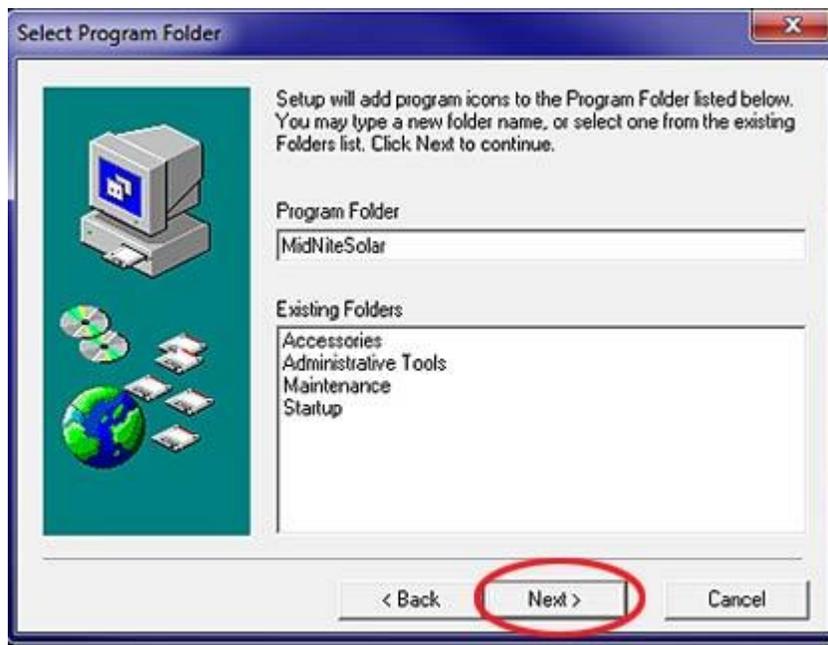
5. After saving the MidNiteSolarSetup_3-4-2011.exe file double click on it to start the installation.



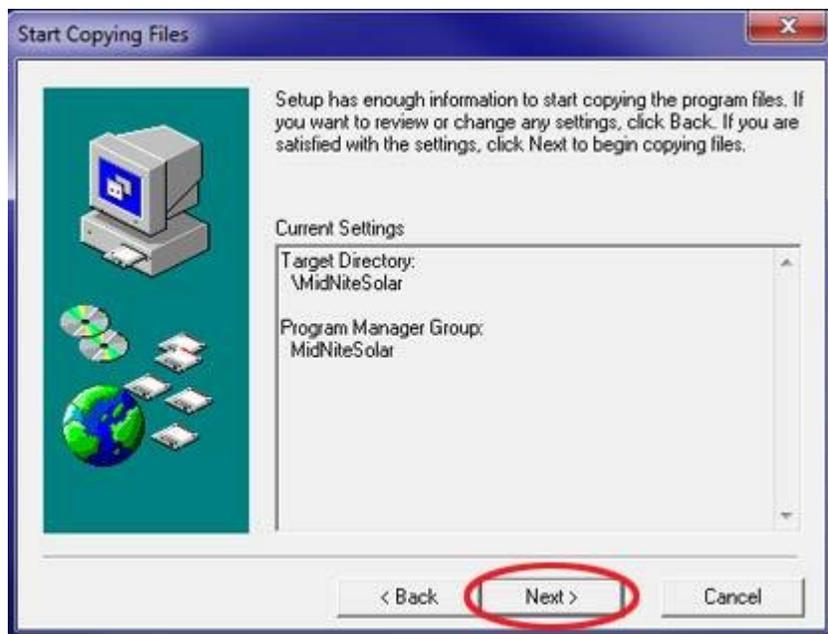
6. The Software License Agreement dialog box will appear. Click "Yes" to except the terms.



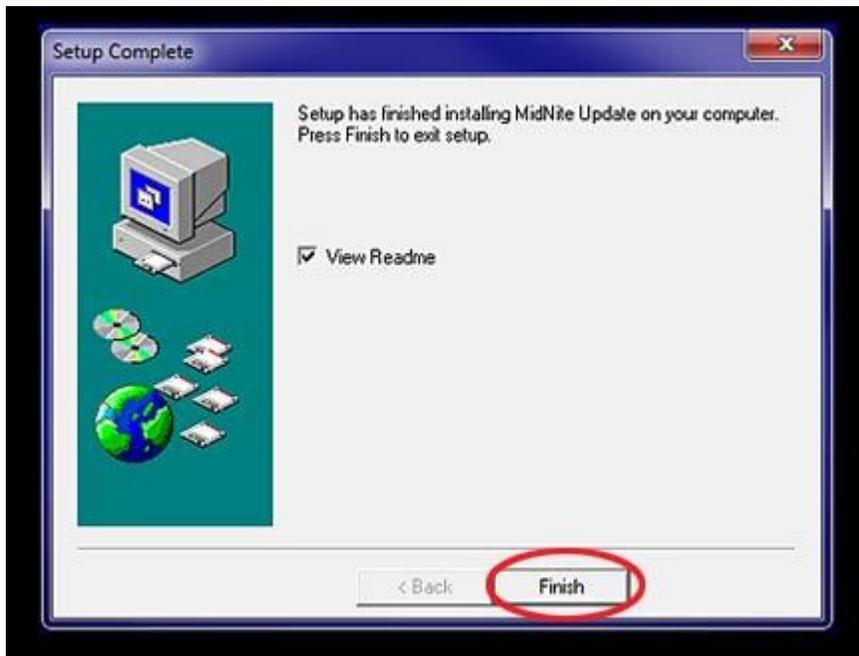
7. In the "Select Program Folder" dialog box make sure that MidNiteSolar is in the Program Folder field, and then click "Next".



8. The “Start Copying Files” dialog box will appear, click “Next”. Files will begin to install on your computer.



9. In the Setup Complete dialog box click “Finished”. A new MidNite Solar folder will be placed in your C:\ drive. We will refer to this folder in step 20. By default the “View Readme” check box is checked. If you don’t want to read the Readme file, uncheck this box before clicking the “Finish” button.



Prepare Classic charge controller for update.

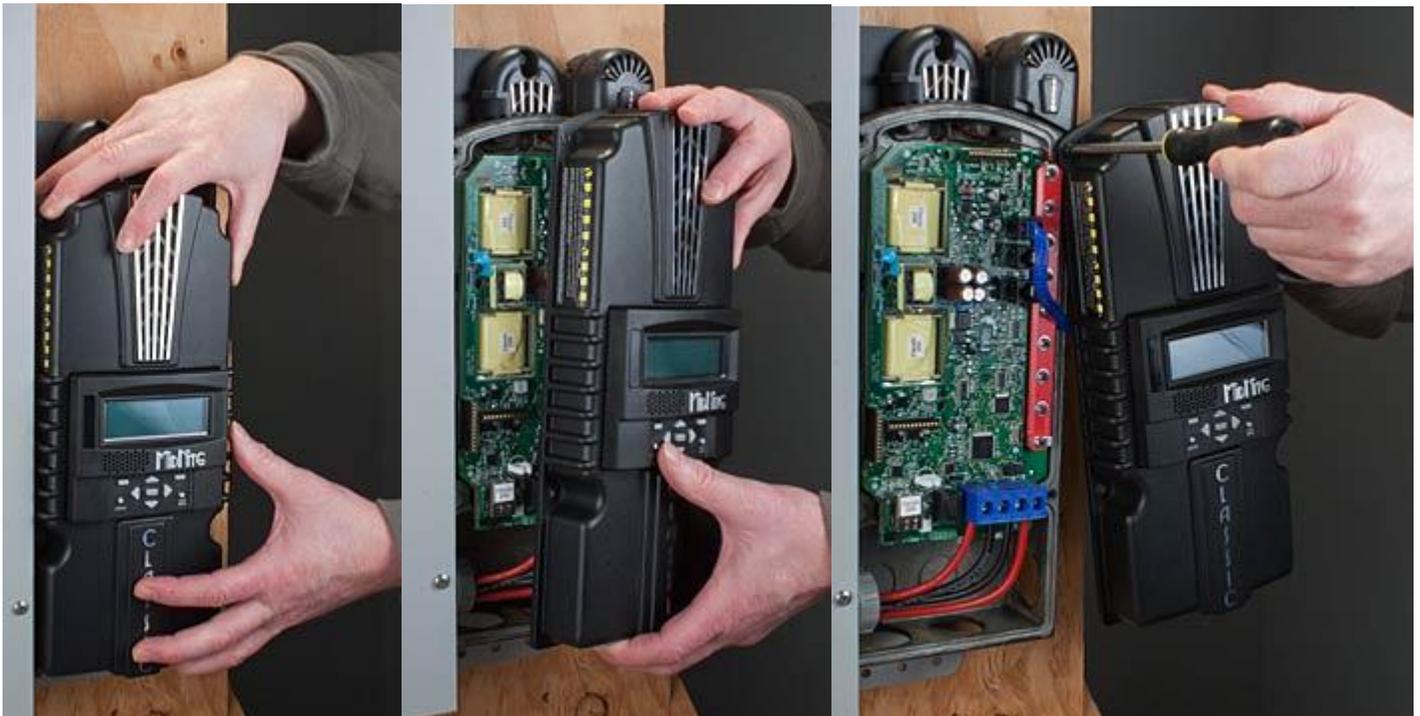
10. Now go to your electrical panel and identify the input and output breakers for the Classic. Turn them off. Wait 3 minutes for the Classic to de-energize.



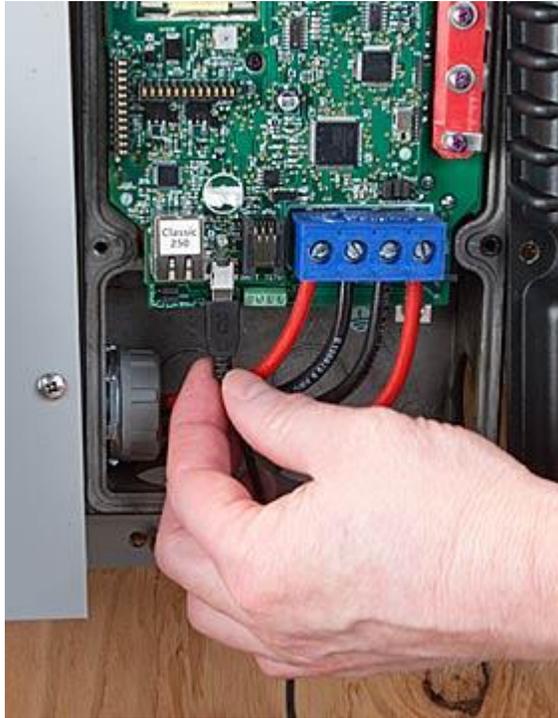
11. Remove the four screws holding the front cover of the Classic charge controller. **Do not let the front cover hang by the cable.**



12. Holding the front cover with one hand, place a screw in the top left hole of the front cover and screw it into the top right hole of the back casting.



13. Use the provided USB cable to connect the Classic to the PC. The smaller terminal connects to the USB port on the Classic. The USB port is located on the right side of the Ethernet Jack in the lower part of the Classic.



14. Connect the other end of the USB cable to an available port of the PC.



Install USB Classic driver

15. Go back to the electrical panel and turn on the battery breaker to the Classic.



16. The LED above the USB port on the Classic will light up and stay on.



17. The computer will prompt with a “Found New Hardware” pop-up. Select “Not at this time” and press “Next”.



18. A “New Found Hardware Wizard” dialog box will appear. Select “Install from a list or specific location (Advanced)” and click “Next”.



19. Select “Search for the best driver in this location”. Check the “Include this location in the search” checkbox and then click “Browse”.

20. Browse to the MidNite Solar folder located on the C:\\ drive and click OK.



21. Click “Next”.



22. In the Hardware Installation dialogue box click on “Continue Anyway”.



23. Click Finish to finish driver installation.



Changing Classics' COM port

The Classic charge controller can only be recognized if it is set up for COM 8 on the PC; most likely

you'll need to change the default COM number of the classic. Here is how:

24. On your computer go to the Control Panel and click on System.



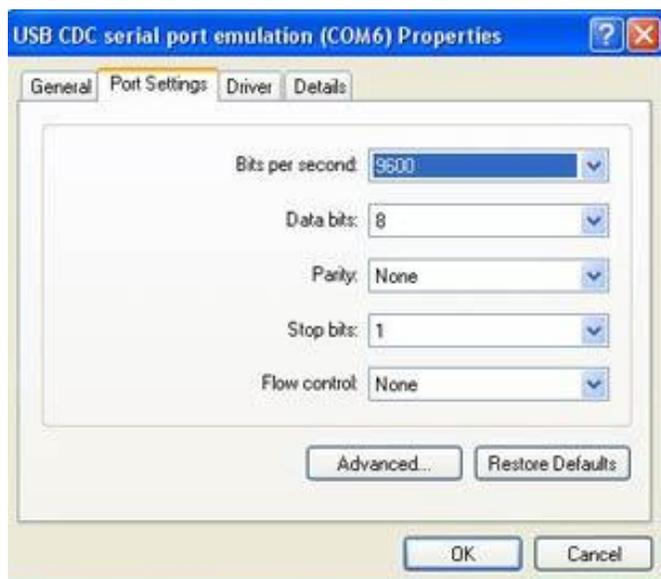
25. Select the tab labeled "Hardware" and click on "Device Manager".



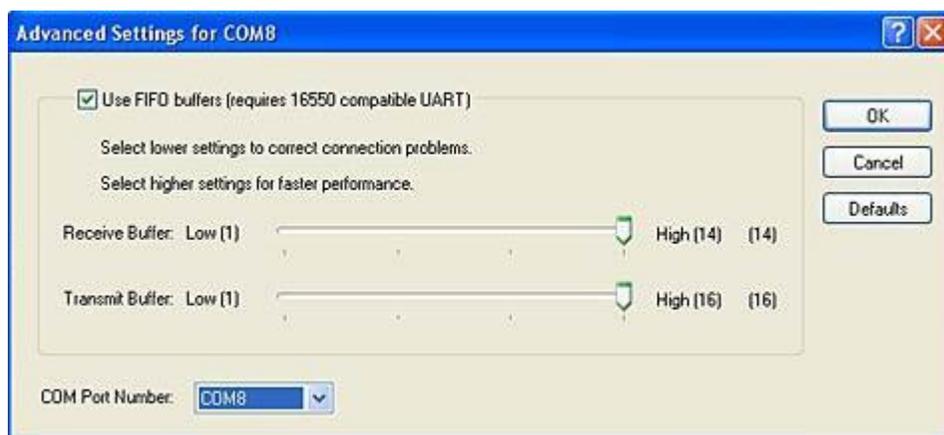
26. In the Device Manager, expand the tree branch labeled “Ports (COM & LPT)”. Right click on “USB CDC serial port emulation (COMxx)” and select “Properties”.



27. Select the tab labeled “Port Settings” and click on “Advanced”.



28. In the “COM Port” number drop down selection box, select “COM8” and press “OK” to exit that window.



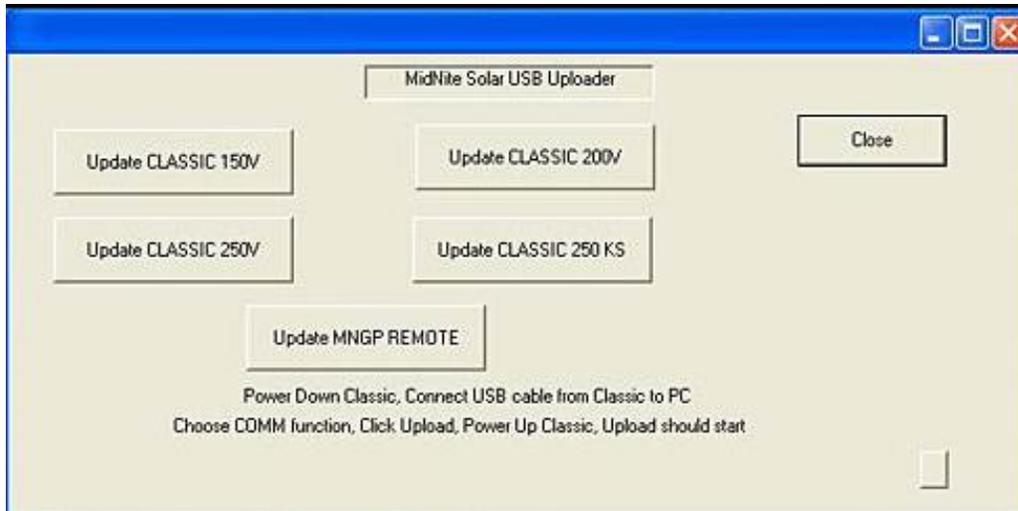
29. Click “OK” on the “USB CDC serial port emulation (COM8) Properties” to save changes. Now close the “Device Manager”, click “OK” on “System Properties” and then close the “Control Panel”.

Uploading Classic Firmware

30. Turn OFF the battery breaker to the Classic on the electrical panel and open the “MidNite Update GUI”. The “MidNite Update GUI” can be found by clicking on the Start menu in the lower left portion of the monitor screen and then selecting “MidNite Update GUI”.



31. Click on the model (150, 200, and 250) of the Classic to be updated. A black window will appear and close automatically upon completion of the update.



32. Now turn ON the battery breaker to the Classic. The update should start automatically. Wait until the “update” goes to 100% then turn the battery breaker to the Classic OFF and then ON.



Turning the breaker off and on resets the Classic so the new settings take effect.



33. If MNGP (MidNite Graphics Panel) needs to be updated as well, turn OFF the battery breaker to the Classic. Click on the “MNGP” button on the “MidNite Update GUI” then turn ON the breaker.
34. Wait until the uploading percentage reaches 100% and then turn the battery breaker to the classic OFF and then ON. **Turning the breaker off and on resets the Classic so the new settings to take effect.** This now completes the firmware installation. The battery settings, saved graphs and LCD settings on the Classic will remain the same.

Beware: If the Classic has been updated with a different model of Classic firmware than the factory default, the charge controller will display a “WRONG CODE” message on the bottom right corner of the Status screen and it will not turn ON.

Connecting the Classic to the Internet

Networking

The Classic supports standard 10/100-base T Ethernet networks. For Gigabit networks you will need a common network switch that is capable of mixed mode operation. The Classic may also be placed on a, b, g, or n wireless networks by using a wireless network bridge device.

Depending on your network you may use one of the topographies detailed in Figures 5 – 5.3. Note that the switch may be self-contained or, in many cases, may already be integrated into your cable or DSL modem. Refer to Figure 1.7B for Ethernet connector location in the Classic.

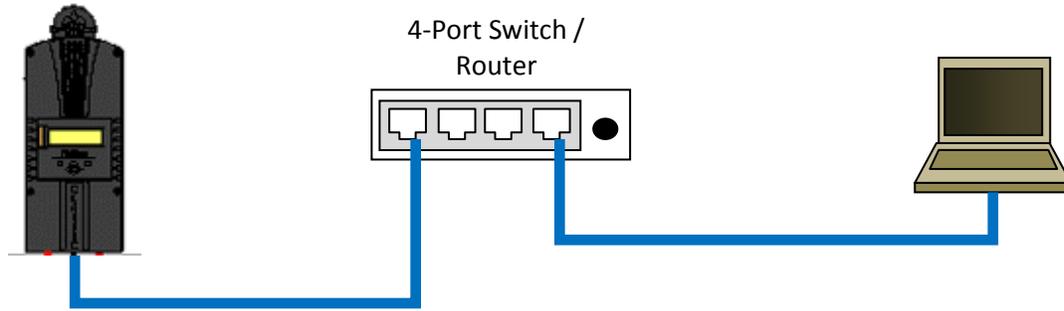


Figure 5 Local network through switch. In some cases you may be able to connect Classic directly to your PC; however, this is not a recommended topography.

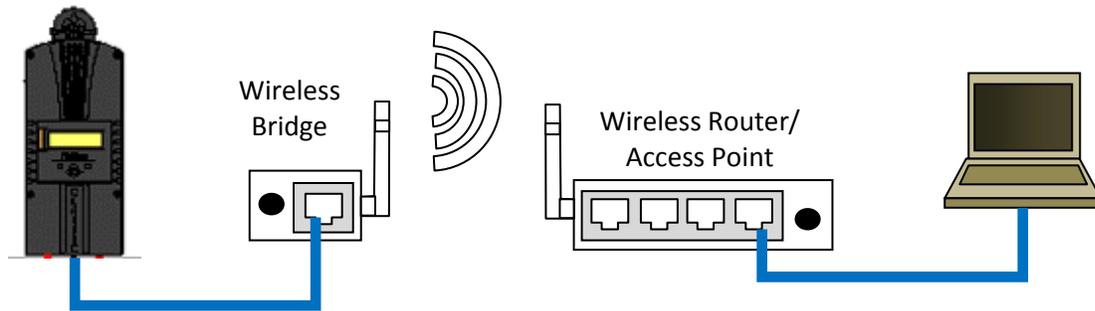


Figure 5.1 Local network through wireless bridge.

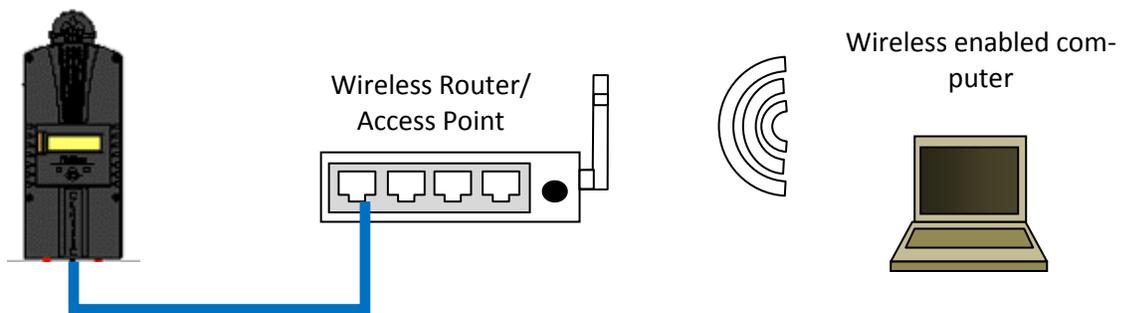


Figure 5.2 Local wireless network

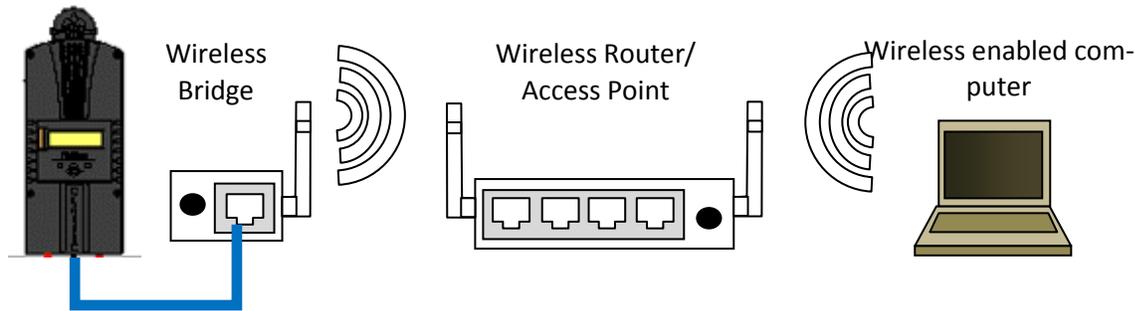


Figure 5.3 Local wireless network through wireless bridge

There are many different configurations possible when it comes to networking that are beyond the scope of this manual. The basic ones in the above figures should help get you going.

Network Setup Through the MNGP

The Classic’s Ethernet capabilities may be configured using the Network menu on the MNGP. From the main menu select “NET”.

There are three screens that configure network settings. Table TBD decodes the descriptions from the MNGP’s small screen.

MNGP	Long-hand	Description
Mode	IP address configuration mode: DHCP/Static	The Classic supports both static and dynamically (DHCP) allocated IP addresses. If you are unsure which to choose try DHCP first. If you have trouble move to the troubleshooting section.
IP	IP Address	The Network address of the Classic
SN	Subnet	The Subnet or address class specifier
GW	Gateway Address	The address of the network’s gateway device
D1	Primary DNS Address	Primary Address lookup device
D2	Secondary DNS Address	Secondary Address lookup device (optional)
Web Access	-	Enables or disables the Classic’s online web service feature
MA	MAC Address	The hardware or Ethernet address of the Classic
DI	Device ID	The unique MidNite Solar address of the Classic

Table 5.1 Net Menu Details

DHCP

The Classic supports Dynamic Host Configuration Protocol (DHCP) in which all networking settings are derived from a DHCP-enabled router. This is the simplest configuration method and recommended unless you explicitly need a statically allocated IP address for your Classic. In this mode all other settings are automatically configured and are read only (informational) with the exception of the Web Access feature.

- Press Main Menu
- Scroll to NET menu and press the Enter button
- Highlight and select DCHP

Please note that the Classic's DHCP protocol implementation usually takes a few seconds up to a minute to update the network settings. If the network settings do not update within a minute, please consult the troubleshooting section.

Static IP

The Classic supports static IP address allocation. In this mode you can assign the Classic a specific IP address. This lets you set up things like port forwarding from your router or for networks with static IP allocations.

- Press Main Menu
- Scroll to **NET** menu and press the Enter button
- Highlight and select **STATIC**
- Using the left and right keys, navigate to the settings to change and use the up and down arrows to adjust the desired fields.
- Press the **COMMIT** softkey at any time to commit the settings to the Classic's Flash memory.

Please note that static settings span two menu screens. You may use the soft keys to navigate between the two menus. Pressing the **ENTER** key in either menu saves all settings to Flash memory.

For convenience when you manually set the device's IP address the Gateway and Primary DNS addresses follow the change. See the following sections for details on each of these fields.

IP Address

This is the local network address of your Classic. It usually takes the form "192.169.0/1.x" or "10.0.0.x" depending on your networking equipment. You must be careful when selecting this address. If it does not match your network subnet then the classic will not be able to communicate with the network. If it is the same as another device on the network then collisions will occur causing both devices to act erratically. Check your router settings or ask your network administrator which local address to use. Also refer to the troubleshooting section for tips.

Subnet

This refers to the class of local network you are using. This depends on your network hardware but most users should use "255.255.255.0" for this field.

Gateway

This is the address of your router or modem – the device which is connected directly to the Internet proper. It will usually take the form 192.168.0/1.1 or 10.0.0.1 depending on your network configuration and hardware. Check your router settings or ask your network administrator which local address to use. Also refer to the troubleshooting section for tips.

DNS 1 & 2

The DNS is the means by which human-readable internet addresses are resolved to actual IP addresses on the network. These values can usually be set identically to the gateway address depending on your network hardware. If your ISP provides you with specific DNS servers then use those addresses in these fields instead.

Example 1: Your gateway is a DSL modem with address 192.168.1.1. If your ISP has not given you explicit DNS servers to use then set the **D1** field to 192.168.1.1. **D2** can be ignored.

Example 2: Your gateway is a cable modem with address 10.0.0.1. Your ISP has specified primary and

secondary DNS server addresses of 11.22.33.44 and 11.22.33.55, respectively. Set the **D1** address to 11.22.33.44 and the **D2** address to 11.22.33.55.

Web Access

MidNite Solar offers a free web service with which you can access your Classic from a web page from anywhere in the world simply by pointing your favorite web browser to

<http://www.mymidnite.com>

See the web section further on for instructions on how to create an account and use the web-based system. All communications between the Classic and MidNite Solar's server are encrypted using a strong session-based algorithm. To respect your privacy, however, it is required that you manually enable this feature if you'd like to use it.

In order to enable the web access feature:

- Press **Main Menu**
- Scroll to **NET** menu and press the Enter button
- using the soft keys, navigate to the **ADVANCED** menu (**NET**→**NEXT**→**ADVANCED**)
- The **Web Access** option should be highlighted.
- Use the up/down keys to now enable or disable the feature.

Note that the **Web Access** selection indicates the current setting of the feature: i.e. **ENABLED** means the feature is currently in operation.

Note also that you will need the values **MA** and **DI** handy in order to create an account on the MidNite Solar web site. This unique number pair identifies your particular classic to our server and helps to prevent malicious users from trying to access your Classic. The **DI** or Device Id is different than your Unit's Serial Number.

Local Network

Note that your classic identifies itself by name to DHCP-enabled routers as "Classic". There is facility to change the name of a given classic via the local and web-based interfaces as well as using third-party MODBUS software packages.

Advanced

The Classic advertises its address every 10 seconds using the UDP protocol on port (TBD). Advanced users and programmers may use this feature to identify Classics on their network.

MODBUS (Preliminary)

DISCLAIMER

There is not a convention on the write-ability of registers. You may write to any register in the system including registers THAT MAY DAMAGE OR DESTROY your Classic and attached equipment like battery banks. Please make sure that you understand what you are doing before attempting to change any settings (like battery voltage) using the raw MODBUS interface. MidNite Solar cannot take responsibility for any damage to your Classic in the event of misconfiguration.

Registers and bits marked RESERVED are not necessarily unimplemented. Great care must be taken not to overwrite these registers or bits to ensure proper operation of the Classic.

Wherever possible we have tried to indicate settings that may have an adverse effect on your system if set incorrectly.

If you need to configure your system, please consider using the MNGP's built in configuration wizard which will step you through the process.

Conventions:

Register units are expressed using formulas to try to reduce the ambiguity surrounding converting from the raw bus formats and human-readable values. Due to the nature of the Classic's operation, there is not a uniform convention as far as data endianness so you may find some classes of values that follow a Most Significant Byte (MSB) first convention and others that use the Least Significant Byte (LSB) first convention.

Bits are numbered from 0-15 in the little-endian or LSB-0 notation. That is, the least significant bit is indexed by 0.

For Example, the number 43,981 is 0xABCD in hex is represented in binary as 1010101111001101.

The bit ordering is as shown in the following table:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	1	0	1	0	1	1	1	1	0	0	1	1	0	1

So that the binary digit indexed by (0) is 1. (1) is 0, (6) is 1, and (10) is 0.

MODBUS registers are 16-bit (2-octet/byte) in size. When using values from the map to indicate conversion formulas the following convention is used to access different octets:

Note that when talking about bytes or octets, it is more convenient to describe them in hexadecimal (base 16) form than in decimal. Some values are expressed in bytes as it is a more compact way of dealing with certain classes of numbers (IP addresses, for example). We use the 'C' convention of referring to hexadecimal numbers by prefixing them with '0x'. So the decimal value 10 is represented by the hexadecimal value 0x0A.

A note on Read/Write: The Classic MODBUS does not strictly enforce the Read/Write accessibility of some registers. It is possible to write to some registers marked Read Only. This will usually have no effect on Classic operation, but in some cases you may corrupt a register from which you wanted to read data. In some cases the registers are reset internally as new values. Additionally, some counters are accessible directly. For example, the AbsorbTime (4139) timer is a "suggested" read only register; however, if your MODBUS application has reason to reset or adjust this register, there is nothing to prevent you from changing it however you please. Don't be surprised if your batteries pop in and out of Absorb stage unexpectedly, though!

Operators:

Indexing

[] square brackets around an address indicate the value of the register specified:

ex: [4116] indicates the value of the register at address 4116.

[]_{MSB} Square brackets followed by an _{MSB} means to use the most-significant byte of the register.

ex: if the value at register 4116 is 0x04B1 (decimal 1201):

[4116] = 0x04B1,

then

[4116]_{MSB} = 0x04

[]_{LSB} Square brackets followed by an _{LSB} means to use the least-significant byte of the register.

ex: if the value at register 4116 is 0x04B1 (decimal 1201):

[4116] = 0x04B1,

then

[4116]_{LSB} = 0xB1

() Parentheses refer to bits within the register.

For example: [4116](0) means “the 0th bit of the value in register 4116.

So if 4116 held the value 1 (0x0001 hex) then [4116](0) would be a 1. [4116](1...15) would all be 0s.

... Ellipses represent ranges of values or indices.

For example to refer to the first three bits of a register you may see:

[4116](0...3) which signifies the first three bits of the value of register 4116.

You may also see spans of registers as:

[4116...4120] which refer to registers 4116 to 4120 inclusive.

Arithmetic

- + Add two numbers together
- Subtract two numbers (or negate the value on the right)
- / Divide two numbers (integer implied)
- * Multiply two numbers (integer implied)

Logical

<< x Binary shift left. Shift the value x binary digits to the left. This is equivalent to multiplying the decimal number by 2^x . Ex:

[4116] = 0x0001

Then

[4116] << 1 = 0x0002.

>> x Binary shift right. Shift the value x binary digits to the right. This is equivalent to dividing the decimal number by 2^x .

[4116] = 0x0002
 Then
 [4116] >> 1 = 0x0001.
 | OR two numbers together (aligned to LSB)
 & AND two numbers together (aligned to LSB)
 ^ XOR two numbers together (aligned to LSB)

String

|| Concatenate.
 [4116] = 0x4142.
 [4116]_{MSB} || [4116]_{LSB} => 0x41 || 0x42 => 'A' || 'B' => "AB"

Examples:

Using the example of the Average PV Voltage register: dispavgVpv @ 4116

Suppose using a MODBUS scanner you retrieve the following (integer) value from the dispavgVpv register at address 4116:

4116: 1201

- The address itself: 4116
- Full 16-bit value at the address: [4116] = 1201 (0x04B1 hex)
- The top-most (MSB) octet of the register: [4116]_{MSB} = 0x04 hex
- The bottom-most (LSB) octet of the register [4116]_{LSB} = 0xB1 hex
- Applying the Conversion (**[4116] / 10**) Volts:
 - [4116] = 1201
 - 1201 / 10 = 120.1 Volts

File Transfer and Function Execution modes:

Coming soon (*next revision of this document*) will be information on how to use the MODBUS File Transfer and Function execution commands. File Transfer will be necessary, for instance, to transfer wind power curves to/from the Classic or logging and audio data to/from the Classic and/or MNGP.

Base Registers				
Address	R/W	Name	Conversion	Notes
4101	R	UNIT_ID	PCB revision = [4101] _{MSB} Unit Type = [4101] _{LSB}	The PCB revision is a value between 0 and 255 indicating the hardware revision of the PC board. The Unit Type is an integer value indicating the voltage category of the Classic See Table 4101-1.
4102 4103	R	UNIT_SW_DATE_RO	Year = [4102] Month = [4103] _{MSB} Day = [4103] _{LSB}	Software Build date.
4104 4105	R	UNIT_SerialNumber	([4105] << 16) + [4104]	The serial number of the unit as appears on the label.
4106 4107 4108	R	UNIT_MAC_AddressI	[4108] _{MSB} : [4108] _{LSB} : [4107] _{MSB} : [4107] _{LSB} : [4106] _{MSB} : [4106] _{LSB}	The unit's Ethernet MAC address.
4109 4110	R	UNIT_IP_Address	[4110] _{MSB} . [4110] _{LSB} . [4109] _{MSB} . [4109] _{LSB}	The Unit's TCP/IP Address
4111 4112	R	UNIT_Device_ID	([4112] << 16) + [4111]	The device ID of the unit.
4113	RESERVED (Do NOT Write)			
4114	R	RestartTimerms	[4114] Mili Seconds	Time after which the Classic can wake up. (countdown)
4115	R	dispavgVbatt	([4115] / 10) Volts	Average Battery Voltage
4116	R	dispavgVpv	([4116] / 10) Volts	Average PV terminal input Voltage
4117	R	IbattDisplaySi_mbus	([4117] / 10) Amps	Average Battery Current
4118	R	kWhoursAdj	([4118] / 10) kWh	Average Energy to the Battery This is reset once per day
4119	R	Watts	([4119] / 10) Watts	Average Power to the Battery
4120	R	mbComboChrgStge	Charge Stage = [4120] _{MSB} State = [4120] _{LSB}	See Table 4120-1 for battery charge state. See Table 4120-2 for State
4121	R	PvInputCurrent	([4121] / 10) Amps	Average PV terminal input Current.
4122	R	VocLastMeasured	([4122] / 10) Volts	Last measured open-circuit Voltage at the PV terminal input.

Address	R/W	Name	Conversion	Notes
4123	RESERVED			
4124	R	MatchPointShadow	[4124]	Instantaneous value of Wind curve being used. Values [1...16]
4125	R	AmpHours	(([4125] / 10) Amp Hour	Daily Amp Hours reset once per day
4126 4127	R	TotalkWhours	((([4127] << 16) + [4126]) kWh	Lifetime Energy Generation
4128 4129	R	TotalAmpHours	((([4129] << 16) + [4128]) Amp Hours	Lifetime Amp-Hour Generation
4130 4131	R	InfoFlagsBits	(([4131] << 16) + [4130]	See Table 4130-1
4132	R	BATTtemperature	(([4132] / 10) °C/F	Temperature measured at the external Battery Temperature Sensor (if installed, else 25C)
4133	R	FETtemperature	(([4133] / 10) °C/F	Temperature of PWM FETs
4134	R	PCBtemperature	(([4134] / 10) °C/F	Temperature of the Classic Control (top) PCB
4135		NiteMinutesNoPwr	[4135] minutes	Nighttime Check
4136 4137	RESERVED (Do NOT Write)			
4138	R	TimeMinutesFloatToday	[4138] minutes	Number of minutes that the Batteries have spent in float today. Reset next AM.
4139	R/W	AbsorbTime	[4139] seconds	Absorb Time Up/Down Counter
4140	R	DaysSinceLastFloat	[4140] days	Elapse days since battery was last in the Float stage
4141	R	PWM_ReadOnly	[4141] (0 to 1023)	Duty Cycle command of PWM signal. (NOT a Percent)
4142	R	SunRiseTodayMsrd	[4142] Minutes	Minutes since first wakeup today for solar modes
4143	R	Equalize Time	[4143] Seconds	Battery Stage Equalize Down Counter. Time remaining in Equalize Stage
4144 4145 4146	RESERVED (Do NOT Write)			

Address	R/W	Name	Conversion	Notes
4147	R	NoDoubleClickTimer	[4142] Seconds	Forced time space between manual MPPT sweeps.
4148	R/W	Battery output Current Limit	[4148] / 10) Amps	Battery Current Limit Amps (example: 23.4 A = 234)
4149	R/W	Absorb Set Point Voltage	([4149] / 10) Volts	Battery Absorb Stage Set point Voltage (example: 28.3V = 283)
4150	R/W	Float Voltage Set Point	([4150] / 10) Volts	Battery Float Stage Set Point Voltage
4151	R/W	Equalize Voltage Set Point	([4151] / 10) Volts	Battery Equalize Stage Set Point Voltage
4152	R	Sliding Current Limit	[4152] Amps	Sliding Current Limit (changes with V/Temp etc.)
4153	R/W	Minimum Absorb Time	[4153] seconds	Minimum time for Batteries to remain in Absorb Stage.
4154	R/W	Maximum Absorb Time	[4154] seconds	Maximum time for Batteries to remain in Absorb Stage.
4155	R/W	Maximum Battery Temperature Compensation Voltage	([4155] / 10) Volts	Highest Charge Voltage is limited to this value when battery temp sensor installed
4156	R/W	Minimum Battery Temperature Compensation Voltage	([4155] / 10) Volts	Lowest Charge Voltage is limited to this value when battery temp sensor installed
4157	R/W	Battery Temp Comp Value for each 2V cell	-([4157] / 10) mV/degree C/cell (0.5 mV steps) 0 to 10 mV per 2V cell	Absolute value of the Temperature Compensation Value in mV/°C /2V cell
4158	R/W	Battery Type	[4158]	Type of Batteries. See Table 4158-1 (unimplemented as of May 2011)
4159	RESERVED			
4160 4161	W	Force Flag Bits	([4161] << 16) + [4160]	See Table 4160-1.

Address	R/W	Name	Conversion	Notes
4162	R/W	Equalize Time	[4162] Seconds	Initialize Time for Batteries to remain in Equalize Stage.
4163	R/W	Equalize Interval Days	[4163] Days	Number of days between Equalize Stages (Auto EQ)
4164	R/W	Mppt Mode (Solar, Wind, etc)	[4164] (bit 0 = On/Off)	Maximum Power Point Mode. See Table 4164-1.
4165	R/W	Aux 1 and 2 Function	[4165]	Combined Aux 1&2 Functions + On/Off. See Table 4208
4166	R/W	Aux1VoltsLoAbs	([4166] /10) Volts	Aux 1 Absolute Low Threshold Voltage
4167	R/W	Aux1DelayT	[4167] Milli Seconds	Aux 1 Delay time before Asserting.
4168	R/W	Aux1HoldT	[4168] Milli Seconds	Aux 1 Hold time before De-asserting.
4169	R/W	Aux2PwmVwidth	([4169] /10) Volts	Voltage range over which PWM operates.
4170	RESERVED			
4171				
4172	R/W	Aux1VoltsHiAbs	([4172] /10) Volts	Aux 1 Absolute High Voltage Threshold
4173	R/W	Aux2VoltsHiAbs	([4173] /10) Volts	Aux 2 Absolute High Voltage Threshold
4174	R/W	Aux1VoltsLoRel (Relative to charge stage set point V)	([4174] /10) Volts	Aux 1 Relative Lower Voltage Threshold (Charge Stage Rel)
4175	R/W	Aux1VoltsHiRel (Relative to charge stage set point V)	([4175] /10) Volts	Aux 1 Relative Upper Voltage Threshold (Charge Stage Rel)
4176	R/W	Aux2VoltsLoRel (Relative to charge stage set point V)	([4176] /10) Volts	Aux 2 Relative Lower Voltage Threshold (Charge Stage Rel)
4177	R/W	Aux2VoltsHiRel (Relative to charge stage set point V)	([4177] /10) Volts	Aux 2 Relative Upper Voltage Threshold (Charge Stage Rel)
4178	R/W	Aux1VoltsLoPv (absolute)	([4178] /10) Volts	Aux 1 Lower PV Voltage Threshold

Address	R/W	Name	Conversion	Notes
4179	R/W	Aux1VoltsHiPv (absolute)	([4179] /10) Volts	Aux 1 High PV Voltage Threshold
4180	RESERVED (Do NOT Write)			
4181	R/W	Aux2VoltsHiPv (absolute)	([4181] /10) Volts	Aux 2 High PV Voltage Threshold
4182	RESERVED (Do NOT Write)			
4183	R/W	ArcFaultSensvtvy	Time = [4183] Sense = [4183]	Arc Fault Protection sensitivity response adjustments
4184	RESERVED (Do NOT Write)			
4185				
4186				
4187	R/W	Enable Flags bits	[4187]	See Table 4187-1
4188	R/W	RESERVED	[4188]	RESERVED(Do NOT Write)
4189	R/W	Vbatt_Offset	([4189] /10)	Battery Voltage Offset Tweak (Range Limited) (Signed)
4190	R/W	Vpv_Offset	([4190] /10)	Input Voltage Offset Tweak (Range Limited) (Signed)
4191	R	VpvTargetRd	([4191] /10) Volts	Input Target (V regulation) Voltage (Usually Vmpp)
4192	RESERVED (Do NOT Write)			
4193				
4194				
4195				
4196				
4197	R/W	LgcySweepIntervalSecs	[4197] Seconds	Legacy P&O, Hydro, Solar, U-Set Sweep Interval, Seconds (Forcing Sweep resets timer)
4198	R/W	MinSwpVocPercentage	([4198] / 100) %	Minimum sweep as a percentage of V _{oc} (Unused)
4199	R/W	MaxSwpVocPercentage	([4199] / 100)%	Maximum sweep as a percentage of V _{oc} (Unused)
4200	R/W	SweepDepth	[4200] Watts %	Percent of last Mpp Watts

4201	RESERVED (Do NOT Write)			
Address	R/W	Name	Conversion	Notes
4202	R/W	ClipperCmdVolts	([4202] /10) Volts	Variable Voltage command to Clipper or Aux in Clipper mode
4203	R/W	WindNumberOfPoles	[4203] poles	Number of turbine alternator poles (for RPM Calc)
4204	R/W	MppPercentVoc	[4204] 00 to 100 %	% of Voc for U-Set mode
4205	R/W	WindTableToUse	[4205]	FUTURE power curve select
4206	R/W	WindTableLearn	[4206]	FUTURE Wind Learn usage
4207	R/W	LEDmode	[4207]	See Table 4207-1
4208 4209	RESERVED			
4210 4211 4212 4213	R/W	ID name	[4210] _{MSB} [4210] _{LSB} [4211] _{MSB} [4211] _{LSB} [4212] _{MSB} [4212] _{LSB} [4213] _{MSB} [4213] _{LSB} (End with 00 if less than 8 characters)	Unit Name. DHCP and MODBUS name. 8 character maximum ASCII. Takes place of MODBUS address in MNGP display if present (this needs some work)
4214 4215	W	CTIME0	([4215] << 16) + [4214] (possibly atomic op)	Consolidated Time Registers SEE Table 4214-1
4216 4217	W	CTIME1	([4217] << 16) + [4216] (possibly atomic op)	Consolidated Time Registers SEE Table 4216-1
4218	W	CTIME2	[4218]	Consolidated Time Registers SEE Table 4218-1
4219	R/W	BaudRateStopStartEtc	[4219] Baud rate, bps (Not implemented as of May 2011)	MODBUS Serial Baud rate. Note that writing this register will immediately change the target unit's serial baud rate which may result in communication problems with other units in the system including the unit's MNGP.
4220	R/W	RemoteMenuMode	[4220]	Present Remote Menu sent from MNGP
4221	R/W	RemoteButtons	[4221]	Remote Buttons pressed from MNGP
4222	R/W	VbatOvrshootSensvtvy	[4222]	Overshoot Sensitivity (<i>not implemented</i>)
4223	R/W	RESERVED	[4223]	RESERVED (Do NOT Write)

4224	R/W	PreVoc	([4224] /10) Volts	PV Terminal V before Relay
Address	R/W	Name	Conversion	Notes
4225	RESERVED (Do NOT Write)			
4226	R/W	VauxA2Dinput	[4226] TBD	Aux 2 A to D input (TBD)
4227	RESERVED (Do NOT Write)			
4228				
4229				
4230				
4231	R	VocRD	([4231] /10) Volts	Last V _{OC} reading
4232	RESERVED (Do NOT Write)			
4233				
4234				
4235				
4236	R/W	AbsorbTime	[4236] seconds	Absorb Time Counter (DUP!)
4237	R/W	AntiClickSensvtvy	[4237]	Best Left Alone
4238		SiestaTime	[4238] seconds	Sleep timer
4239		SiestaAbortVocAdj	([4239] / 10) Volts	Volts above last Voc reading to abort Siesta.
4240 4241	R	flagsRD	([4241] << 16) + [4240]	Internal Flags See Table 4240-1
4242	RESERVED (Do NOT Write)			
4243				
4244	R	VbattRegSetPTmpComp	([4244] / 10) Volts	Temperature compensated battery regulation target voltage
4245	R/W	VbattNominal	[4245] 12 * 1 thru 10 (120 Max for 250 KS)	Nominal Battery bank voltage (i.e. 12V, 24V, etc)
4246	R/W	EndingAmps	([4246] /10) Amps	Goes to Float below this Batt I
4247		EndingSoc		
4248		EndAmpSocMBaddress		
4249	R/W	RebulkVolts	([4249] /10) Volts	Rebulks if battery drops below this for > 90 Seconds

4250	R	BattMonVolts		
Address	R/W	Name	Conversion	Notes
4251	R	BattMonSOC		
4252	R	BattMonAmps		
4253	R	BattMonAHefficiency		
4254	RESERVED (Do NOT Write)			
4255				
4256				
4257	R/W	RebulkTimerSec	[4257] seconds	Rebulk interval timer. Cleared if Vbatt >= Rebulk V
4258 4259 4260 4261 4262 4263	RESERVED (Do NOT Write)			
4264 4265		Voc_Qualify_Timer_1ms	(([4265] << 16) + [4264]) msec	Timer (msec) qualifying time till turn on valid (not 2 useful)
4266	R	MinVpvTurnOn	([4266] / 10) Volts	Minimum Turn On Volts(Best Left Alone) Not too useful
4267 4268 4269 4270 4271	RESERVED (Do NOT Write)			
4272	R	RestartTimerms	[4271] Milli Seconds	Count Down Time until Wake Allowed
4273	R	Ibatt	([4272] /10) Amps	Battery Current, Unfiltered
4274 4275	RESERVED (Do NOT Write)			
4276	R	ReasonForResting	[4275] Reason number	Reason Classic went to Rest (See Table 4275-1)
4277	R	Output Vbatt	([4376] / 10) Volts	Battery Voltage Unfiltered

4278 4279	R	Input V _{pv}	([4377] / 10) Volts	PV Voltage Unfiltered
Address	R/W	Name	Conversion	Notes
4280		Typeint	([4279] << 16) + [4278]	TBD
4281	RESERVED (Do NOT Write)			
4282				
4283				

Table 4101-1 Device Type

Name	Value	Description
Classic150	150	Classic 150
Classic200	200	Classic 200
Classic250	250	Classic 250
Classic250 KS	251	Classic 250 with 120 V Battery bank capability (lower current than 250)

Table 4120-1 Battery Stage (UPPER Byte of mbComboChrgStge register)

Name	Value	Description
Resting	0	Off , No Power, Waiting for Power Source, Battery V over set point, etc.
Absorb	3	Regulating battery voltage at Equalize Set point
BulkMppt	4	Max Power Point Tracking until Absorb (Bulk Terminate) Voltage reached
Float	5	Battery is FULL and regulating battery voltage at Float Set point
FloatMppt	6	Max Power Point Tracking. Seeking Float set point Voltage
Equalize	7	Regulating battery voltage at Equalize Set point
HyperVoc	10	Input Voltage is above maximum Classic operating Voltage
EqMppt	18	Max Power Point Tracking. Seeking Equalize set point Voltage

Table 4120-2 Classic States (LOWER Byte of mbComboChrgStge register)

Name	Value	Description
Internal Resting state 0	0	
Internal state 1 through 6	1,2,3,4,5, 6,7	Internal state machine states

Table 4130-1 Info Flag Bits: READ ONLY

Flag	Value	Description
Classic Over Temperature	0x00000001	Classic Over Temperature if set
EEPROM error	0x00000002	Classic EEprom read/write found an error if set
RESERVED	0x00000004	RESERVED
Equalize In Progress	0x00000008	Equalize Charge stage Active if set
RESERVED	0x00000010	RESERVED
RESERVED	0x00000020	RESERVED
RESERVED	0x00000040	RESERVED
EQ MPPT	0x00000080	Battery V is less than EQ Voltage (EQ MPPT)
In V is Lower Than Out	0x00000100	Input Voltage (PV) is lower than Vbatt if set
Current Limit	0x00000200	User current limit or internal temperature current limit reached
HyperVoc	0x00000400	Hyper Voc PV input is between Vmax and Vmax+Vbatt
RESERVED	0x00000800	RESERVED
RESERVED	0x00001000	RESERVED
Battery Temp Sensor Installed	0x00002000	Battery temperature sensor installed if set
Aux1 State On	0x00004000	Aux 1 ON (aux 1 connector has V or relay closed)
Aux2 State On	0x00008000	Aux 2 ON (aux 2 connector has V present)
GroundFaultF	0x00010000	Ground Fault detected if set
DefCon4ErrF	0x00020000	FET Drive Error if set (lower priority than DefCon3)
ArcFaultF	0x00040000	Arc Fault occurred if set
NegBatCurrentF	0x00080000	Negative battery current if set
DefCon3ErrF	0x00100000	FET error (higher priority and DefCon 4)
XtraInfo2DsplayF	0x00200000	Extra info is available to display (Shading, etc)
PvPartialShadeF	0x00400000	Partial Shade detected during SOLAR sweep
WatchdogResetF	0x00800000	watchdog reset flag indicator (for debugging)
LowBatteryVF	0x01000000	VERY low battery) Vbatt is lower than 8.0 Volts
StackumperF	0x02000000	Stack Jumper is NOT installed if set
EqDoneF	0x04000000	EQ Finished. Resets when mode changed or new day
TempCompShortedF	0x08000000	Indication of shorted Temp Comp if set (all fans should come on if this is true)
LockJumperF	0x10000000	Lock Jumper is NOT installed if set
XtraJumperF	0x20000000	Extra Jumper is NOT installed if set

Table 4158-1 Battery Type (not used yet as of May 2011)

Name	Value	Description
Flooded	1	Lead Acid (Flooded)
Gel	2	Lead Acid (Gel)
AGM	3	Lead Acid (AGM)
AGM2	4	Lead Acid (AGM2)
Lithium	5	Lilon
Nicad	6	Nickel Cadmium
VRLA	7	AGM or AGM or AGM2 actually
AbsolytelIP	8	TBD
User1	9	TBD

Table 4160-1 ForceFlagsBits (can write to low or high 16 bits independently if wanted)

Name	Value	Description
RESERVED	0x00000001	RESERVED (Do NOT Set to 1)
ForceRstDailyKwHrsF	0x00000002	Reset Daily kWh count
ForceEEPromUpdateWriteF	0x00000004	Write all current settings to internal EEPROM
ForceEEPromInitReadF	0x00000008	Reset all values to EEPROM defaults (MAY not work yet)
ForceResetInfoFlags	0x00000010	Force ALL Info Flags to zero when set to 1 (Will reset info flags to 0) (or course some may pop back to 1 after resetting if applicable)
ForceFloatF	0x00000020	Force battery charge stage to Float
ForceBulkF	0x00000040	Force new Bulk/Absorb charge stage
ForceEqualizeF	0x00000080	Force new Equalize stage
ForceNiteF	0x00000100	Force a new night time
Force25HrDayF	0x00000200	Otherwise it's a 24 Hour day
ForcePandOsweepF	0x00000400	Force a Mini-Sweep for Legacy P&O mode
ForceSweepF	0x00000800	Force a Sweep (at least for U-Set)
RESERVED	0x00001000	RESERVED (Do NOT Set to 1)
ForceGetTimeF	0x00002000	Set time from MNGP Remote Modbus (CTIME)
RESERVED	0x00004000	RESERVED (Do NOT Set to 1)
RESERVED	0x00008000	RESERVED (Do NOT Set to 1)
RESERVED	0x00010000	RESERVED (Do NOT Set to 1)
RESERVED	0x00020000	RESERVED (Do NOT Set to 1)
RESERVED	0x00040000	RESERVED (Do NOT Set to 1)
RESERVED	0x00080000	RESERVED (Do NOT Set to 1)
RESERVED	0x00100000	RESERVED (Do NOT Set to 1)
RESERVED	0x00200000	RESERVED (Do NOT Set to 1)
RESERVED	0x00400000	RESERVED (Do NOT Set to 1)
ForceResetFaultsF	0x00800000	Just reset all of the faults
RESERVED	0x01000000	RESERVED (Do NOT Set to 1)

Table 4164-1 MPPT MODE†

	Value	Description
PV_Uset	0x0001	U-SET MPPT MODE (includes MPPT ENABLED (On) FLAG i.e. if 0x0000 MPPT mode is OFF)
DYNAMIC	0x0003	Slow Dynamic Solar Tracking (old Solar 1 O & P)
Legacy P&O	0x0009	Legacy P & O sweep mode
SOLAR	0x000B	Fast SOLAR track (old PV Learn mode)
MICRO HYDRO	0x000D	Micro Hydro mode (similar to Legacy P&O)
WIND TRACK	0x0005	Wind Track Mode
WIND LEARN (future mode)	0x0007	Wind Learn Mode (not implemented as of May 2011)
PV COMBO 1	0x000F	PV COMBO 1
RESERVED	0x0011	RESERVED
BOOST CHRГ	0x0013	Boost Charge Mode (Lower to Higher Voltage, Unimplemented as of May 2011)

†Bit 0 is the ON/OFF (Enable/Disable) Table shows modes as ON

NOTE: MPPT MODE will automatically revert to OFF during mode change

Table 4207-1 LED Mode

Name	Value	Description
All Off	0	No LED activity except on startup
Rick Mode	1	Minimal Activity: Remote Yellow LED indicates Current Limiting or FET Temperature Limit.
Blinky	2	All LEDs Active: Lightshow! MNGP Red LED : MNGP->Classic MODBUS active
LED 1	3	Status Mode: MNGP Green LED = Battery Full (Float) Classic Red LED = Aux 1 Active. Classic Yellow LED = Aux 2 Active Classic Blue LED = Unimplemented
LED 2	4	Unimplemented
LED 3	5	Unimplemented

Table 4240-1 Internal Flags bits (Read Only) (flagsRD)

Name	Value	Description
RESERVED	0x00000001	RESERVED
RESERVED	0x00000002	RESERVED
RESERVED	0x00000004	RESERVED
RESERVED	0x00000008	RESERVED
RESERVED	0x00000010	RESERVED
RESERVED	0x00000020	RESERVED
RESERVED	0x00000040	RESERVED
AbsorbTimeRunf	0x00000080	Bulk/Absorb Timer Counting is Enabled
EqTimeRunf	0x00000100	EQualize Timer Run flag
FloatTimeRunf	0x00000200	Float Time accumulate flag
kWhAccumRunf	0x00000400	kiloWatt-hour & Amp-Hour accumulate enabled
RESERVED	0x00000800	RESERVED
AbsorbCountUpf	0x00001000	Absorb Timer is counting UP if set
OK2WriteIVtables	0x00004000	OK to write WindPowerTableV[] & I[]
WindLowflag	0x00008000	Indicates that we turned off because of low power
SweepDwnEnabledf	0x00010000	Slowly Sweeping Down V input
LowLightflag	0x00020000	State 2 detected low light (May not be accurate)
RESERVED	0x00040000	RESERVED
RESERVED	0x00080000	RESERVED
RESERVED	0x00100000	RESERVED
SweepUpEnabledf	0x00200000	Slowly Sweeping UP V input
RESERVED	0x00400000	RESERVED
RESERVED	0x00800000	RESERVED
RESERVED	0x01000000	RESERVED
BattFull	0x02000000	Battery Full, Absorb complete, Float
RESERVED	0x04000000	RESERVED
EqCountUpf	0x08000000	EQ Timer is counting Up
RESERVED	0x10000000	RESERVED
RESERVED	0x20000000	RESERVED
RESERVED	0x40000000	RESERVED
RESERVED	0x80000000	RESERVED

AUX 1 and 2 modes

Extracted and encoded as combined in Aux12Function

Table 4165-1 AUX 1 Off – Auto – On (Extracted/Encoded as Aux12Function bits 6,7)

Name	Value	Description
Aux 1 Off	0	Aux 1 output is OFF (0 Volts)
Aux 1 Auto	1	Aux 1 operates as defined in Aux2Funtion
Aux 1 On	2	Aux 1 output is ON (~14 Volts)
Aux 1 Unimplemented	3	Unassigned at present

Aux1OffAutoOn = (((Aux12Function & 0xc0) >> 6));

Table 4165-2 AUX 2 Off – Auto – On (Extracted/Encoded as Aux12Function bits 14,15)

Name	Value	Description
Aux 2 Off	0	Aux 2 output is OFF (0 Volts)
Aux 2 Auto	1	Aux 2 operates as defined in Aux2Funtion
Aux 2 On	2	Aux 2 output is ON (~14 Volts)
Aux 2 Unimplemented	3	Unassigned at present

Aux2OffAutoOn = ((Aux12FunctionS & 0xc000) >> 14);

Table 4165-3 AUX 1 Function (Extracted/Encoded as Aux12Function bits 0-5)

Name	Value	Description
DIVERSION SLW+	1	Non-PWM On at Vbatt > Aux1VoltsHiAbs Off at Vbatt < Aux1VoltsLoAbs (Active High)
DIVERSION SLW-	2	Same as DIVERSION SLW+ but Active Low
BAT DIV V REL+	3	Non-PWM On at Vbatt > Aux1VoltsHiAbs Off at Vbatt < Aux1VoltsLoAbs (Active High)
BAT DIV V REL-	4	Non-PWM On at Vbatt > Aux1VoltsHiAbs Off at Vbatt < Aux1VoltsLoAbs (Active Low)
PV V TRIGGER +	7	Active High output if Vin exceeds Aux1VoltsHiPv
PV V TRIGGER -	8	Active Low output if Vin exceeds Aux1VoltsHiPv
MANUAL ON-OFF	9	MANUAL On/Off allowed using Off-Auto-On Selection
TOGGLE TEST	13	Out Once per second On-Off-On-Off automatic toggle
NITE LITE HIGH	14	Active High indicating Night Time. Inactive at Wakeup
NITE LITE LOW	15	Active Low indicating Night Time. Inactive at Wakeup
WIND CLIPPER	16	Output goes Active High when V input is above PV input V plus headroom voltage

Aux1Function = Aux12Function & 0x3f;

Table 4165-4 AUX 2 Function *(Extracted/Encoded as Aux12Function bits 8-13)*

Name	Value	Description
DIVERT DGTL F+	0	Digital Out PWM Battery Diversion (Active High)
DIVERT DGTL F-	1	Digital Out PWM Battery Diversion (Active Low)
BAT DIV V REL+	2	Digital Out PWM Relative to Charge Stage Voltage Threshold Diversion (Use It Or Lose It) (Active High)
BAT DIV V REL-	3	Digital Out PWM Relative to Charge Stage Voltage Threshold Diversion (Use It Or Lose It) (Active Low)
TOGGLE TEST	6	Out Once per second On-Off-On-Off automatic toggle
PV IN TRIG +	7	Active High output if Vin exceeds Aux2VoltsHiPv
PV IN TRIG -	8	Active Low output if Vin exceeds Aux2VoltsHiPv
MANUAL ON-OFF	9	MANUAL On/Off allowed using Off-Auto-On Selection
WIND CLIPPER	10	PWM output Active High when V input is above PV input V plus headroom voltage
NITE LITE HIGH	11	Active High indicating Night Time. Inactive at Wakeup
NITE LITE LOW	12	Active Low indicating Night Time. Inactive at Wakeup

Aux2Function = (Aux12FunctionS & 0x3f00) >> 8; (Digital/Analog Input/Output)

Table 4187-1 EnableFlags bits [4187]

Name	Value	Description
GroundFaultEn	0x0001	Ground Fault Protection Enabled when Set to 1
ArcFaultEn	0x0002	Arc Fault Protection Enabled when Set to 1
RESERVED	0x0004	RESERVED (Do NOT set this bit)
PvPartialShadeEn	0x0008	Partial Shade reporting Enabled when Set to 1
RESERVED	0x0010	RESERVED (Do NOT set this bit)
DefCon3ErrEn	0x0020	DefCon3 Error reporting enabled if set to 1
DefCon4ErrEn	0x0040	DefCon3 Error reporting enabled if set to 1
PwmLowMaxFlag	0x0080	Low Max Enabled if Set to 1 (Low Vin - Vout)
RESERVED	0x0100	RESERVED (Do NOT Set to 1)
RESERVED	0x0200	RESERVED (Do NOT Set to 1)
BumpWindI	0x0400	When adjusting wind curve, automatically “bumps” adjacent current set points out of the way if set to 1
DivrsnAbsEqTmrEn	0x0800	Enables Absorb & EQ timer counting when Aux functions are diverting if set to 1.
RESERVED	0x1000	RESERVED (Do NOT Set to 1)
RESERVED	0x4000	RESERVED (Do NOT Set to 1)
RESERVED	0x8000	RESERVED (Do NOT Set to 1)

Table 4214-1 Consolidated Time Registers 0 (write only to set Classic Time -- Normally, MNGP will set these registers from its battery backed RTC)

Name	Value	Description
BITS 5:0	0 to 59	Seconds Seconds value in the range of 0 to 59
BITS 5:0	RESERVED	RESERVED (Do NOT write ones to these bits)
BITS 13:8	0 to 59	Minutes value in the range of 0 to 59
BITS 15:14	RESERVED	RESERVED (Do NOT write ones to these bits)
BITS 20:16	0 to 23	Hours value in the range of 0 to 23
BITS 23:21	RESERVED	RESERVED (Do NOT write ones to these bits)
BITS 36:24	0 to 6	Day Of Week Day of week value in the range of 0 to 6
BITS 31:27	RESERVED	RESERVED (Do NOT write ones to these bits)

Table 4216-1 Consolidated Time Registers 1 (write only to set Classic Time -- Normally, MNGP will set these registers from its battery backed RTC)

Name	Value	Description
BITS 4:0	1 to 28, 29, 30, 31	Day of month value in the range of 1 to 28, 29, 30, or 31(dependent on the month and whether it is a leap year)
BITS 7:5	RESERVED	RESERVED (Do NOT write ones to these bits)
BITS 11:8	1 to 12	Month value in the range of 1 to 12
BITS 15:12	RESERVED	RESERVED (Do NOT write ones to these bits)
BITS 27:16	0 to 4095	Year value in the range of 0 to 4095
BITS 31:28	RESERVED	RESERVED (Do NOT write ones to these bits)

Table 4218-1 Consolidated Time Register 2 (write only to set Classic Time -- Normally, MNGP will set these registers from its battery backed RTC)

Name	Value	Description
BITS 11:0	1 to 366 *	Day of year value in the range of 1 to 365 * (366 for leap years)
BITS 31:12	RESERVED	RESERVED (Do NOT write ones to these bits)

Table 4275-1 Reason For Resting

VALUE	REASON FOR RESTING
1	Anti-Click. Not enough power available (Wake Up)
2	Insane Ibatt Measurement (Wake Up)
3	Negative Current (load on PV input ?) (Wake Up)
4	PV Input Voltage lower than Battery V (Vreg state)
5	Too low of power out and Vbatt below set point for > 90 seconds
6	FET temperature too high (<i>always</i> shows up on boot up) (Cover is on maybe ?)
7	Ground Fault Detected
8	Arc Fault Detected
9	Too much negative current while operating
10	Battery is less than 8.0 Volts
11	PV input is available but V is rising too slowly. Low Light or bad connection
12	Voc has gone down from last Voc or low light. Re-check
13	Voc has gone up from last Voc enough to be suspicious. Re-check
14	Same as 11
15	Same as 12
16	Mppt MODE is OFF (Usually because user turned it off)
17	PV input is higher than operation range (too high for 150V Classic)
18	PV input is higher than operation range (too high for 200V Classic)
19	PV input is higher than operation range (too high for 250V or 250KS)
25	Battery Voltage too high of Overshoot (small battery or bad cable ?)

The network registers are all Read/Write. You may write any values to these registers, however this may result in erratic operation in some instances.

To set A static IP address, be sure to clear the DHCP bit in register 20481 before writing the static values to the

Network			
Address	Name	Units	Description
20481	IP Settings	[20481]	Network Settings Flags. See Table 20481-1
20482 20483	IP Address	[20483] _{MSB} . [20483] _{LSB} . [20482] _{MSB} . [20482] _{LSB}	The IP address of the Classic [†]
20484 20485	Gateway Address	[20485] _{MSB} . [20485] _{LSB} . [20484] _{MSB} . [20484] _{LSB}	Network Gateway Address. [†]
20486 20487	Subnet	[20487] _{MSB} . [20487] _{LSB} . [20486] _{MSB} . [20486] _{LSB}	Network Subnet Mask [†]
20488 20489	DNS_1	[20489] _{MSB} . [20489] _{LSB} . [20488] _{MSB} . [20488] _{LSB}	Primary DNS Address [†]
20490 20491	DNS_2	[20491] _{MSB} . [20491] _{LSB} . [20490] _{MSB} . [20490] _{LSB}	Secondary/Alternate DNS Address [†]
[†] Read Only if the DHCP flag is set. To assign a static IP to the Classic, first clear the DHCP flag in the IP Settings Register (20481).			

Table 20481-1

Name	Value	Description
DHCP	0x0001	Set this bit to enable DHCP.
Web Access	0x0002	Set this bit to enable online access to your Classic through http://www.mymidnite.com

The Version Registers are all Read Only. Writes to any of these registers will have no long-term effect.

Version			
Address	Name	units	Description
16385	app_version	Major: [16385](15...12) Minor: [16385](11...8) Release: [16385](8..4)	Release version of the application code
16386	net_version,	Major: [16386](15...12) Minor: [16386](11...8) Release: [16386](8...4)	Release version of the communications stack
16387 16388	app_rev	([16388] << 16) + [16387]	Build Revision of the application code
16389 16390	net_rev	([16390] << 16) + [16389]	Build Revision of the communications code stack

Communication Statistics are all Read/Write registers. You may write any value to these registers which will be incremented should the trigger for that counter occur. The most useful type of write may be to periodically reset the counters to zero. These are all lifetime counters and due to the number of MODBUS transactions may overflow to 0.

Communication Statistics			
Address	Name	units	Description
Master / In Bus Interface			
10001 10002	rx_ok	(([10002] << 16) + [10001])	Number of correctly received packets
10003 10004	rx_crc_err	(([10004] << 16) + [10003])	Number of packets received with crc errors
10005 10006	requested_ok	(([10006] << 16) + [10005])	Number of transactions originating from this unit that completed successfully
10007 10008	requested_err	(([10008] << 16) + [10007])	Number of transactions originating from this unit that failed
10009 10010	forwarded	(([10010] << 16) + [10009])	Number of packets forwarded through this interface
10011 10012	broadcast	(([10012] << 16) + [10011])	Number of broadcast packets received
10013 10014	dropped_busy	(([10014] << 16) + (10013))	Number of packets dropped due to the interface being busy.
10015 10016	RESERVED		
Slave / Out bus interface			
10017 10018	rx_ok	(([10018] << 16) + [10007])	Number of correctly received packets
10019 10020	rx_crc_err	(([10020] << 16) + [10020])	Number of packets received with crc errors
10021 10022	requested_ok	(([10022] << 16) + [10021])	Number of transactions originating from this unit that completed successfully
10023 10024	requested_err	(([10024] << 16) + [10023])	Number of transactions originating from this unit that failed
10025 10026	forwarded	(([10026] << 16) + [10025])	Number of packets forwarded through this interface
10027 10028	broadcast	(([10028] << 16) + [10027])	Number of broadcast packets received
10029 10030	dropped_busy	(([10030] << 16) + [10029])	Number of packets dropped due to the interface being busy.
10031 10032	RESERVED		

Communication Statistics			
Remote bus interface			
10033 10034	rx_ok	(([10034] << 16) + [10033])	Number of correctly received packets
10035 10036	rx_crc_err	(([10036] << 16) + [10035])	Number of packets received with crc errors
10037 10038	requested_ok	(([10038] << 16) + [10037])	Number of transactions originating from this unit that completed successfully
10039 10040	requested_err	(([10040] << 16) + [10039])	Number of transactions originating from this unit that failed
10041 10042	forwarded	(([10042] << 16) + [10041])	Number of packets forwarded through this interface
10043 10044	broadcast	(([10044] << 16) + [10043])	Number of broadcast packets received
10045 10046	dropped_busy	(([10046] << 16) + [10045])	Number of packets dropped due to the interface being busy.
10047 10048	RESERVED		
TCP bus interface			
10049 10050	rx_ok	(([10050] << 16) + [10049])	Number of correctly received packets
10051 10052	rx_crc_err	(([10052] << 16) + [10051])	Number of packets received with crc errors
10053 10054	requested_ok	(([10054] << 16) + [10053])	Number of transactions originating from this unit that completed successfully
10055 10056	requested_err	(([10056] << 16) + [10055])	Number of transactions originating from this unit that failed
10057 10058	forwarded	(([10058] << 16) + [10057])	Number of packets forwarded through this interface
10059 10060	broadcast	(([10060] << 16) + [10059])	Number of broadcast packets received
10061 10062	dropped_busy	(([10062] << 16) + [10061])	Number of packets dropped due to the interface being busy.
10063 10064	RESERVED		

Reserved			
Address	Name	units	Description
61441-61442	Reserved		Reserved

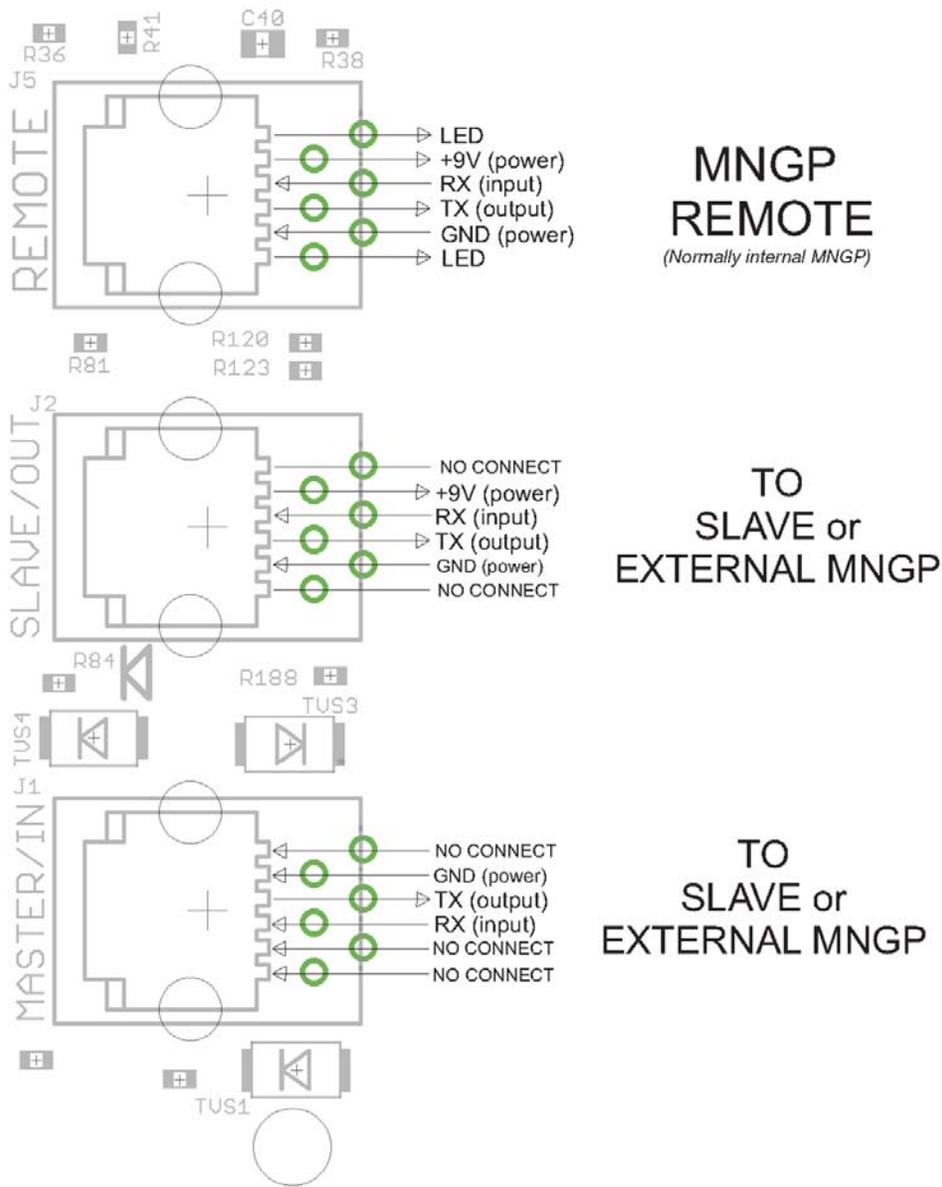


Figure 1. Classic RS-232 MODBUS RJ-11 PHONE JACK PINOUTS (Top View)

Dealer Information Screen

For dealers' convenience the Classic has a display screen that can be modified to publicize the dealers' business information. This is helpful because the customer will know who to contact in case they want to report any problems regarding the product. This will also help to promote retailers' accessories that are compatible with the Classic. This screen is capable of 20 characters per row and four rows, for a total of 80 modifiable characters.

To modify this display screen, follow these steps:

- ◆ Press main menu
- ◆ Scroll to MISC and select it
- ◆ On the following screen, select MNGP and press enter
- ◆ On this screen select LOAD DEFAULTS press enter
- ◆ On the password select 365 and press enter
- ◆ Using the up and down keys will allow you to change the alphabet characters
- ◆ Now scroll left and right to go to the next character block
- ◆ Do this until your desired message is complete
- ◆ Press enter to save on the classic memory

Positive Ground systems

When installing the Classic in a positive ground systems there are a few extra steps that need to be taken. The Ground fault jumper needs to be removed, and ground fault needs to be disabled in the menu. Refer to page 19 for instructions on doing this.

The overcurrent protection needs to be done a little different as well. The input and output breakers need to be double poles. Battery negative and positive conductor both need to be protected. Refer to *Classic Breaker Sizing*. Table 6.1

IMPORTANT: Do not connect both, positive battery and positive PV input to ground. One or the other positive (normally battery +) but not both otherwise the Classic input and output will be shorted.

HyperVOC™

HyperVOC is a unique feature the Classic has built in. HyperVOC refers to; when the DC Input Voltage raises above the maximum operating voltage (150V, 200V, 250V, depending on the Classic model). HyperVOC gives you the flexibility to go up to the maximum operating voltage PLUS the nominal battery voltage. For example, the Classic 150 has an input voltage rating of 150 operating volts, if the Classic 150 is connected to a 48 volt battery bank, the HyperVOC voltage limit will be: 150V + 48V a total of 198 Volts that the Classic can withstand without breaking. When the Classic input voltage rises above 150 volts it will switch off (stop outputting power). As long as the Classic is in HyperVOC mode, the microprocessor and all other functions like AUX will continue running. When the input voltage comes back down below 150v (or the rated operating voltage of the Classic, depending on model) the Classic will wake up and start charging again automatically. This could happen in a really cold morning with a system that has a Voltage Open Circuit (VOC) close to the maximum operating input voltage.

Note 1. A **HyperVOC** message will be displayed on the bottom right side of the Status screen.

Note 2. Max nominal battery voltage to be added is 48v

HyperVOC™ Origins

HyperVOC can be useful in overcoming an industry shortcoming in charging 48 volt battery's with standard panels. For example let's take a sample system with Solar World 165's that have a VOC of 44.1vdc. The industry has limited us to 2 of these panels in series making it hard to charge a 48vdc battery on hot summer days. With the Classic we designed in Hyper VOC to allow you to run 3 of these in series. 3 panels at 44.1vdc will give you a total VOC of 132.3vdc. When temperature compensated for cold climates to 125% gives you 165vdc. This is above the maximum safe limits for most controllers but falls well into the Hyper VOC range of the Classic. We do have to use Hyper VOC wisely though if we abuse it the Controller will never wake up in colder weather.

Troubleshooting

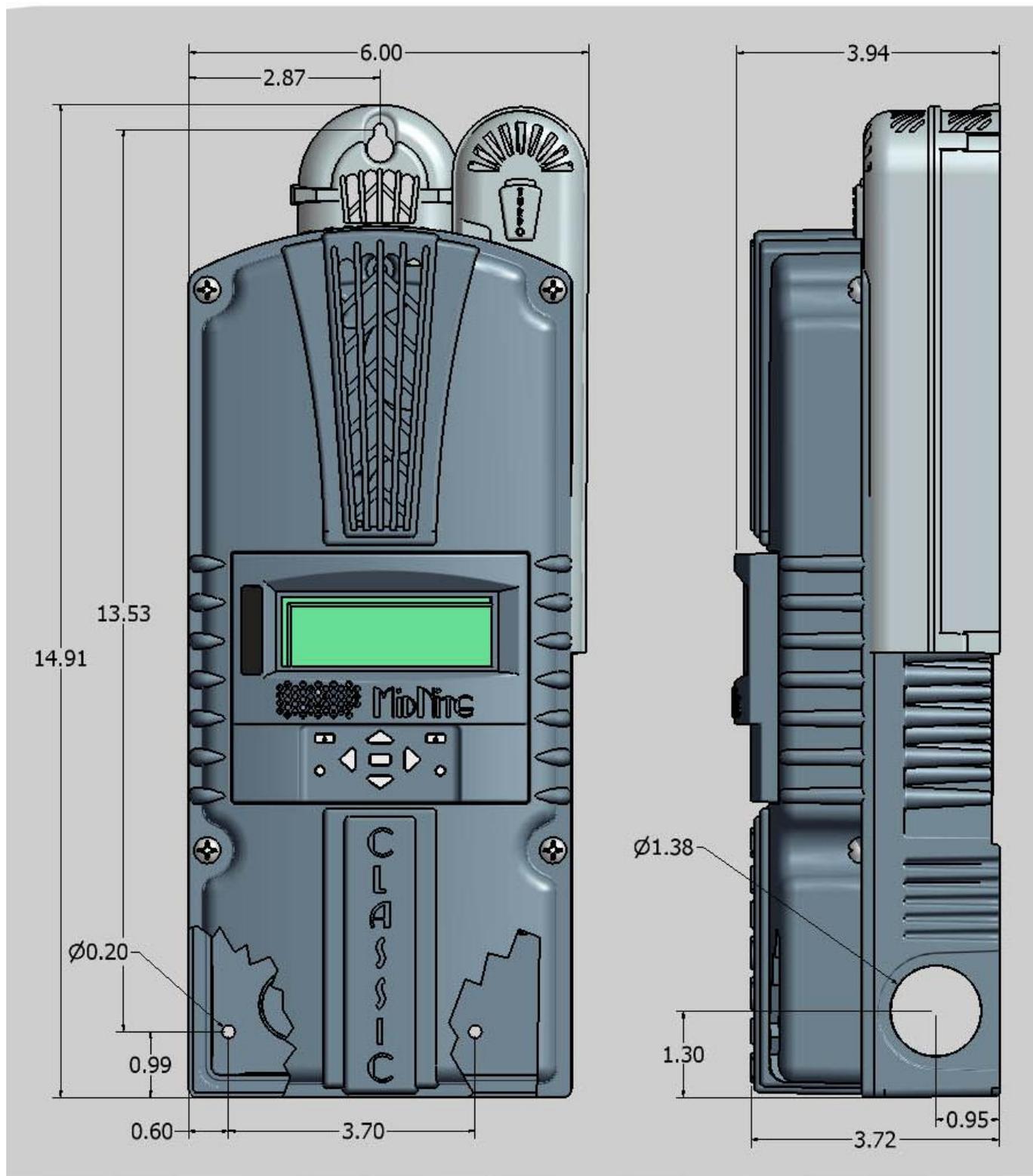
Technical information

Specifications Electrical

Table 6.1

Model	Classic150	Classic200	Classic250	Classic250KS
Operating Volts in	150VDC	200VDC	250VDC	250VDC
Max Hyper VOC	150+battery	200+battery	250+battery	250+battery
*Battery Charge Volts	12-93 volts	12-93 volts	12-93 volts	12-150 volts
**Absolute Current Output at 25°C	96a at 12v battery 94a at 24v battery 83a at 48v battery	74a at 12v battery 70a at 24v battery 65a at 48v battery	60a at 12v battery 62a at 24v battery 55a at 48v battery	40a at 120v battery
De-rate current at 40°C+	80 amperes	66 amperes	52 amperes	33 amperes
Environment	-40c to 40c			
Dimensions of Classic	14.87"X 5.95"X 4.00"		378mm X 151mm X 102mm	
Dimensions of Box	19.00"X 8.50"X 5.70"		483mm X 216mm xX145mm	
Shipping Weight	11.5 lb		4.9 kg	
NOTE: Current output ratings were measured with 75% of the PV array's VOC (Open Circuit Voltage)				
*NOTE: Calculated by adding battery voltage to the maximum input operating voltage (48V battery max)				
**NOTE: Measurement Accuracies: +- 0.12v, offset calibration adjustment maybe necessary				

Specifications Mechanical



Default Battery charge set points

The table below describes the default preset voltages for the different nominal battery voltages. This means that if you set the Classic from the QUICK SET Menu (see page 25) to a different battery voltage the Classic will take the default voltage set points. Note. If you manually adjust the absorb float or equalize voltage set point, and then nominal battery voltage is changed to a different nominal voltage, (e.g. from 24v to 12v or to 48v etc.) manually adjustments may be required. See page 6 for further information

Table 6.2

Battery Voltage	12v	24v	36v	48v	60v	72v
Bulk MPPT	14.3v	28.6v	42.9v	57.2v	71.5v	85.8v
Float	13.6v	27.2v	40.8v	54.4v	68.0v	81.6v
Equalize	14.3	28.6v	42.9v	57.2v	71.5v	85.8v

To adjust these voltage set point see page 25 of this manual.

Optional accessories

Optional accessories for the Classic include:

Blank display for multiple Classic installations
MidNite network cables various Lengths.

Regulatory Approval

The MidNite Solar Classic charge controller conforms to *UL 1741, Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, Second Edition, May 7, 1999 with revisions through January 28, 2010 and CAN/CSA C22.2 No. 107.1: 2001/09/01 Ed: 3 (R2006)*



Warranty

MidNite Solar's Classic comes with a standard 5 year warranty we will repair or replace the Classic at no charge to the consumer during this 5 year period

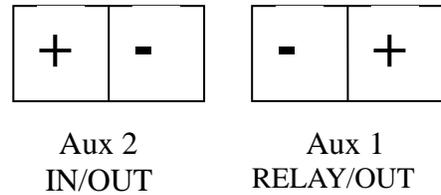
End of Warranty tune up

MidNite Solar offers a industry first Tune up / Extended Warranty. 6 months prior to the end of the warranty period Customers can ship their Classic back to MidNite Solar with a check for \$125 dollars and we will replace any wearable items like the fans and the capacitors and in general tune the Classic up. This will also extend the warranty by 2 additional years as well.

Aux 1 and Aux 2 Graphs/Jumpers

Figure 3.0

Figure 3.0 shows the two Aux port terminals, with their respective polarities. These terminals are located at the bottom of the power board below the battery temperature jack. Use a mini flat head screw driver to tighten the screws. The jumpers are described in the section below.



In order to select operation of Aux 1 between relay contact or 12v output JP6 and JP8 need to be configured accordingly following the instructions provided in this section.

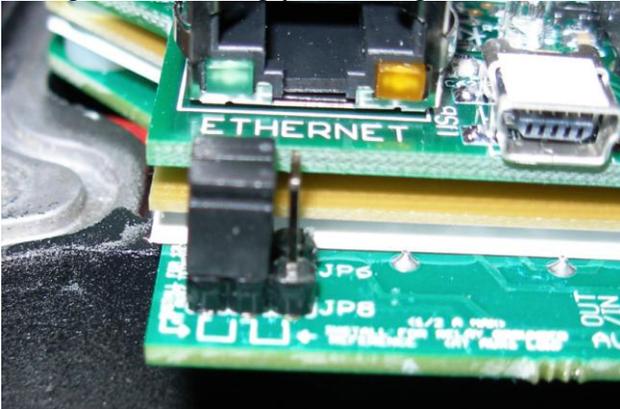


Figure 3.1
JP6 and JP8 positioned to supply 12v out of the Aux 1 terminals

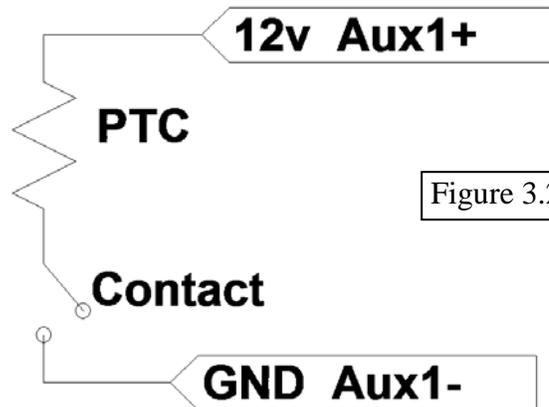


Figure 3.2

When Aux 1 is used to supply 12v out, JP6 and JP8 have to be in the position shown in Figure 3.1. The basic schematic of how this works is shown in Figure 3.2. The 12v out is more like 14.5v. The maximum current from Aux 1 should not exceed 200mA. The Aux 1 output can be set to operate at either Active High (12V) or Active Low (0V) when the Aux 1 function condition is true. For more information see Table 2.1, page 31.

Figure 3.3

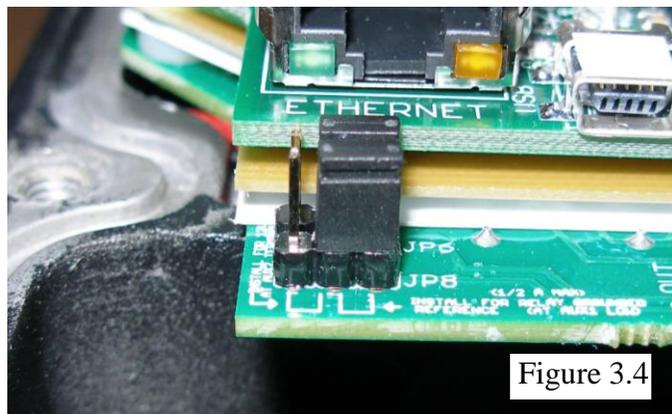
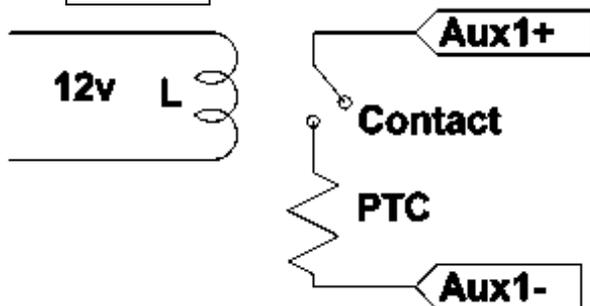


Figure 3.4

To configure Aux 1 to use the internal relay, JP6 and JP8 have to be in the position shown in Figure 3.4. This configuration is commonly known as “dry contact” because it does not provide 12v at the Aux1 terminals; it acts more like an isolated switch (to the ratings of the relay). The Aux 1 output can be set to operate at either normally open, (Active High) or normally closed (Active Low) when the Aux 1 function condition is true. For more information see Table 2.1, page 31. This is ideal for an Auto Gen Start.

Aux 1 Voltage-Time Relation (Relay/12v)

Aux 1 Function Graph shows the relationship between voltage and time of AUX 1. (The axis labeled VOLTAGE could be battery, PV, wind input voltage, etc. depending on the function selected by the user) VHIGH is the upper voltage limit, as soon as the voltage reaches this limit the Delay time will then start, as soon as the Delay time expires AUX1 will change state and stay there until the voltage drops below VLOW set point, then another timer called Hold Time will start and when this expires the out put will go back to the original state.

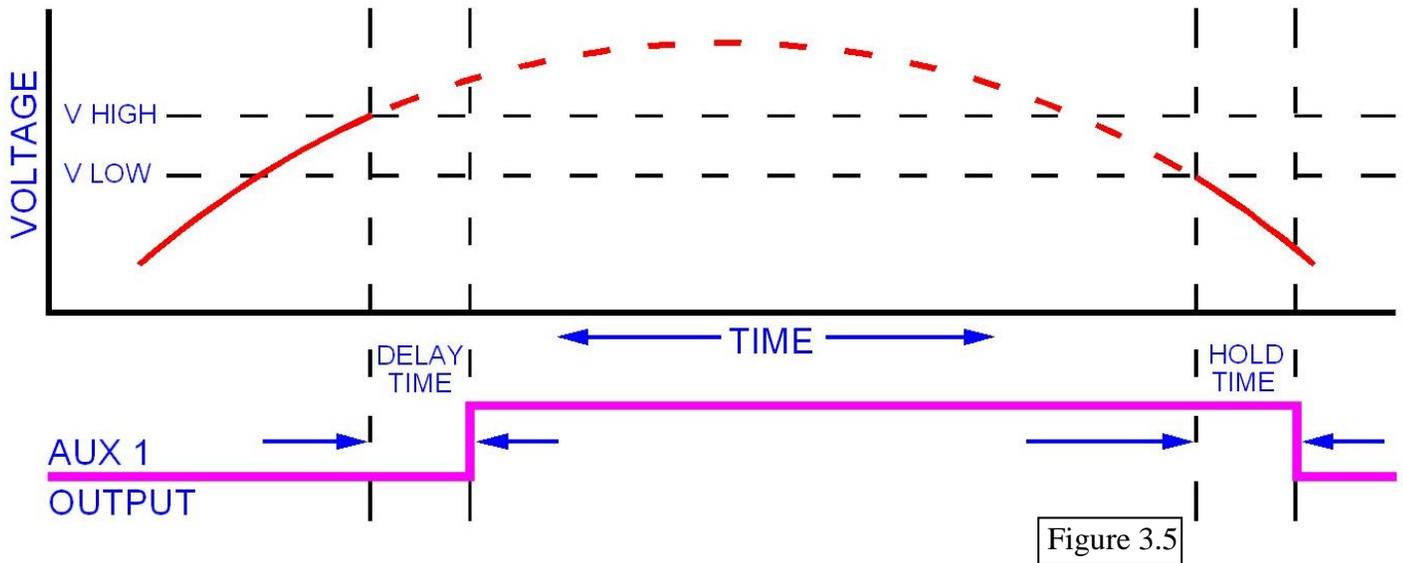


Figure 3.5

Aux 2 Voltage-Time Relation (PWM)

The graph below describes the relation in Aux 2, between voltage and time. The difference in Aux 2 is the use of PWM running at a hundreds of Hz rate and is suitable for use with Solid State Relays (SSRs). The way this works is: user sets a desired threshold and a width voltage, this means that at the desired voltage (VOLTS), the aux will start to PWM and it has to go above or below the width to completely change states (from 0v to 12v, or from 12v to 0v depending on the user selection, active high or active low). This gives a much smoother transition. For more information see; *Configuring Auxiliary Input/Output*. Page 29

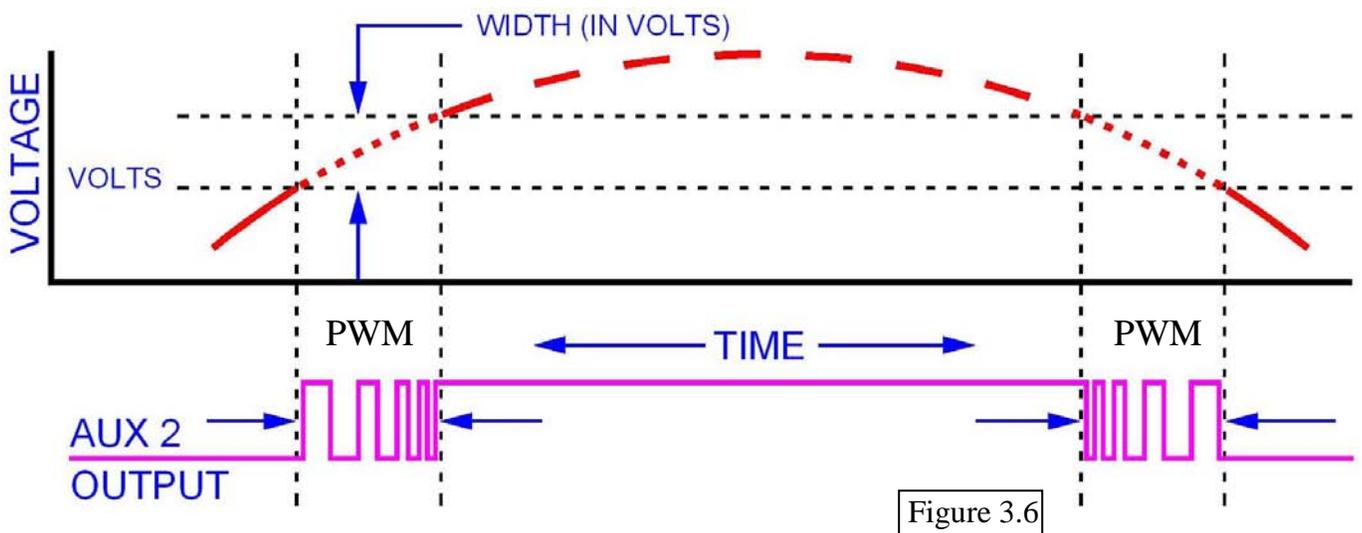


Figure 3.6

Table 6.1

Classic Breaker sizing

Model	Bat V	MPPT V (not VOC)	In/Out ratio	Max output A	Output brkr 150VDC	Wire size 310-17*	Max input A	Input breaker/wire with 125% factor**
Classic 150	12	70	5.83	96	100	4AWG	16.46	30A /10AWG - 63A /6AWG 150V
Classic 150	24	70	2.92	94	100	4AWG	32.19	50A/8AWG - 63A/ 6AWG 150V
Classic 150	48	70	1.45	86	90-100	4AWG	59.31	80A/4AWG 150V
Classic 150	12	90	7.5	96	100	4AWG	12.8	30A /10AWG - 63A /6AWG 150V
Classic 150	24	90	3.75	94	100	4AWG	25.06	50A/8AWG - 63A/ 6AWG 150V
Classic 150	48	90	1.87	83	90-100	4AWG	44.38	63A 150V
Classic 150	12	100	8.33	92	100	4AWG	11.04	30A /10AWG - 63A /6AWG 150V
Classic 150	24	100	4.16	91	100	4AWG	21.87	30A /10AWG - 63A /6AWG 150V
Classic 150	48	100	2.08	80	80-90	4AWG	38.46	50A/8AWG - 63A/ 6AWG 150V
Classic 150	12	110	9.16	93	100	4AWG	10.15	30A /10AWG - 63A /6AWG 150V
Classic 150	24	110	4.58	84	90-100	4AWG	18.34	30A /10AWG - 63A /6AWG 150V
Classic 150	48	110	2.29	76	80-90	4AWG	33.18	50A/8AWG - 63A/ 6AWG 150V
Classic 150	12	120	10	92	100	4AWG	9.2	30A /10AWG - 63A /6AWG 150V
Classic 150	24	120	5	82	90-100	4AWG	16.4	30A /10AWG - 63A /6AWG 150V
Classic 150	48	120	2.5	76	80-90	4AWG	30.4	50A/8AWG - 63A/ 6AWG 150V
Classic 200	12	70	5.83	79	80-90	4AWG	13.55	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	24	70	2.91	78	80-90	4AWG	26.8	50A/6AWG or 8AWG 300V
Classic 200	48	70	1.46	76	80-90	4AWG	52.05	80A/4AWG 300V
Classic 200	12	120	10	77	80-90	4AWG	7.7	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	24	120	5	74	80-90	4AWG	14.8	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	48	120	2.5	70	70-80	4AWG	28	50a/6AWG or 8AWG 300V
Classic 200	72	120	1.66	65	70-80	4AWG	39.15	50a/6AWG or 8AWG 300V
Classic 200	12	140	11.66	74	80-90	4AWG	6.34	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	24	140	5.83	72	80-90	4AWG	12.34	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	48	140	2.92	65	70-80	4AWG	22.26	50a/6AWG or 8AWG 300V
Classic 200	72	140	1.94	63	63-70	6AWG	32.47	50A/6AWG or 8AWG 300V
Classic 200	12	160	13.33	73	80-90	4AWG	5.47	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	24	160	6.66	72	80-90	4AWG	10.81	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	48	160	3.33	65	70-80	4AWG	19.52	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 200	72	160	2.22	53	60-63	6AWG	23.87	50A/6AWG or 8AWG 300V
Classic 250	12	180	15	61	63-70	6AWG	4.06	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	24	180	7.5	62	63-70	6AWG	8.26	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	48	180	3.75	55	60-83	6-4AWG	14.66	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	72	180	2.5	43	50-63	6AWG	17.2	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	12	200	16.6	58	60-70	6AWG	3.49	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	24	200	8.33	60	60-70	6AWG	7.2	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	48	200	4.16	53	60-63	6AWG	12.74	30A/10AWG - 50A/6AWG or 8AWG 300V
Classic 250	72	200	2.77	40	40-63	8-6AWG	14.44	30A/10AWG - 50A/6AWG or 8AWG 300V

*NEC310-17 is the chart for single conductors in free air. This chart is conservatively based on this chart, 75C wire inside a MidNite E-Panel
 ** MidNite Solar breakers are all rated for 100% duty cycle and do not require 156% safety factor. * above also applies to input breaker and wire.

CLASSIC MENU MAP

Apr 28, 2011
MidNite Solar Inc.

