

All-Weather PVH Kit

NRG SRA System | Kits #11708, 11709, 11710

Authors:

Technical Services





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INTRODUCTION

The NRG SRA's All-Weather PVH Kit adds the capability of the Hukseflux VU01 Ventilation unit to your SRA system. When used in conjunction with a Hukseflux SR20 pyranometer, the VU01 will increase the reliability, dependability, and accuracy of the sensor in all conditions.

Ventilation prevents the formation of dew and frost on pyranometers. During warmer months, the ventilation fan helps eliminate dew, while in colder months the heater promotes evaporation of water droplets and sublimation of snow and ice.

To accommodate the power requirements of the VU01, the PVH Kit uses a second 2.2m tower, frame-mounted PV panels, a deep-cycle battery bank, and charge controller. The system is controlled by a preprogrammed PLC which switches the fan and heater on and off. The system status is monitored by our SymphoniePRO data logger.

NRG Systems has created three PVH Kit options, depending on the climate of your site. Make sure that you have the proper number of panels and batteries for your intended application.

- Kit 11708: (1) 60W PV panel; (1) deep-cycle battery. Optimized for sites that experience dust and dew accumulation.
- Kit 11709: (2) 60W PV panels; (2) deep-cycle batteries. Optimized for sites that experience minor snow accumulation.
- Kit 11710: (3) 60W PV panels; (3) deep-cycle batteries. Optimized for sites that experience snow & ice buildup.



MATERIALS & TOOLS

In the Kits

- NRG SRA Tower Assembly, 2.2m (NRG #9118)
- Hukseflux VU01 Pyranometer Ventilator
- 1 to 3 PV panel(s), 60W each
- Panel frame, angle-adjustable
- 1 to 3 Deep cycle batteries (108 Amp hours each), battery boxes
- Shelter box, charge controller, PLC with pre-loaded program, terminal block
- NRG 110S temperature sensor
- Assorted cabling

Required Tools

- NRG SRA Tower tools (see SRA System manual)
- 3/16" hex key
- 5/32" hex key
- 7/16" combination wrench
- 3/4" combination wrench
- 5/16" nut driver or Cordless drill/impact driver with 5/16" nut driver bit
- Small flathead screwdriver
- Diagonal cutters
- Tape measure
- 6ft stepladder
- Wire crimpers
- 5lb Sledgehammer or similar-sized hammer
- Slope angle meter (included with tower)
- Compass or GPS
- Electrical tape
- Documentation equipment (Camera, pen, & paper)
- Gloves
- Fold-up table or workbench – 6' x 2.5' or larger recommended
- Digital Voltmeter (optional)
- Wire strippers (optional)

Recommended Additional Documentation

- NRG SRA System manual
- Hukseflux VU01 Ventilator manual
- NRG SymphoniePRO manual



Precautions



Assembling the SRA's All-Weather PVH Kit requires working around electrical systems and batteries. **Please use caution when working on electrified systems. De-energize the system by disconnecting PV panels and batteries before servicing the system in any way.**



The SRA's All-Weather PVH Kit, once assembled, is large and heavy. **Two people are required** for assembly and mounting to the tower.



During assembly of the SRA's All-Weather PVH Kit, **do not connect PV panels until the system is ready** to be put into service.



Kit #11709 & #11710 contain multiple 12V deep-cycle batteries that must be connected together into a battery bank. **Check the orientation of the batteries and polarity of the terminal posts before attempting to chain the batteries together! Serious injury could result from an improper connection.**

Notes

-Slide nuts used in this kit have one side with a lip around the threaded hole. When inserting a slide nut into an extruded aluminum rail, the lip should always face the center of the rail, not outward towards the bolt. Failure to do so can prevent the nut from sliding easily inside the channels of the rail.

-Do not overtighten bolts. Overtightening bolts may result in damage to hardware.

-Loctite 242 has been provided in all hardware kits. NRG recommends that Loctite be applied to all slide nut threads to help prevent loosening over time. Pre-assembled components have Loctite applied already.

SECTION 1: ASSEMBLING THE ALL-WEATHER SYSTEM TOWER

1.1 Construct and Erect the 2.2m Tower

The SRA's All-Weather PVH Kit includes a 2.2m NRG SRA tower assembly (kit #9118). Construction of this tower is recommended prior to assembling the PV brackets. Choose a suitable location for the tower that is close enough for sensor wires (5m length) to reach your NRG SRA System and data logger.

Orient the guy ring and wires so that the PV frame will fit in between two guy wires.

Please read the SRA manual for instructions about how to safely erect the tower. To download the manual from our website, follow the link below:

<https://www.nrgsystems.com/assets/resources/SRA-Manual2.pdf>



SECTION 2: ASSEMBLING THE PV PANELS & BRACKETS

2.1 Open and unpack all items.

Your All-Weather PVH kit comes packaged in several boxes. Verify that all contents are present and undamaged.

2.2 Construct the PV Frame

2.2.1 Attach the longest frame pieces (extruded aluminum, 65" length) to the PV panels.

Place PV panels on work surface face-down. Place multiple panels together with the long sides touching each other. Be careful not to scratch glass surface.

Thread four 1/4-20x.375 hex bolts (#11052) through the PV panel holes indicated (Figure 2-1) and attach 1/4" flat washers and slide nuts (Figure 2-2).



Figure 2-1: PV panel with bolt holes indicated. Figure 2-2: Bolt/washer/nut alignment in PV panel frame.



Attach aluminum frame pieces to the panel frames through the slide nuts. Push the bolt head up against the panel frame to create a gap between washer and slide nut (Figure 2-3). Make sure that the washer remains between the extruded aluminum and panel (Figure 2-4).



Figure 2-3: Create space for aluminum rail.

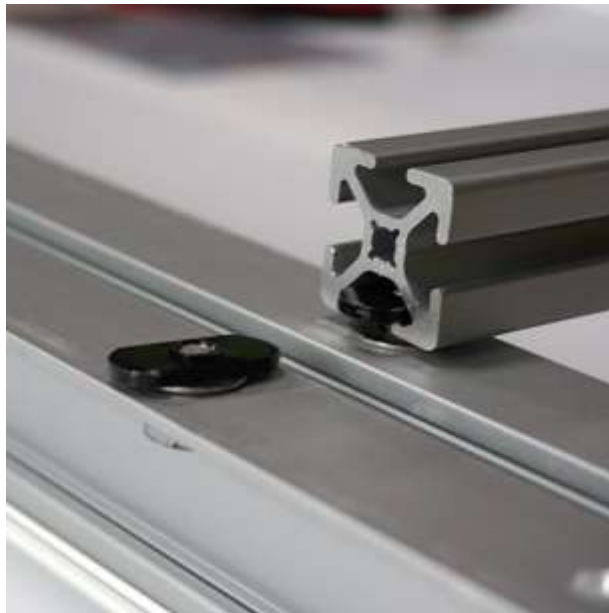


Figure 2-4: Slide rail onto the slide nuts.

Determine which PV panel will be at the top, then make sure it is flush with the ends of the rails. If more than one panel is included with your kit, leave a small (about 1/8") gap between panels on the rails.

2.2.3 Assemble the top tower mount.

Use the diagonal cutters to cut the zip tie packaging holding together all aluminum rails. Remove the hinged assembly with 12" and 25" rail sections. Remove the V-block/U-bolt assembly from the hardware box (Figure 2-5, following page).



Figure 2-5: Assembled hinges on shorter aluminum rails.

Remove slide nuts from the 1/4-20x1.25 bolts on the V-block, then add Loctite to the threads and reattach. Slide the V-block assembly onto the 12" rail in the channel opposite of the hinge (Figure 2-6). Center the block onto the rail and tighten bolts to secure.



Figure 2-6: Slide V-block onto the 12" rail, then center.



2.2.4 Attach frame crosspiece and top tower mount to the main assembly.

Thread 1/4-20x.375 bolts (#11697) through small corner brackets and into slide nuts (Figure 2-7).



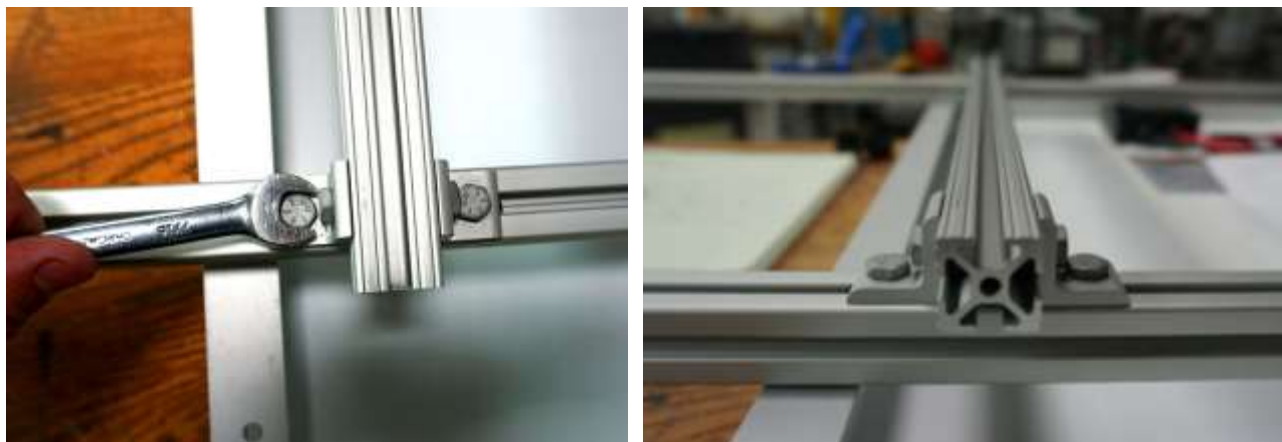
Figure 2-7: Corner brackets for use with aluminum rails; slide nuts and bolts are attached.

Slide corner brackets onto the ends of the 25" aluminum crosspieces (Figure 2-8). Orient the corner brackets so that the round hole is touching the crosspieces (the oval holes will attach to the long, PV-mounted rails). Do not tighten yet.



Figure 2-8: Corner brackets attached to crosspiece. Note the orientation of the hinge.

Slide the crosspieces onto the 65" rails of the main assembly. The top tower mount goes behind the top PV panel, about 1" from the end. The single 25" crosspiece goes about 24" from the bottom of the vertical rails. There should be about 1/2" of space at each end of the crosspieces. Tighten all corner bracket hardware (Figure 2-9, Figure 2-10, following page).



Figures 2-9 & 2-10: Tighten aluminum crosspieces into place with appropriate spacing.

2.2.5 Mount the PV panel assembly to the tower.

Loosen the nuts on the 3.5" U-bolt to allow enough space to fit around the tower tube.

Using two people and the 6ft stepladder, lift the assembly up and slide it over the top of the tower. U-bolt should be approximately 4.5" from the top of the tower for adequate spacing to mount the shelter box.

Tighten U-bolt nuts with 3/4" wrench (Figure 2-11). Do not overtighten.

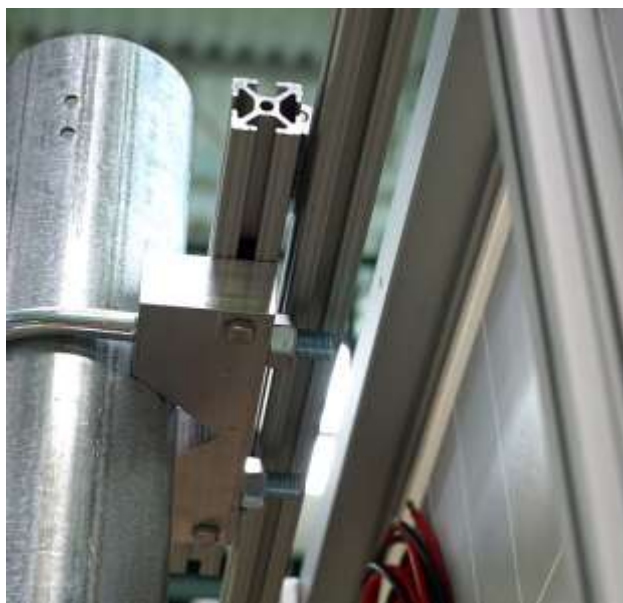


Figure 2-11: PV frame & panels mounted to tower with 3.5" ID U-bolt.



2.2.6 Attach angle adjustment rails to tower and PV assembly.

The angle adjustment tower mount comes pre-assembled (Figure 2-12). First, remove the slide nuts and add Loctite, then loosely reattach.



Figure 2-12: Out-of-box assembly of lower tower/angle adjuster mount.

To mount around the tower, first remove the components from one side of the threaded rods (Figure 2-13). Slide around the tower approximately 44" below the U-bolt and reassemble (Figure 2-14). Ensure that the threaded rod is evenly distributed on each side of the mount (1.5 – 1.75" beyond the innermost rectangular bracket).



Figure 2-13: Disassembly of one side of lower tower mount.

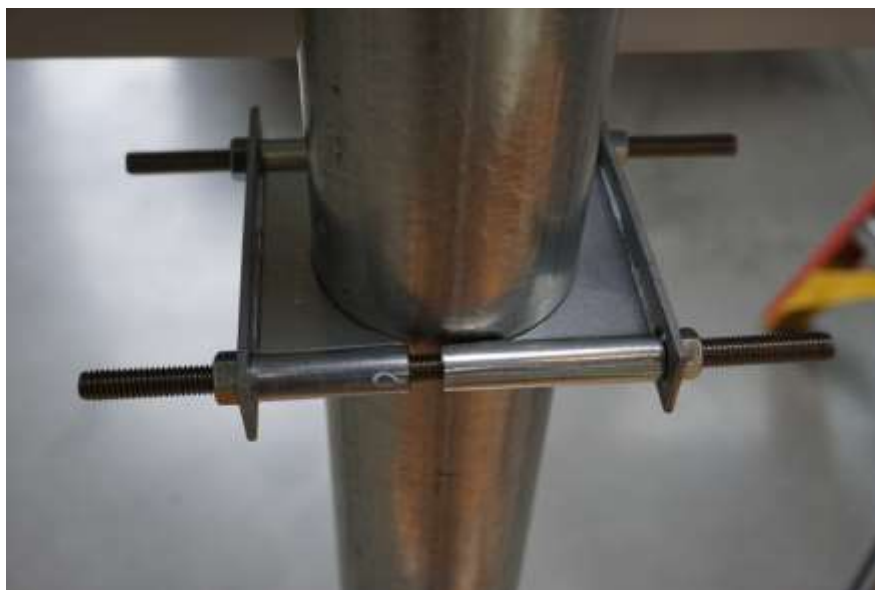


Figure 2-14: Inner components of Figure 12 assembled onto tower. Complete removal of the outer components is not necessary.

Mount the 48" angle adjustment rails to the outer brackets of the assembly through the slide nuts (Figure 2-15). Orient the rail such that the hinge attached to the end is at the top and the semicircular piece is facing the PV frame.



Figure 2-15: Complete assembly of lower tower/angle adjuster mount. Aluminum rail is mounted onto slide nut and outer bracket is not tightened down.



2.2.7 Attach angle adjustment rails to PV frame

Remove the semicircular end pieces from the assembled hinge (Figure 2-16), then remove the slide nuts from each semicircular piece. Add Loctite to the threads of all three bolts in each hinge.



Figure 2-16: Semicircular end piece removed and attached to PV frame.

Reattach the slide nuts, then slide semicircular end pieces onto the lower PV assembly crosspiece (Figure 2-16). Line up with angle adjustment rail, then tighten thru-bolt to lock in place. If lined up correctly, the hinge should assemble easily (Figure 2-17).



Figure 2-17: Assembled & tightened lower tower mount/angle adjuster.



2.3 Attach Ventilator Control System (Shelter Box) to Tower.

Thread the provided band clamps through the outer slots of the brackets on the back of the shelter box. Wrap the band clamps around the tower and secure with a 5/16" hex nut driver. An electric drill or impactor with a 5/16" nut driver will speed up the tightening process.



Figures 2-18 & 2-19: Shelter box brackets and attachment to the tubular tower.



2.4 Mount 110S Temperature Sensor

Using the supplied band clamps, secure the 110S Temperature sensor to the tower directly above the Shelter Box.



Figure 2-20: NRG 110S Temperature sensor attached to the tubular tower with band clamps.

2.5 Chain the Deep-Cycle Batteries Together

Place the battery (ies) in the black housing box(es).

When using kits 11709 or 11710, it will be necessary to chain the included 12V, deep-cycle batteries using the supplied cables to create a battery bank.



These batteries contain a significant amount of energy. Use caution or serious injury may result.

- Place the batteries in the supplied battery boxes/enclosures so they are protected from weather prior to making the connections.
- **Connect [+] to [+] on the batteries, and connect [-] to [-] using the 4 Gauge (AWG) battery cables. Use black for [-] and red for [+] terminals.**
- Connect the 10 AWG 2C cable to the battery bank you have created. At a later step, this cable will feed into the shelter box and connect to the control system.



Keep the bare ends of the 10 AWG 2C cable separated. Do not let them come in contact with each other or you.



SECTION 3: INSTALLATION OF THE VU01 TO THE SRA TOWER

3.1 Install the SR20 Pyranometer into the VU01 ventilator unit

See section 5.2 and 5.3 of the Hukseflux VU01 manual for detailed instructions on how to install the SR20 into the VU01 ventilator unit. Excerpts from the Hukseflux manual have been provided below.

5.2 Installation of the sensor

- Remove the pyranometer's or pyrgeometer's sun screen.
- Attach the sensor mounting plate to the bottom of the sensor using two M5x10 screws (See Figure 5.2.1). A T25 torx key to do so is included with VU01.
- Affix the sensor with the sensor mounting plate to the ventilation unit using two M5x10 screws (See Figure 5.2.1 for placement of the gasket).
- The sensor cable connector should be positioned alongside the engraved "cable" marking on the VU01 base.
- The VU01 levelling feet can be used to fine-tune the sensor levelling. Even with the VU01 cover installed (see next page), the sensor can still be levelled since the instrument's bubble level is still visible below the VU01 cover.

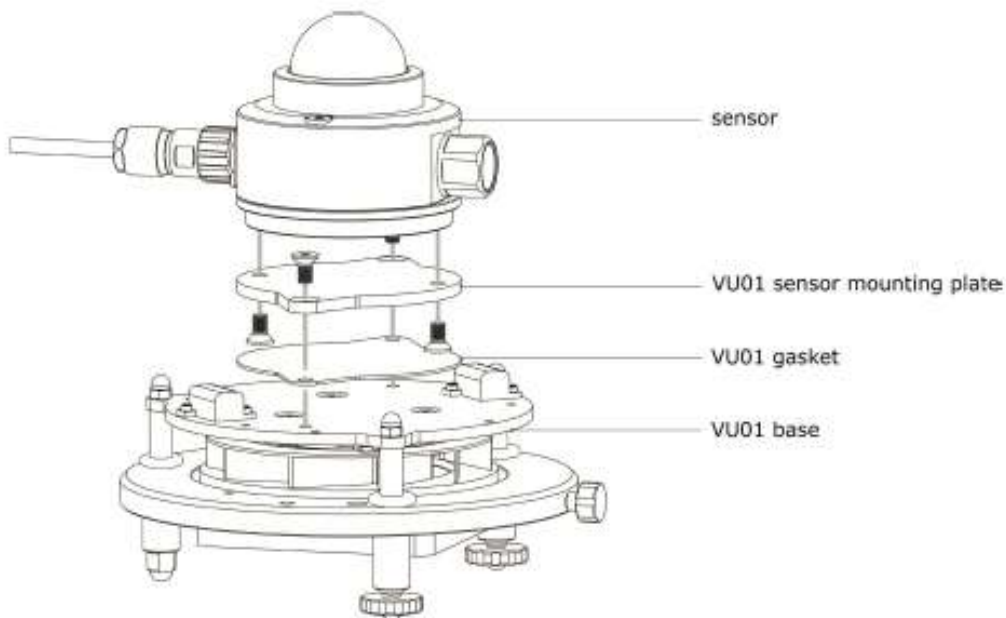


Figure 5.2.1 VU01 base with gasket, sensor mounting plate and SR20 pyranometer: the instrument is affixed to VU01 using four M5x10 screws.



5.3 Installation of the VU01 cover

To install:

- Connect the sensor cable connector (3) to the sensor, guiding the connector through the designated hole in the VU01 cover
- Position the cover (2) at an angle on positioning pin (5)
- Close the cover using positioning pin (5) as swivel point
- Affix the cover using thumbscrew (1)
- Connect the VU01 cable connector to the VU01 connector (4)

To remove cover:

- Loosen thumbscrew (1) by turning counterclockwise until the tapered part of the thumbscrew is ejected from the ventilation unit base
- Lift the cover, tilting around positioning pin (5)

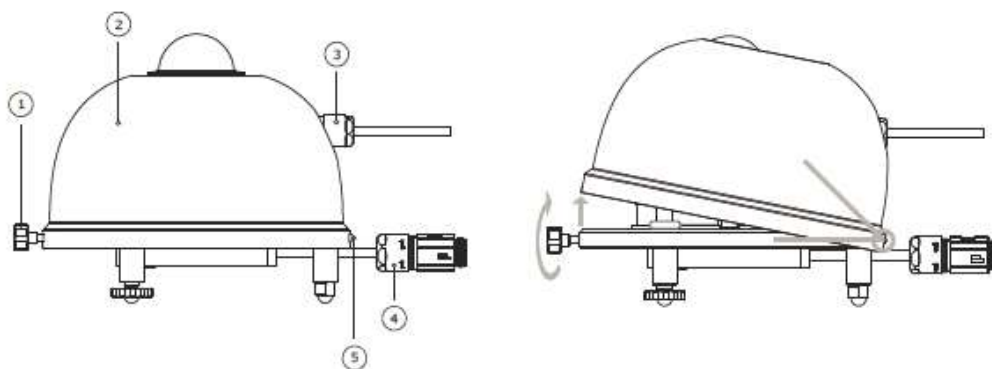


Figure 5.3.1 Installation and removal of ventilator cover: (1) VU01 thumbscrew, (2) VU01 cover, (3) sensor connector, (4) VU01 connector, (5) VU01 positioning pin.



Figure 5.3.2 Cutaway of VU01 showing internal components and SR20 pyranometer.



3.2 Connecting the VU01 & Pyranometer to the SRA Tower & SymphoniePRO

3.2.1 Attach the ventilator to the SRA Tower top plate

Mount the ventilator and pyranometer to the top plate of the NRG SRA tower using the appropriate holes. Level the ventilator and pyranometer. See figure 3-1

Note: *NRG SRA Tower top plates produced before September 2017 may not have the appropriate holes to mount the VU01 ventilator. You can either measure and carefully drill the appropriate holes, or contact NRG to purchase an updated top plate.*



Figure 3-1: Mounted VU01 (with SR20) and a second SR20.

3.2.2 Connect the Hukseflux pyranometer to your SymphoniePRO data logger

The Hukseflux-supplied pyranometer cable has 8 wires. Not all wires are needed to connect to the SymphoniePRO. Figure 3-2 below illustrates how to make this connection properly.

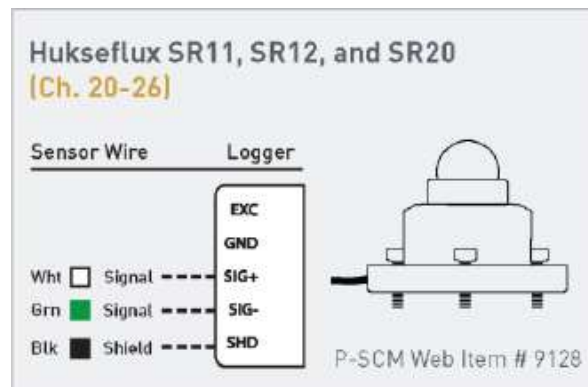


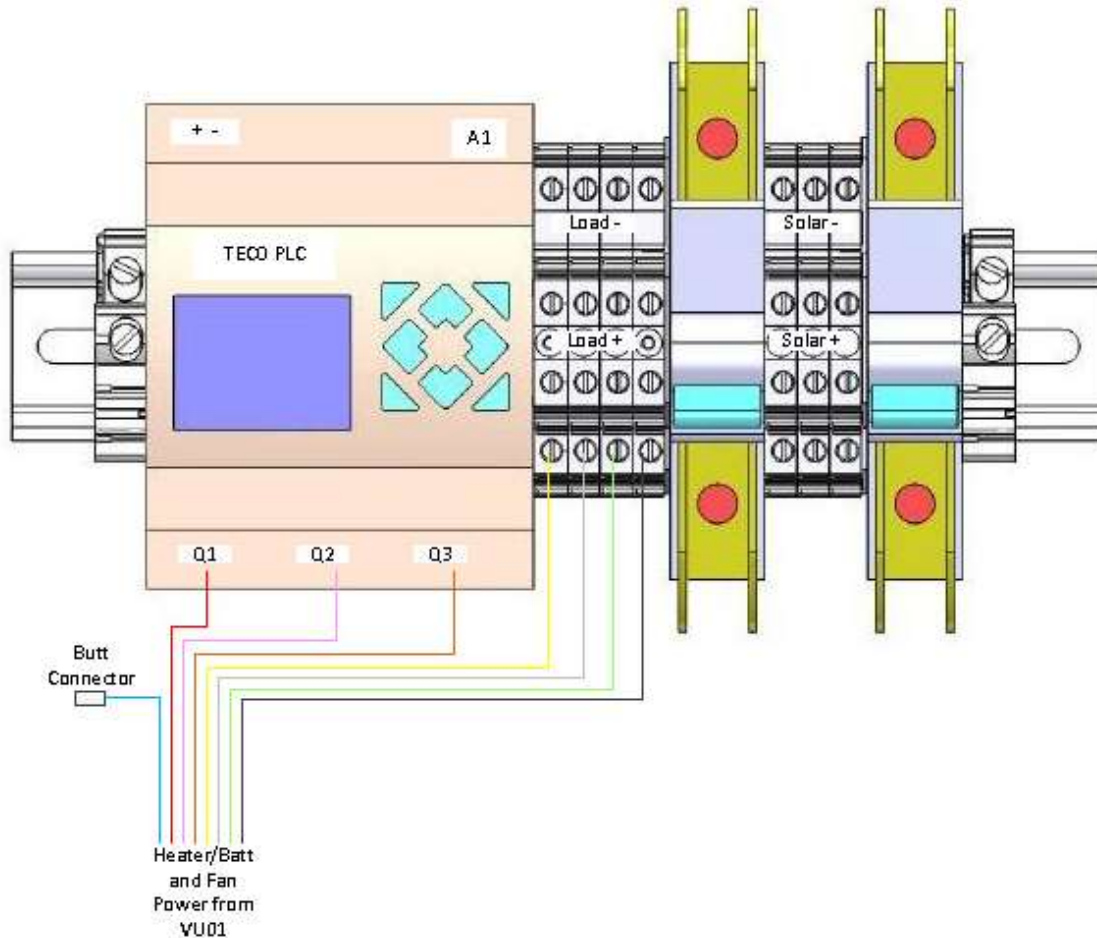
Figure 3-2



SECTION 4: WIRING THE ALL-WEATHER SYSTEM

4.1 Wiring the Ventilator to the Control System

The VU01 is supplied with a multi-conductor cable which plugs into the ventilator. At the other end, the bare wires connect to the All-Weather Control System according to Figure 4-1 and Table 4-1 below.



Blue | Red | Pink | Brown | Yellow | Gray | Green | Black

Figure 4-1

Note that the blue wire from the VU01 cable connects to the red wire of the supplied NRG 4C cable by a butt connector. Crimp the connector properly to ensure that the bare wire ends adequately make contact with each other.

**TABLE 4-1: VU01 WIRE CONNECTIONS**

| PIN | VU01 Cable Wire | VU01 Signal | All-Weather Control System Connection |
|------------|------------------------|--------------------------------|--|
| 1 | Brown | fan [+] | TECO PLC Q3 |
| 4 | Yellow | fan [-]; fan status signal [-] | Load [-] |
| 6 | Blue | fan status signal [+] | Crimp to NRG 4C Cable Red Wire |
| 2 | Red | heater 1 [+] | TECO PLC Q1 |
| 8 | Grey | heater 1 [-] | Load [-] |
| 3 | Pink | heater 2 [+] | TECO PLC Q2 |
| 5 | Green | heater 2 [-] | Load [-] |
| 7 | White | not connected | not connected |
| 9 | Black | shield | Load [-] |



4.2 Wiring the NRG 110S Temperature Sensor to the Control System

The All-Weather Control Algorithm relies on ambient temperature to operate the heaters. The NRG 110S Temperature sensor connects to the TECO PLC A1 analog input (Figure 4-2, Table 4-2).

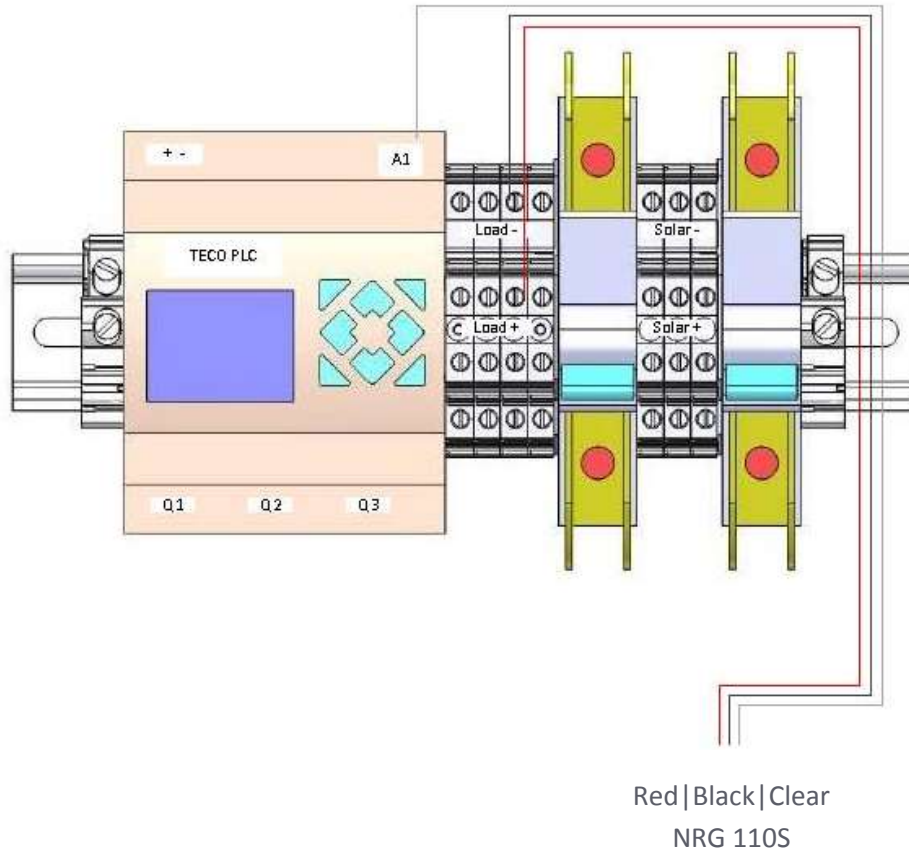


Figure 4-2

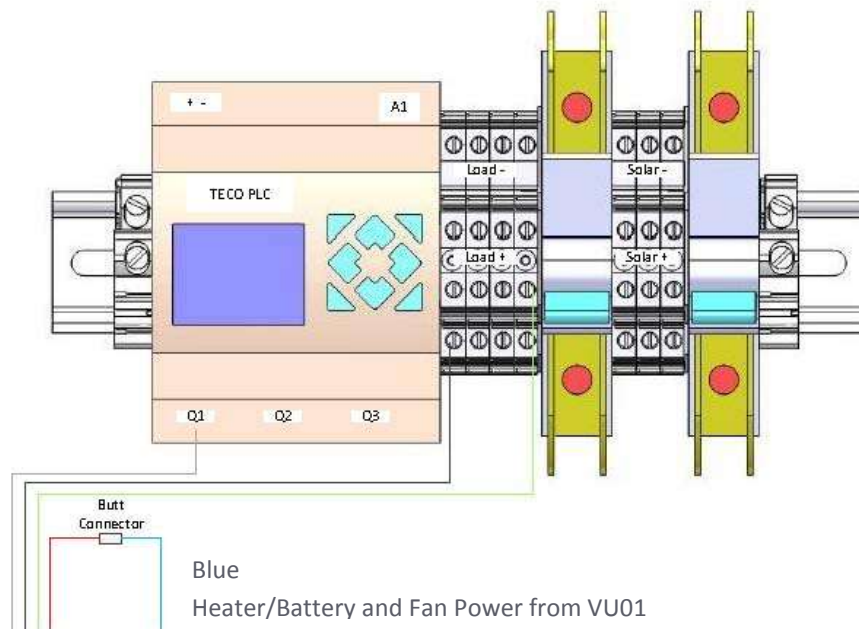
TABLE 4-2: 110S TEMPERATURE SENSOR CONNECTIONS

| SENSOR | Sensor Cable Wire | All-Weather Control System Connection |
|------------|-------------------|---------------------------------------|
| EXCITATION | Red | Load [+] |
| SIGNAL | Clear | TECO PLC A1 |
| GROUND | Black | Load [-] |
| SHIELD | Bare (Braided) | Load [-] |



4.3 Wiring Status Signals from the Control System to the Data Logger

Using the supplied NRG 4C cable, the heater, fan, and battery status signals are fed to the Data Logger so they appear in the data stream. Section 5 describes how to configure the logger channels.



Clear | Black | Red | Green
Heater/Battery and Fan Status to SymPRO

Figure 4-3

TABLE 4-3: STATUS SIGNALS

| SIGNAL | NRG 4C Cable Wire | All-Weather Control System Connection | Logger Connection | PRO Logger Channels | Signal Type |
|----------------------------|-------------------|---------------------------------------|--|---------------------|-------------------------------|
| HEATER ON/OFF | Clear | TECO PLC Q1 | -Any Available Analog Channel -P-SCM Channel Sig [+] (with P-SCM # 9135 installed) | 16-26 | 0: Off ~12: On |
| | Black | Load [-] | -Any Available Analog Channel -P-SCM Channel Sig [-] (with P-SCM # 9135 installed) | 16-26 | |
| FAN ON/OFF | Red | Crimp to VU01 Cable Blue Wire | Any Available Analog Channel -P-SCM Channel Sig [+] (with P-SCM # 9132 installed) | 13-26 | 0: Off 0.4-2.5: On |
| BATTERY BANK STATUS | Green | Load [+] | P-SCM Channel Sig [+] (with P-SCM # 9135 installed) | 20-26 | Value = Battery Voltage |



4.4 Wiring the Batteries to the Control System

The All-Weather packages use 1-3 12V, deep-cycle batteries. **Section 2.5** explained how to chain the batteries together and connect one end of the 10 AWG 2C cable.

Connect the other end of the 10 AWG 2C cable to the locations specified in Figure 4-4 and Table 4-4 below.

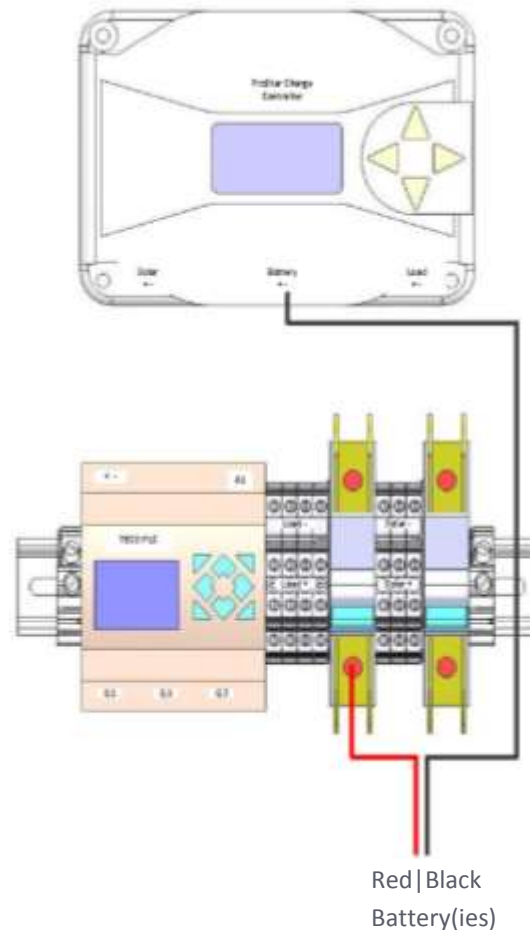


Figure 4-4

TABLE 4-4: BATTERY CONNECTIONS

| 12V BATTERY BANK | Heavy Duty Battery Cable Wire | All-Weather Control System Connection |
|------------------|-------------------------------|---------------------------------------|
| BATTERY [+] | Red | Circuit Breaker bottom terminal |
| BATTERY [-] | Black | Morningstar Battery [-] |

Note: keep the battery breaker switch in the off position until you are ready to power on the entire system (after all connections have been made and double checked).



4.5 Wiring the PV Panels to the Control System

Connect the PV panel(s) to the system after everything else has been wired as shown in Sections 4.1-4.4. As shown in Figure 4-5 and Table 4-5, attach the wires from the PV panels to the solar terminal block.

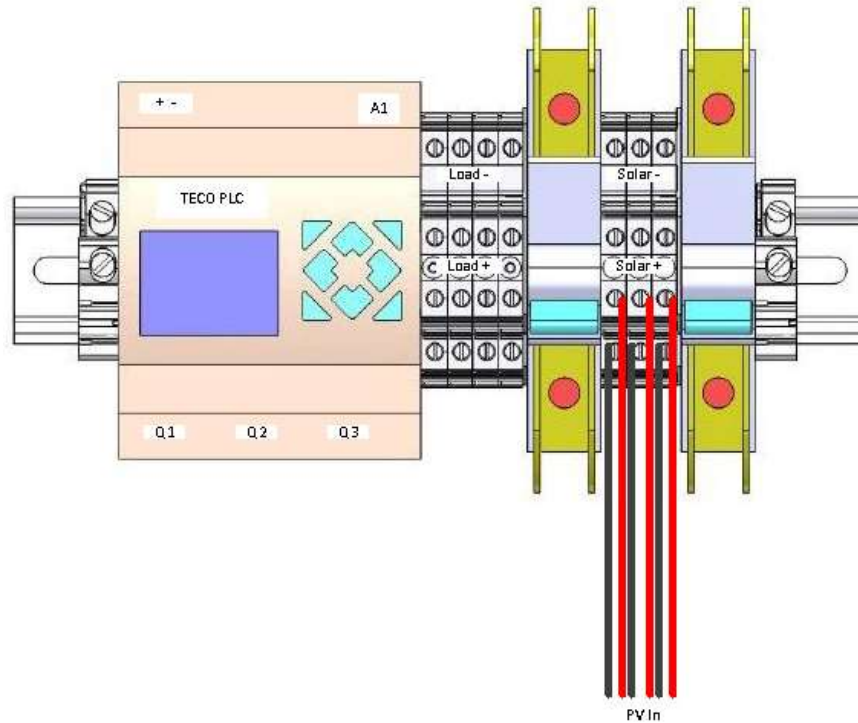


Figure 4-5

TABLE 4-5: PV PANEL CONNECTIONS

| PV PANEL | PV Cable(s) Wire(s) | All-Weather Control System Connection |
|----------|---------------------|---------------------------------------|
| 1 | Red | PV [+] |
| | Black | PV [-] |
| 2 | Red | PV [+] |
| | Black | PV [-] |
| 3 | Red | PV [+] |
| | Black | PV [-] |



SECTION 5: LOGGER CONFIGURATION FOR STATUS SIGNALS

5.1 Heater Status

The heater status signal must be programmed into channels 20-26 with P-SCM #9135 (included with the kit). Configure the logger channel as follows:

The screenshot shows the configuration for channel 26, 'VU01 Heater Status'. The 'Data Logging Mode' is set to 'Statistics' and 'Channel Type' is 'Analog'. The 'Description' is 'VU01 Heater Status'. The 'Serial Number' field is empty. The 'Height' is set to 2.2 Meters, and 'Boom Bearing' is empty. The 'Scale Factor' is 1 V per V, and the 'Offset' is 0 V. The 'Units' are set to V. The 'SymphoniePRO Signal Conditioning Module (P-SCM)' is set to P-SCM #9135, (0 to 30) V, SE Input, Constant 12V EXC.

When the voltage is at 12V the heater is on, and when the voltage is at 0 V, the heater is off.

5.2 Fan Status

The fan status signal can be connected to any analog channel 13-26 (Note: channels 20-26 also require P-SCM #9132, sold separately).

The screenshot shows the configuration for channel 19, 'VU01 Fan Status'. The 'Data Logging Mode' is set to 'Statistics' and 'Channel Type' is 'Analog'. The 'Description' is 'VU01 Fan Status'. The 'Serial Number' field is empty. The 'Height' is set to 2.2 Meters, and 'Boom Bearing' is empty. The 'Scale Factor' is 1 V per V, and the 'Offset' is 0 V. The 'Units' are set to V. The 'Excitation' section shows 'Mode' set to Off and 'Voltage' set to 12 V.

The fan status is considered healthy when the measured signal is between 2.5V and 0.4V. Readings below 0.4V indicate an issue if the fan is programmed to be on during that time.

If the fan is configured to be off, voltages below 0.4V should be expected.



5.3 Battery Bank Voltage Monitoring

The heater status signal must be programmed into channels 20-26 and requires P-SCM #9135 (included with the kit). Configure the logger channel as follows:

The screenshot shows the configuration interface for a channel named "VU01 Battery Volts". The interface is divided into three main sections:

- Data Logging Mode:** Shows "Load From Defaults", "Statistics" (with a green checkmark), and "Channel Type" set to "Analog". Below this, it lists statistical information recorded: Average, Standard Deviation, Min, and Max.
- Description:** "VU01 Battery Volts".
- Serial Number:** "3_12V_108_AH".
- Height:** "0" Meters.
- Boom Bearing:** (empty) Degrees.
- Scale Factor:** "1" V per V.
- Offset:** "0" V.
- Units:** "V".

On the right, the "SymphoniePRO Signal Conditioning Module (P-SCM)" is configured to "F-SCM #9135, (0 to 30) V, SE Input, Constant 12V EXC".

The battery voltage will fluctuate above 12V during the solar charging phase. When the battery dips below 12V, the VU01 power is affected.

Note: The PS-15M charge controller comes preconfigured for the NRG supplied batteries and the low voltage disconnect set to 11.5V. If a different battery type is used, the charging settings of the charge controller will need to be modified to minimize the risk of damaging the system.

The SymphoniePRO data logger and iPack at the SRA station are powered independently from the VU01. If the All-Weather PVH System loses power, it will not cause the logger and sensors to stop working.

5.4 Logger Configuration Summary Table

| Measurement | Channels | P-SCM (Ch. 20-26) | Included With Kit |
|----------------------|----------|-------------------|-------------------|
| Heater Status | 16-26 | #9135 | Yes |
| Fan Status | 13-26 | #9132 | No |
| Battery Bank Voltage | 20-26 | #9135 | Yes |



SECTION 6: CONFIGURING THE PLC



PLC must be properly configured to ensure function of the All-Weather PVH System.

6.1 Set the PLC Date and Time

The PLC will need the date and time set in the RTC Set menu (the unit defaults to this menu when first powered on).

*Note: The NRG program must not be running in order to set the date and time. If the PLC has the program running already, you must stop the program first. Press **ESC**, arrow to “STOP” on the screen, and press **OK** twice to confirm. Then arrow down to select “RTC SET” menu and proceed.*



- Press the select button.
- Use the left right arrows to navigate through YYYY-MM-DD HH:MM, and the up/down arrows to select the proper values.
- Press the OK button to save the date and time

6.2 Start the PLC Program

Once the date and time are set, start the PLC program. To start the program:





SRA System | All-Weather PVH Kit

- Press ESC.
- Use the up and down arrows to select the RUN menu.
- Press OK.
- The screen will show YES and NO for options.
- Select YES and press OK.
- The menu will no longer show RUN as an option. Instead it will show STOP. The PLC is now running its program.

6.3 Understanding the NRG Default Control Algorithm (PLC)

The battery bank and PV sizing follows the expected climate conditions for a particular site.

- Kit 11708: (1) 60W PV panel; (1) deep-cycle battery. Optimized for sites that experience dust and dew accumulation.
- Kit 11709: (2) 60W PV panels; (2) deep-cycle batteries. Optimized for sites with minor snow accumulation.
- Kit 11710: (3) 60W PV panels; (3) deep-cycle batteries. Optimized for sites where snow accumulates and ice builds up.

The 3 PVH Kit options contain a PLC preloaded with a control algorithm which works as follows:

- Heater turns on 6 AM to 8 AM
- Heater turns on between 8 AM and 8 PM when ambient temperature is below 3 °C
- Heater turns off between 8 AM and 8 PM when ambient temperature is above 5 °C
- Ventilator turns on between 6 AM and 8 PM (14 hours/day)

Heater operation times and temperatures are user-adjustable, if desired. Ventilator operation times are user-adjustable up to 24-hours (continuous operation).

For kits 11709 and 11710, the system will require the heater to be connected. For kit 11708, the user should disconnect the heater leads to ensure adequate power for the ventilator.

6.4 How to Configure the Controller for Kit 11708

When using kit 11708, disconnect the heater to ensure adequate power reserves. To accomplish this, disconnect the heater wires from the Q1 and Q2 terminals of the PLC. No modification of the PLC program is necessary.



6.5 How to Configure the Controller for Kits 11709 and 11710

Both heating and ventilation are required when using kits 11709 and 11710, and the default program in the PLC comes preconfigured to handle the climate types for these kits. No modification of the PLC program is necessary.

6.6 Advanced User Settings – PLC Control Algorithm

A few settings are available for advanced users who want to custom tailor the control algorithm of the PLC.

- Heater switch on time
- Heater switch off time
- Temperature threshold for switching on the heater
- Temperature threshold for switching off the heater
- Ventilator can be configured to run continuously in addition to the default 6AM to 8PM

Notes for Advanced Users:

- *Be careful when making adjustments to these settings as there is no master reset which can restore the PLC to the original NRG factory settings! A programming key is required for factory reset.*
- *Adjustments to the default settings can significantly change the power required to run the system. As a reference, the system runs on 12 Volts. The heater consumes 10 Watts and the Ventilator consumes 8 Watts. NRG supplied battery capacity is 108 ampere hours (per battery) and NRG designed the system to nominally have a 4 day reserve (4 days without PV power input) for the specified target climate conditions. Be sure to account for these specifications when making any changes to the control algorithm!*

The following sub-sections describe how to make adjustments to these settings.

Note: *The PLC needs to be in RUN mode in order to adjust these settings.*

6.6.1 Heater switch on time

Press ESC. You should see the PLC home screen “NRG Systems”, press the up arrow once to enter the heater switch time menu.



- Press SEL.
- Use the left / right and up down arrows to make your selection. Once you are on the setting you wish to modify, press SEL. Use the up/down arrows to adjust the value for that setting.
- Press OK to save your selection.

6.6.2 Heater switch off time

Press ESC. You should see the PLC home screen “NRG Systems”, press the up arrow once to enter the heater switch time menu.



- Press SEL.
- Use the left / right and up down arrows to make your selection. Once you are on the setting you wish to modify, press SEL. Use the up/down arrows to adjust the value for that setting.
- Press OK to save your selection.

6.6.3 Temperature Threshold for Switching on the Heater

Press ESC. You should see the PLC home screen “NRG Systems”, press the up arrow twice to enter the Temperature Threshold menu.

The threshold values are in the units of Volts. Use the table below to determine the voltage for the desired switch-on temperature.



SRA System | All-Weather PVH Kit

| AMBIENT TEMPERATURE (DEGREES C) | 110S TEMPERATURE PROBE SIGNAL OUTPUT (VOLTS) |
|---------------------------------|--|
| -5 | 1.46 |
| -4 | 1.48 |
| -3 | 1.50 |
| -2 | 1.52 |
| -1 | 1.54 |
| 0 | 1.55 |
| 1 | 1.57 |
| 2 | 1.59 |
| 3 | 1.61 |
| 4 | 1.63 |
| 5 | 1.65 |
| 6 | 1.66 |
| 7 | 1.68 |
| 8 | 1.70 |
| 9 | 1.72 |
| 10 | 1.74 |



- Press SEL.
- Use the left / right and up / down arrows to make your selection. Once you are on the setting you wish to modify, press SEL. Use the up/down arrows to adjust the value for that setting.
- Press OK to save your selection.

6.6.4 Temperature Threshold for Switching off the Heater

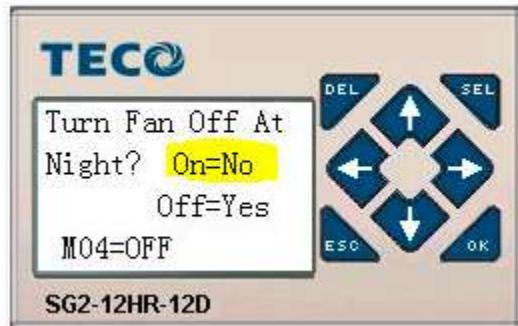
Press ESC. You should see the PLC home screen “NRG Systems”, press the up arrow three times to enter the Temperature Threshold menu. The threshold values are in the units of Volts. Use the table found in the section above to determine the voltage for the desired switch-off temperature.



- Press SEL.
- Use the left / right and up / down arrows to make your selection. Once you are on the setting you wish to modify, press SEL. Use the up/down arrows to adjust the value for that setting.
- Press OK to save your selection.

6.6.5 Ventilator (Continuous Operation or Off at Night)

Press ESC. You should see the PLC home screen “NRG Systems”, press the up arrow four times to enter the ventilator menu.



- Press SEL.
- You should see the default selection “Turn Fan Off At Night”.
- If you wish to run the fan continuously
 - Press SEL
 - Use the left / right and up / down arrows to navigate to the selection “On=No”.
 - Press OK to save.