PATENT PENDING RABBIT EARS THERMOELECTRIC GENERATOR

Introduction:

The Rabbit Ears CHP (Combined heat & power) is a Thermoelectric wood stove Generator Nominally rated at 100 watts. It has the ability to supply reliable solid-state BASE LOAD power. The ONLY moving device for this system is a 12VDC mag drive liquid pump. As long as the stove is operating the system will charge batteries. Its unique design coupled with a smart controller /PLC operated by direct inputs from wireless sensors (optional) automatically operates all functions of the generator. Once installed the unit has multiple fail safes that protect its function and the user*. Any part close to the flue is metal or high temperature materials. By generating reliable **BASE LOAD POWER,** it is ideal for winter use when solar and other power systems may not supply the required constant power output. It is a great compliment to other green power systems.

The Rabbit Ears generator can operate 24/7 providing constant power charging to a battery bank. An added feature of the product is that it also can distribute warm water for both supplementary hot water or for hydronic and or base board heating.

This novel thermoelectric TEG system will provide continuous power as long as a quality heat load is present on the hot side of the thermoelectric modules. There is no need to drill or cut into your wood stove, gas, or coal stoves. The Rabbit Ears system comes with a pump, DC to DC 100 Watt controller with a custom designed integrated PLC system. The unit comes semi assembled out of the box with the Generator already assembled to the 6" diameter stove pipe, 24" long (included). Just drop into place on the exhaust flue of your stove and plumb your water for circulation and cooling of cold side.

The RABBIT EARS TEG GENERATOR will run both 12V & 24V direct loads & or bulk, trickle charge functionality for battery charging up to 24 Volts DC with sufficient heat loads. The charger is a smart charger for bulk charging down to float charging automatically as the batteries are close to full charge. Heat exchangers are mounted inside the towers with PEX ends for easy hook up to a ½" circulating liquid system. Vent plugs equalize atmosphere pressure to tower pressure, no chance of high-pressure build -up. Two large heat absorbers penetrate the flue gas stream maximizing heat absorption which in turn produces maximum heat flux for optimal power output. This arrangement is much more efficient compared with other systems that are affixed to the outside surface of a wood stove, including the top. The metal to metal contact is much less efficient compared to direct flue stream penetration.

* Please note:

The water in the tower liquid reservoir is separate from liquid cooling circulating loop. This is often referred to as a tube-in-tube heat exchanger.

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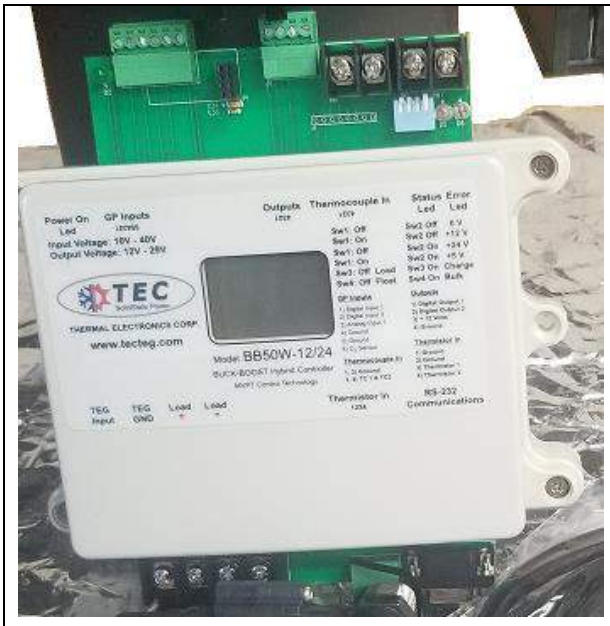
The output from the thermoelectric generator modules in the Rabbit Ears system is Direct Current (D.C.) power that is not regulated or automatically adjusted to be compatible with load devices or external batteries. The BB50W-12/24 primarily performs the function of power conditioning and regulation. Also it serves as a charge controller for batteries to ensure that your battery is not overcharged. A typical storage battery for home energy needs is rated at 12V with a charging voltage of approximately 14.4V. The characteristic of this battery is that when the battery cannot absorb more charge, the current that is consumed will begin to reduce as it approaches the fully charged point.

The current consumption will fall to a low value compared to the charging current. When this occurs, the voltage delivered to the battery should be reduced to a value that simply maintains or “floats” the battery, so that it consumes almost no current, something like a standby mode. This is the recommended storage condition for a battery. This float voltage is approximately 13.8 volts and can be applied safely to the battery to keep it in standby mode, ready to deliver full charge at anytime.

Using the blue switch on the rear side of the board, the BB50W-12/24 can be placed in a number of pre-set operating states to accommodate these charging modes This is preset by Factory before shipping, you will be contacted. The controller features a bulk charge mode that monitors the current consumption at 14.4V and when it reaches a pre-set value, 200 milliamps for example, the controller will automatically switch to a float maintenance voltage of 13.8V and maintain that voltage for standby conditions, thereby protecting the batteries from being overcharged, the quality of our charger is that of a MPPT charge controller in the $600 to $700USD range. The LCD display will show the input voltage and output power state of the controller, as well as the temperature of each thermocouple and thermistor input set (**if those options are purchased along with base system**).



Control DC to DC Power Controller with pump and Power cord all included.

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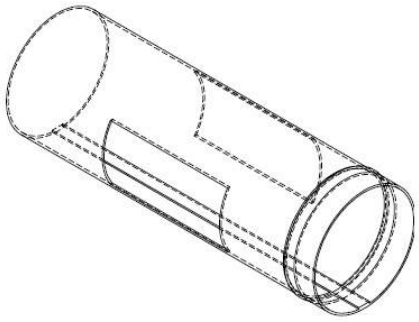
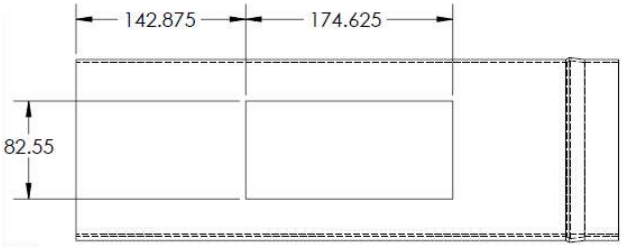
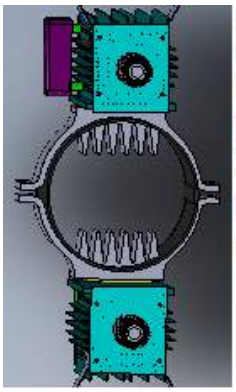
Above graph based on 1 tower only. Rabbit ear system comes with 2 towers





Cut out for 6" stove pipe in mm /Imperial conversions to right 24" long also included with system!



Fins on heat sinks penetrate flue pipe to provide exceptional heat transfer which provides maximum power production.

Cut out for 6" stove pipe in mm:

82.55mm = 3 1/4"

174.625mm = 6 14/16"

142.875mm = 5 10/16"

SMART MVPT/PLC Controller Specifications:

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100W PEAK TEG Input Battery SMART MVPT Charging Board – Specifications

Number of inputs for TEG arrays:	1 (Terminal block for series-parallel connected arrays)
Output voltage ranges:	12V & 24V output charging voltages. Switch selectable direct load drive or battery charging.
Output power rating:	100W nominal charging at 24V.
External Fan voltage support:	2 outputs, individually adjustable. 12V nominal output, PWM output voltage adjustable with on-board Flash memory output voltage selection.
Relay Contact outputs:	2 relay driver outputs. Assignable via software. Transistor output to ground.
Opto-coupled inputs:	2 digital inputs, isolated optical inputs.
Analog Inputs:	1 Analog voltage inputs, 0V to 24V maximum.
Thermistor Inputs:	2 independent inputs, shown on the LCD display by software.
Thermocouple Inputs(optional) :	2 independent inputs, shown on the LCD display by software.
Communications options:	GSM modem, European or N. American frequency assignments as required. Software assigned as per user requirement for remote function activation or error reporting as desired via SMS text messaging to named cell phone number, bi-directional operation. RS-232 Serial port for local communication, configuration options including external data logging & monitoring.

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PATENT PENDING RABBIT EARS THERMOELECTRIC GENERATOR

About the charger

- **Use it as a fixed 12V or 24V supply, or a full featured 12V /24V battery charging controller with automatic microcontroller-based control for Constant Current/ Constant Voltage charging with float battery voltage charge termination.**

- **Built in support for widely available, low cost GSM wireless communication modems, allowing SMS text message capability. Receive a text message on your cell phone for high or low temperatures for example or send a text to the system to receive operational status. Optional**

- **Temperature sensors for reliable operation, with status LED error indication for low or high temperatures. Optional thermocouple input board available for hot side measurement.**

- **External analog and digital isolated inputs and transistor outputs for interfacing with off-board systems or control systems. Control a feedstock delivery unit for example based on operating temperatures.**

- **Expandable for additional functions or custom requirements with the additional of an expansion circuit board, where quantities are favorable to the addition of a custom designed hardware and firmware solution.**

- **Front panel switch selects operation modes for main operating conditions to quickly select various options. For more detailed setup and configuration a Windows compatible setup program will allow the user to set and change the parameters or view the system status. Can be used for remote data logging and collection if GSM modem is not used.**

- Specifications can change without notice. We recommend before buying that you consult our qualified staff.

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Included in package:

- **Rabbit Ears Thermoelectric generator with liquid cooling**
- **100 watt 12/24V charging Dc to Dc charge controller with PLC operation.**
- **12VDC MAG drive pump (15 watt if required)**
- **Ceramic Blanket to lower the ambient air temperature above the stovetop.**
- **8ft High temperature power cord from TEG to controller**
- **6” diameter standard (24” long stove pipe) with cut outs pre-assembled to 2 absorber heat sinks. All preassembled!**
- **3 pcs Black silicone sleeves to cover exposed PEX tube around stove**

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PATENT PENDING RABBIT EARS THERMOELECTRIC GENERATOR

Specifications:

-Overall unit is 28” (71cm) High

-Weight: 40 lbs. (18kg) Box Net 38lbs.

-Packaging : Foam in Place

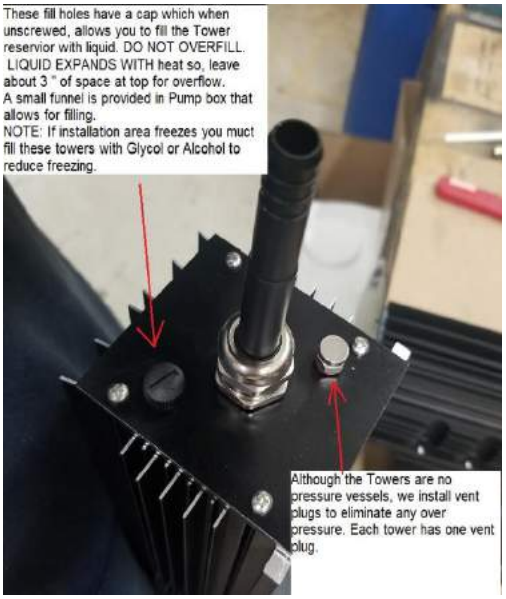
- Box size double walled 31” (79cm) x 21” (53cm) x 17” (43cm)

-Liquid fill cold side tower is ~2.5 Liters of liquid/side. Glycol is recommended if system is installed in a non winterized cabin when heat is turned off.

-(Do not overfill, leave room in top as water will expand when heated) If unit will be in area that freezes please us Glycol 50/50 to protect against freezing. Th outlet tubes run an indepent liquid loop. Fill reservoirs first by removing plastic caps on top of both towers.

Pex Elbow fitting TOP:

PEX Elbow fitting BELOW:



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Quick wiring diagram!

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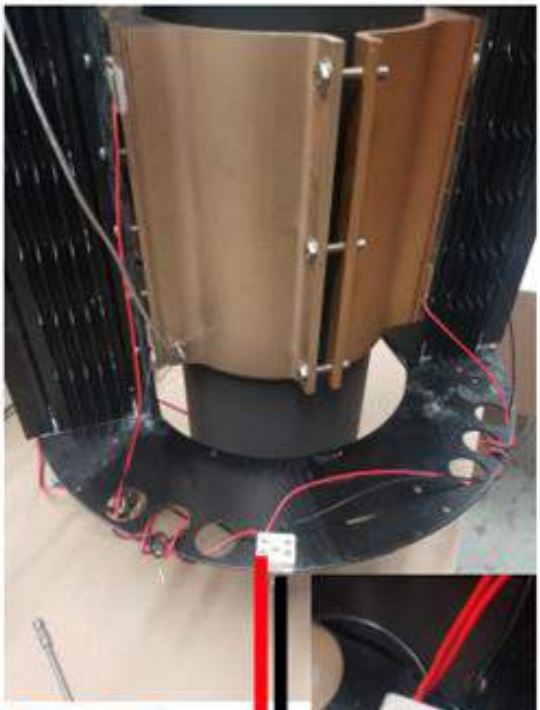

This is the rear view of the Rabbit Ears Generator showing the ceramic terminal block with the Red and Black Output Terminals from the TEG array

When TEG output is sufficient above 13V LCD will display Voltage, Current,Watts, Optional readings if purchased Temperature: Hot side/Cold side

Voltmeter placed here will show the output voltage of the TEG array

If you want to independantly test voltage use a multimeter

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What is needed to install which is NOT INCLUDED:

- Reservoir cold water tank if needed
- Copper heat exchanger tubing as an example to dump heat that will be transferred from hot to cold side (heat removal side) of generator
- 4 pieces ½" PEX Elbow fitting.
- Pex cripper tool kit
- Pex tubing or equivalent
- connectors for pump to PEX ½" NPT fitting female to ½" PEX ends.

Recommended: For liquid storage on cold side it is recommended you have at least use:

- 55 gallons to 110 Gallons required,

0r

Radiant or baseboard loop to dissipate the heat collected from heat absorber side, with base hydronic loop heat exchangers.

Base board heat exchangers work well for radiant heat into cold areas of house!

Example:
https://www.grainger.ca/en/product/p/WWG5E307?gclid=Cj0KCQiA4feBBhC9ARIsABp_nbVdBCGIbWZBBtEURVmAHjgmnuULqx_5Jhfd3HP4lNehpNf5KFWHkIcaAimhEALw_wcB&cm_mmc=PPC:+Google+PLA&ef_id=Cj0KCQiA4feBBhC9ARIsABp_nbVdBCGIbWZBBtEURVmAHjgmnuULqx_5Jhfd3HP4lNehpNf5KFWHkIcaAimhEALw_wcB:G:s&s_kwcid=AL!3645!3!303422060307!!!g!339899120568!

PATENT PENDING RABBIT EARS THERMOELECTRIC GENERATOR

The 100W and 200W Rabbit Ears fit in the same 24” x 6” Diameter pipe foot print!

Mechanical Dimension of the 6” diameter Rabbit ears 100 W Generator

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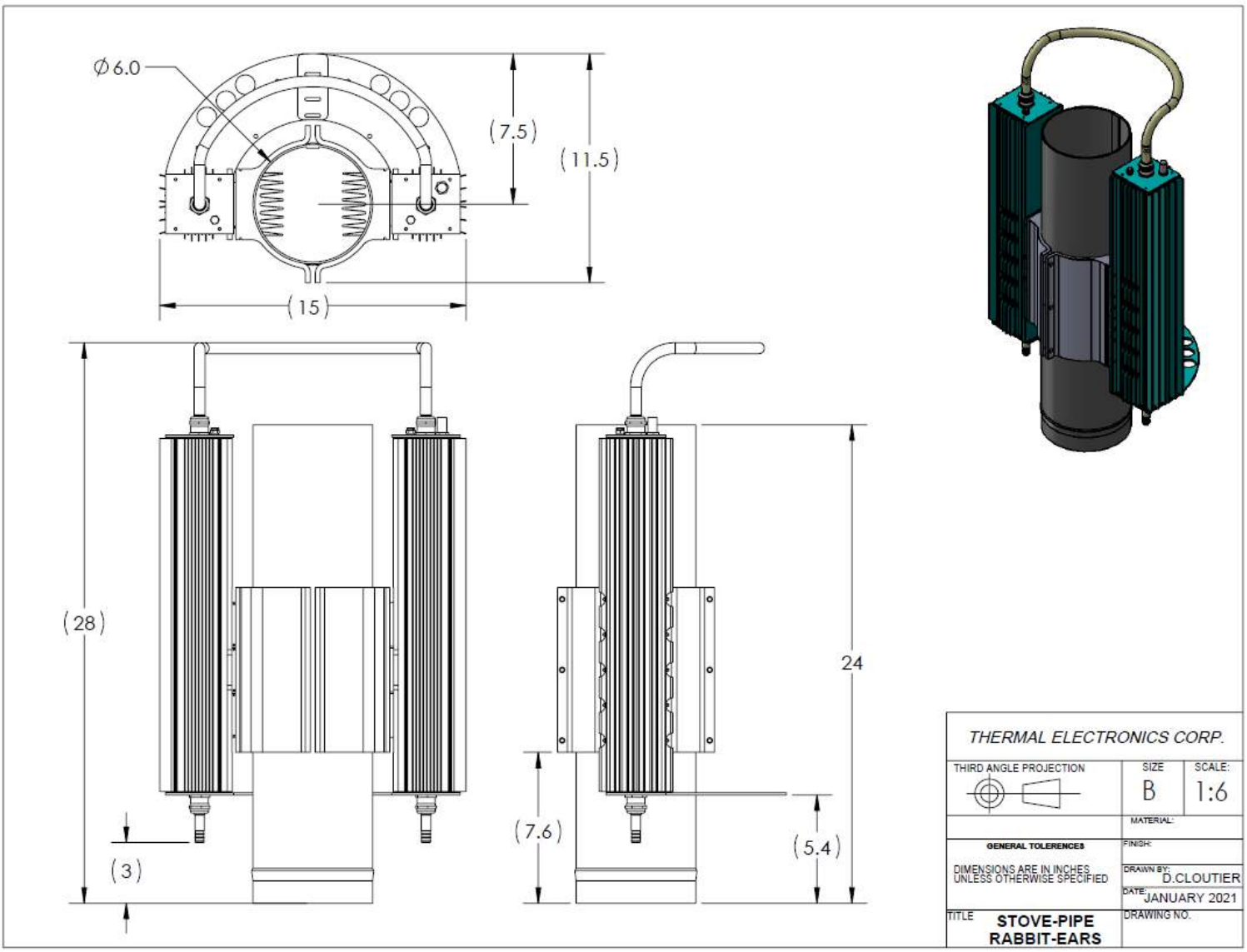

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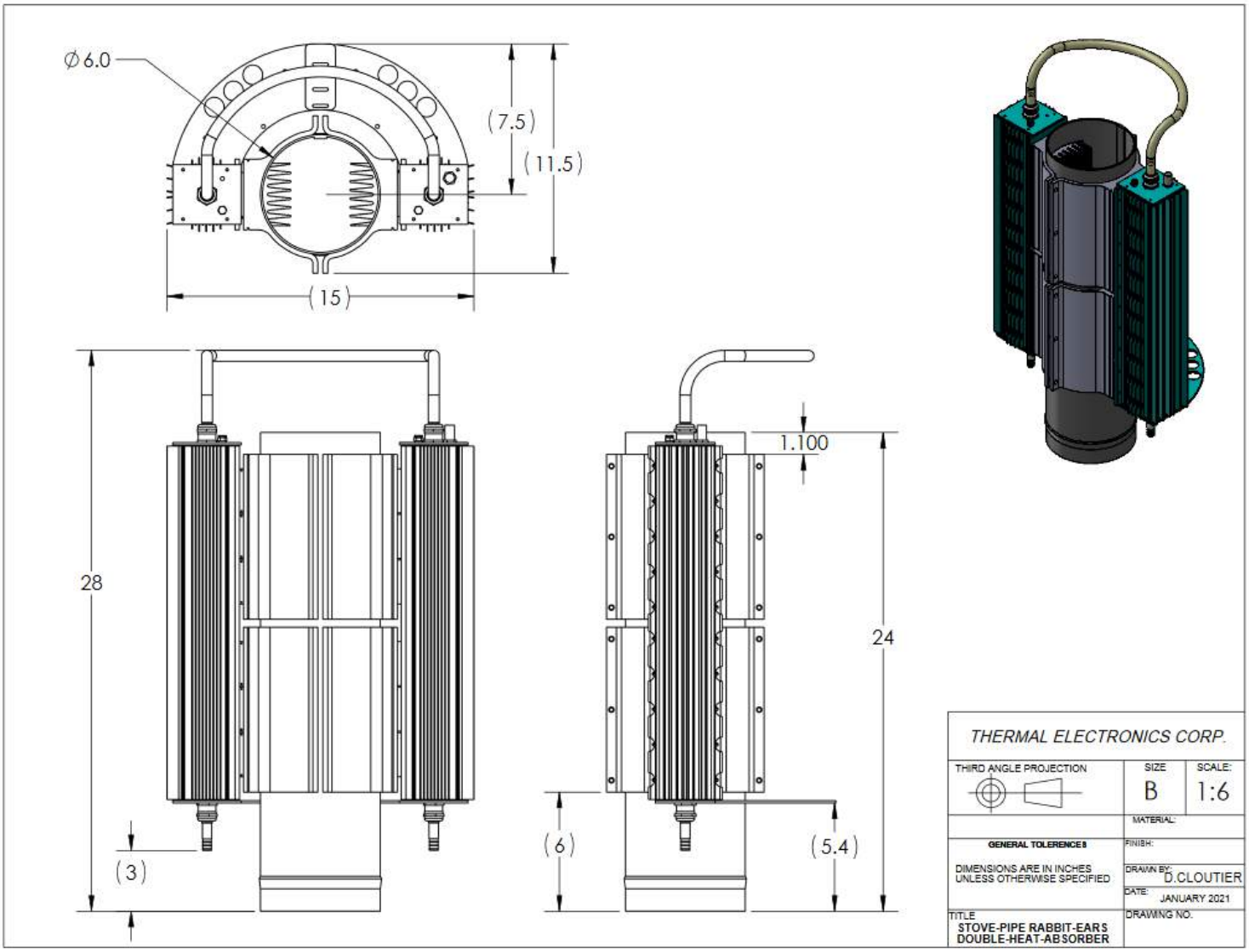
NOT available presently! Expected January 2022.

Mechanical Dimension of the 6” diameter Rabbit Ears 200 Watt Generator



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ONLY READ if pump control option is purchased:

Addendum A: Liquid Pump Features Guide: Jan 2021

Model BB50W-12/24 Buck-Boost Hybrid Controller

PATENT PENDING RABBIT EARS THERMOELECTRIC GENERATOR

Introduction

The BB50W-12/24 is an integrated buck-boost hybrid control system that is expressly designed to allow TEG based power systems to be implemented easily without the need for external PLC control.

With an on-board microcontroller and integrated LCD display, the BB50W-12/24 is intended to be the heart of every TEG based power generation system for many applications including wood stove-based waste heat to power requirements.

The BB50W-12/24 is flexible enough to be used as a stand-alone product, or with some customization of the PLC firmware, it has a host of available digital and analog inputs and outputs including both on-board thermistor and thermocouple temperature measurement (Options) allowing both the hot side and the cold side temperatures to be displayed and/or used as active control loop sensors for feedback control of external pumps, fans, dampers, or other external systems as required.

The four individual switches are set in either the up or down position as required to select the desired mode. A table printed on the face near the switch shows the required position of each switch to select the desired mode. Although it is not shown on the panel, the contrast setting of the LCD can be adjusted to compensate for ambient temperature variations during hot or cold seasonal variations in ambient (as may be required).

The LCD display cycles continuously in real time displaying Input Voltage, Current, Output Power, Thermistor temperature, and Thermocouple temperature with the optional board installed.

DIP Switch Settings

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Fig.1 Rear side showing the DIP switch setting for pump mode operation. The LCD images at right show the response to selecting this mode.

The software can control an external pump for the heat exchange towers for cooling. The controller is configured using the dip switch for different operating modes. For pump control, the following procedure is used to set the mode.

1) Use a suitable short term power source for the controller to begin. During operation **the power input from the TEG generator is used**. For short term testing and configuration, any power source can be used that provides 12V. in this case a 12V battery is used to power the controller for these tests. **After the configuration, the TEG array is reconnected.**

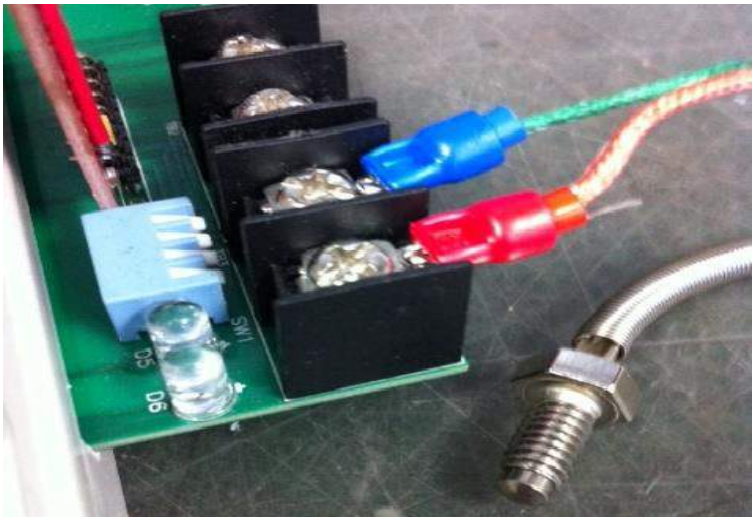

Fig.2 Rear side showing the DIP switch setting for pump mode operation for automatic operation. Also shown is the correct connection for a threaded bolt style thermocouple that should be attached to the heat absorber.

2) Remove the power to the controller. Set all DIP switches to the off (down) position as shown in Fig.2 and then apply power to the controller from your battery. After a short delay the controller will indicate that the pump has been configured in **Pump Auto mode** (Above middle) Fig.1, a message waiting for the user to cycle the power (Disconnect the battery) then back on after a short wait add power again to controller to complete the selection.

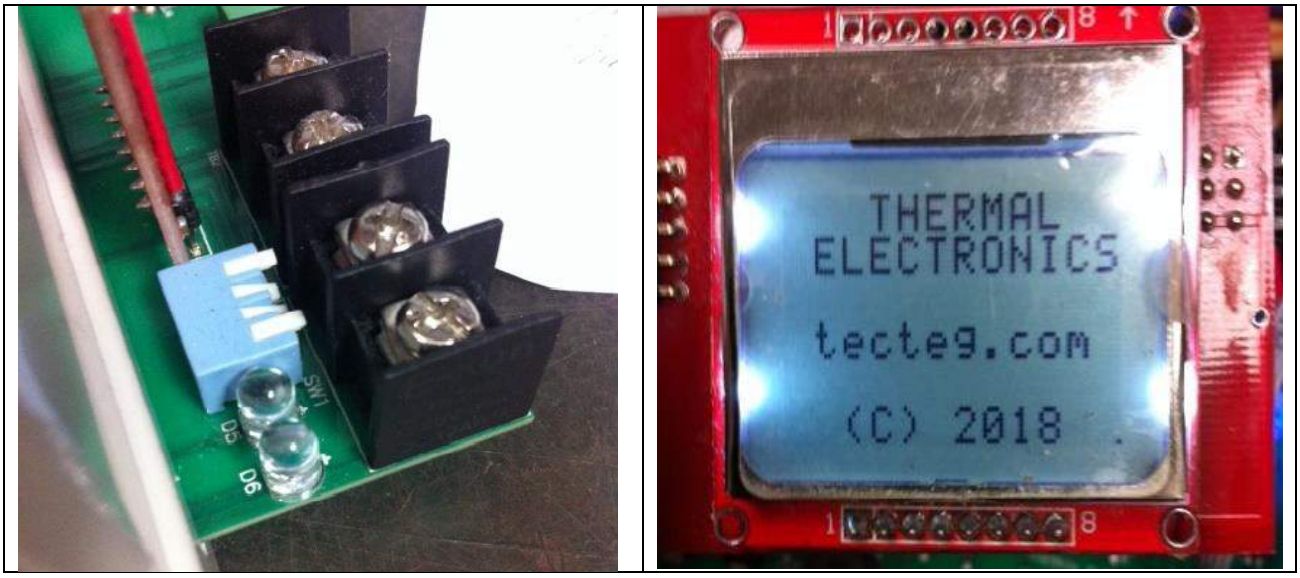

Fig.3 Rear side showing the DIP switch setting for standard 14.4V bulk charging operation.

3) After the dip switches have been adjusted as shown in Fig.3 (2 middle dips in down position outside in up position) above, and the power has been cycled from step 2, the controller will begin a new start-up cycle with the output voltage at 14.4V, bulk charge voltage for a 12V lead acid battery.

4) The pump operation in **Auto Mode** provides a convenient backup operation in the event that the thermocouple is not present or becomes intermittent at any time due to breakdown of the wires. In Auto Mode, the on/off pump cycle is activated cycling the pump on and off to preserve power. With the thermocouple connected, the pump follows an internal setpoint of 38°C (100°F) allowing the pump to turn on above the setpoint , and turn off below the setpoint to preserve power. As a backup feature, the controller will cycle the pump fan automatically if the thermocouple is not found, with a cycle time of approximately 5 mins on and 5 minutes off.

LCD Contrast Adjustment

When all of the switches are in the down position as in Fig.1 power is applied, the LCD contrast can be adjusted at the same time. The LCD contrast is dependent on the ambient temperature and requires minor adjustment for seasonal conditions.

The LCD adjustment a potentiometer or “pot” . With all switches in the down position apply power to the controller and it will boot with the following LCD display in Fig.4 below.

Fig.4 LCD Contrast Adjust panel when all DIP switches are in the down position to allow the contrast to be adjusted for seasonal ambient temperature variations.

Under certain conditions, the display may appear to be blank if the pot is too far to the left or counter-clockwise condition.

Using a small straight blade screwdriver, rotate the pot in a clockwise or to-the-right rotation until the contrast adjust screen above is visible. The further the pot is rotated to the right; the display will reach a condition where the entire display begins to appear as a dark rectangle with no text visible. Correct this condition by rotating the pot to the left until the desired darkness of the text is reached.