Addendum A: Liquid Pump Features Guide: Jan 2021

Model BB50W-12/24 Buck-Boost Hybrid Controller

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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 of most popular control elements.

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 woodstove 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 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.

External batteries can be charged at 12V or 24V, as well as 12V and 24V load-only applications. The bulk charge mode will monitor the output current as the battery is charging and switch to float charge when the charging current falls below a specific user programmable threshold current. The float output mode will maintain the battery at the required float voltage. The various operational modes are selected with a small board-mounted DIP switch as it is called. 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 positon 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.

The LCD display cycles continuously as the microcontroller presents various parameters and measurements in real time including Input Voltage, Output Power, Thermistor temperature, and Thermocouple temperature with the optional board installed.

DIP Switch Settings

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 of the unit can control an external pump for the heat exchange towers for cooling. The controller can be 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. Normally the power input to the controller is taken from the output of the TEG array. For short term testing and configuration, any power source can be used including any benchtop power supply that provides 12V. It may also be convenient to use an external 12V battery to power the controller for these tests. Fig. 2 below shows a typical setup with a battery. After the configuration, the TEG array is reconnected.

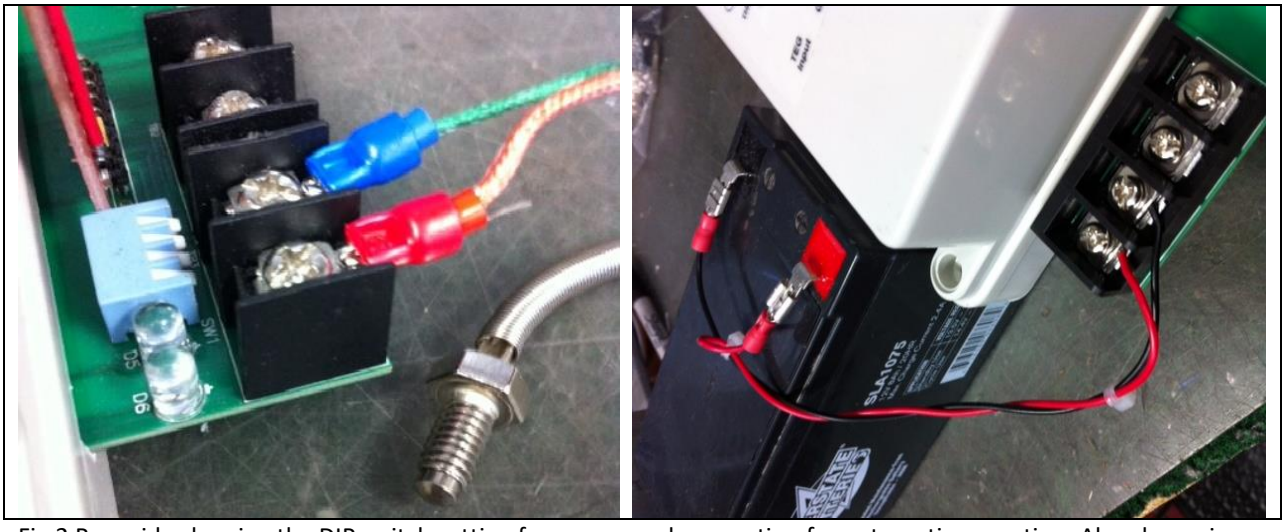

Fig.2 Rear side showing the DIP switch setting for pump mode operation for automatic operation. Also shown is the correct connection for a threaded bolt style thermocouple that should be attached to the heat absorber.

2) Remove the power to the controller. Set the DIP switches to the off (down) position as shown in Fig.2 and then apply power to the controller. After a short delay the controller will indicate that the pump has been configured in Pump Auto mode as shown in the middle photo for Fig.1, and then show the message waiting for the user to cycle the power (turn it off and back on after a short wait) to the 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 above, and the power has been cycled from step 2, the controller will begin a new startup cycle with the output voltage at 14.4V which is the 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 designed to reduce the power consumption of the fan. With the thermocouple connected, the pump follows an internal setpoint of 38 +/- 2 Degrees Celsius allowing the pump to turn on above the setpoint to pump cooling water around the loop, 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 when power is applied, the LCD contrast can be adjusted at the same time. The LCD contrast is dependent on the ambient temperature and could require a minor adjustment for seasonal conditions.

The LCD adjustment is made using a variable resistor called a potentiometer or “pot” as it is often referred to. 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.