APPLICATION NOTE 201

Battery Precharge Sequence for IBC-30kW-480

1.0 PURPOSE & SCOPE

This application note details the battery precharge control sequence for use with Ideal Power's ("IPWR") IBC30kW-480 Battery Converter (IBC-30). Implementing this precharge control sequence as described below minimizes battery in-rush currents, prolonging contactor life. Ideal Power strongly recommends that this precharge sequence be implemented in your controller system software. This document assumes that the reader is already familiar with the IBC-30 Battery Converter Modbus Interface, and that manual control, rather than automatic control of the IBC-30 contactors is in use. Contact Ideal Power at support@idealpower.com for technical support as required.

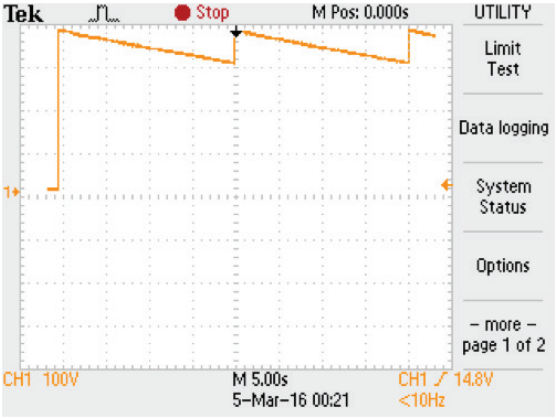
Note that this precharge sequence applies to the IBC-30. IPWR has developed separate documentation for the 30B3 and 125B2 product families, which utilize a different and enhanced set of Control Methods for battery charge and discharge.

2.0 OVERVIEW

Battery in-rush currents can be minimized by "matching" the battery voltage with the IBC-30's DC2 port voltage. This is achieved by precharging port DC2 from AC1, using a AC Conductance Control Method, while DC2 = NET. DC2's output voltage is set using the V_P2_V_max register to ~5% above your actual battery voltage.

With battery contactors open (and IBC-30 contactors closed), execute the code sequence detailed in Section 3.0 of this document. You will then observe the following sawtooth waveform on the IBC-30 DC2 port. The IBC-30 will charge its DC2 port to the voltage noted, and then trip out, due to an DC2 overvoltage fault condition. The DC2 port output voltage will then slowly discharge for 20 seconds, until the system restarts, and again charges the DC output capacitors again. The 20 second timeout is the IBC-30's default system restart clock for internal fault conditions.

DIAGRAM 1. IBC-30 DC2 Precharge output Waveform, relative to Earth Ground



The precharge sequence exploits this recurring waveform: command your site controller to close the battery contactors 1 to 3 seconds after launching the precharge sequence

Use a lab scope to adjust timing as necessary to best match DC2 voltage to your battery voltage. Once the battery contactors are closed, the sawtooth immediately stops, and you will observe battery voltage on both the IBC-30 front panel display, and your scope.

3.0 CONTROL SEQUENCE

1. Set V_contactors to 8011: this closes the IBC-30 contactors.
   Closing the converter's contactor first, ensures that output voltages are balanced on DC2, and protects the contactors from in-rush currents.

2. Set V_P2_V_max to your battery voltage + 5%.

3. Set V_P2_V_min to 0.
   Otherwise, you will have a DC low error, DCL, when you launch the precharge sequence

4. Set V_P2_Method_ID to 1 (NET Control Method).

5. Set V_P1_Method_ID to 202 (AC Conductance Control Method).

6. Set V_P1_Ctrl_A_setpoint to 500.
   This command will initiate the sawtooth waveform as described above. Observe this waveform on a lab scope to determine best timing and voltage match.

7. When battery and waveform voltages match: close your battery contactors.

8. Set V_P1_Method_ID to 1 (NET Control Method).

9. Restore V_P2_V_max to your maximum battery operating voltage, and V_P2_V_min to your minimum battery operating voltage.
   Batteries and the IBC-30 now have voltages matched and contactors closed: charge/discharge power flows may now commence.

For additional questions, please contact:
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