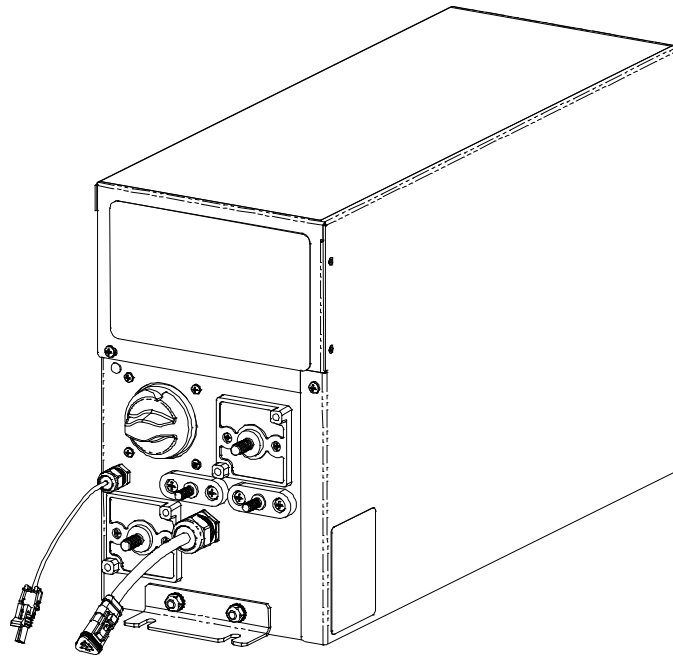


# ***StartSentry***

## **UCS-80Kj and UCS-80KjC**

### **Ultra Capacitor**



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## Introduction

Thank you for purchasing a Vanner *StartSentry Ultra Capacitor*. We are confident that you will be very pleased with its performance. Vanner products are designed and manufactured by skilled professionals using the highest standards in workmanship. With minimum maintenance and care you can be assured of many years of trouble free service.

## General Description

The Vanner *StartSentry Ultra Capacitor "UltraCap"* improves the reliability of the vehicle's starting system. Used in parallel with the vehicle's OEM starting batteries the UltraCap assists the starting batteries on every start. Parasitic loads do not affect the UltraCap since it disconnects from the batteries soon after the engine starts. The IS model supports engine starting with low batteries as long as the MUX (vehicle computer) can generate the STARTER SIGNAL. The GS model supports engine starting with battery voltage so low the vehicle multiplex system (MUX) has shut down.

"KJC" UltraCap model numbers are provisioned with a J1939 CAN Bus interface. The interface provides a means for a vehicle controller to send commands to and receive status messages from the UltraCap. Reference Vanner's "PH11 80kJ Bus Ultracap CAN Messages Specification" for more details about PGN definitions and message ID's. Contact Vanner engineering to ensure you receive the latest version of the specification.

A laptop computer provisioned with Vanner's Dashboard Interface tool can be used to simplify monitoring and/or troubleshooting an UltraCap provisioned with a CAN Bus interface. Reference Vanner's "Vanner CAN Interface User Manual" for details on the Dashboard software and the hardware interface required. Contact Vanner engineering to ensure you receive the latest version of the manual.

The UltraCap is shipped discharged. After installation into the vehicle the UltraCap automatically pre-charges with the first engine start. After that the UltraCap automatically maintains a full charge by remaining connected to the batteries for up to 20 minutes following each engine start.

Some configurations may allow the fleet operator to remove secondary starting batteries, saving weight and maintenance costs. Faster cranking during starting lowers exhaust emissions at engine start and relieves stress on the starter and other electrical system components.

## Safety Precautions

The capacitors contained inside the UCS24-80KJ systems use the organic solvent Acetonitrile. Acetonitrile has a NFPA Health Hazard rating of Class 2 and a Flammability Hazard of Class 3. Although the capacitor itself is enclosed in a strong aluminum enclosure care should be taken to not physically damage the system. If the system does receive damage that results in an Acetonitrile leak proper care must be taken for clean up.

### Spill:

Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, or earth), and place in a chemical waste container. Do not use combustible materials, such as sawdust. Do not flush to sewer.

### Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

### Inhalation:

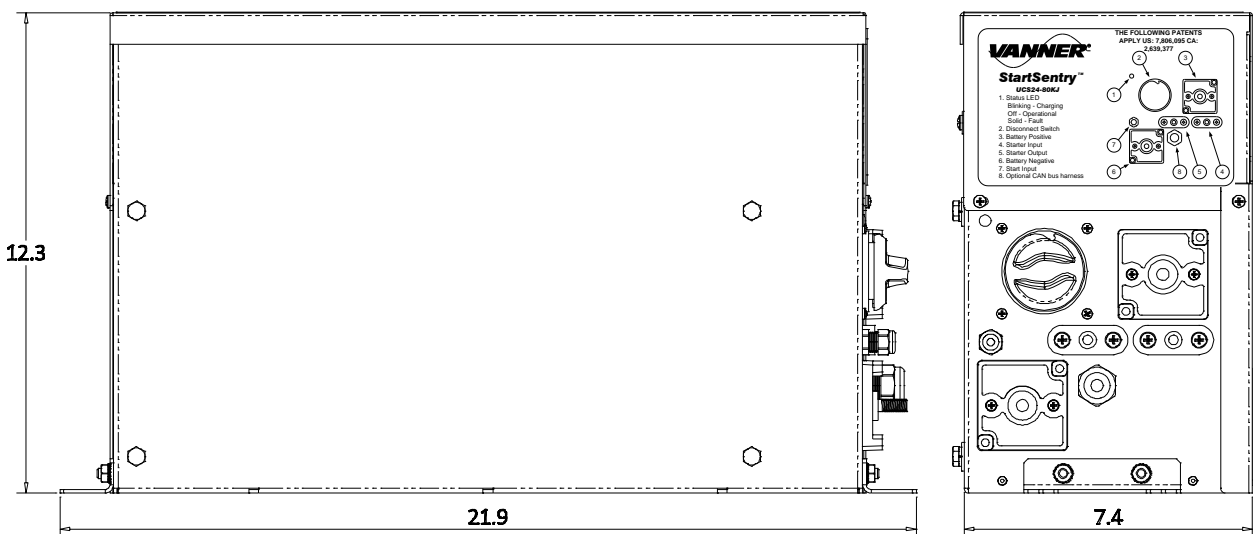
If inhaled, remove to fresh air. If breathing is labored or with coughing, give 100% supplemental oxygen. Get medical attention immediately.

## Specifications

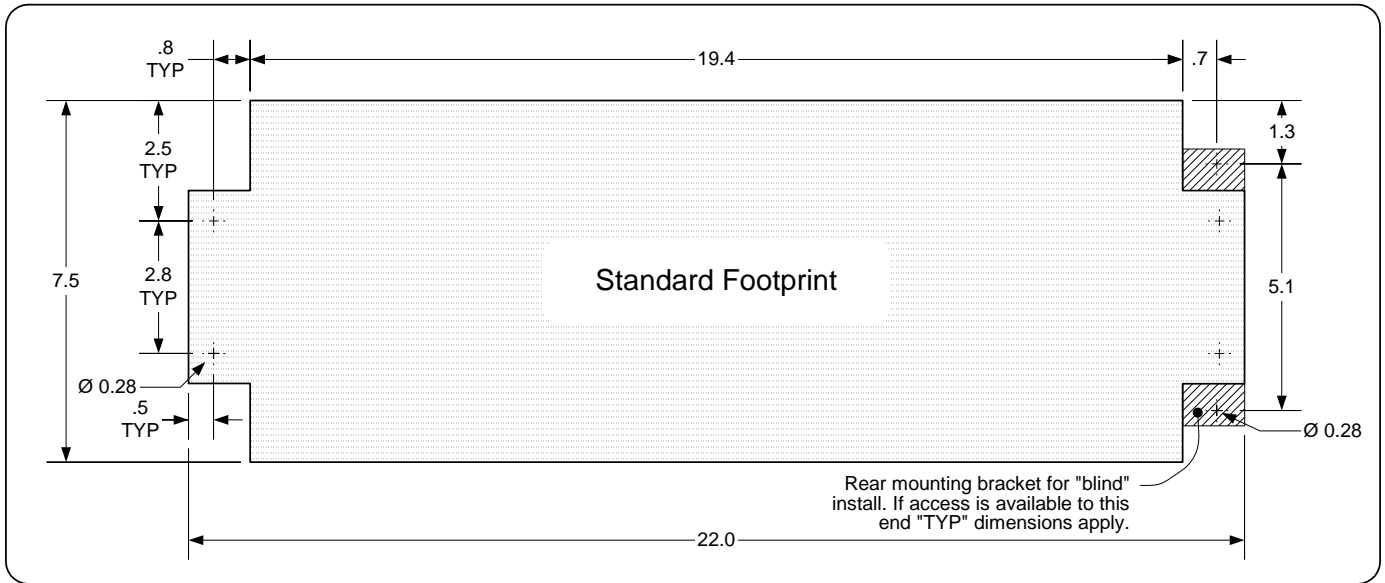
UCS24-80Kj Ultra Capacitor		
Model Number	UCS24-80KJ-IS * UCS24-80KJC-IS	UCS24-80KJ-GS * UCS24-80KJC-GS
Rated Voltage	24V Nominal, 32V Maximum	
Rated Temperature	-40° C to +60° C, -40° F to +140° F	
Cranking Power	30kW at -18° C for 1.5 second	
Peak Cranking Power	50kW at -18° C for 1.5 second	
Cold Cranking Amps	1800A at -18° C for 1.5 second	
Cranking Support Range	10V to 30V	
Leakage Current	10mA	
Self Discharge Time	10 days to 80% voltage at 27° C	
START COMMAND (Activation Signal)	Ignition Signal (6-30V, less than 3ma)	Ground Signal (0-3V, less than 3ma)
STARTER SIGNAL	Interrupts/controls existing signal, 20a max continuous, thermally limited, auto-resetting	
Operation	Self Controlled	
Chassis	Powder Coated Aluminum	
Hardware	Stainless Steel	
Dimensions	12.5H x 22.0D x 7.5W	
Weight	40 lbs.	

\* UCS24-80KJC-XX model numbers are provisioned with CAN communication capabilities.

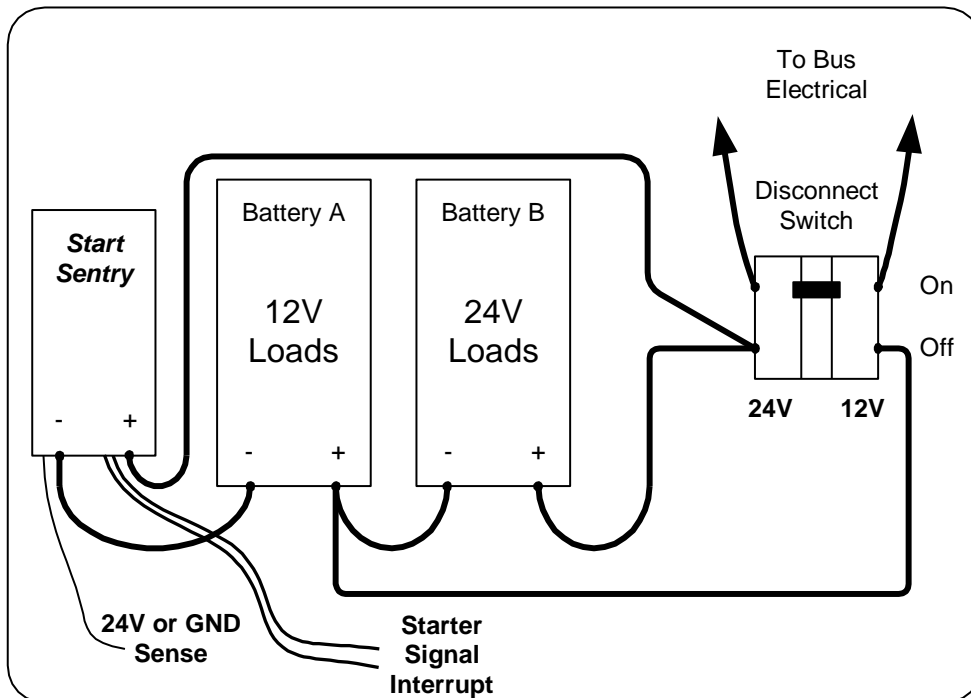
### UCS24-80KJ and UCS24-80KJC Dimensional Specifications



## Mounting Requirements



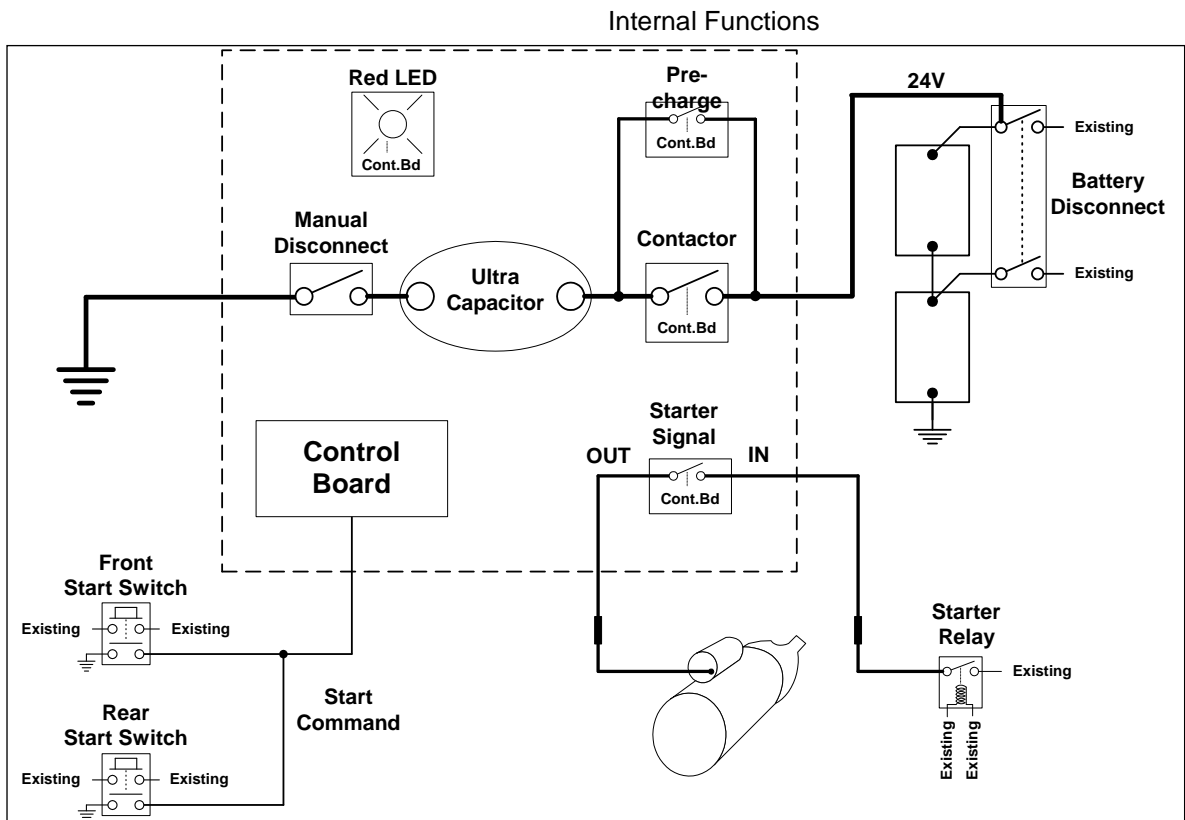
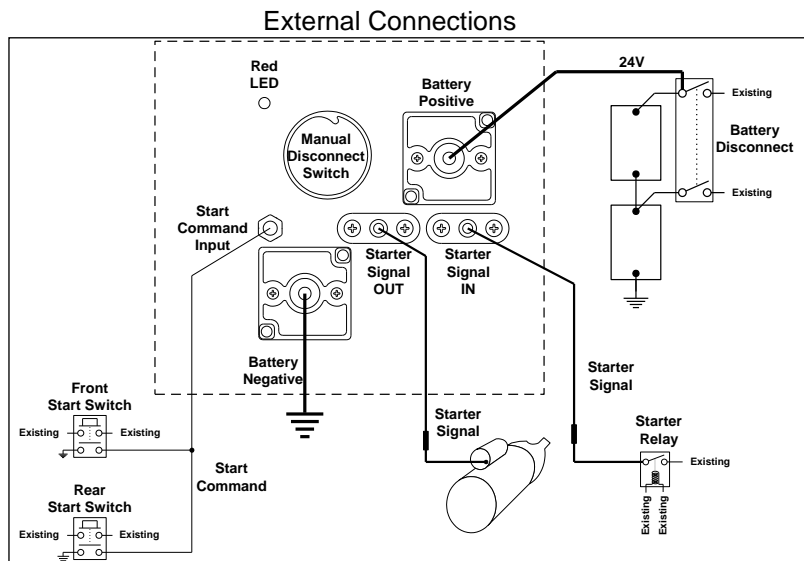
## Typical Transit Bus Wiring



## Connections for "Traditional" Series Operation

**Key Points:**

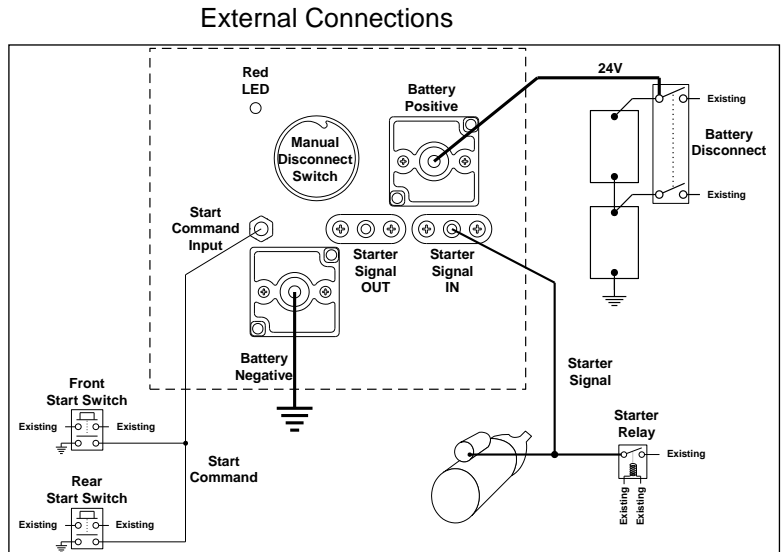
- StartSentry interrupts Starter Signal
- StartSentry logic receives starter signal, then closes UC contactor, and then passes starter signal through. The contactor will always be closed before starter is engaged
- Maximizes Battery Life
- Maximizes StartSentry Contactor life
- StartSentry will block starting if cap voltage is too low



## Connections for Parallel Operation

**Key Points:**

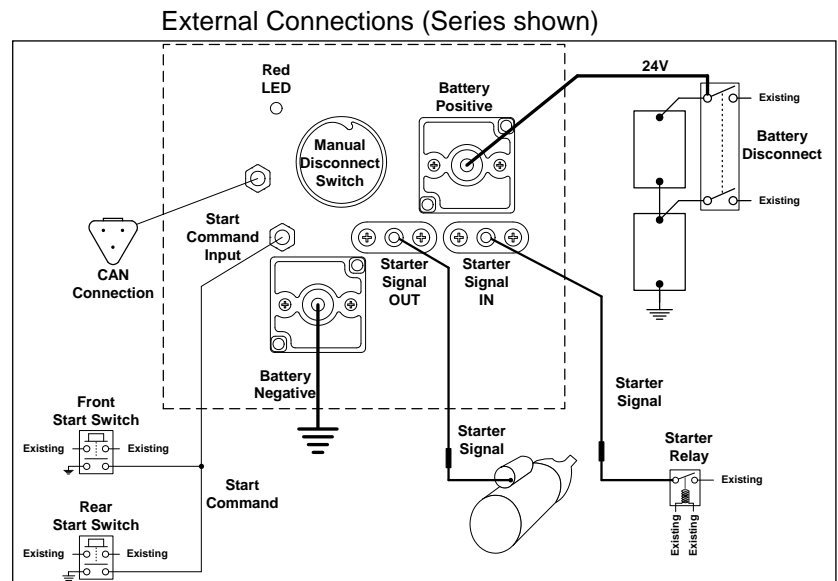
- StartSentry does not interrupt Starter Signal
- StartSentry cannot block starter signal
- StartSentry logic closes contactor in parallel with starter operation
- The starter may engage before StartSentry contactor closes
- Allows batteries to start engine without StartSentry assistance, such as during jump starting.



## Series or Parallel Operation with CAN

**Key Points:**

- StartSentry monitors engine RPM
- StartSentry remains connected to batteries as long as engine is running. (Without CAN the StartSentry disconnects from batteries after running 20 minutes.)
- StartSentry dampens charging system transients



## Installation Instructions

**Do not exceed the specified torque** when connecting cables to the terminal posts of the UltraCap. Torque values higher than specified may damage the product, reduce performance, and/or create hazardous conditions. Torque the 5/16-18 nuts on the positive and negative 24Vdc terminals to 100 lb-in max. Torque the 1/4-20 nuts on the STARTER SIGNAL IN and STARTER SIGNAL OUT terminals to 50 lb-in max. Products damaged by improper torque are not covered by the warranty.

**Mounting Location** –The UltraCap should be mounted on a flat mounting surface suitable to support the UltraCap during application.

**Environmental Protection** – Your UltraCap has been designed to withstand exposure to rain and moisture. The UltraCap has been tested for exposure to direct pressure spray but continual exposure to direct pressure spraying may reduce the UltraCap serviceable life. Damage due to water contamination from high pressure spray may not be covered under warranty.

**Activation signal START COMMAND input wire** – This wire accepts the activation signal to “wake up” the control board prior to receiving the STARTER SIGNAL.

Model UCS24-80KJ-IS requires a momentary or maintained 6V to 30V signal be supplied to the START COMMAND input wire. This signal should originate from the Engine Start circuit.

Model UCSC24-80KJ-GS requires a momentary (recommended) or maintained ground signal be supplied to the START COMMAND input wire. This signal should originate from a switched chassis ground.

The Delphi Weather-Pack part number for the connector on the 14 AWG "START COMMAND" input wire is 12015791. The Delphi part number for the customer's mating connector is 12010996. Select the appropriate Weather-Pack cable seal to ensure the connection is fully protected from the elements.

**DC cable wiring** – DC Cables should be 4/0 minimum. If the vehicle's battery disconnect switch is a circuit breaker, connect the UltraCap positive to the vehicle side of the breaker to prevent nuisance trips.

**Disconnect Switch** – The UltraCap has a built-in DC Disconnect Switch which disconnects the internal capacitor from the negative DC terminal. Turn the built-in Disconnect Switch OFF when installing or removing the UltraCap. Keep the built-in Disconnect Switch OFF when the vehicle DC disconnect switch is OFF. Keep the built-in Disconnect Switch ON when the vehicle DC disconnect switch is ON. Do not leave the UltraCap Disconnect Switch OFF while the vehicle disconnect is ON, or vice versa.

**STARTER SIGNAL IN and STARTER SIGNAL OUT:** Terminals labeled Starter IN and Starter OUT provide the connections to interrupt the existing starter signal. This can be the low current (approx 1 amp) signal that controls the starter relay, or the medium current (approx 10 amps) output from the starter relay to the starter solenoid, mounted on the starter.

**CAN Communication:** A pigtail is provided for UltraCap models with CAN communication capabilities. The Deutsch part number for the connector on the pigtail is DT06-3S-E008 with a W3S wedge lock. The Deutsch part number for the customer's mating connector is DT04-3P-E008 with a W3P wedge lock.

Note: A hole plug is provided for all UltraCap models that don't have CAN communication.

**Operation Flow Charts:** Detailed Flow Charts for standard and parallel operation are available upon request. The flow charts assist with understanding the UltraCap/vehicle interaction during the starting process. Contact Vanner engineering for more information.

**When installation is complete:** Refer to the troubleshooting section in this manual and start the engine.



## Status LED

**LED OFF** – The LED will be OFF during normal operation, whether assisting or at rest.

**LED Blinking** – The capacitor is pre-charging. The LED will turn OFF when pre-charge is complete. The UltraCap automatically pre-charges when the capacitor voltage is lower than battery voltage at the time the STARTER SIGNAL is received. Pre-charge will finish in approximately 15 minutes after initial installation and thereafter in a few seconds or a few minutes. The STARTER SIGNAL is blocked during pre-charge. A new STARTER SIGNAL is required (the operator must release and press the start button again) after pre-charge is complete. The unit will fault if pre-charge is not complete in 30 minutes.

**LED ON Solid** – The UltraCap faulted. Faults are caused by battery voltage being too low or too high, capacitor voltage too low or not increasing. Low and high voltage faults block the STARTER SIGNAL. Faults automatically reset in 1 minute, or 1 minute after the STARTER SIGNAL is removed. (If the engine won't crank during a fault, the STARTER SIGNAL is being blocked. Wait 1 minute for the fault to reset. Do not press the start button again during the fault as this will only extend the fault.) If the UltraCap faults repeatedly and battery voltage is below 20 volts, the fault probably is caused by capacitor voltage being too low. Correct the problem by jumping or charging the batteries.

## Troubleshooting

The following are the most likely questions that may be asked. If your situation does not apply to the following categories, please contact Vanner Inc Customer Service Department: 1-800-AC-POWER (1-800-227-6937). Please have your model and serial number before calling.

### Tools Required:

Clamp-On Amp Meter, Fluke Model 337 or equal, rated 1000 amps DC and with "Peak Hold" feature.  
Multi-meter, Fluke Model 87 or equal.

### Optional for UltraCap Models with CAN interface:

Vanner laptop provisioned with Vanner Dashboard software  
USB to CAN adapter module. (PEAK System's PCAN-USB IPEH-002021)

**Note:** There are kits available for purchase from Vanner that include the Dashboard software, USB to CAN adapter module and a harness to connect to the UltraCap pigtail. Please contact Vanner sales or engineering to ensure purchase of the proper kit for your application.

### **BATTERY OUTPUT AMP TEST verifies the UltraCap is working.**

This test will verify the UltraCap is working and supporting the batteries during starting. Use the DC clamp-on meter's Peak Hold function to measure peak cranking amps on the 24V BATTERY positive cable. With the UltraCap **Disconnect Switch ON**, start the engine and capture the BATTERY peak output amps. Record the reading. With the UltraCap **Disconnect Switch OFF**, start the engine and capture the BATTERY peak output amps. Record the reading. Shut the engine off and then turn the Disconnect Switch back ON. (Starting the engine while UltraCap Disconnect Switch is OFF may cause the unit to fault. Other than during this test, always keep both disconnects ON or OFF together.)

Compare the two readings. Battery output amps should be several hundred amps LOWER when the Disconnect is ON.

If the UltraCap does not seem to be working, continue with the trouble shooting below. If a problem is found and is corrected, allow the UltraCap to pre-charge and then perform the Battery Output Amp Test again.

**CHECK THE FOLLOWING FIRST:**

Verify the built-in Battery Disconnect Switch and vehicle battery disconnect switch are both ON.  
Verify electrical connections are connected, properly torqued, and free of corrosion.  
Verify proper battery voltage is present at the UltraCap DC terminals.  
Verify UltraCap is receiving START COMMAND.  
Verify UltraCap is receiving STARTER SIGNAL.

**Symptom      LED is flashing after pushing the Engine Start switch. Engine will not crank.**

**Cause**            The UltraCap is pre-charging. The STARTER SIGNAL is being blocked until pre-charge is complete. This is normal and will occur anytime capacitor voltage is BELOW battery voltage when a start is attempted.

**Solution**        Wait until the LED goes out. The LED will go out when pre-charge is complete. The UltraCap is shipped with the capacitor completely discharged. Following initial installation, at the first attempt to start the engine, pre-charge may last for approx 15 minutes. Subsequently, the need to pre-charge should be infrequent and should be complete in a few seconds or a few minutes.

**Symptom      LED ON SOLID after pushing the Engine Start switch. Engine will not crank.**

**Comment**        The starter signal is being blocked due to low or high voltage on the battery or on the capacitor. The fault will automatically reset in 1 minute. Do not turn the built-in disconnect switch OFF in an attempt to clear the fault. It will not clear the fault and an additional fault may be created by doing so. If the starter signal is being blocked, wait 1 minute. The fault will reset. Do not press the start button during the fault as this will only extend the fault.

**Cause**            Battery voltage and capacitor voltage both below 20V.

**Solution**        Charge or jump batteries. UltraCap will pre-charge when start is attempted.

**Cause**            Battery voltage above 32V.

**Solution**        Find and correct the high voltage charging problem.

**Cause**            Battery voltage below 3V.

**Solution**        Batteries may be disconnected or connected backwards. Correct battery problem.

**Symptom      LED ON SOLID after engine starts or after engine is shut down. Starting is OK.**

**Cause**            Capacitor voltage did not increase within 10 sec following release of STARTER SIGNAL.

**Solution**        Alternator not charging. Address charging problem.

**Cause**            Capacitor is not fully charged. Voltage stopped rising before reaching 26V.  
Capacitor is not fully charged. Voltage was above 26V but fell to 26V before the contactor had been closed for 20 minutes.

**Solution**        This is normal when the vehicle is shut down before running for 20 minutes. This fault does NOT block the STARTER SIGNAL. Restart can be attempted immediately.

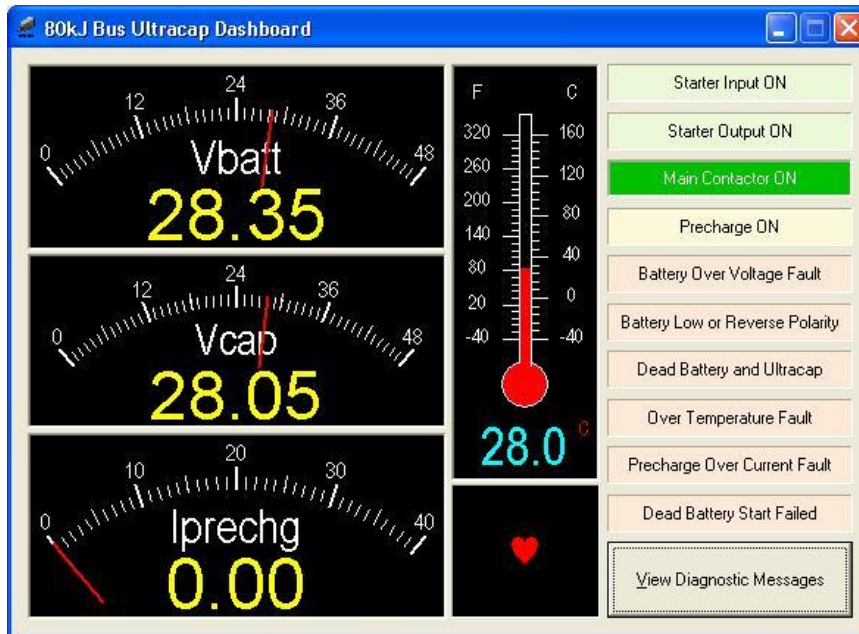
- Symptom**      **Bus will not start and the LED is not ON or flashing.**
- Solution**      Internal temp above 90°C (194°F) will cause complete shut down. Allow unit to cool/reset.
- Solution**      The UltraCap is suspected to be defective. Bypass the UltraCap and verify the engine will start from battery power with UltraCap bypassed.  
**Bypass the UltraCap as follows:**
1. Turn the built-in Disconnect Switch OFF.
  2. Remove the STARTER SIGNAL IN wire and the STARTER SIGNAL OUT wire from the ultracap. Do not allow wires to remain on the ultracap Starter Signal IN or Starter Signal OUT terminals. Connect the two wires together using a ¼" bolt.
  3. Verify the bus will start with the UltraCap bypassed.

## Dashboard Interface ("KJC" Model Numbers)

With the UltraCap dashboard interface, the user can

- View the running status of the Ultracap, as well as fault messages
- View the battery voltage, ultracap voltage, pre-charge current, and control board temperature
- View diagnostic CAN messages

### Dashboard Screenshot



The left portion of the dashboard displays the battery and UltraCap voltages in addition to the Pre-charge current. The right portion of the dashboard illustrates status and fault messages.

### STATUS DEFINITIONS

**Starter Input ON:** This icon indicates the status of the starter input on terminal 4. Green indicates the starter input is present and will dim upon contactor closure.

**Starter Output ON:** This icon indicates the status of the starter output on terminal 5. Green indicates that the starter signal has been passed through to the output terminal and will dim upon contact closure.

**Main Contactor ON:** This icon indicates the status of the main contactor. Green indicates that the main contactor is closed and will dim upon opening.

**Precharge ON:** This icon indicates the status of the pre-charge circuit for the capacitors. Green indicates that the caps are being pre-charged and can be verified by viewing the pre-charge current ( $I_{prechg}$ ). Once the caps are fully pre-charged, the icon will dim.

#### **FAULT DEFINITIONS**

**Note:** If a fault condition exists, the contactor will open and the red LED on the front of the unit will be on solid. After approximately one minute, the control board will enter sleep mode, the fault will clear and the LED will turn off. Another start attempt can then be made.

**Battery Over Voltage Fault:** This icon indicates if an over voltage fault ( $V_{batt} > 32V$ ) condition exists.

**Battery Low or Reverse Polarity:** This icon indicates if an under voltage ( $V_{batt} < 3V$ ) or reverse polarity condition exists.

**Dead Battery and Ultracap:** This icon indicates if both the battery and capacitor voltages are less than 20V.

**Over Temperature Fault:** This icon indicates if an over temperature ( $T > 100^{\circ}C$ ) condition exists on the control board.

**Precharge Over Current Fault:** This icon indicates if the precharge current exceeds 20A.

**Dead Battery Start Failed:** This fault indicates if the UltraCap failed to charge the batteries above 20V.

**View Diagnostic Messages:** Selecting this icon will open a Diagnostic Messages window that can be used to inspect Diagnostic Messages (DM1) sent from the Ultracap. The user can also request DM1 messages, Software ID, and Component ID information from the Ultracap.

Reference Vanner's "PH11 80kJ Bus Ultracap CAN Messages Specification" for more details about PGN definitions and message ID's. Contact Vanner engineering to ensure you receive the latest version of the specification.

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