



22KW DC/DC Graphical User Interface (GUI) Introduction



Overview of CAN

CAN Features:

- **two-wire**(differential signal) serial
- half duplex
- 1Mbit/s maximum
- Multi-Master network

Why is CAN used?



- Robust in noisy environments
- Reliable: built-in error confinement and detection
- High speed
- Cost effective

CAN Open Systems Interconnection (OSI)

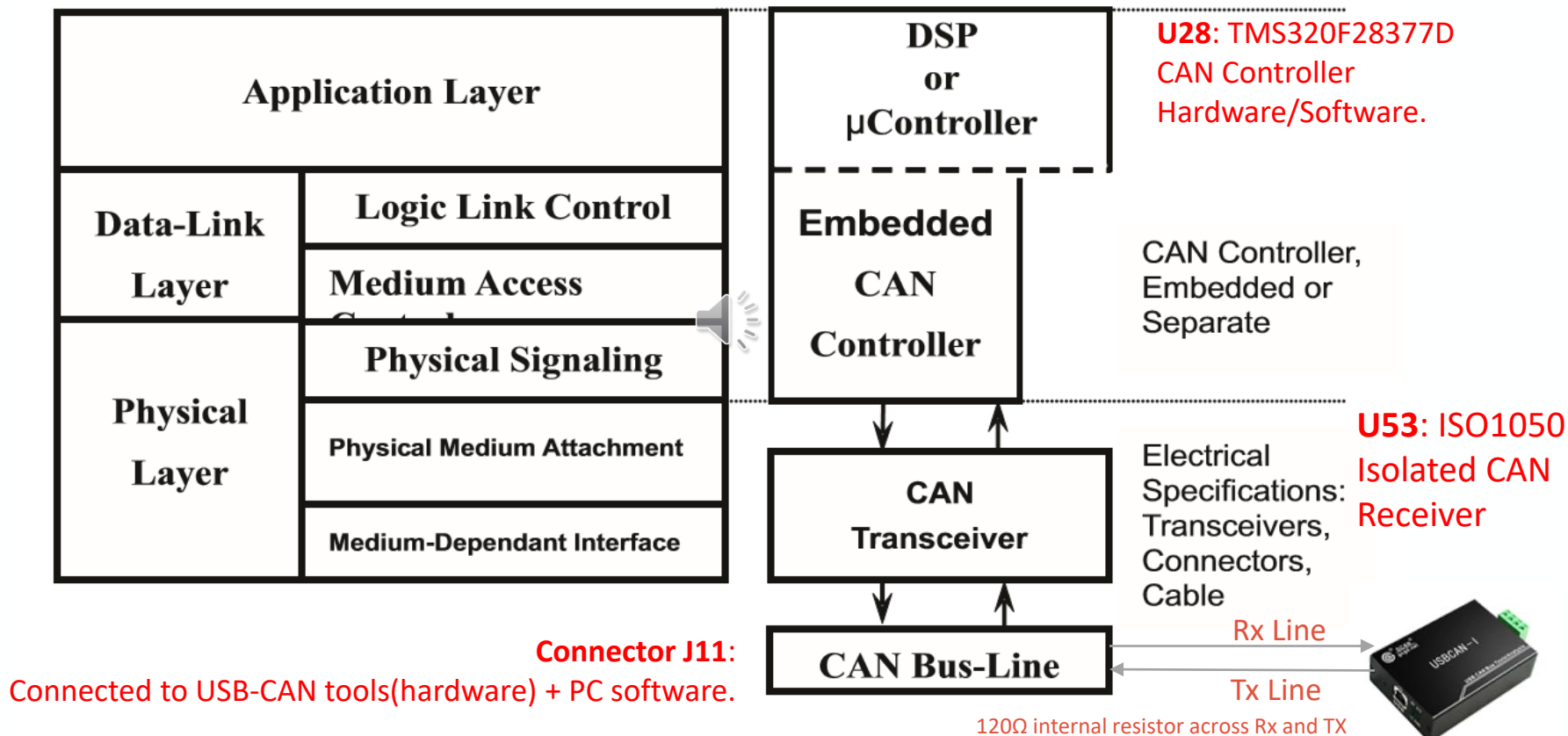
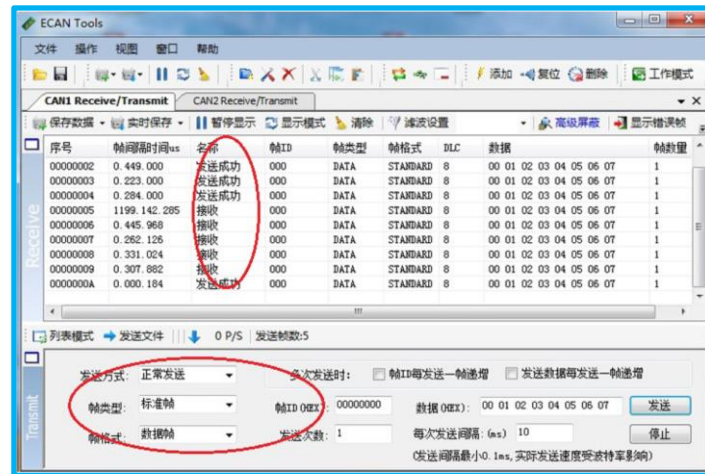
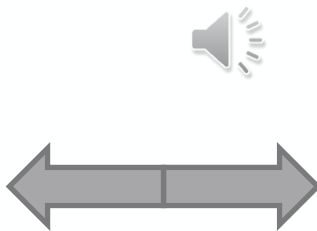


Figure 1. The Layered ISO 11898 Standard Architecture

USB-CAN Tools and GUI

- The USB to CAN tools/adapters (CAN Analyzers) enable simple connection between CAN networks and a PC.
- CREE's GUI for its 22KW OBC also relies on a unique driver.
 - Thus, the GUI can only work with USBCAN-I hardware from GCAN.
 - Without this restriction any other USB to CAN tools could be used.



Official GUI

CAN Network and CAN Data Frame Format

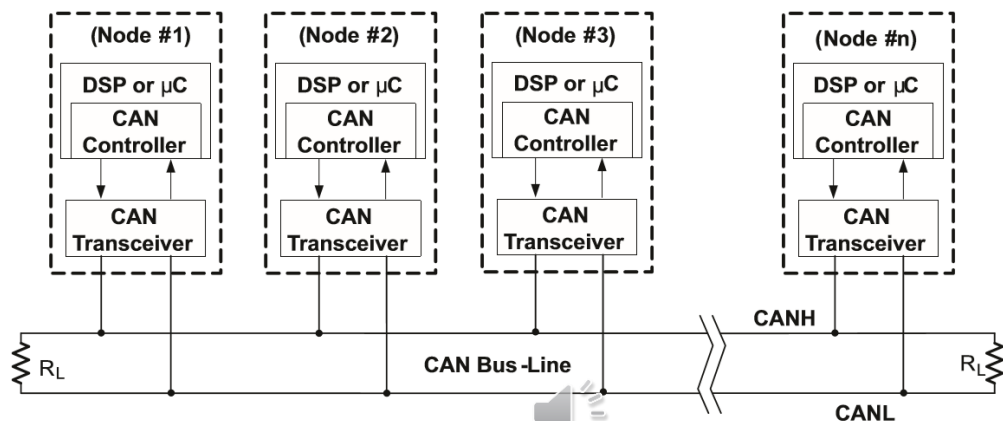


Figure 2. CAN Network ($R_L = 120\Omega$ Typ.)

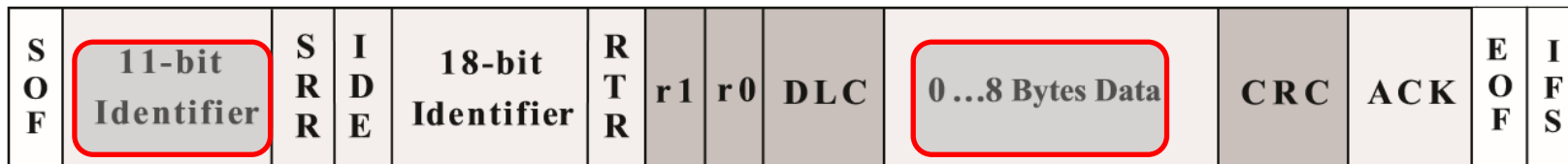


Figure3. Extended CAN (CAN2.0B) frame format

- Only 29-bit Identifier and Data Bytes are used by users.
- Remaining bits are calculated and stuffed by CAN hardware.

GUI CAN Data Format

If you don't have GCAN tools, you can also send command to adjust the output voltage in the data format described below without visually displaying. You also have to judge if there is warning in the data stream.


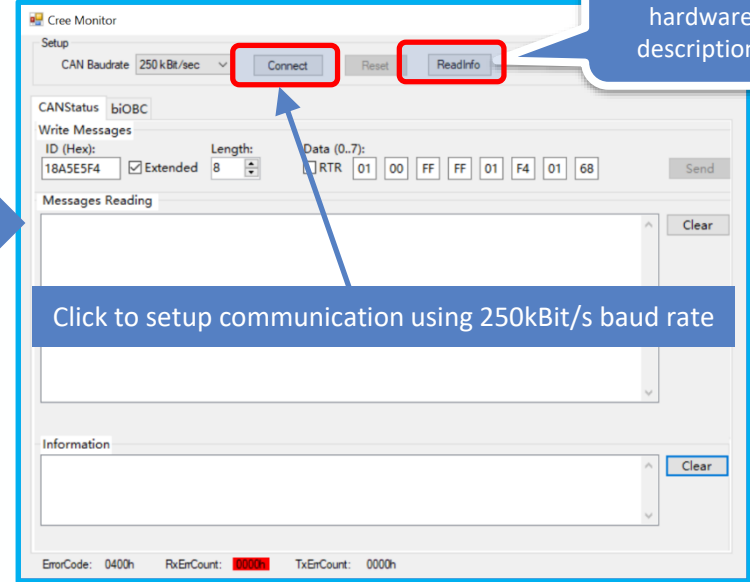
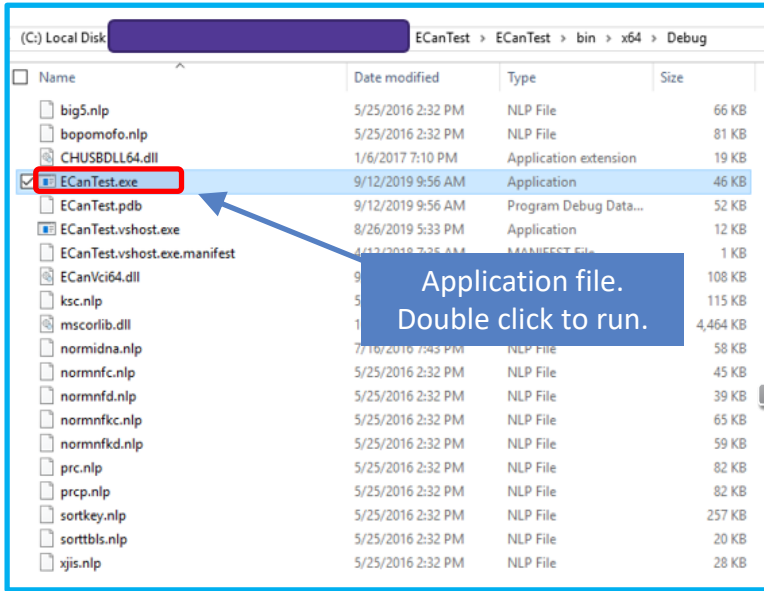
Message Identifier: 0x18A5E5F4					
Data	Byte0 = 01	Byte1= 00	Byte2+Byte3	Byte4+Byte5 = 0x12C0	Byte6+Byte7 = 0x0168
Property	Charging Mode; Full Bridge	On	Reserved 0xFFFF 	DC Voltage: $0x12C0 * 0.1V = 480V$	DC Current: $0x0168 * 0.1A = 36A$

Table 7: Example of Control Command

For example, use “0x18A5E5F4” as the message identifier and “0x0100FFFF12C00168” as CAN data to set the OBC to 480V with full current capacity. The first byte in the CAN instruction needs to match the real work mode situation when the second byte is zero or the instruction will be ignored by the reference board. The voltage control message only matters in charging mode because the output voltage is fixed in discharging mode.

For other frames, please refer to section 12.2/12.3 in user's guide.

GUI Execution



Step 1: Start the program after hardware connection is done.
Connect USB port to PC and CAN port to connector J11 of OBC.

Step 2: Click "connect" to setup the communication.

Note: Microsoft C# visual studio was used to develop the GUI application. Installation is not needed.

GUI Windows: CAN Status Tab

The screenshot shows the Cree Monitor application window with the CAN Status tab selected. The window title is "Cree Monitor". The "Setup" section includes "CAN Baudrate" set to "250 kBit/sec", and buttons for "Disconnect", "Reset", and "ReadInfo". The "CANStatus" section shows "biOBC" and a "Write Messages" area with "ID (Hex): 18A5E5F4", "Extended" checked, "Length: 8", and a "Data (0..7)" field containing "RTR 01 00 FF FF 01 F4 01 68". A "Send" button is next to it. The "Message Reading" section displays a list of received messages with columns for Time, ID, Format, Type, and Data. An "Information" box shows "Open Success" and "Start CAN1 Success". At the bottom, the "Communication Status Bar" displays "Error Code: 0000h", "RxErrCount: 0000h", and "TxErrCount: 0000h".

Click to show CAN Status info. Display. (Default)

Raw data to send manually

Information box: Message will show communication success.

Raw data received

Communication Status Bar

Step 3: Check for successful communication setup.
If not, check CANH and CANL wire positions and if control board has power.

GUI Windows: biOBC Tab

Click to show OBC info. display

Operational Information Display Area

Voltage/Current Control Area
Command area is invisible unless CAN frame from the converter is received.

RESERVED AREA

Specification Display Area

Reminder Display Area

Communication Status Bar

Cree Monitor
Setup
CAN Baudrate: 250 kBit/sec
Disconnect
Reset

CANStatus: biOBC

BAT Side Info
Vdc: 0.8 V Idc: 0.0 A
BUS Info
Vbus: 4.9 V Ibus: 0.0 A
Current Work Mode: ---
Ambient Temperature: 27.0 °C

CLLC Control CMD
Power Direction: Charge (selected) Discharge
ON/OFF: ON (selected) OFF
Topology: Full Bridge (selected) Half Bridge
Vmax(V): 610.0 Ibat(A): 36.0
Send to OBC

General Info.
SWVER:--- COMVER:---
BatVmin:--- BusVmin:---
BatVmax:--- BusVax:---
Vbat_CCCP:---
ChgCurMax:--- Get Para

SR Auto TurnOff

ErrorCode: 0000h RxErrCount: 0000h TxErrCount: 0000h

Step 4: Open biOBC tab.

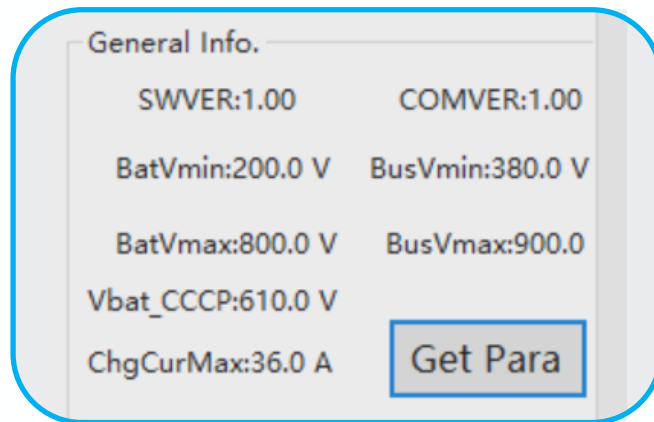
GUI Windows: biOBC Tab

The screenshot displays the Cree Monitor software interface for the biOBC tab. The window title is "Cree Monitor".

- Operating Mode (OFF):** A blue callout box points to the "Operating Mode" dropdown menu, which is currently set to "OFF".
- OVER/UNDER VOLTAGE:** A yellow callout box with red text indicates "RED: Fault" and green text indicates "GREEN: Normal". A red arrow points to the "Vdc: 0.0 V" value in the "Battery Side Info" section, which is highlighted in green.
- Battery side information:** A blue callout box points to the "Battery Side Info" section, which shows "Vdc: 0.0 V" and "Idc: 0.0 A".
- Bus Side information:** A red callout box points to the "BUS Info" section, which shows "bus: 650.6 V" and "bus: 0.0 A". A purple callout box labeled "RESERVED" points to the "Vbus" and "Ibus" fields.
- OVER TEMPERATURE:** A yellow callout box with red text indicates "RED: Fault" and green text indicates "GREEN: Normal". A red arrow points to the "Ambient Temperature: 25.2 °C" value, which is highlighted in green.
- Current Operation Mode:** A yellow callout box points to the "SR Auto TurnOff" field, which is set to "BAT<<<<BUS@Full Bridge".
- CLLC Control CMD:** The "Power Direction" is set to "Charge" (radio button selected). The "ON/OFF" mode is set to "OFF" (radio button selected). The "Topology" is set to "Full Bridge" (radio button selected). The "Send to OBC" button is visible.
- General Info:** A yellow callout box labeled "Get Para" points to the "Get Para" button in the "General Info" section.
- Status:** The "CLLC" status is "Charging". The "Ambient Temperature" is "25.2 °C". The "Error Code" is "0000h". The "RxErrCount" is "0000h" (highlighted in green). The "TxErrCount" is "0000h".

Step 4: Open biOBC tab.

GUI Specification Display Area



SWVE:	Software Version, Ver1.00
COMVER:	Software Version for Communication, Ver 1.00
BatVmin:	Vmin at battery side, 200V
BatVmax:	Vmax at battery side, 800V
BusVmin:	Vmin at bus side, 380V
BusVmax:	Vmax at bus side, 900V
Vmax_CCCP:	Max voltage (610V) with Max Current (36A): 22KW/610V/36A.
ChgCurMax:	Max Current in charging mode, 36.0A

GUI Reminder Display Area

CLLC tank over current protection is detected!
This protection needs a power off reset to clear!

Short circuit protection is detected!
This protection needs a power off reset to clear!

Hardware PFCOCP is detected!

Power derating is caused by low AC input.

DCOCP issued! Reset! PFCOCP issued! Short Circuit! Power Limited by Low AC

SR Status

Power Limited by High Temperature

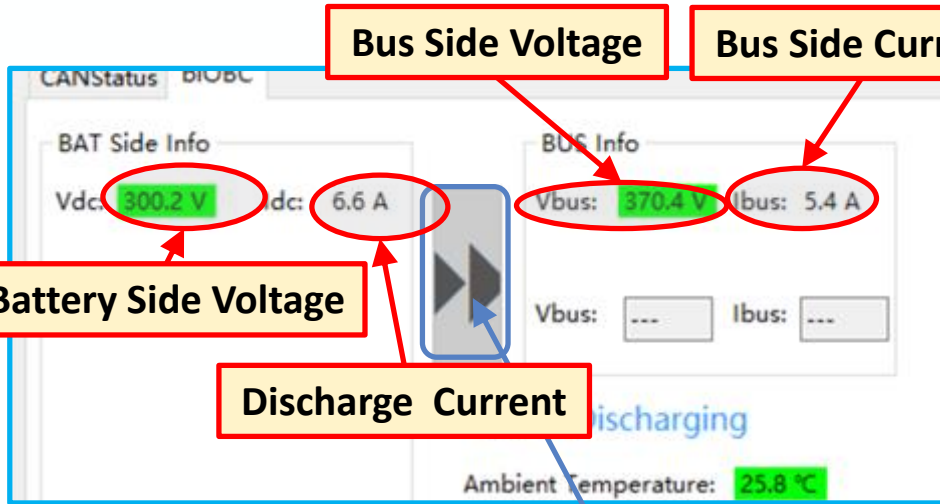
Power derating is caused by high temperature.

CLLC secondary side drive status:
turn off or turn on.

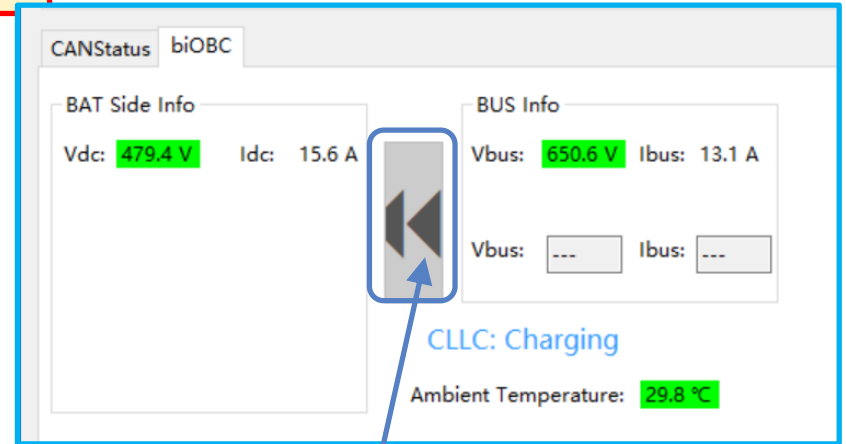
Operation mode(power direction and topology)

Note: Most reminders are invisible during normal operation.

GUI Operational Information Display



Discharging Mode



Charging Mode

GUI Voltage/Current Control Area

1. Referring to Chapter 6 in the Users' Guide, select the right power direction based on the set-up connection.

The screenshot shows the 'CLLC Control CMD' interface. It features several control elements: a 'Power Direction' section with radio buttons for 'Charge' and 'Discharge' (the latter is selected); a section with radio buttons for 'ON' and 'OFF' (the former is selected); a 'Topology' section with radio buttons for 'Full Bridge' and 'Half Bridge' (the former is selected); and two input fields for 'Vmin(V): 610.0' and 'Imax(A): 36.0'. A 'Send to OBC' button is located at the bottom right. Red circles highlight the 'Discharge', 'ON', 'Full Bridge', and 'Send to OBC' elements. Red arrows point from text boxes to these elements.

3. Select ON/OFF to start/shut down the converter respectively.

4. Voltage/Current Reference Input

2. Referring to Chapter 2 in the Users' Guide, select topology selection for the input side.

5. Click to send out the command.

GUI Usage Example

Take 650V input and charging mode as example

GUI Usage Example

1. Send OFF command to converter before applying DC input.

2. Verify the sample value of input voltage. Take 650V at bus side terminals for example.

Left Screenshot (biOBC):

- BAT Side Info: Vdc: 0.1 V, Idc: 0.0 A
- BUS Info: Vbus: 4.9 V, Ibus: 0.0 A
- Power Direction: Charge (selected), Discharge
- ON/OFF: ON, OFF (selected)
- Topology: Full Bridge (selected), Half Bridge
- Vmax(V): 610.0, Ibat(A): 36.0
- Send to OBC button
- Ambient Temperature: 29.0 °C

Right Screenshot (CANSt):

- BAT Side Info: Vdc: 0.0 V, Idc: 0.0 A
- BUS Info: Vbus: 650.6 V, Ibus: 0.0 A
- Power Direction: Charge (selected), Discharge
- ON/OFF: ON, OFF (selected)
- Topology: Full Bridge (selected), Half Bridge
- Vmax(V): 610.0, Ibat(A): 36.0
- Send to OBC button
- Ambient Temperature: 23.8 °C

GUI Usage Example

The screenshot displays the GUI interface for a power electronics controller. It is divided into several sections:

- BAT Side Info:** Shows Vdc: 0.0 V and Idc: 0.0 A.
- BUS Info:** Shows Vbus: 650.7 V and Ibus: 0.0 A.
- CLLC Control CMD:** Includes Power Direction (Charge selected), ON/OFF (ON selected), Topology (Full Bridge selected), Vmax(V): 610.0, Ibat(A): 36.0, and a Send to OBC button.
- CLLC: Charging:** Shows Ambient Temperature: 23.6 °C.
- SR Auto TurnOff:** Shows BAT<<<<BUS@Full Bridge.

Annotations include:

- A red box around the Vbus value (650.7 V) with the text "Calculated start up voltage".
- A red box around the "Charge" radio button with the text "3. Select 'charge' according to the input terminals."
- A red box around the "Full Bridge" radio button with the text "4. Select 'Full Bridge' according to possible operation definition in Section 2 of Users' Guide."
- A red box around the "ON" radio button and the "Send to OBC" button with the text "5. Select ON and send out to OBC. Start-up voltage is calculated by controller. The voltage reference for startup has no impact here."
- A red box around the "SR Auto TurnOff" text with the text "operation mode display for verification".

GUI Usage Example

6. Set reasonable voltage reference as desired when the input voltage is at about 650V or 900V. That is 340V~490.8V for 650V input. Input tolerance is 3V.

CLLC Control CMD
Power Direction: Charge Discharge
ON/OFF: ON OFF
Topology: Full Bridge Half Bridge
Vmax(V): 340.0 Ibat(A): 36.0
Send to OBC

CLLC Control CMD
Power Direction: Charge Discharge
ON/OFF: ON OFF
Topology: Full Bridge Half Bridge
Vmax(V): 490.0 Ibat(A): 36.0
Send to OBC

SR Auto TurnOn: BAT<<<<<BUS@Full Bridge

SR is enabled automatically.

GUI Usage Example

The screenshot shows the Cree Monitor software interface. At the top, there's a 'Setup' section with 'CAN Baudrate' set to 250 kBit/sec and buttons for 'Disconnect', 'Reset', and 'ReadInfo'. Below that is 'CANStatus' showing 'biOBC'. The 'BAT Side Info' section displays 'Vdc: 0.0 V' and 'Idc: 0.0 A'. The 'BUS Info' section shows 'Vbus: 650.6 V' and 'Ibus: 0.0 A'. A temperature reading of '25.2 °C' is visible. The 'CLLC Control CMD' section has 'Power Direction' set to 'Charge' and 'ON/OFF' set to 'OFF'. 'Topology' is set to 'Full Bridge'. A 'Send to OBC' button is present. At the bottom, 'SR Auto TurnOff' is set to 'BAT<<<<BUS@Full Bridge'. A 'Get Para' button is also visible.



7. Shut down the converter.
The OFF command will be accepted no matter what the power direction or topology is.

Please following the procedure in Section 7 of Users' Guide to shut down the power after test.

SR is disabled automatically.

