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Vanner CAN Interface User Manual

Rev 5.0

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Document Revision History

Revision	Date	Corresponding Software Version	Description
1.0	3/12/2010	1.6	Initial Release
1.1	3/22/2010	1.7	Added support for Vector CAN
1.2	5/12/2010	1.7	Updated dashboard for PMEC
1.3	11/17/2010	2.0	Updated dashboards for HVDC Converter, Standalone Battery Monitor, PMEC, and Converter Isolator
1.4	8/16/2012	3.7	Added HVDM dashboard, updated dashboards for HVDC Converter, 70/80 Equalizer, and PMEC
1.5	9/10/2012	3.8	Added Ultracap dashboard
1.6	9/26/2012	3.9	Added configurable source address for sending CAN command
1.7	1/4/2014	4.6	Updated main interface, added ultracap dashboard, VannBus simulator, and CAN data analyzer
5.0	2/12/2015	5.0	Revised revision number to match software version. Added IAP II and VEPI dashboard. Updated HBA dashboard and CAN data analyzer.

Content at a Glance

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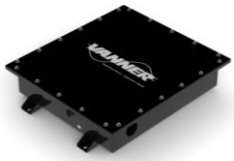
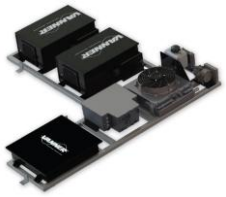
1. Introduction

Vanner CAN Interface software provides a graphical user interface (or dashboards) to CAN messages sent to or received from Vanner CAN-based products. It also supports other CAN functions such as CAN message inspection, logged CAN data analysis, and CAN bootloading. Each CAN-based product or CAN function is implemented as a separate module, which can be invoked by clicking an icon in the main user interface.

A list of Vanner CAN-based products currently supported by Vanner CAN interface software is as follows,

-  70/80 series CAN equalizers
-  90-60 converter isolators
-  Hybrid high voltage DC/DC converters (a.k.a. HBA, hybrid beltless alternators)
-  Standalone battery monitors
-  Idle Watch (a.k.a. PMEC, power management and engine controller)
-  HVDM (high voltage distribution modules)
-  80kJ bus ultra-capacitor

-  IAP II (Increased Accessory Power II)
-  VEPI (Vanner Exportable Power Inverter), embedded in IAP II

Other CAN function modules included in Vanner CAN interface software are as follows,

- 

Vanner CAN Bootloader
- 

Vann-Bus Simulator
- 

CAN Message/Data Logger
- 

CAN Data Analyzer

2. Connection to CAN Bus

To connect a computer to CAN bus, a CAN/USB adapter is needed, as shown in Figure 1. The Vanner CAN Interface currently supports two different CAN/USB adapters:

(1) PCAN, a CAN/USB adapter from Peak. See details at http://www.peak-system.com
(2) Vector CAN, a CAN/USB adapter from Vector. See details at http://www.vector.com/vi_cancase_xl_en.html.

The Vanner CAN Interface will search for connected CAN USB adapters automatically. If both Vector CAN adapter and Peak CAN adapter are connected, Vector CAN adapter will be used. Disconnect Vector CAN adapter from computer USB port if Peak CAN adapter is desired.

Please make sure two 120-ohm terminating resistors are used at both ends of the CAN bus backbone to ensure reliable CAN communication. The Vanner CAN Interface follows J1939 CAN communication protocol, with a fixed speed of 250K bit/second.Support of the new speed of 500K bit/second per SAE-J-1939-14 standard is possible in future versions.

Figure 1. Vanner CAN Interface System Connection

3. Package Content of Vanner CAN Interface Software

Vanner CAN Interface software package consists of three files:

- ✓ **Vanner CAN Interface.exe**

This is the main executable file. Run it to bring up the main user interface. All product dashboards and function modules can be accessed from the main user interface.

- ✓ **PCAN_USB.dll**

This is the Peak CAN USB driver. It is needed for the computer to talk to the Peak CAN adapter through a USB port.

- ✓ **vxlapi.dll**

This is the Vector CAN USB driver. It is needed for the computer to talk to the Vector CAN adapter through a USB port.

Simply save these three files to any folder on the user's computer. No installation is required.

4. Main User Interface and Registration

Before starting the Vanner CAN Interface, make sure the Peak CAN adapter (PCAN in short) or Vector CAN adapter (VCAN in short) is connected to a USB port of the computer. If it is the first time the adapter is connected, the user may be prompted to install the driver program, which is located on the accompanying CD for the PCAN or VCAN. Please refer to PCAN or VCAN user's guide for details.

When a CAN adapter is connected and recognized by the computer, double click "Vanner CAN Interface.exe" file to start. The main user interface window will appear, as shown in Figure 2. Only activated modules (by registration code) will appear on the main user interface.

At any time, the user can connect to or disconnect from CAN bus by clicking the power switch button.

Click the left/right arrow to switch between screen pages.

Click the X button to exit the Vanner CAN Interface and close all opened windows.

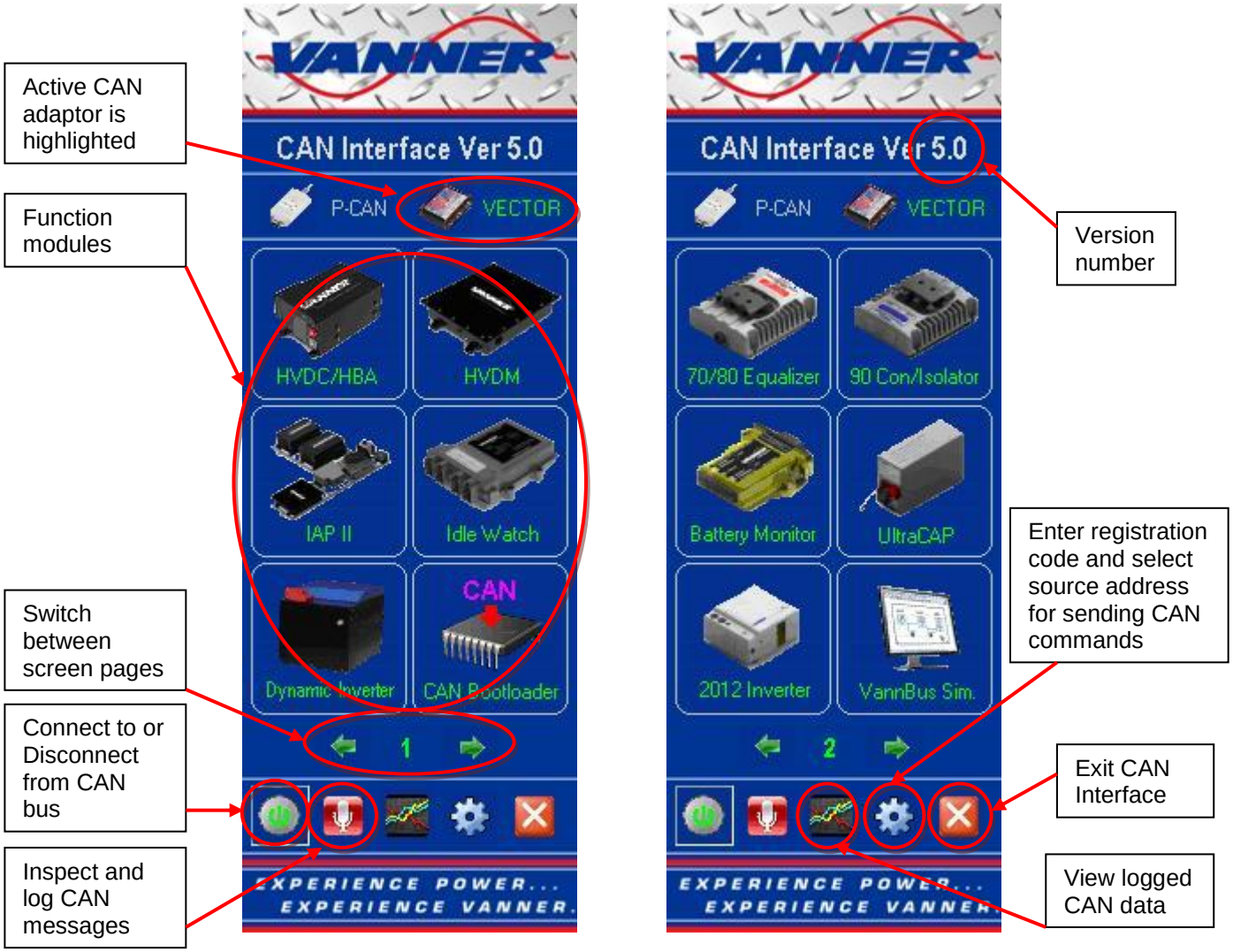


Figure 2. Vanner CAN Interface Main Window

4.1 Hiding and Showing Main User Interface

The main user interface can be hidden by double clicking on the main window. The main user interface is actually minimized to a tray icon on the start menu bar at lower right corner, as shown in Figure 3. Double click the tray icon to bring up the main window.

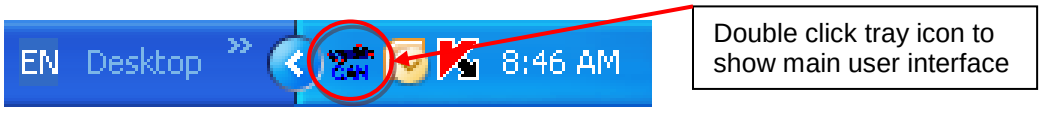


Figure 3. Vanner CAN Interface Tray Icon

The main user interface can be hidden automatically on startup. See the option in Figure 4.

4.2 Entering Registration Code

The Vanner CAN interface contains several function modules that need to be activated by registration code. Please contact Vanner to get your registration code.

To enter registration code, click the gear button on the main window (see Figure 2). The software and registration information window will appear, as shown in Figure 4.

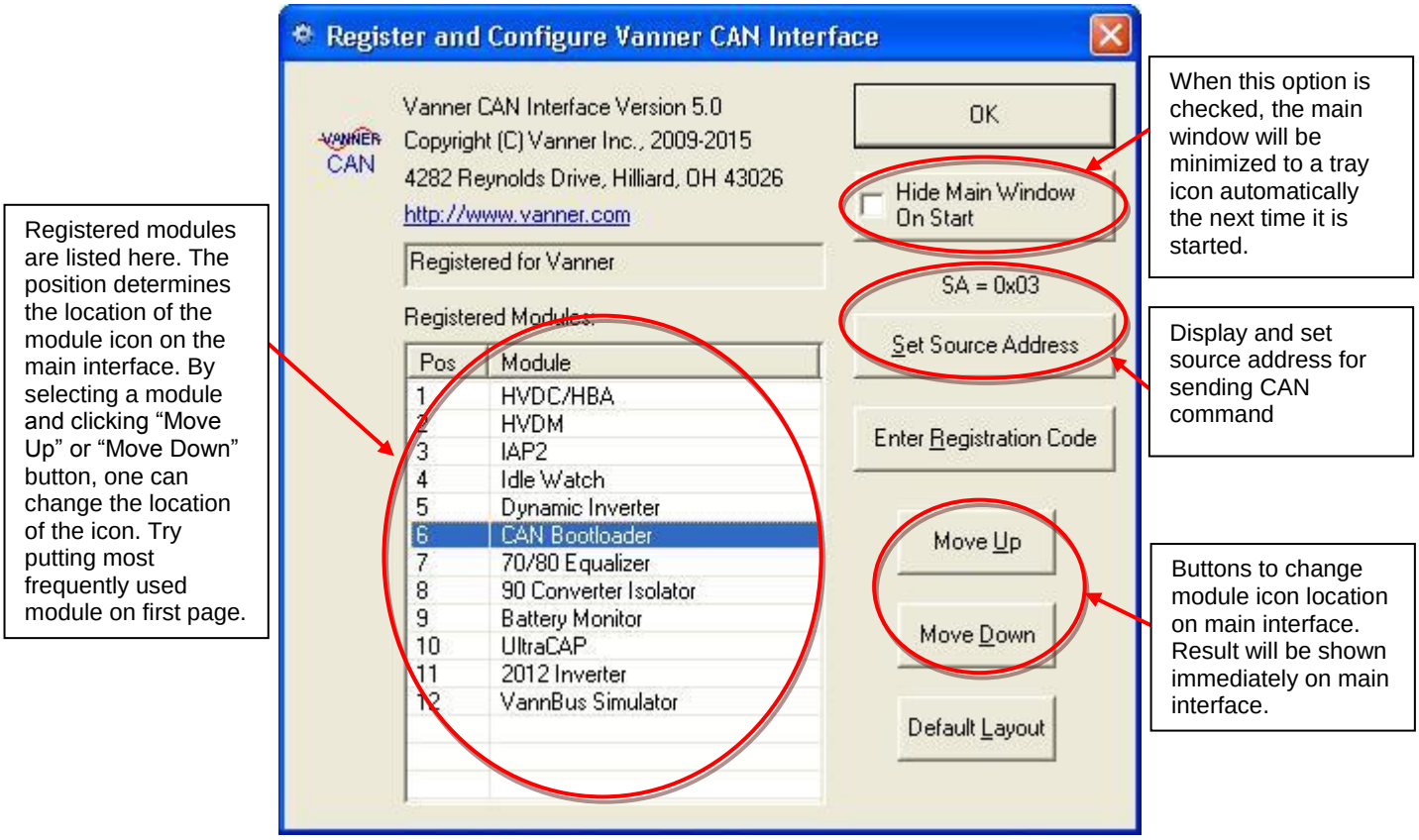


Figure 4. Software and Registration Information Window

Click the “Enter Registration Code” button to open the registration window (see Figure 5). Please note that the registration code is case sensitive. Information about activated modules will be shown in the “About” window after the code is entered.

Figure 5. Enter Registration Code Window

Once a function module is activated, the corresponding module icon will appear on the main window. Click it to start the module. The details of each module are described in the following sections.

4.3 Set Source Address

The Vanner CAN interface can simulate CAN messages sent from a system controller or other devices. The source address used in these messages can be configured by customer, see Figure 4. The current source address (default 0x03) is displayed. Select the “Set Source Address” button to change. All changes are saved in the registry which will be loaded automatically on next start.

5. Product Dashboards and CAN Function Modules

The Vanner CAN Interface integrates Vanner product dashboards and other CAN function modules into a single software package. The main user interface provides access to all separated modules. Each module can be activated by corresponding registration code. See section 4.2 for details on how to enter the registration code.

5.1 Dashboards and Function Modules

The man window of Vanner CAN Interface is shown in Figure 6.

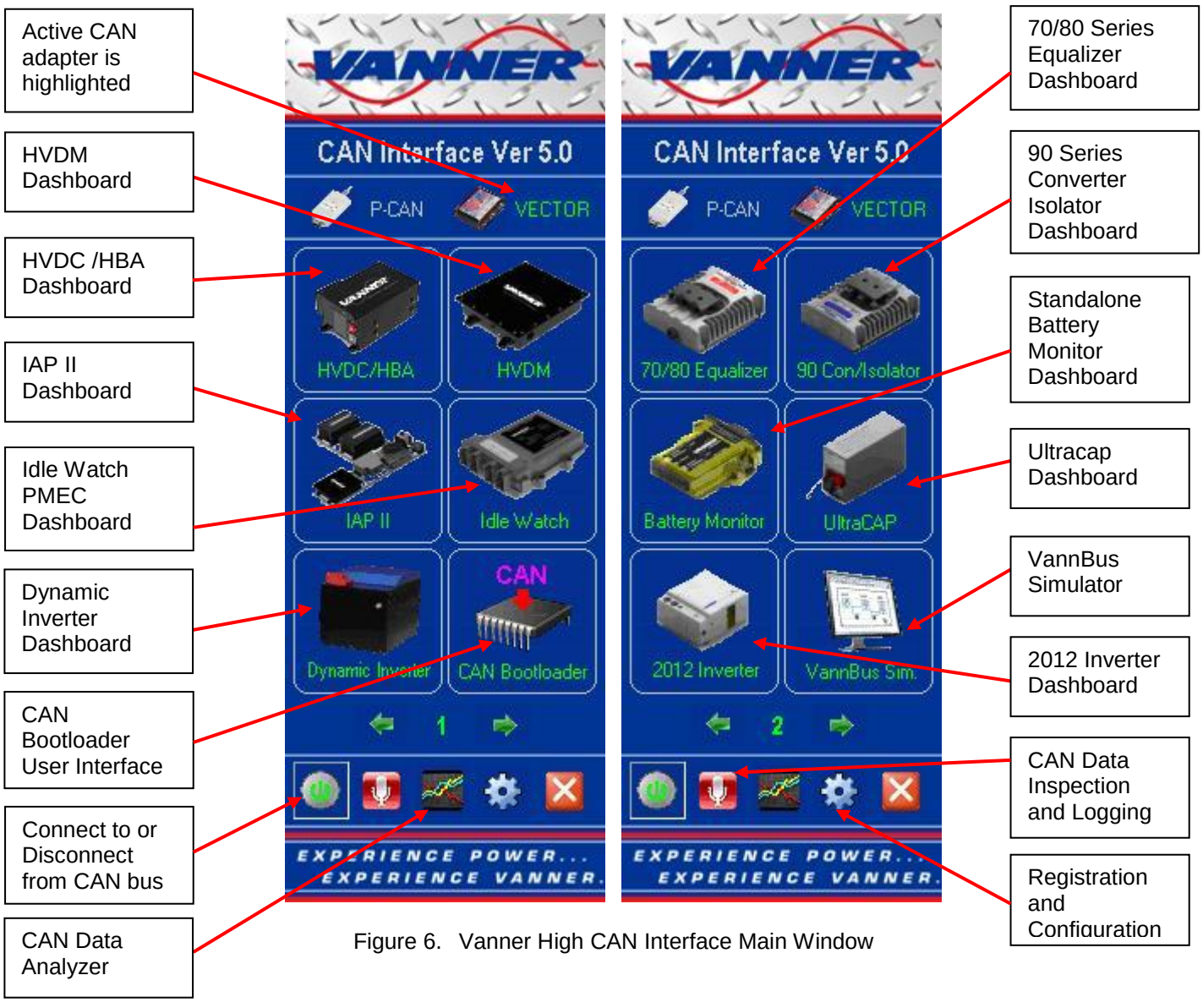


Figure 6. Vanner High CAN Interface Main Window

Each activated module can be invoked by clicking the corresponding icon in the main window.

5.2 CAN Messages Inspection and Logging Window

When the Vanner CAN Interface is connected to CAN bus, all receiving and transmitting CAN messages (allowed by the filters setting) can be inspected and logged into a file.

 Click the microphone button in the main window to open the “Inspect and Record CAN Messages Window” as shown in Figure 7.

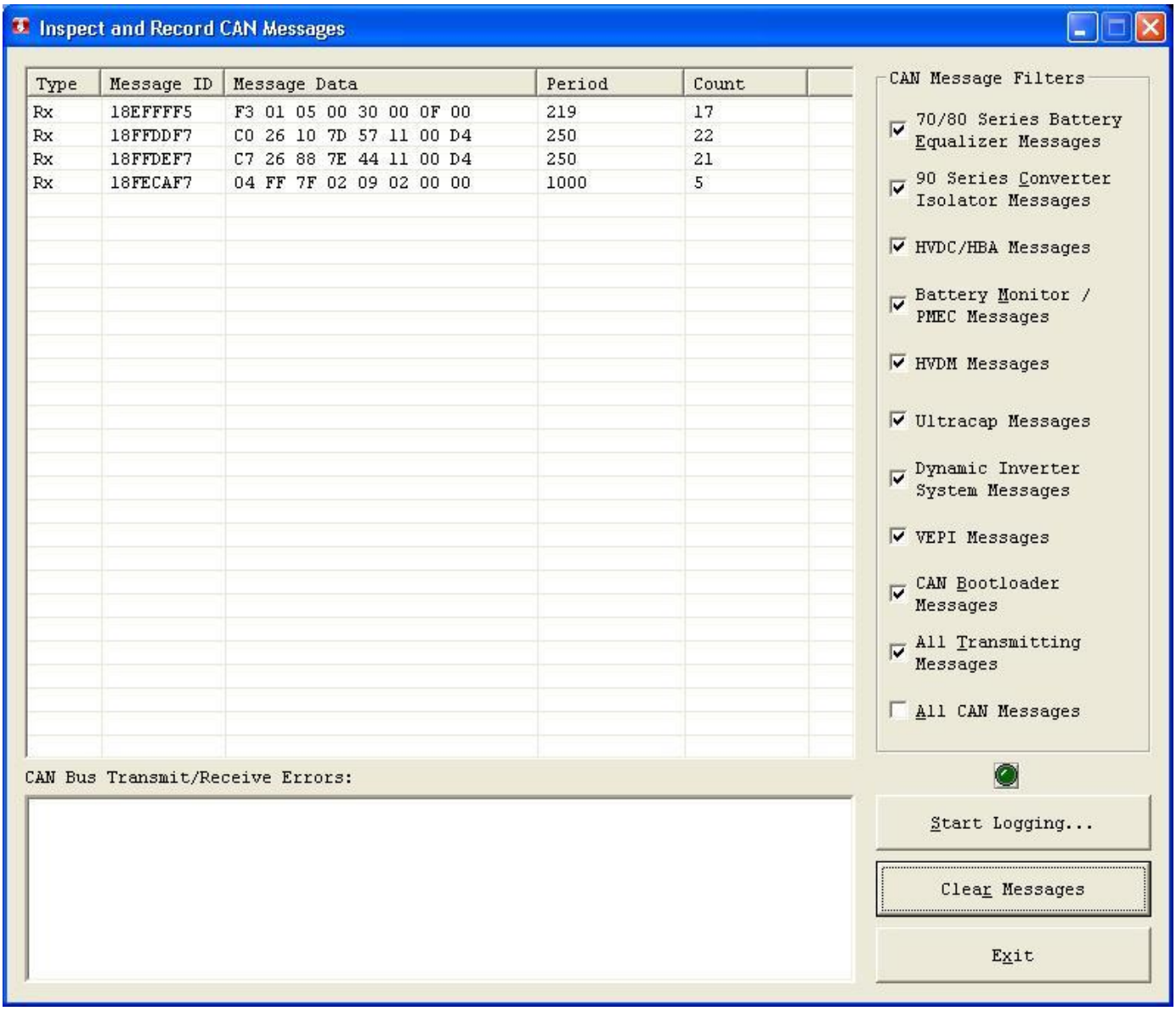


Figure 7. Inspect and Record CAN Messages Window

CAN message filters can be set on upper right of the window. Select a checkbox to inspect all messages specified in the corresponding category; clear a checkbox to ignore all messages in that category.

On upper left of the window, a list-box shows all messages received or transmitted according to the message filters. For each message, the following content is shown:

- Type – "Rx" for received messages and "Tx" for transmitted messages
- Message ID – a 32-bit ID that incorporates the PGN, priority level and source address of the message
- Message Data – Data bytes contained in the message
- Period – repeating period of the message in milliseconds
- Count – number of messages received or transmitted with same message ID

All error messages are shown in the text box on lower left of the window.

To log the received or transmitted messages in a file, click the "Start Logging" button. The small LED on top of the button will become lit (bright green) when logging is in progress, and the button text will change to "Stop Logging". Click the button again to stop logging messages and save them in a file named as "*CANLog_YYYYMMDD_hhmm.txt*", where *YYYY* represents the 4-digit year number, *MM* represents the 2-digit month number, *DD* represents the 2-digit day number, *hh* represents the 2-digit hour number, and *mm* represents the 2-digit minute number of the time when logging is started. The file is normally saved in the same folder where Vanner CAN Interface program file is located. Only messages allowed by message filters will be logged. Logged CAN data can be viewed in CAN Data Analyzer module, which is described in section 5.3 CAN Data Analyzer.

The "Clear Messages" button will clear all error messages in the text box and empty the message list-box. The messages already logged in file will not be affected by this function.

Click the "Exit" button to close the "Inspect and Record CAN Messages" window. If data logging is still in progress, it will be stopped automatically.

5.3 CAN Data Analyzer

CAN messages logged from the Vanner CAN Interface or CANalyzer in text file format can be open and analyzed in a data table or curve format. This is done in the CAN Data Analyzer function module.

 Click the waveform icon in the main window to open the CAN Data Analyzer window, as shown in Figure 8.

Supported file formats:

- CANalyzer ascii format log file: *.asc
- HEM data logger file: *.log
- Vanner CAN Interface log file: *.txt
- Vanner Equalizer/PMEC internal memory data log file: *.dat

5.3.1 CAN Data Analyzer Main Window

The major part of the CAN Data Analyzer window is a list box which shows all the CAN data read from log file. The data is grouped by product type.

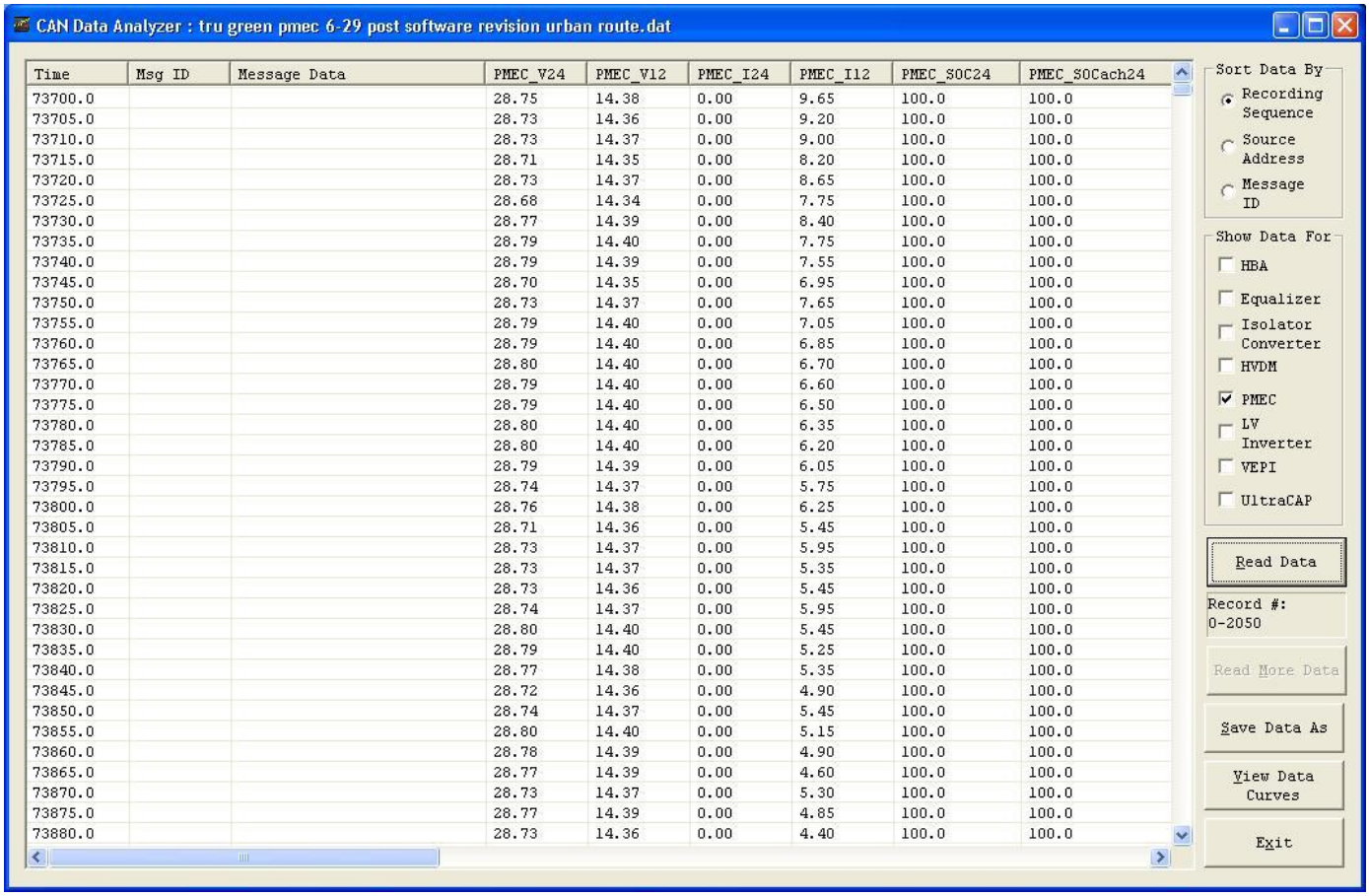


Figure 8. CAN Data Analyzer Main Window

On the top right corner there are options to sort the CAN data in the list box. The CAN data can be sorted by

- Recording sequence, or the time stamp of each recorded message.
- Source address. CAN messages received from same source address will be listed together
- Message ID. CAN messages with same message ID (32-bit extended ID of the CAN messages) will be listed together. The ID of each CAN message (if available in corresponding log file) is shown in second column of the list.

If Source address or Message ID is chosen as the sorting method, the messages with the same source address or message ID are sorted by time stamp.

Besides the options to sort data, the user can also choose what data is to be included in the list. The data is categorized by product. Check the corresponding product if the user wants the data to be read from the log file. Set the options before reading a log file. Messages in log file will be discarded if the related product is not checked.

5.3.2 Read CAN Data From Log File

When all options are set, the user can start reading data from a log file by clicking the “Read Data” button. A dialog (as shown in Figure 9) will pop up asking the number of records to be read from the file. A maximum of 100,000 records can be read into the list each time. If there are more than specified numbers of records in the log file, the button “Read More Data” will become active and the user can click this button to read the next specified number of records. The newly read data will overwrite the old data. The record # of the data in the list is shown below the “Read Data” button.

By selecting a proper number of records to be read, one can determine how the data is best shown in the data curve.

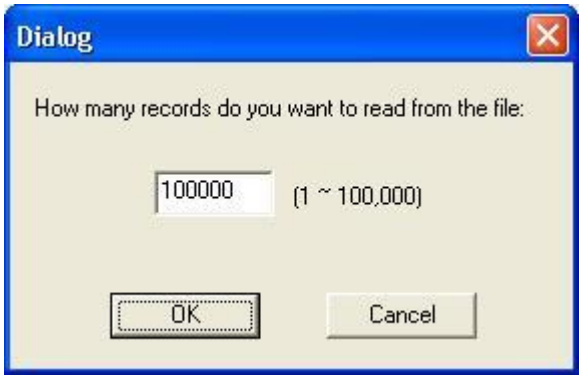


Figure 9. Read Data Option Window

When data is successfully read from a log file, it will be displayed in the list. The user can save the data into a text file that can later be imported to other software (like Microsoft Excel) and perform further analysis there. Click the “Save Data As” button to save the data into a comma (,) separated text file.

5.3.3 Display CAN Data In Curves

When data is successfully read from a log file, the user can also display the data in a format of curves. Curves of different data are grouped by product. Within each product, the user can specify the data to be shown in curves. By clicking the “View Data Curves” button, a “Select Curve Data” window will show first, as shown in Figure 10. Click the product on the left side first, then select data on the right side to decide what will be included in the curves.

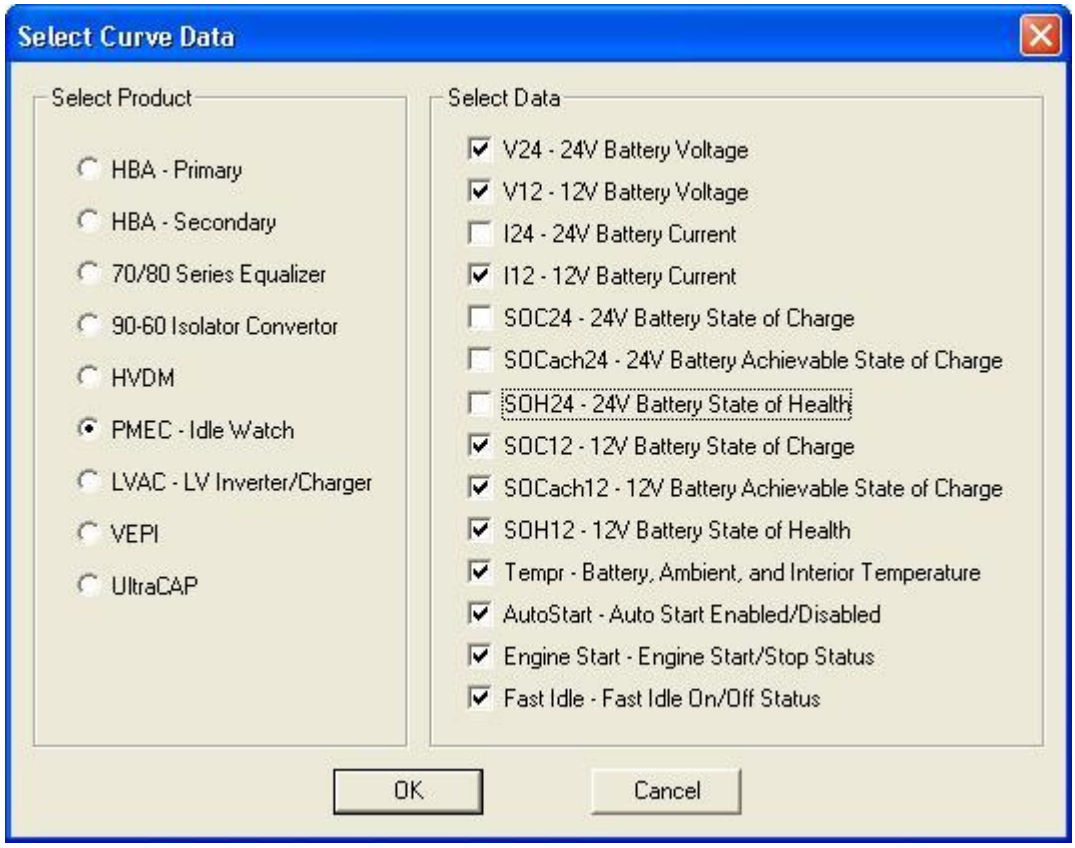


Figure 10. Select Data Curves Window

The selected data is grouped automatically into several charts and displayed in curve format. A sample curve window is shown in Figure 11. By default, the curves are shown in different colors on a black background. The user can double click on the curve to change it into white background, as shown in Figure 12. By pressing “Alt+PrtScn” keys on keyboard, the user can copy the screen and paste the curves into any other software tools and save as files.

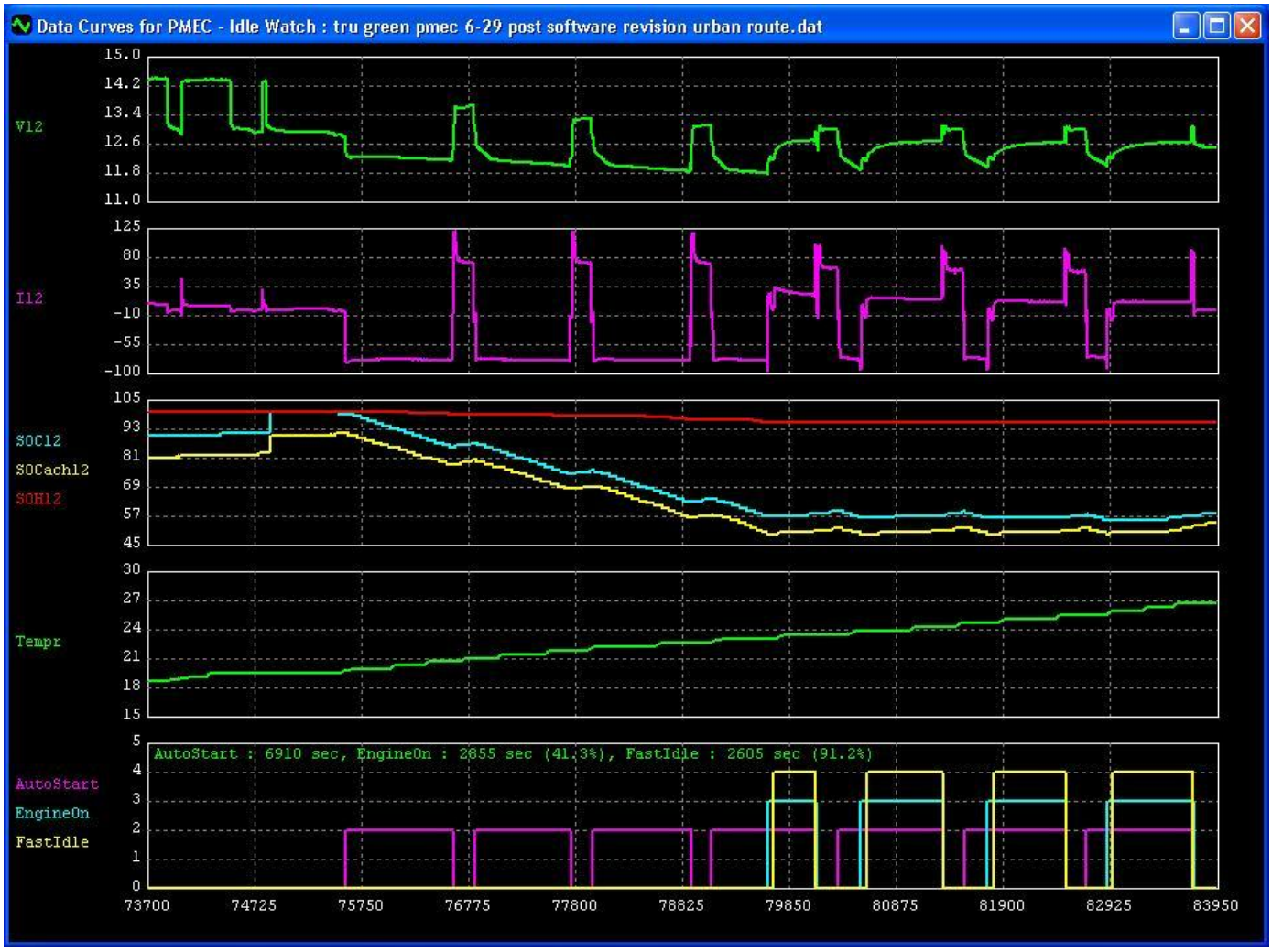


Figure 11. Data Curves Window – Black Background

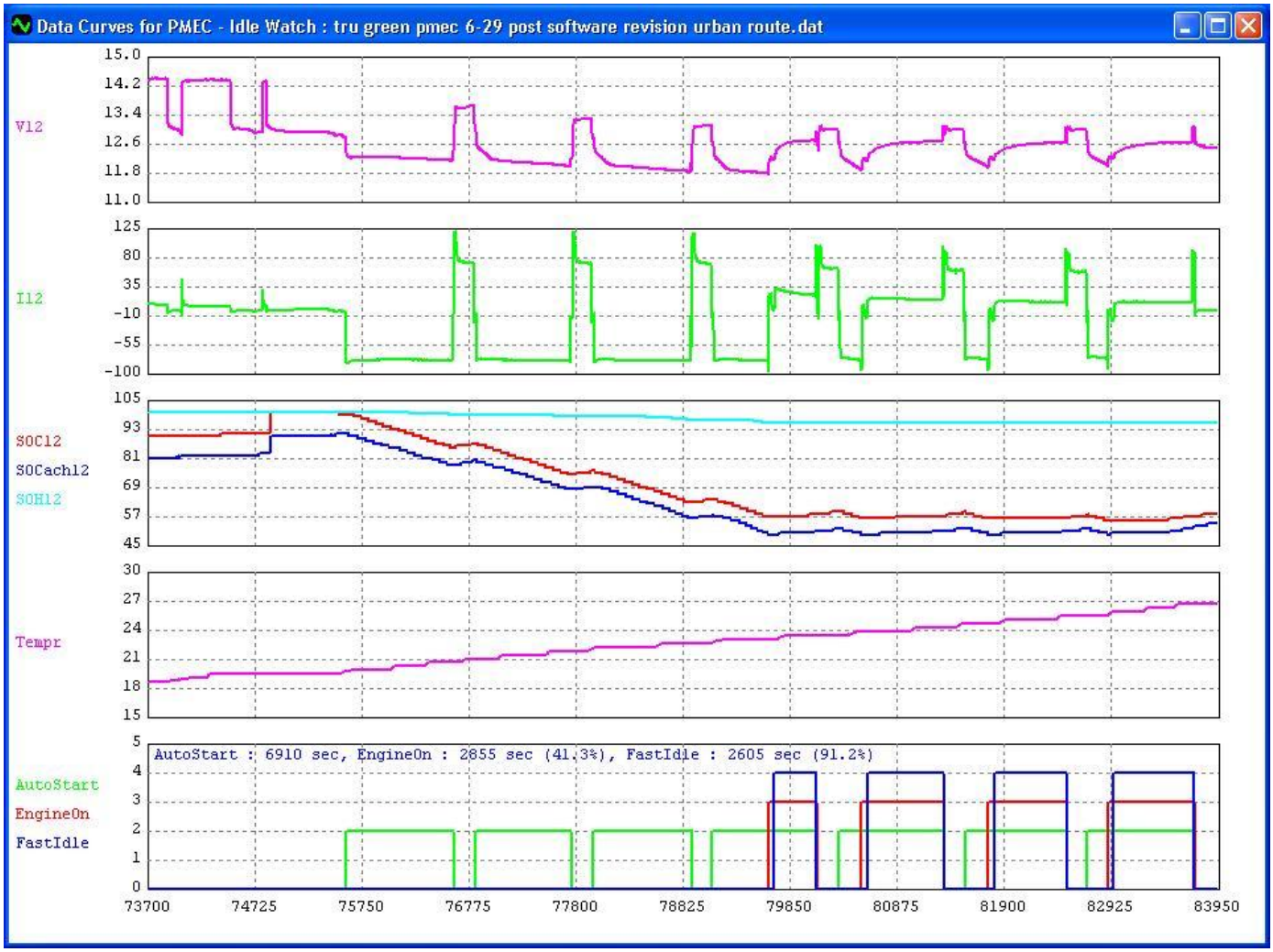


Figure 12. Data Curves Window – White Background

5.4 70/80 Series Equalizer Dashboard

With this dashboard, the user can

- view the running status of the equalizer, as well as the fault signals
- check and log the status data of batteries, such as voltage, current, SOC, SOH, etc
- set battery and equalizer parameters
- view the diagnostic CAN messages

5.4.1 Equalizer Dashboard Main Window

Click the "70/80 Equalizer" button in Vanner CAN Interface main window to open the “70/80 Series Battery Equalizer Dashboard” as shown in Figure 13.

The top section of the window displays the battery voltages, currents, and temperature. Please note that battery currents and temperature information is not available in the 70 series equalizer.

The heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly.

The bottom left section of the window shows battery monitoring information (for 80 series equalizer only), which includes SOH (State of Health), SOC (State of Charge), SOCach (Achievable SOC), U (Time to Run), Up (Time to Run Adjusted by SOH and Temperature of Battery), and the major and minor states of battery.

(1) Battery Major States:
- Charge
- Discharge
- Quiescent

(2) Battery Minor States:
- Boost charge
- Bulk charge
- Floating charge
- Fully charged
- Open circuit
- Open circuit poor
- Trickle charge
- Battery bad
- Parasitic
- Start
- Cold start
- Virtual cell

The bottom right section shows the equalizer status and the fault information. The corresponding light bar will be on when it is active. The top right section contains all the control buttons of the Equalizer Dashboard.

Please refer to the 70/80 Series Equalizer CAN Specification for details about the equalizer control, status, and fault information.

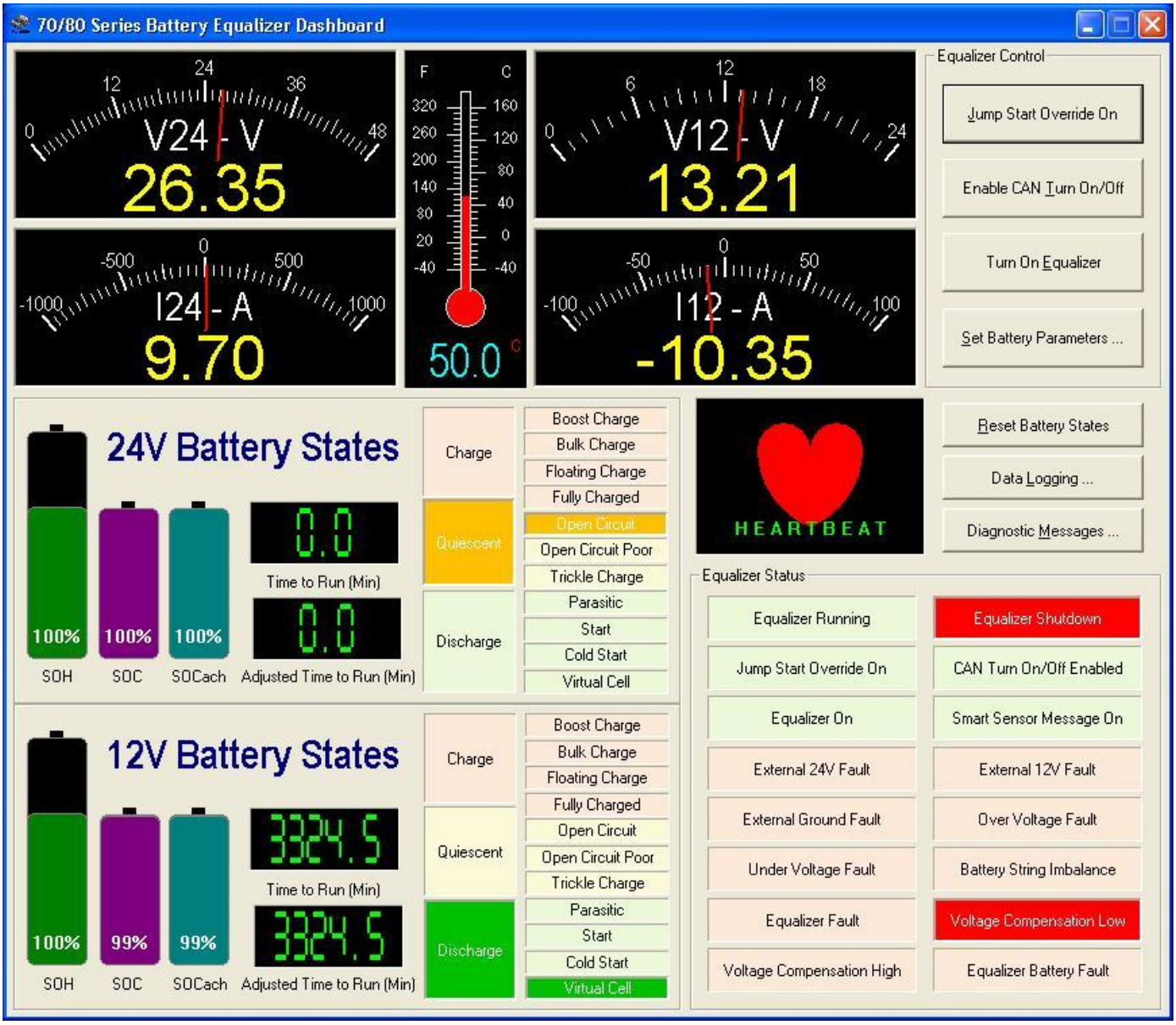
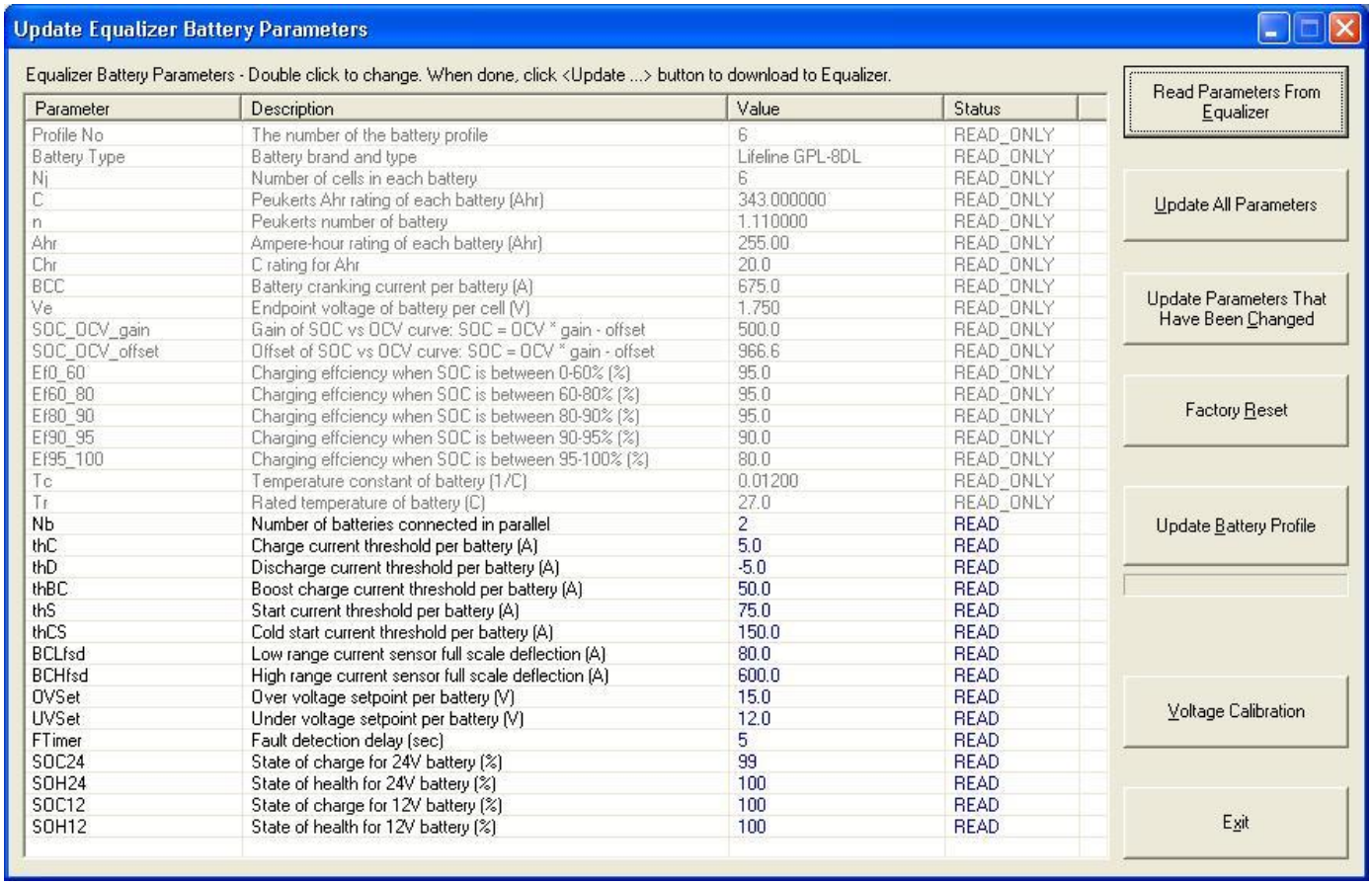


Figure 13. 70/80 Series Battery Equalizer Dashboard

5.4.2 Update Equalizer Battery Parameters Window

This window is provided for the user to update the battery parameters if they differ from factory default values. Correct battery parameters are needed by the battery monitoring algorithm to accurately monitor battery status. Click the "Set Battery Parameters" button on the Equalizer Dashboard to open the “Update Equalizer Battery Parameters Dialog” as shown in Figure 14.



Parameter	Description	Value	Status
Profile No	The number of the battery profile	6	READ_ONLY
Battery Type	Battery brand and type	Lifeline GPL-8DL	READ_ONLY
Nj	Number of cells in each battery	6	READ_ONLY
C	Peukerts Ahr rating of each battery (Ahr)	343.000000	READ_ONLY
n	Peukerts number of battery	1.110000	READ_ONLY
Ahr	Ampere-hour rating of each battery (Ahr)	255.00	READ_ONLY
Chr	C rating for Ahr	20.0	READ_ONLY
BCC	Battery cranking current per battery (A)	675.0	READ_ONLY
Ve	Endpoint voltage of battery per cell (V)	1.750	READ_ONLY
SOC_OCV_gain	Gain of SOC vs OCV curve: SOC = OCV * gain - offset	500.0	READ_ONLY
SOC_OCV_offset	Offset of SOC vs OCV curve: SOC = OCV * gain - offset	966.6	READ_ONLY
Ef0_60	Charging effciency when SOC is between 0-60% (%)	95.0	READ_ONLY
Ef60_80	Charging effciency when SOC is between 60-80% (%)	95.0	READ_ONLY
Ef80_90	Charging effciency when SOC is between 80-90% (%)	95.0	READ_ONLY
Ef90_95	Charging effciency when SOC is between 90-95% (%)	90.0	READ_ONLY
Ef95_100	Charging effciency when SOC is between 95-100% (%)	80.0	READ_ONLY
Tc	Temperature constant of battery (1/C)	0.01200	READ_ONLY
Tr	Rated temperature of battery (C)	27.0	READ_ONLY
Nb	Number of batteries connected in parallel	2	READ
thC	Charge current threshold per battery (A)	5.0	READ
thD	Discharge current threshold per battery (A)	-5.0	READ
thBC	Boost charge current threshold per battery (A)	50.0	READ
thS	Start current threshold per battery (A)	75.0	READ
thCS	Cold start current threshold per battery (A)	150.0	READ
BCLfsd	Low range current sensor full scale deflection (A)	80.0	READ
BCHfsd	High range current sensor full scale deflection (A)	600.0	READ
OVSet	Over voltage setpoint per battery (V)	15.0	READ
UVSet	Under voltage setpoint per battery (V)	12.0	READ
FTimer	Fault detection delay (sec)	5	READ
SOC24	State of charge for 24V battery (%)	99	READ
SOH24	State of health for 24V battery (%)	100	READ
SOC12	State of charge for 12V battery (%)	100	READ
SOH12	State of health for 12V battery (%)	100	READ

Figure 14. 70/80 Series Equalizer Battery Parameters Window

A list box on the left side of the window shows all parameters used by the Equalizer. The current value of each parameter can be read back by pressing the “Read Parameters From Equalizer” button. Double click any parameter in the list that is not marked as “READ_ONLY” to change its value. When all changes are made, click “Update All Parameters” or “Update Parameters That Have Been Changed” to apply the changes to the Equalizer. This will cause the dashboard to send several CAN messages to the Equalizer for corresponding parameter changes. Please note that the user always needs to click either “Update All Parameters” or “Update Parameters That Have Been Changed” button to apply the changes to the Equalizer.

The “READ_ONLY” parameters are related to a specific battery profile. They can only be changed altogether by uploading a different battery profile. To do this, click the “Update Battery Profile” button, a file selection dialog will be open to let user select the desired battery profile file (please contact Vanner for proper battery profile files for your application), as shown in Figure 15.

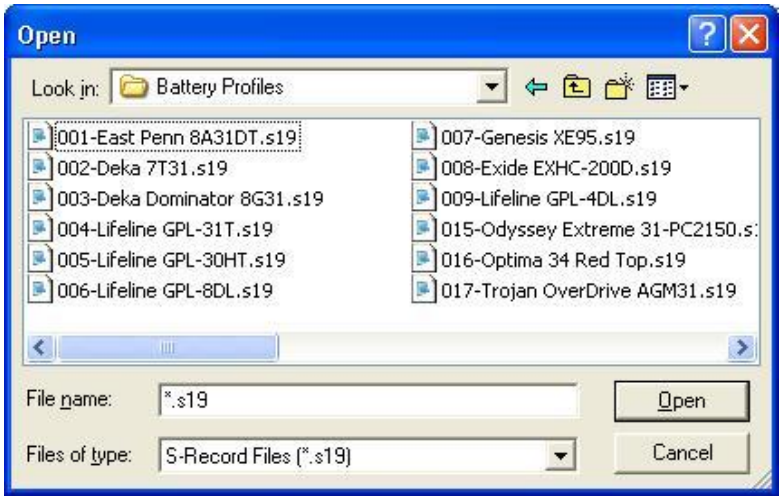


Figure 15. Battery Profile Selection Window

Once a battery profile is selected, the battery data stored in the file will be automatically sent to the Equalizer. A status bar is displayed to show the progress, as show in Figure 16.

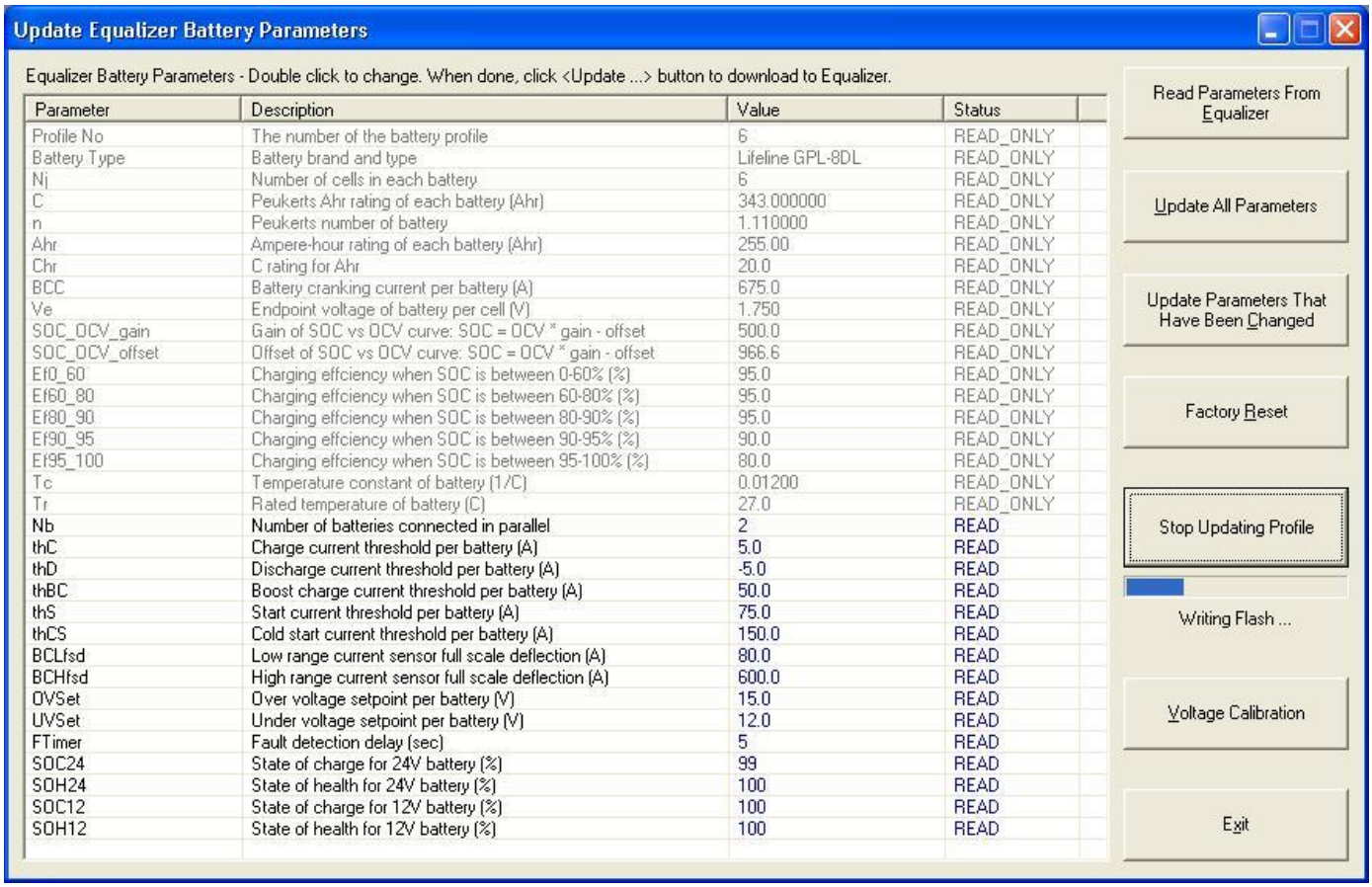


Figure 16. 70/80 Series Equalizer Battery Parameters Window – Update Battery Profile

When all data is successfully loaded in the Equalizer, a message box will pop up, as shown in Figure 17.

Figure 17. Update Battery Profile Message

Click “OK” to read all parameters from the Equalizer for the user to verify.

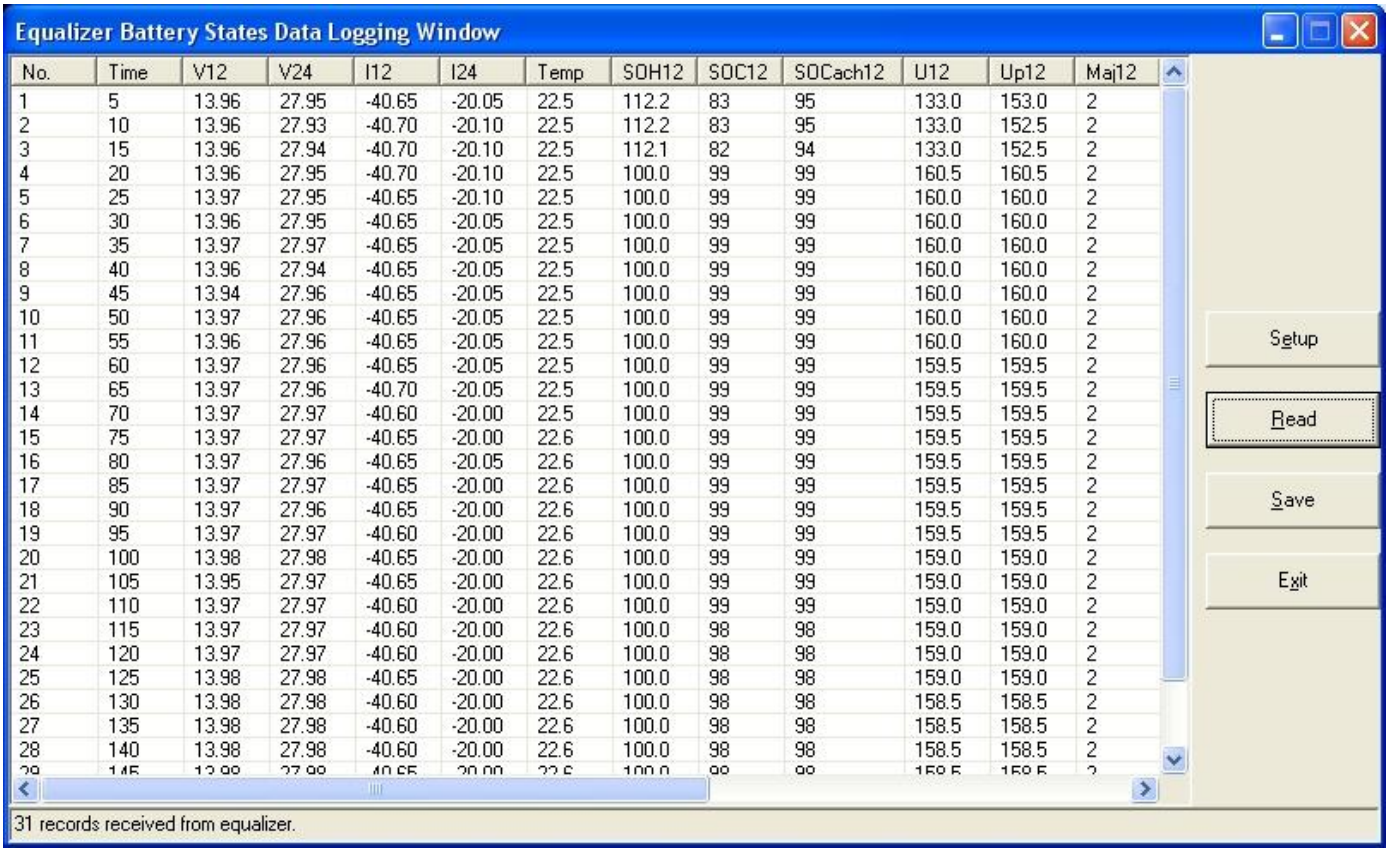
Caution: If any problem occurs when updating the battery profile, repeat above steps until a successful update is obtained. An incomplete profile update may have unexpected results in battery monitoring.

A "Factory Reset" button is provided for both 70 and 80 series Equalizers to reset all parameters to factory default values. **Please note that all saved data from user input or from battery monitoring will be lost by resetting. The** battery profile will not be changed by a “Factory Reset”.

Another button, "Voltage Calibration", is used for factory calibration. This is a two-step procedure to calibrate voltage sensing. In step 1, accurate 28V and 14V voltages need to be connected to the Equalizer. In step 2, accurate 24V and 12V voltages need to be connected to the Equalizer. Voltage sensing gains and offsets will be calibrated from these values. Inaccurate voltages in any step will result in incorrect voltage calibration. **This function is reserved for the Vanner production team only.** Calibration results are saved in EEPROM of the Equalizer that can be read at power up. Please note that "Factory Reset" will erase this data.

5.4.3 Equalizer Battery States Data Logging Window

Battery status information can be logged in two RAM chips (if populated) on Equalizer the monitor board at a user-specified rate. The logged data will be lost if the ignition signal to the Equalizer is turned off but it can be read out before that via CAN bus. The Equalizer Dashboard provides this reading function. Click the "Data Logging" button on the Equalizer Dashboard to open the “Equalizer Battery States Data Logging Window” as shown in Figure 18.



No.	Time	V12	V24	I12	I24	Temp	SOH12	SOC12	SOCach12	U12	Up12	Maj12
1	5	13.96	27.95	-40.65	-20.05	22.5	112.2	83	95	133.0	153.0	2
2	10	13.96	27.93	-40.70	-20.10	22.5	112.2	83	95	133.0	152.5	2
3	15	13.96	27.94	-40.70	-20.10	22.5	112.1	82	94	133.0	152.5	2
4	20	13.96	27.95	-40.70	-20.10	22.5	100.0	99	99	160.5	160.5	2
5	25	13.97	27.95	-40.65	-20.10	22.5	100.0	99	99	160.0	160.0	2
6	30	13.96	27.95	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
7	35	13.97	27.97	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
8	40	13.96	27.94	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
9	45	13.94	27.96	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
10	50	13.97	27.96	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
11	55	13.96	27.96	-40.65	-20.05	22.5	100.0	99	99	160.0	160.0	2
12	60	13.97	27.96	-40.65	-20.05	22.5	100.0	99	99	159.5	159.5	2
13	65	13.97	27.96	-40.70	-20.05	22.5	100.0	99	99	159.5	159.5	2
14	70	13.97	27.97	-40.60	-20.00	22.5	100.0	99	99	159.5	159.5	2
15	75	13.97	27.97	-40.65	-20.00	22.6	100.0	99	99	159.5	159.5	2
16	80	13.97	27.96	-40.65	-20.05	22.6	100.0	99	99	159.5	159.5	2
17	85	13.97	27.97	-40.65	-20.00	22.6	100.0	99	99	159.5	159.5	2
18	90	13.97	27.96	-40.65	-20.00	22.6	100.0	99	99	159.5	159.5	2
19	95	13.97	27.97	-40.60	-20.00	22.6	100.0	99	99	159.5	159.5	2
20	100	13.98	27.98	-40.65	-20.00	22.6	100.0	99	99	159.0	159.0	2
21	105	13.95	27.97	-40.65	-20.00	22.6	100.0	99	99	159.0	159.0	2
22	110	13.97	27.97	-40.60	-20.00	22.6	100.0	99	99	159.0	159.0	2
23	115	13.97	27.97	-40.60	-20.00	22.6	100.0	98	98	159.0	159.0	2
24	120	13.97	27.97	-40.60	-20.00	22.6	100.0	98	98	159.0	159.0	2
25	125	13.98	27.98	-40.65	-20.00	22.6	100.0	98	98	159.0	159.0	2
26	130	13.98	27.98	-40.60	-20.00	22.6	100.0	98	98	158.5	158.5	2
27	135	13.98	27.98	-40.60	-20.00	22.6	100.0	98	98	158.5	158.5	2
28	140	13.98	27.98	-40.60	-20.00	22.6	100.0	98	98	158.5	158.5	2

Figure 18. 70/80 Series Equalizer Battery States Data Logging Window

To read logged data, click the “Read” button and specify the number of data records the user wants to read. The maximum number of records that can be read is 16384.

Battery status data read from the Equalizer is displayed in a list box on the left of the window. The data can be saved to a text file by clicking the “Save” button. The text file can be imported later into Microsoft Excel for further analysis, or use Vanner CAN Data Analyzer to display the data in curves, as described in section 5.3.

Click the “Setup” button to specify the data logging speed (interval in seconds between two data records) and length (number of data records to log). The logging speed can be chosen from 1 record per second to 1 record per hour. The corresponding logging interval is 1 through 3600 (seconds). The logging length can be 1 through 16384. Data logging will stop when the specified number of records is logged. The user can specify a length greater than 16384 to enable continuous data logging. Please note that even in continuous mode, a maximum of 16384 data records can be saved in the RAM chip. However, when this number is reached, the new data will overwrite old data to continue logging.

5.4.4 Equalizer Diagnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the Equalizer. The user can also request DM1 message, Software ID, and Component ID information from the Equalizer. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 19. The DM1 messages are sent once per second if any faults are detected by the Equalizer. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the 70/80 Series Equalizer CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1EQ8031***", with two digits before ending '*' denoting the software version number (3.1 for this example). The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***EQ8003***", with two digits before ending '*' denoting the hardware version number (0.3 for this example).

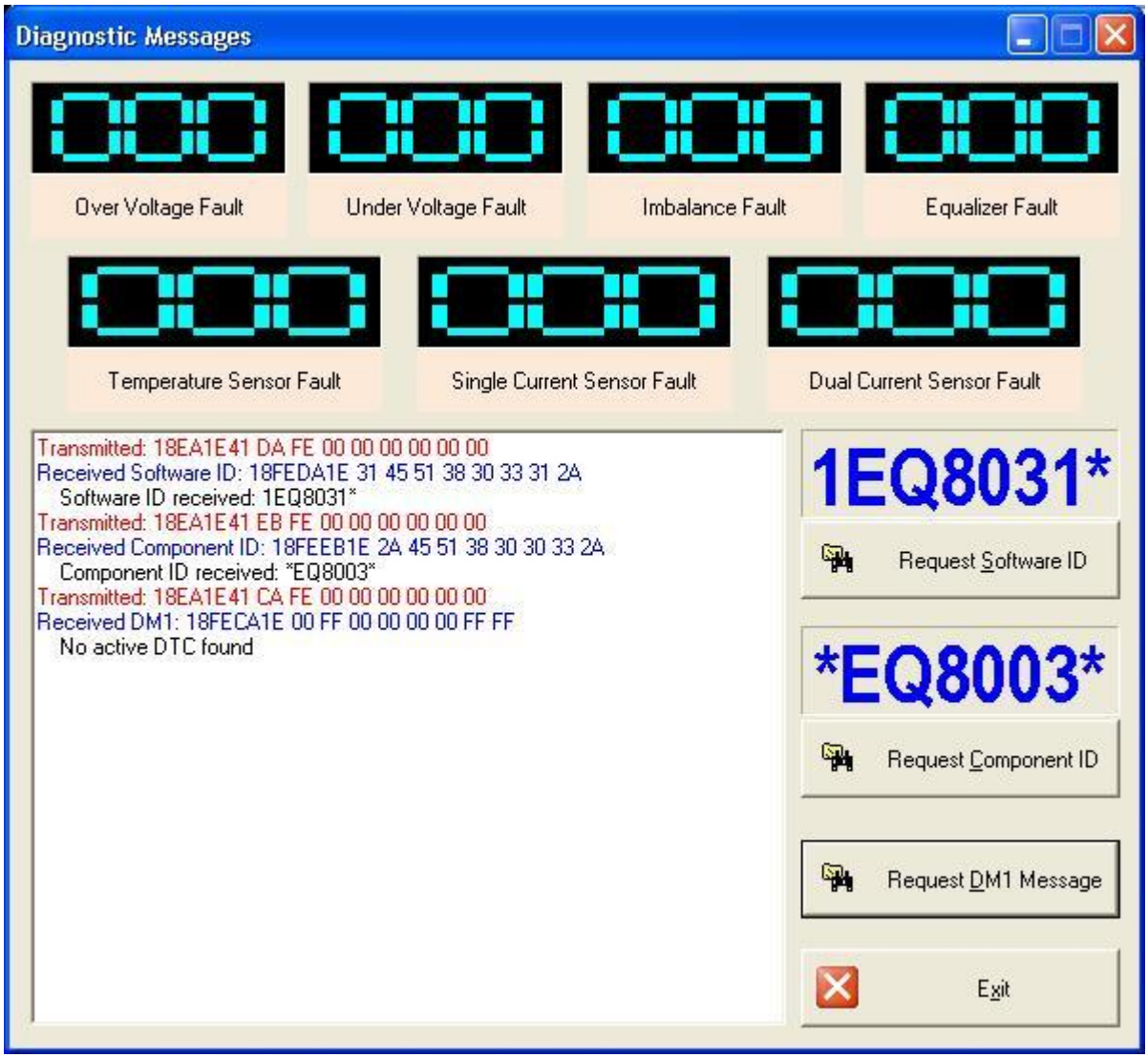


Figure 19. 70/80 Series Equalizer Diagnostic Messages Window

5.5 90 Series Converter Isolator Dashboard

With this dashboard, the user can

- view the running status of the converter isolator, as well as the fault signals
- view the status data of batteries, such as voltage, current, SOC, SOH, etc
- set battery and converter input/output parameters
- view the diagnostic CAN messages

5.5.1 Converter Isolator Dashboard Main Window

Click the "Converter Isolator" button in the Vanner CAN Interface main window to open the “90 Series Converter Isolator Dashboard” as shown in Figure 20.

The top left section of the window displays input/output voltage, current, and temperature of battery. The middle left section displays the internal temperature of the converter isolator.

The heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly.

The bottom left section of the window shows the battery status information, which includes SOH (State of Health), SOC (State of Charge), SOCach (Achievable SOC), U (Time to Run), Up (Time to Run Adjusted by SOH and Temperature of Battery), and the major and minor states of battery.

(1) Battery Major States:
- Charge
- Discharge
- Quiescent

(2) Battery Minor States:
- Boost charge
- Bulk charge
- Floating charge
- Fully charged
- Open circuit
- Open circuit poor
- Trickle charge
- Battery bad
- Parasitic
- Start
- Cold start
- Virtual cell

The bottom right section shows the converter isolator status and the fault information. The corresponding light bar will be on when it is active.

The top right section contains all the control buttons. The “Factory Reset” button will reset battery status data and clear all saved error flags. Error flags such as “External 24V Input Fault”, “External 24V Output Fault”, and “Over Temperature Fault” are saved at power down and can only be cleared by “Factory Reset”.

The middle right section is a list box which contains all parameters changed by the user by clicking the control buttons.

Please refer to the 90 Series Converter Isolator CAN Specifications for details about the converter isolator control, status, and fault information.

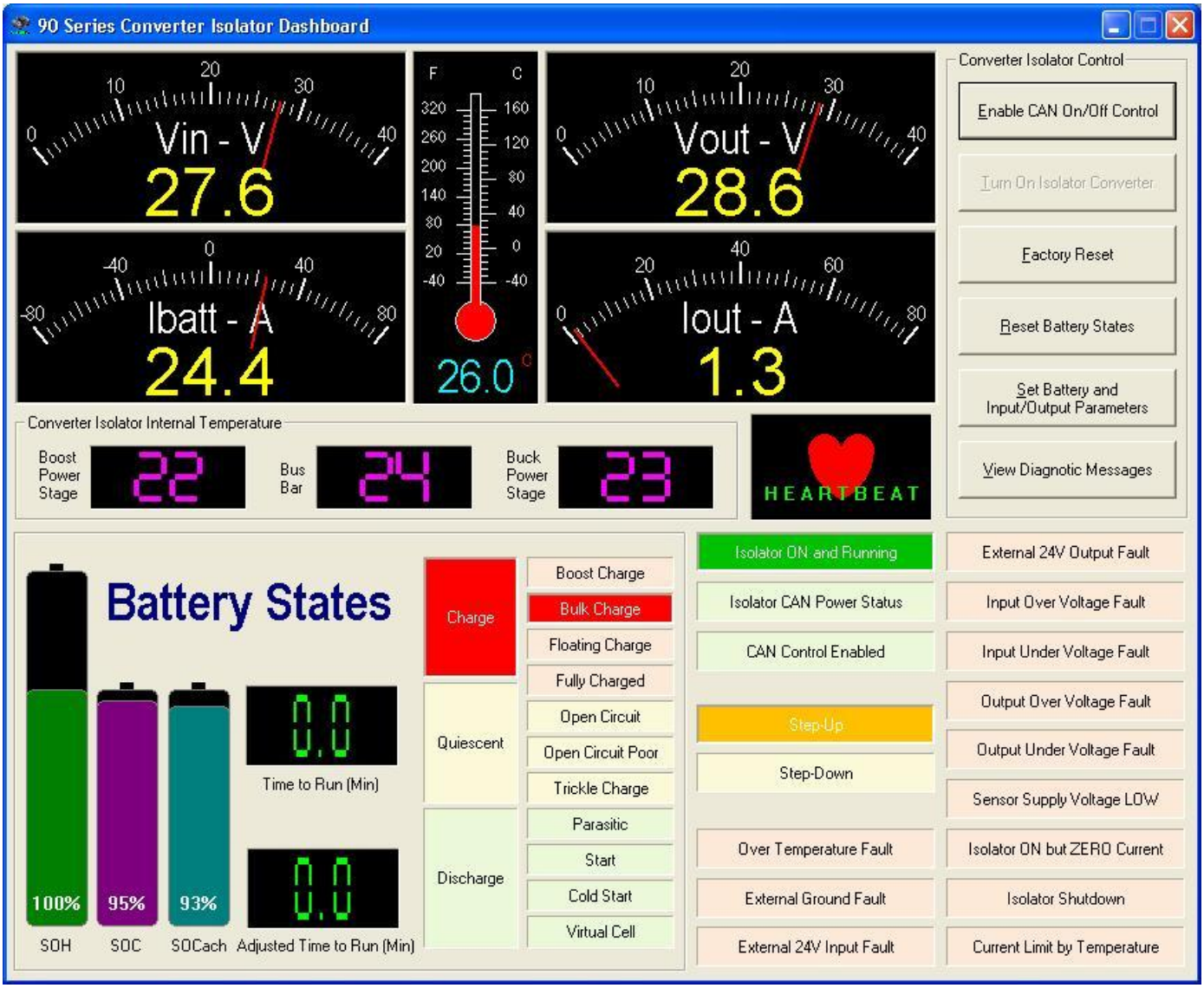
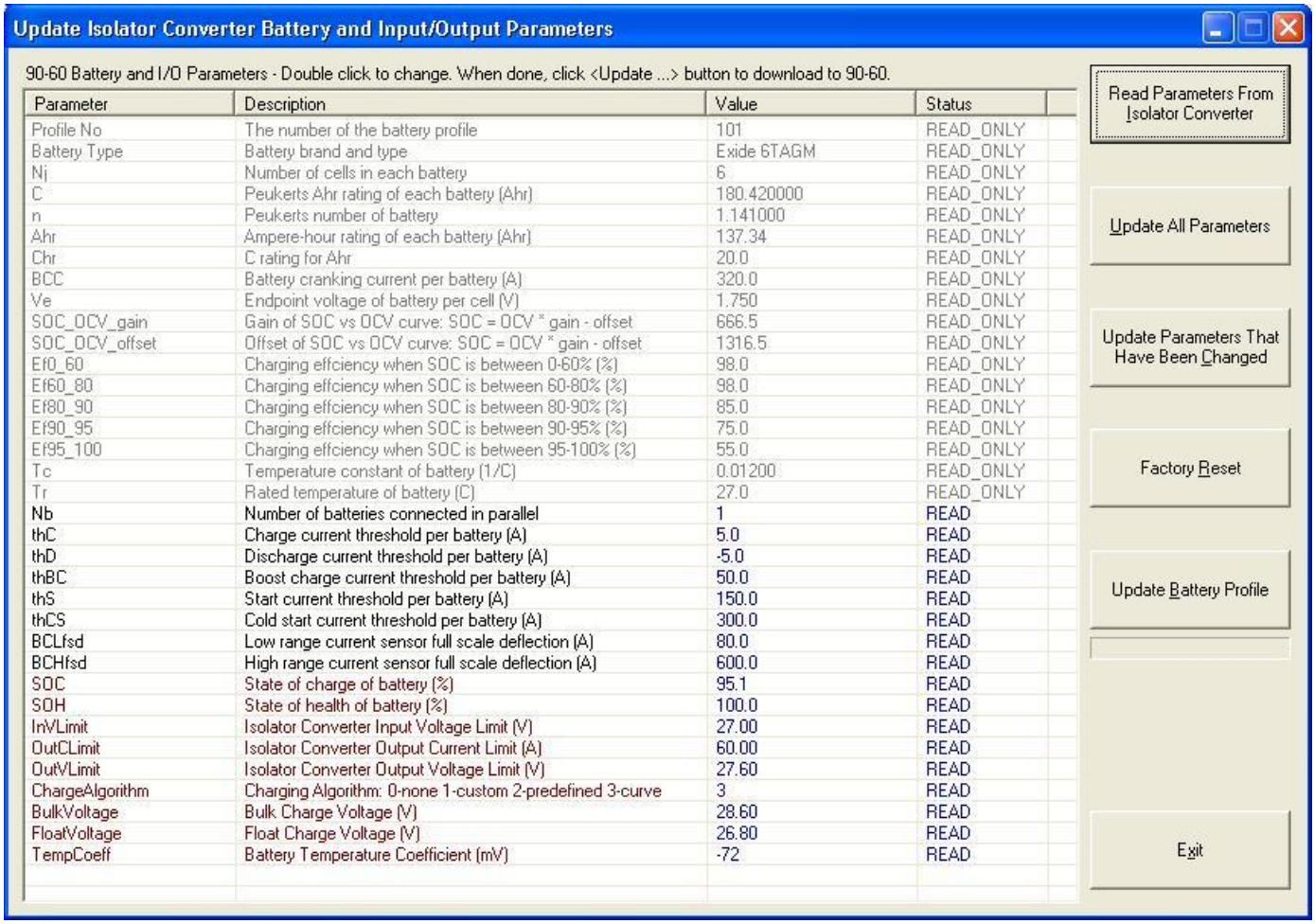


Figure 20. 90 Series Converter Isolator Dashboard

5.5.2 Set Battery and Input/Output Parameters Window

Click the “Set Battery and Input/Output Parameters” button on the Converter Isolator Dashboard to open the “Update Converter Isolator Battery and Input/Output Parameters Window” as shown in Figure 21.



Parameter	Description	Value	Status
Profile No	The number of the battery profile	101	READ_ONLY
Battery Type	Battery brand and type	Exide 6TAGM	READ_ONLY
Nj	Number of cells in each battery	6	READ_ONLY
C	Peukerts Ahr rating of each battery (Ahr)	180.420000	READ_ONLY
n	Peukerts number of battery	1.141000	READ_ONLY
Ahr	Ampere-hour rating of each battery (Ahr)	137.34	READ_ONLY
Chr	C rating for Ahr	20.0	READ_ONLY
BCC	Battery cranking current per battery (A)	320.0	READ_ONLY
Ve	Endpoint voltage of battery per cell (V)	1.750	READ_ONLY
SOC_OCV_gain	Gain of SOC vs OCV curve: SOC = OCV * gain - offset	666.5	READ_ONLY
SOC_OCV_offset	Offset of SOC vs OCV curve: SOC = OCV * gain - offset	1316.5	READ_ONLY
Ef0_60	Charging effciency when SOC is between 0-60% (%)	98.0	READ_ONLY
Ef60_80	Charging effciency when SOC is between 60-80% (%)	98.0	READ_ONLY
Ef80_90	Charging effciency when SOC is between 80-90% (%)	85.0	READ_ONLY
Ef90_95	Charging effciency when SOC is between 90-95% (%)	75.0	READ_ONLY
Ef95_100	Charging effciency when SOC is between 95-100% (%)	55.0	READ_ONLY
Tc	Temperature constant of battery (1/C)	0.01200	READ_ONLY
Tr	Rated temperature of battery (C)	27.0	READ_ONLY
Nb	Number of batteries connected in parallel	1	READ
thC	Charge current threshold per battery (A)	5.0	READ
thD	Discharge current threshold per battery (A)	-5.0	READ
thBC	Boost charge current threshold per battery (A)	50.0	READ
thS	Start current threshold per battery (A)	150.0	READ
thCS	Cold start current threshold per battery (A)	300.0	READ
BCLfsd	Low range current sensor full scale deflection (A)	80.0	READ
BCHfsd	High range current sensor full scale deflection (A)	600.0	READ
SOC	State of charge of battery (%)	95.1	READ
SOH	State of health of battery (%)	100.0	READ
InVLimit	Isolator Converter Input Voltage Limit (V)	27.00	READ
OutCLimit	Isolator Converter Output Current Limit (A)	60.00	READ
OutVLimit	Isolator Converter Output Voltage Limit (V)	27.60	READ
ChargeAlgorithm	Charging Algorithm: 0-none 1-custom 2-predefined 3-curve	3	READ
BulkVoltage	Bulk Charge Voltage (V)	28.60	READ
FloatVoltage	Float Charge Voltage (V)	26.80	READ
TempCoeff	Battery Temperature Coefficient (mV)	-72	READ

Figure 21. Converter Isolator Battery and Input/Output Parameters Window

A list box on the left side of the window shows all parameters used by the Converter Isolator. The current value of each parameter can be read back by pressing the “Read Parameters From Isolator Converter” button. Double click any parameter in the list that is not marked as “READ_ONLY” to change its value. When all changes are made, click “Update All Parameters” or “Update Parameters That Have Been Changed” to apply the changes to the Converter Isolator. This will cause the dashboard to send several CAN messages to the Converter Isolator for corresponding parameter changes. Please note that the user always needs to click either “Update All Parameters” or “Update Parameters That Have Been Changed” button to apply the changes to the Converter Isolator.

The “READ_ONLY” parameters are related to a specific battery profile. They can only be changed altogether by uploading a different battery profile. To do this, click the “Update Battery Profile” button, a file selection dialog will be open to let user select the desired battery profile file (please contact Vanner for proper battery profiles files for your application), as shown in Figure 22.

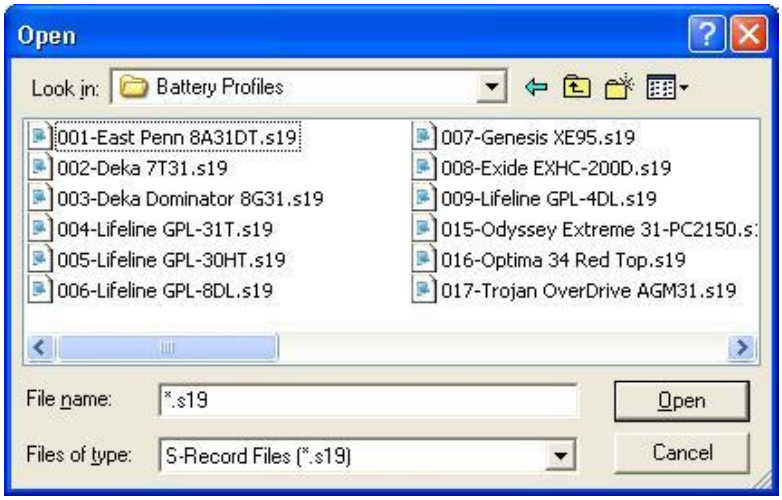


Figure 22. Battery Profile Selection Window

Once a battery profile is selected, the battery data stored in the file will be automatically sent to Equalizer. A status bar is displayed to show the progress, as shown in Figure 23.

When all data is successfully loaded in the Equalizer, a message box will pop up, as shown in Figure 24.

Click “OK” to read all parameters from the Equalizer for the user to verify.

Caution: If any problem occurs when updating the battery profile, repeat above steps until a successful update is obtained. An incomplete profile update may have unexpected results in battery monitoring.

A "Factory Reset" button is provided to reset all parameters to factory default values. **Please note that all saved data from user input or from battery monitoring will be lost by resetting. The** battery profile will not be changed by a “Factory Reset”.

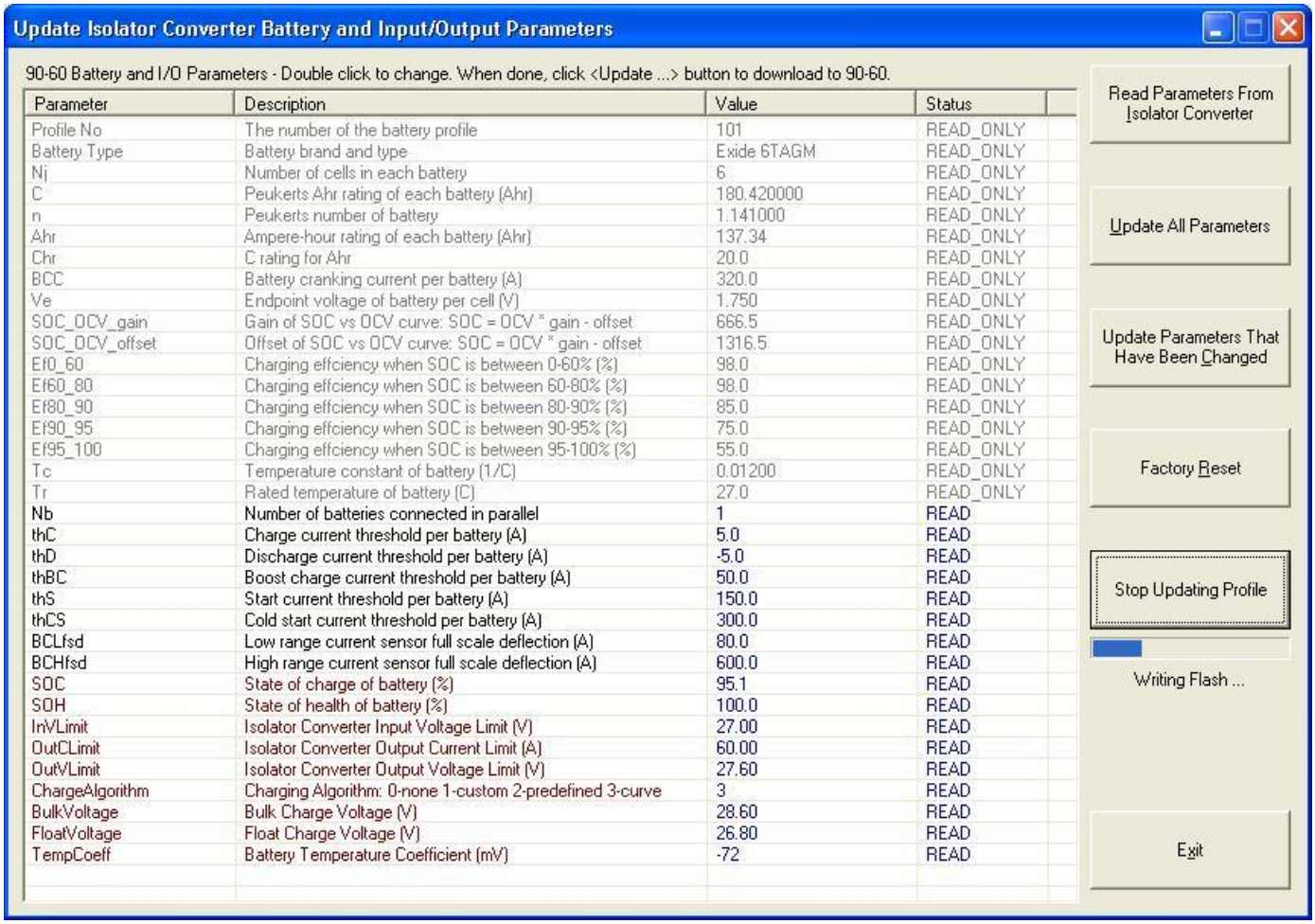


Figure 23. Converter Isolator Input/Output Parameters Window

Figure 24. Update Battery Profile Message

5.5.3 Converter Isolator Diagnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the Converter Isolator. The user can also request DM1 message, Software ID, and Component ID information from the Converter Isolator. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 25.

The DM1 messages are sent once per second if any faults are detected by the Converter Isolator. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the 90 Series Converter Isolator CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1906005***", with two digits before ending '*' denoting the software version number (0.5 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***906002***", with two digits before ending '*' denoting the hardware version number (0.2 for this example).

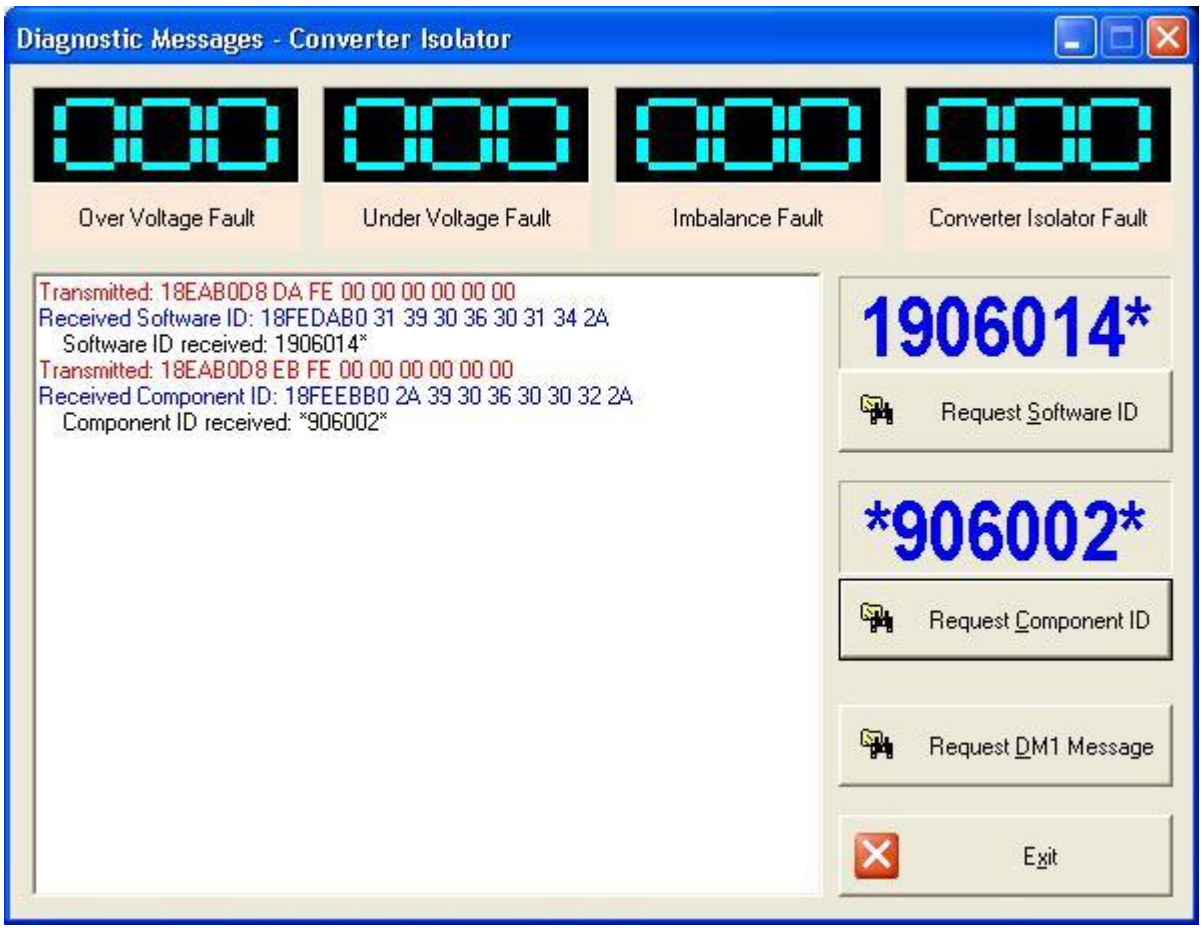
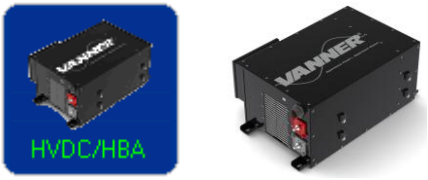


Figure 25. Converter Isolator Diagnostic Messages Window

5.6 HVDC Dashboard



With this dashboard, the user can

- view the running status of the DC/DC converter, as well as fault signals
- view the input/output voltages and currents, and temperatures of the control board and power stages
- display above information in curves
- save and open data curves
- set the output voltage of the DC/DC converter
- view diagnostic CAN messages
- simulate transmission of engine RPM messages to start the DC/DC converter if not connected to the vehicle CAN bus
- simulate transmission of converter On/Off control messages if not connected to the vehicle CAN bus
- view low voltage battery status such as SOC, SOH and charge/discharge state (reserved for future integration with 80 series equalizer and sensors)

5.6.1 HVDC Dashboard Main Window

Click the "HVDC Converter" button in the Vanner CAN Interface main window to open the HV DC/DC Converter Dashboard, as shown in Figure 26.

The top section of the window displays the input/output voltages and currents, as well as temperatures of the control board (T_CTRL) and power stages (high voltage side T_HV and low voltage side T_LV).

The bottom left section shows the converter status and fault information. The corresponding light bar will be on when it is active.

The bottom right section of the window shows battery status information for the low voltage battery which includes SOH (State of Health), SOC (State of Charge), SOCach (Achievable SOC), U (Time to Run), Up (Time to Run Adjusted by SOH and Temperature of Battery), and the major and minor states of the battery. This function hasn't been implemented in the current version of the DC/DC converter software. It is reserved for future use.

The middle left section of the window shows engine RPM information. The Engine-RPM-turn-on version of DC/DC converter will be turned on only if the engine speed is above 400 RPM. The engine RPM received in CAN messages will be shown here. To turn on the DC/DC converter without connecting to the vehicle CAN bus, the dashboard can simulate the transmission of engine RPM messages by clicking the "Transmit Engine Speed" button.

The middle center section of the window shows converter control buttons for CAN-command-turn-on-off version of DC/DC converter. Click "Turn On" button to send CAN-turn-on message to the converter, and click "Turn Off" button to send CAN-turn-off message to the converter.

Caution: Do NOT try to send engine RPM messages or CAN turn-on/off messages from the dashboard if it is connected to the vehicle CAN bus. The messages sent from the dashboard may cause conflicts with the engine speed messages transmitted from the engine controller or the CAN turn-on/off messages transmitted from the hybrid control module.

The middle right section of the window contains the control buttons and heartbeat information. Heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly. The quick status of the slave (or secondary) unit is displayed here too. Please refer to the HVDC CAN Specification for details about HV DC/DC converter control, status, master/slave operation, and fault information.

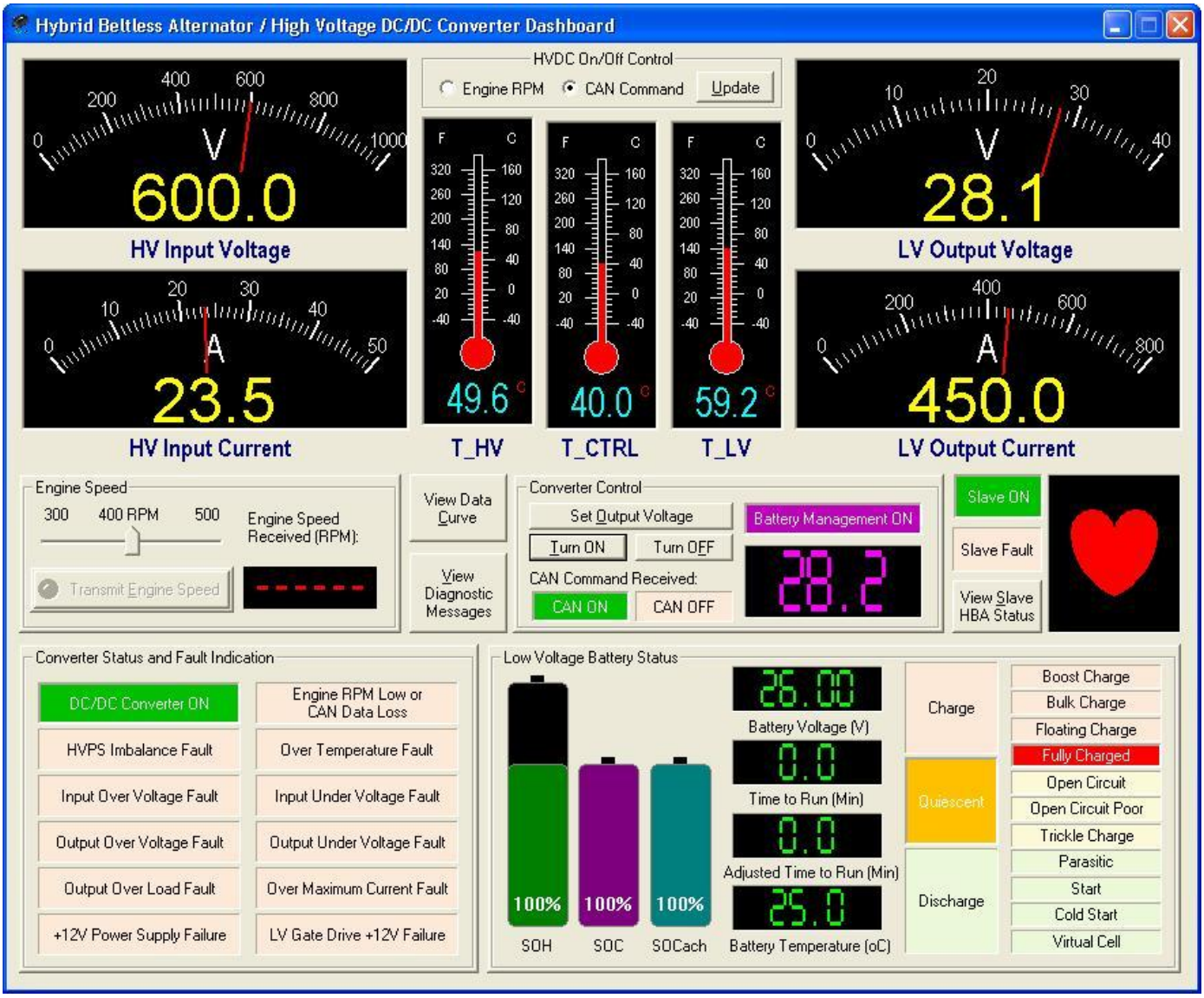
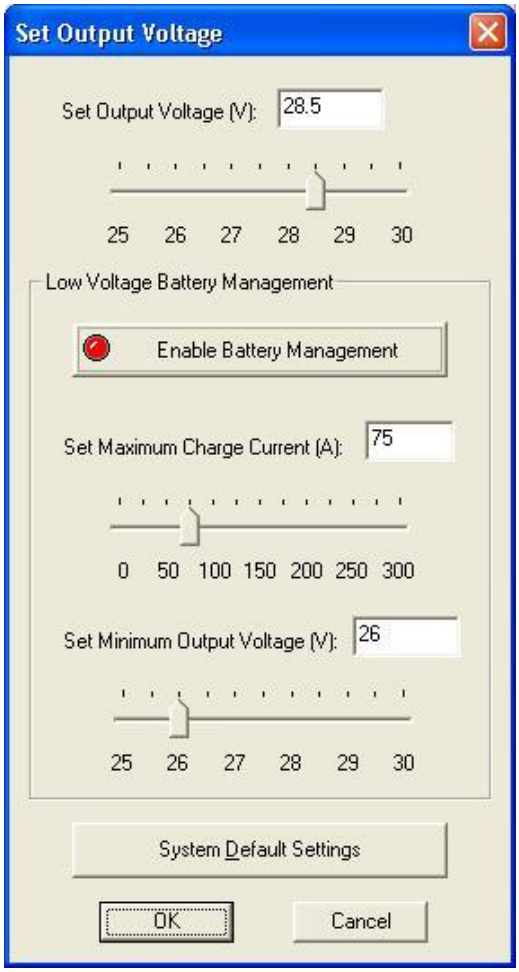


Figure 26. HVDC Dashboard

The output voltage of the converter can be adjusted between 24V and 30V. Click the “Set Output Voltage” button to open the Set Output Voltage window, as shown in Figure 27 - a. Choose the desired voltage and hit OK to send the corresponding CAN message to the DC/DC converter. The new output voltage setting will be stored in none-volatile memory of the DC/DC converter so it will not be lost at power down.

Please note that the existing voltage/current settings on the DC/DC converter cannot be read back via CAN bus. When the Set Output Voltage window is open, the factory default values are shown as reference. They don’t necessarily represent the actual settings on the converter.

The HVDC can be turned on by either engine RPM CAN message or specific CAN on/off command message. The current software configuration is displayed in “HVDC On/Off Control” section on top middle of the main window. User can change the configuration by clicking “Update” button. The “Set HVDC Control” window will be displayed, as shown in Figure 27 - b. Make the selection and click OK.



a. Set Output Voltage Window

b. Set On/Off Control Window

Figure 27. Set HVDC Parameters Window

5.6.2 HVDC Dashboard For Slave Unit

The Vanner HBA supports two HBAs operating in master/slave (or primary/secondary) mode. In such circumstances the main dashboard displays the status of the master unit and the summation of the input/output currents. The status of the slave unit can be seen by clicking the "View Slave HBA Status" button in the Vanner CAN Interface main window. This will open the HV DC/DC Converter Slave Unit Dashboard, as shown in Figure 28.

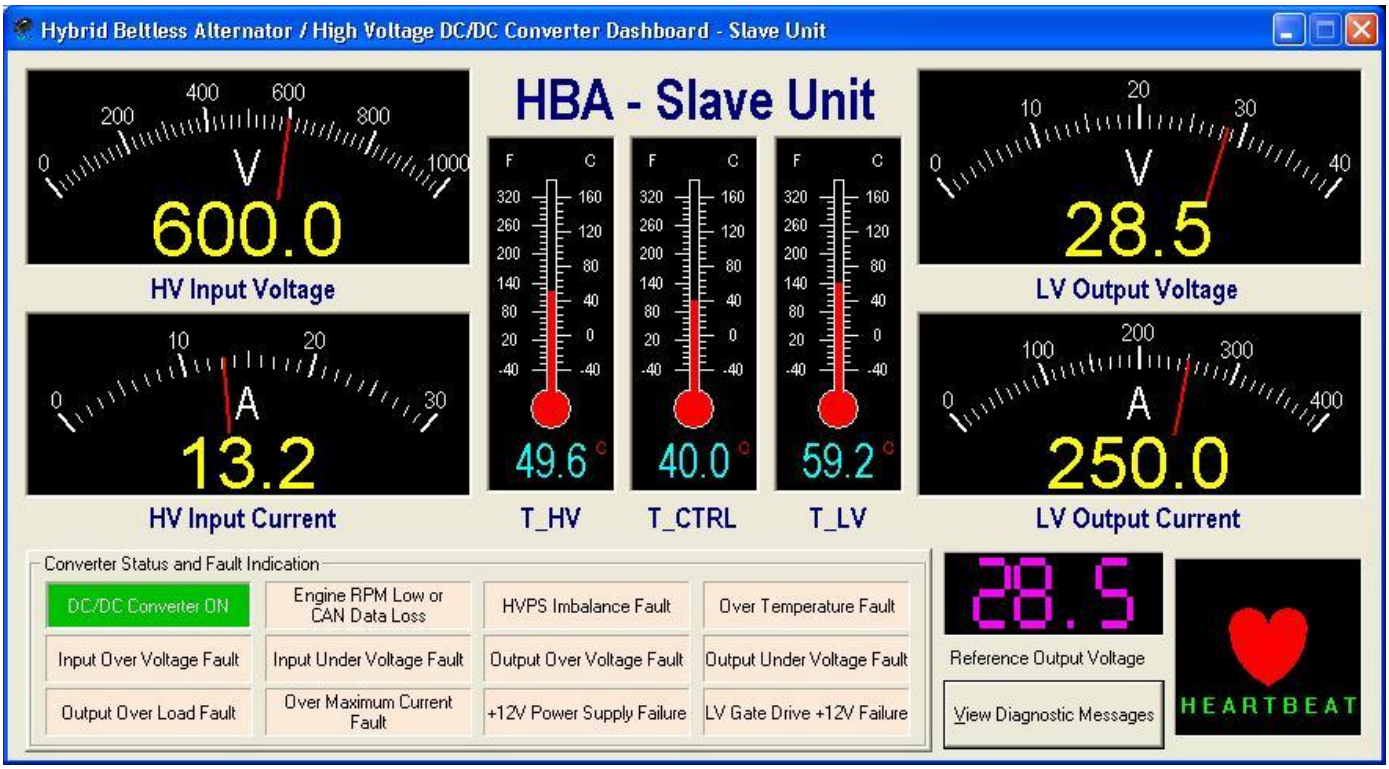


Figure 28. HVDC Dashboard – Slave Unit

The slave HBA dashboard is similar to the main window, but with less information and no controls. The operation of the slave unit is controlled by the master unit. Please refer to the HVDC CAN Specification for more information.

5.6.3 HVDC Data Curves Window

The operating data of the HVDC can be displayed and recorded as data curves. Click the “View Data Curves” button on the HVDC dashboard to open the View Data Curve window as show in Figure 29.

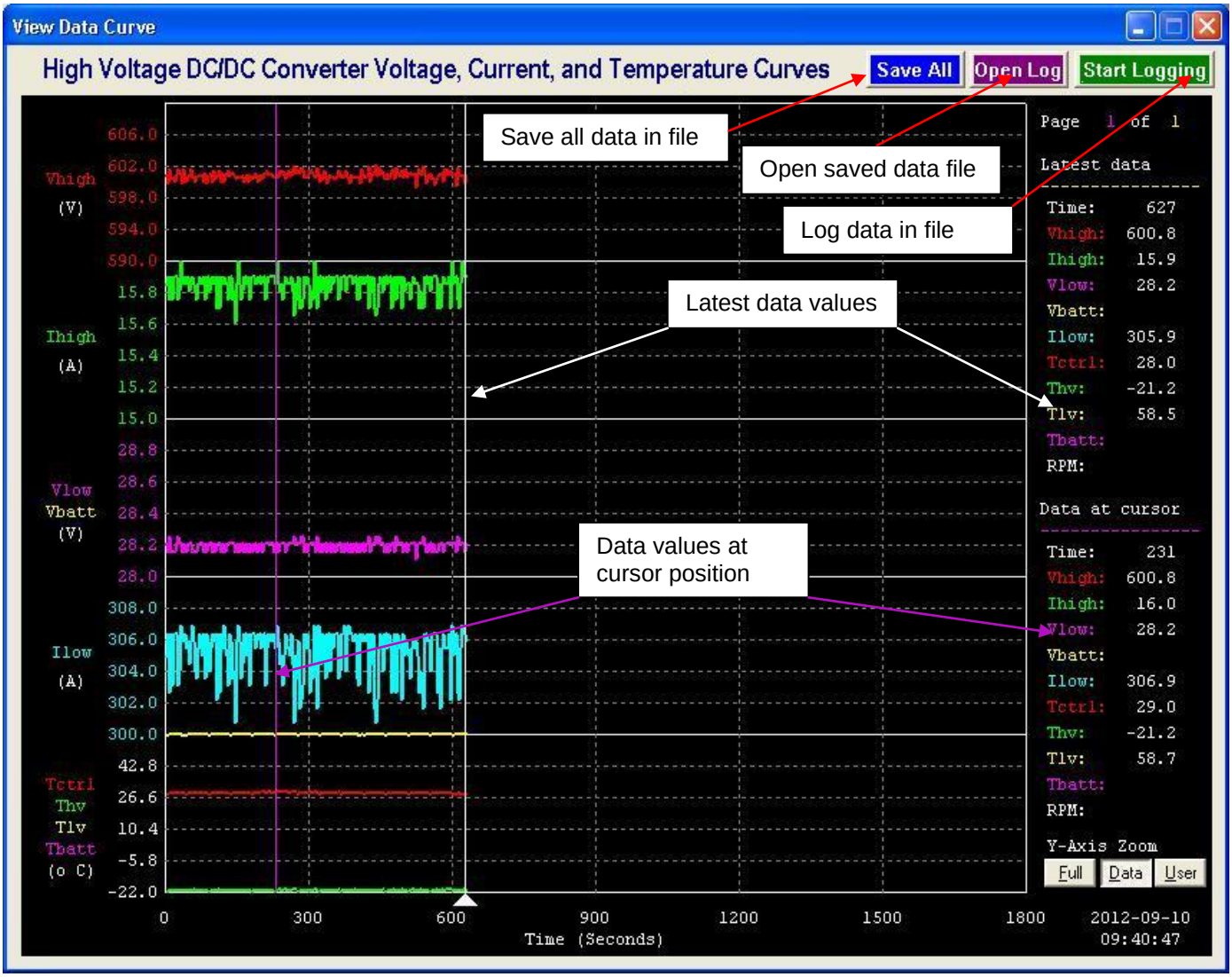


Figure 29. HVDC Data Curves Window – Real Time Data

The following operating data is displayed:

- `Vhigh` – input voltage
- `Ihigh` – input current
- `Vlow` – output voltage
- `Vbatt` – battery voltage (when connected to Vanner 80-series CAN equalizer)
- `Ilow` – output current
- `Tctrl` – control board temperature

- Thv – high voltage power stage temperature
- Tlv – low voltage power stage temperature
- Tbatt – battery temperature ((when connected to Vanner 80-series CAN equalizer)

Additional data – Engine RPM – recorded but not displayed as curve.

Data curves are displayed in pages. One page displays 30 minutes (1800 seconds) of data. Use the “Page Up” and “Page Down” keys to browse through pages.

The white vertical cursor bar indicates the latest data points. Curves on the right side of the cursor represent old data (if available) that will be overwritten by new data. (Data is overwritten graphically only. It can be saved continuously in a text file which is explained later in this section.)

To check data values at any given time, the user can move a pink cursor bar by hitting the arrow keys (left, right, up, and down). The user can also click the left mouse button inside the data curves window to position the cursor.

The Y-axis of the data curves can be scaled to three different levels for better viewing of the curves. Click the three buttons at the bottom right corner of the data curves window to change y-axis scaling settings:

- Full – the full possible range for each data curve will be used
- Data – maximum and minimum values of recorded data will be used
- User – User specified lower and upper ranges for each data curve will be used

The default full range for each data curve is as follows;

- Vhigh – [500V, 1000V]
- Ihigh – [0A, 40A]
- Vlow, Vbatt – [10V, 35V]
- Ilow – [0A, 800A]
- Tctrl, Thv, Tlv, Tbatt – [-40^{o}C, 110^{o}C]

The data curves can also be logged into text files. Click the “Start Logging” button on the top right corner of the data curves window (see Figure 29) to start logging data. The button text will change to “Stop Logging” when logging is on. A green blinking message “Data Logging…” is also displayed at bottom left corner of the window. Click the button again to stop logging. The button text will change back to “Start Logging”. The saved data file can be opened later in data curves window by clicking the “Open File” button next to the “Start Logging” button. It can also be open and graphed in Vanner CAN Data Analyzer, as described in section 5.3. The “Save All” button will save all received data into a data log file.

When a saved data file is open, the data curve window will change slightly as shown in Figure 30. The latest data values portion is replaced by data file information and a button to “Close Data Curve File”. Other operations are still the same: use “Page Up” and “Page Down” keys to browse through pages; use arrow keys or mouse button to move pink cursor for data values; and scale the y-axis by clicking the “Full”, “Data”, “User” buttons.

Click the “Close Data Curve File” button to return to the real time data curves.

The data curves are recorded at a rate of every 3 seconds. If for any reason the new data is not received from the CAN bus within 3 seconds, there will be a gap (blank point) on the data curves. The latest data cursor (white) will keep scrolling to the right. A gap in the data curves indicates data lost in CAN communication.

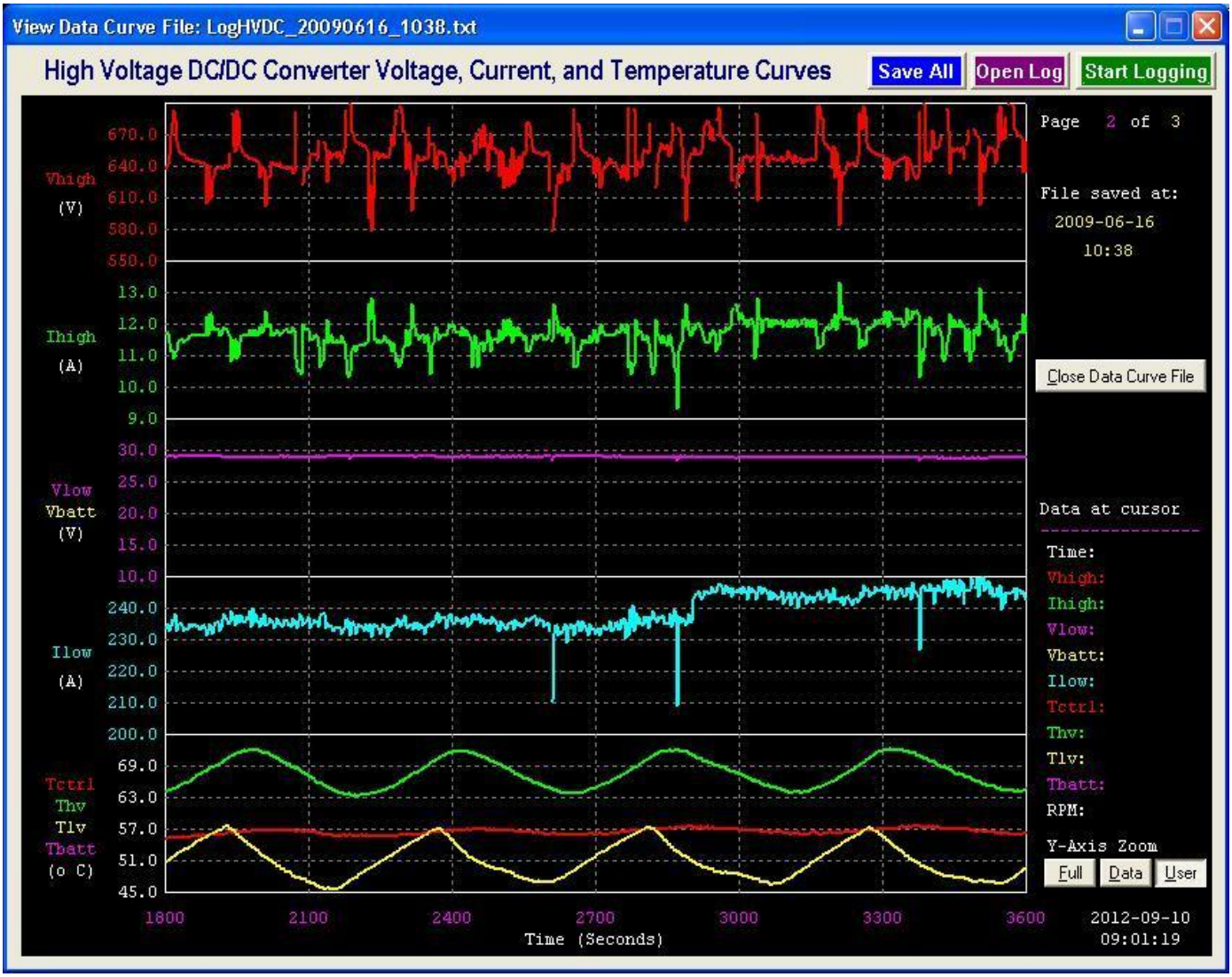


Figure 30. HVDC Data Curves Window – Open Saved Data

Note: when two HBAs work in parallel mode (master/slave), the data curves show the total input/output currents by two HBAs.

5.6.4 HVDC Diagnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the HVDC. The user can also request DM1 message, Software ID, and Component ID information from the HVDC. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 31.

The DM1 messages are sent once per second if any faults are detected by the HVDC. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the HVDC CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1HVDC08***", with two digits before ending '*' denoting the software version number (0.8 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***HVDC02***", with two digits before ending '*' denoting the hardware version number (0.2 for this example).

Figure 31. HVDC Diagnostic Messages Window

5.7 Standalone Battery Monitor Dashboard

With this dashboard, the user can

- view the running status of the standalone battery monitor, as well as the fault signals
- view the voltage, current, and temperature of the batteries
- view the battery status such as SOC, SOH, charge/discharge state, etc
- set the battery parameters
- view the diagnostic CAN messages

5.7.1 Standalone Battery Monitor Dashboard Main Window

Click the "Battery Monitor" button in the Vanner CAN Interface main window to open the “Standalone Battery Monitor Dashboard” as shown in Figure 32.

The top section of the window displays the battery voltage, current, and temperature of the two batteries (according to system configuration).The heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly.

The bottom left section of the window shows the battery monitoring information, which includes SOH (State of Health), SOC (State of Charge), SOCach (Achievable SOC), U (Time to Run), Up (Time to Run Adjusted by SOH and Temperature of Battery), and the major and minor states of batteries:

(1) Battery Major States:
- Charge
- Discharge
- Quiescent

(2) Battery Minor States:
- Boost charge
- Bulk charge
- Floating charge
- Fully charged
- Open circuit
- Open circuit poor
- Trickle charge
- Battery bad
- Parasitic
- Start
- Cold start
- Virtual cell

The bottom right section shows the battery monitor status and the fault information. The corresponding light bar will be on when it is active.

The middle right section contains all the control buttons of the Standalone Battery Monitor Dashboard.

Please refer to the Standalone Battery Monitor CAN Specification for details about the battery monitor control, status, and fault information.

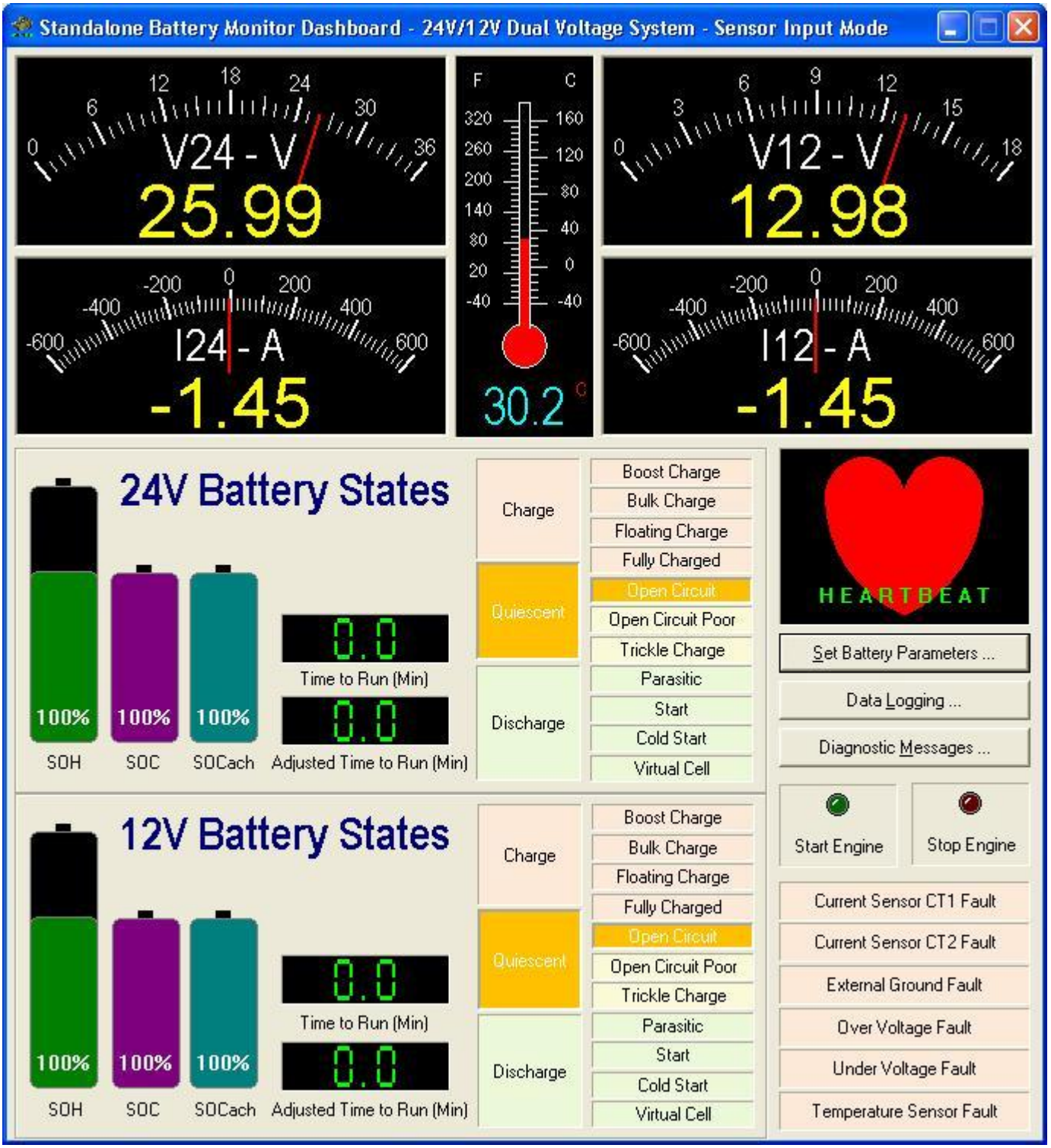


Figure 32. Standalone Battery Monitor Dashboard

5.7.2 Update Battery Parameters Window

This window is provided for the user to update the battery parameters if they differ from factory default values. Correct battery parameters are needed by the battery monitoring algorithm to accurately monitor battery status. Click the "Set Battery Parameters" button on the Equalizer Dashboard to open the “Update Equalizer Battery Parameters Dialog” as shown in Figure 33..

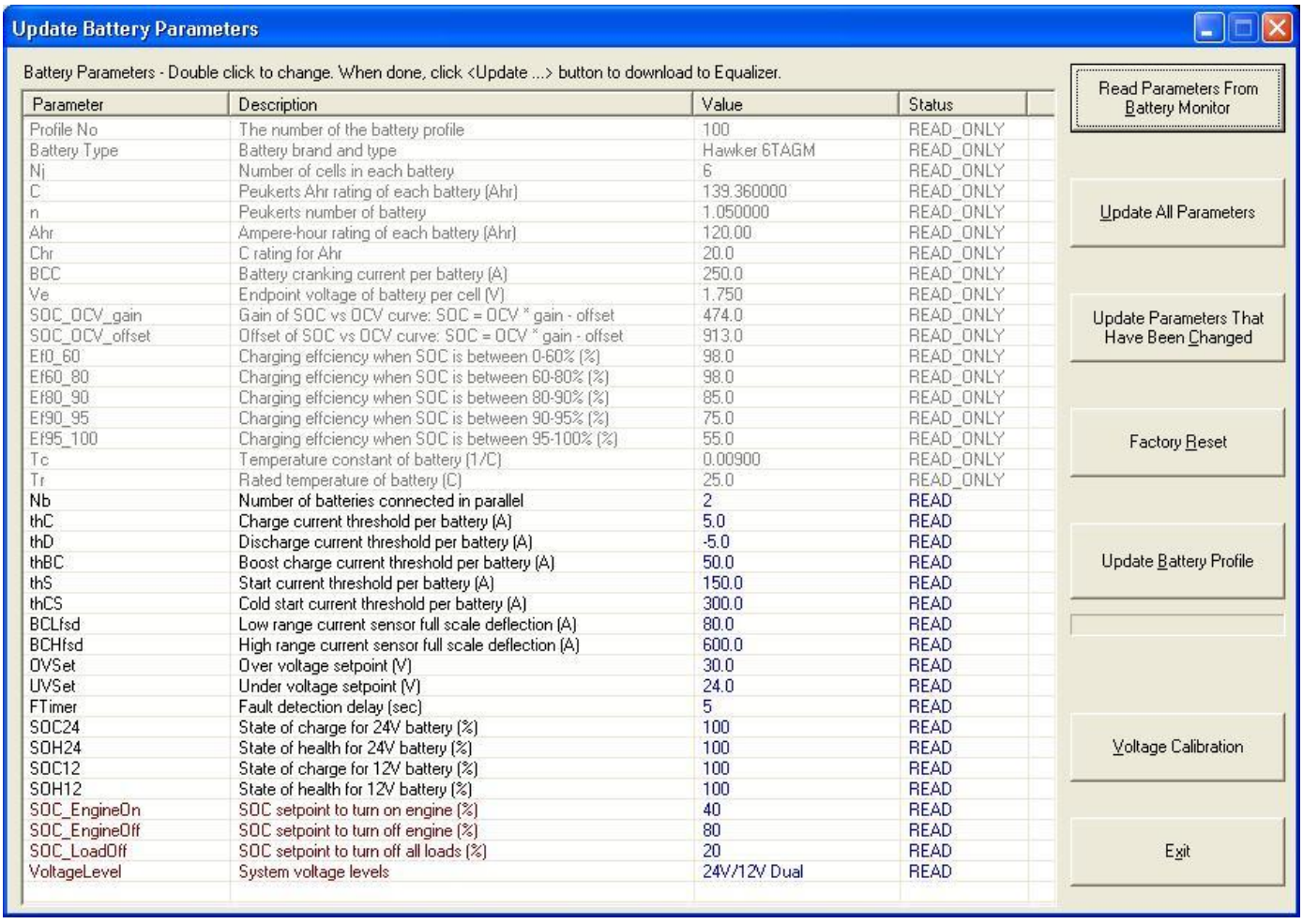


Figure 33. 70/80 Series Equalizer Battery Parameters Window

A list box on the left side of the window shows all parameters used by the Standalone Battery Monitor. The current value of each parameter can be read back by pressing the “Read Parameters From Battery Monitor” button. Double click any parameter in the list that is not marked as “READ_ONLY” to change its value. When all changes are made, click “Update All Parameters” or “Update Parameters That Have Been Changed” to apply the changes to the Battery Monitor. This will cause the dashboard to send several CAN messages to the Battery Monitor for corresponding parameter changes. Please note that the user always needs to click either “Update All Parameters” or “Update Parameters That Have Been Changed” button to apply the changes to the Battery Monitor.

The “READ_ONLY” parameters are related to a specific battery profile. They can only be changed altogether by uploading a different battery profile. To do this, click the “Update Battery Profile” button, a file selection dialog will be open to let user select the desired battery profile file (please contact Vanner for proper battery profile files for your application), as shown in Figure 34.

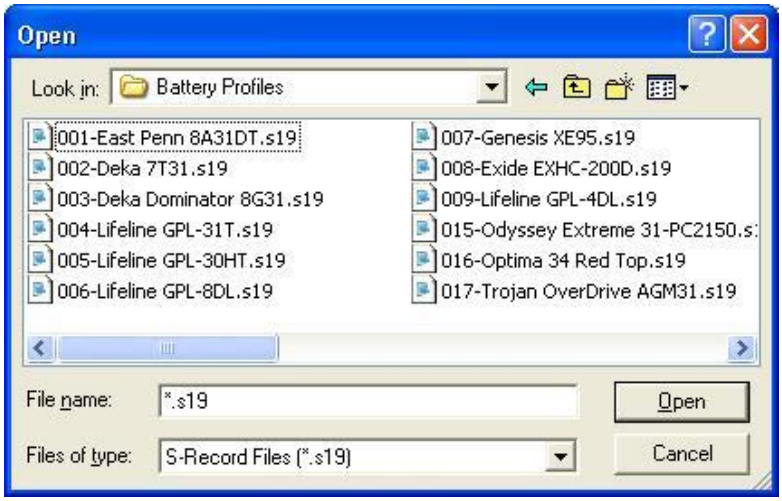


Figure 34. Battery Profile Selection Window

Once a battery profile is selected, the battery data stored in the file will be automatically sent to the Battery Monitor. A status bar is displayed to show the progress, as show in Figure 35.

When all data is successfully loaded in the Battery Monitor, a message box will pop up, as shown in Figure 36.

Click “OK” to read all parameters from the Battery Monitor for the user to verify.

Caution: If any problem occurs when updating the battery profile, repeat above steps until a successful update is obtained. An incomplete profile update may have unexpected results in battery monitoring.

A "Factory Reset" button is provided for Battery Monitors to reset all parameters to factory default values. **Please note that all saved data from user input or from battery monitoring will be lost by resetting. The** battery profile will not be changed by “Factory Reset”.

Another button, "Voltage Calibration", is used for factory calibration. This is a two-step procedure to calibrate voltage sensing. In step 1, accurate 28V and 14V voltages need to be connected to the Battery Monitor. In step 2, accurate 24V and 12V voltages need to be connected to the Battery Monitor. Voltage sensing gains and offsets will be calibrated from these values. Inaccurate voltages in any step will result in incorrect voltage calibration. **This function is reserved for Vanner production team only.** Calibration results are saved in EEPROM of the Battery Monitor that can be read at power up. Please note that "Factory Reset" will erase this data.

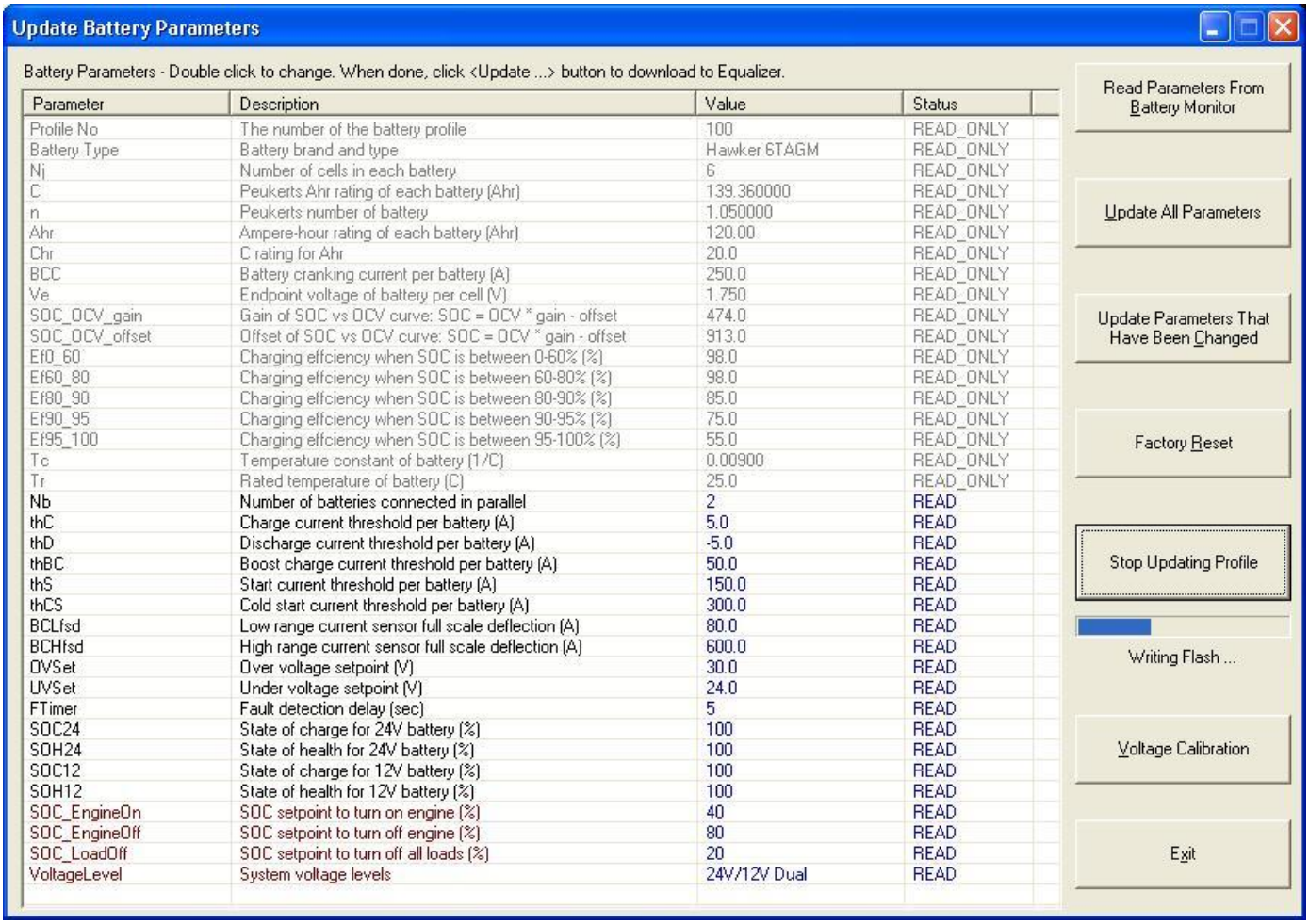


Figure 35. Standalone Battery Monitor Battery Parameters Window – Update Battery Profile

Figure 36. Update Battery Profile Message

5.7.3 Battery States Data Logging Window

Battery status information can be logged in two RAM chips (if populated) at a user-specified rate. The logged data will be lost if the ignition signal to the Battery Monitor is turned off but it can be read out before that via CAN bus. The Standalone Battery Monitor Dashboard provides this reading function. Click the "Data Logging" button on the Standalone Battery Monitor Dashboard to open the “Battery States Data Logging Window” as shown in Figure 37.

To read logged data, click the “Read” button and specify the number of data records the user wants to read. The maximum number of records that can be read is 16384.

Battery status data read from the Battery Monitor is displayed in a list box on the left of the window. The data can be saved to a text file by clicking the “Save” button. The text file can be imported later into Microsoft Excel for further analysis.

Click the “Setup” button to specify the data logging speed (interval in seconds between two data records) and length (number of data records to log). The logging speed can be chosen from 1 record per second to 1 record per hour. The corresponding logging interval is 1 through 3600 (seconds). The logging length can be 1 through 16384. Data logging will stop when the specified number of records is logged. The user can specify a length greater than 16384 to enable continuous data logging. Please note that even in continuous mode, a maximum of 16384 data records can be logged into the RAM chip. However, when this number is reached, new data will overwrite the old data to continue logging.

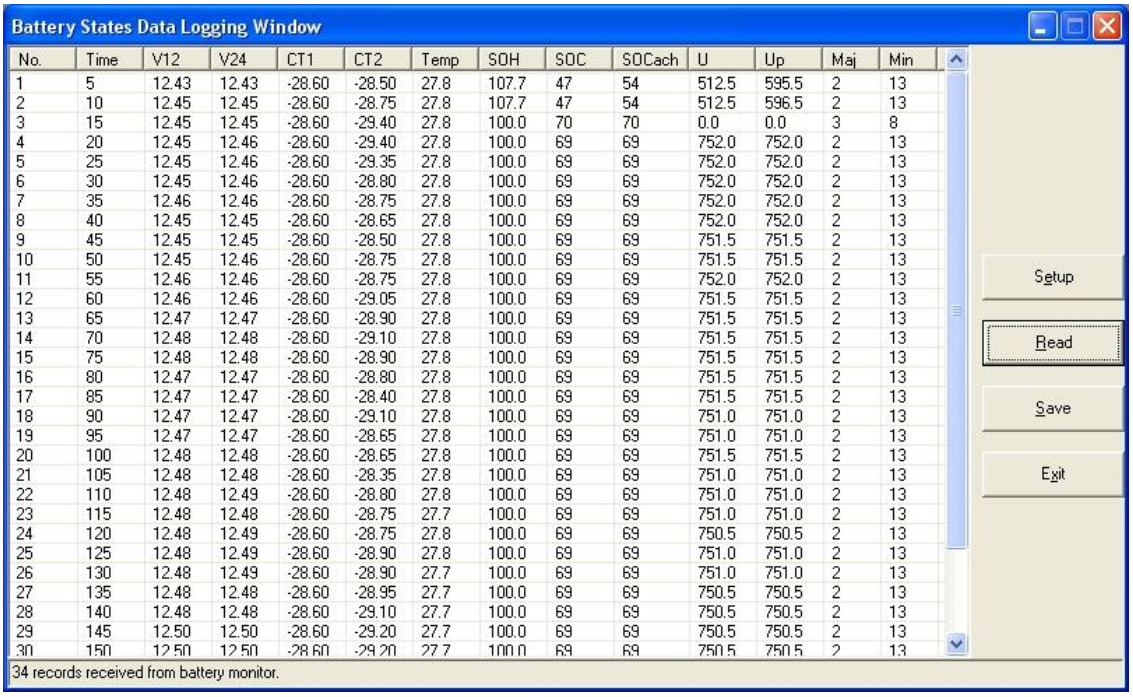
5.7.4 Standalone Battery Monitor Disgnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the Battery Monitor. The user can also request DM1 message, Software ID, and Component ID information from the Battery Monitor. Click the "View Diagnostic Messages" button to open the “Diagnostic Messages Dialog” as shown in Figure 38.

The DM1 messages are sent once per second if there are any faults detected by the Battery Monitor. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the Standalone Battery Monitor CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1BM0002***", with two digits before ending '*' denoting the software version number (0.2 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***BM0001***", with two digits before ending '*' denoting the hardware version number (0.1 for this example).



No.	Time	V12	V24	CT1	CT2	Temp	SOH	SOC	SOCach	U	Up	Maj	Min
1	5	12.43	12.43	-28.60	-28.50	27.8	107.7	47	54	512.5	595.5	2	13
2	10	12.45	12.45	-28.60	-28.75	27.8	107.7	47	54	512.5	596.5	2	13
3	15	12.45	12.45	-28.60	-29.40	27.8	100.0	70	70	0.0	0.0	3	8
4	20	12.45	12.46	-28.60	-29.40	27.8	100.0	69	69	752.0	752.0	2	13
5	25	12.45	12.46	-28.60	-29.35	27.8	100.0	69	69	752.0	752.0	2	13
6	30	12.45	12.46	-28.60	-28.80	27.8	100.0	69	69	752.0	752.0	2	13
7	35	12.46	12.46	-28.60	-28.75	27.8	100.0	69	69	752.0	752.0	2	13
8	40	12.45	12.45	-28.60	-28.65	27.8	100.0	69	69	752.0	752.0	2	13
9	45	12.45	12.45	-28.60	-28.50	27.8	100.0	69	69	751.5	751.5	2	13
10	50	12.45	12.46	-28.60	-28.75	27.8	100.0	69	69	751.5	751.5	2	13
11	55	12.46	12.46	-28.60	-28.75	27.8	100.0	69	69	752.0	752.0	2	13
12	60	12.46	12.46	-28.60	-29.05	27.8	100.0	69	69	751.5	751.5	2	13
13	65	12.47	12.47	-28.60	-28.90	27.8	100.0	69	69	751.5	751.5	2	13
14	70	12.48	12.48	-28.60	-29.10	27.8	100.0	69	69	751.5	751.5	2	13
15	75	12.48	12.48	-28.60	-28.90	27.8	100.0	69	69	751.5	751.5	2	13
16	80	12.47	12.47	-28.60	-28.80	27.8	100.0	69	69	751.5	751.5	2	13
17	85	12.47	12.47	-28.60	-28.40	27.8	100.0	69	69	751.5	751.5	2	13
18	90	12.47	12.47	-28.60	-29.10	27.8	100.0	69	69	751.0	751.0	2	13
19	95	12.47	12.47	-28.60	-28.65	27.8	100.0	69	69	751.0	751.0	2	13
20	100	12.48	12.48	-28.60	-28.65	27.8	100.0	69	69	751.5	751.5	2	13
21	105	12.48	12.48	-28.60	-28.35	27.8	100.0	69	69	751.0	751.0	2	13
22	110	12.48	12.49	-28.60	-28.80	27.8	100.0	69	69	751.0	751.0	2	13
23	115	12.48	12.48	-28.60	-28.75	27.7	100.0	69	69	751.0	751.0	2	13
24	120	12.48	12.49	-28.60	-28.75	27.8	100.0	69	69	750.5	750.5	2	13
25	125	12.48	12.49	-28.60	-28.90	27.8	100.0	69	69	751.0	751.0	2	13
26	130	12.48	12.49	-28.60	-28.90	27.7	100.0	69	69	751.0	751.0	2	13
27	135	12.48	12.48	-28.60	-28.95	27.7	100.0	69	69	750.5	750.5	2	13
28	140	12.48	12.48	-28.60	-29.10	27.7	100.0	69	69	750.5	750.5	2	13
29	145	12.50	12.50	-28.60	-29.20	27.7	100.0	69	69	750.5	750.5	2	13
30	150	12.50	12.50	-28.60	-29.20	27.7	100.0	69	69	750.5	750.5	2	13

Figure 37. Standalone Battery Monitor Battery States Data Logging Window

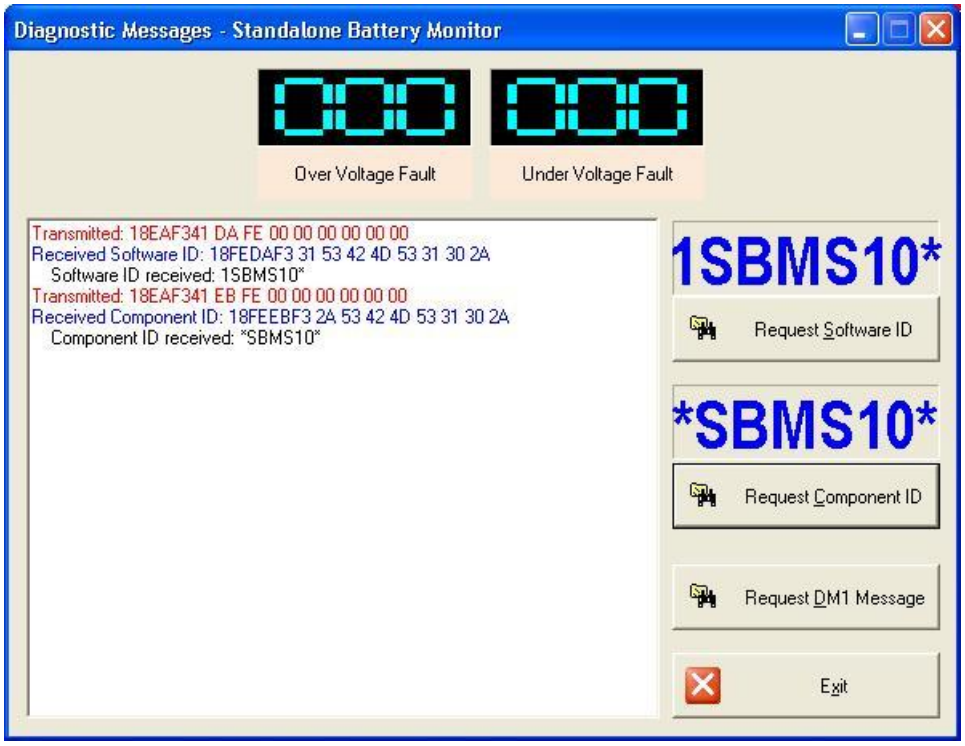


Figure 38. Standalone Battery Monitor Diagnostic Messages Window

5.8 PMEC/idleWATCH Dashboard

With this dashboard, the user can

- view running status of PMEC, as well as fault signals
- view batteries voltage, current, and temperature, and load currents
- view batteries status such as SOC, SOH, charge/discharge state, etc
- set PMEC parameters
- view diagnostic CAN messages

5.8.1 PMEC Dashboard Main Window

Click "Idle Watch." button in Vanner CAN Interface main window to open Power Management with Engine Control Dashboard, as shown in Figure 39.

The top section of the window displays batteries voltage, current, temperature, and load currents. V24 represents the voltage of the upper (24V) battery; V12 represents the voltage of the lower (12V) battery; I24 represents the current into the upper (24V) battery; I12 represents the current into the lower (12V) battery; LoadA represents current of load A; and LoadB represents current of load B.

Heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly.

The bottom left section of the window shows battery monitoring information, which includes SOH (State of Health), SOC (State of Charge), SOCach (Achievable SOC), U (Time to Run), Up (Time to Run Adjusted by SOH and Temperature of Battery), and the major and minor states of both batteries. Uengine (Time to Turn on Engine) and Ncycle (Number of Charge/Discharge Cycles Before Next Top-Off Charge) are also shown

(3) Battery Major States:
- Charge
- Discharge
- Quiescent

(4) Battery Minor States:
- Boost charge
- Bulk charge
- Floating charge
- Fully charged
- Open circuit
- Open circuit poor
- Trickle charge
- Battery bad
- Parasitic
- Start
- Cold start
- Virtual cell

The bottom right section shows the PMEC status and fault information. The corresponding light bar will be on when it is active.

The middle left section contains all battery monitor control buttons.

Please refer to PMEC CAN Specification for details about PMEC control, status, and fault information.

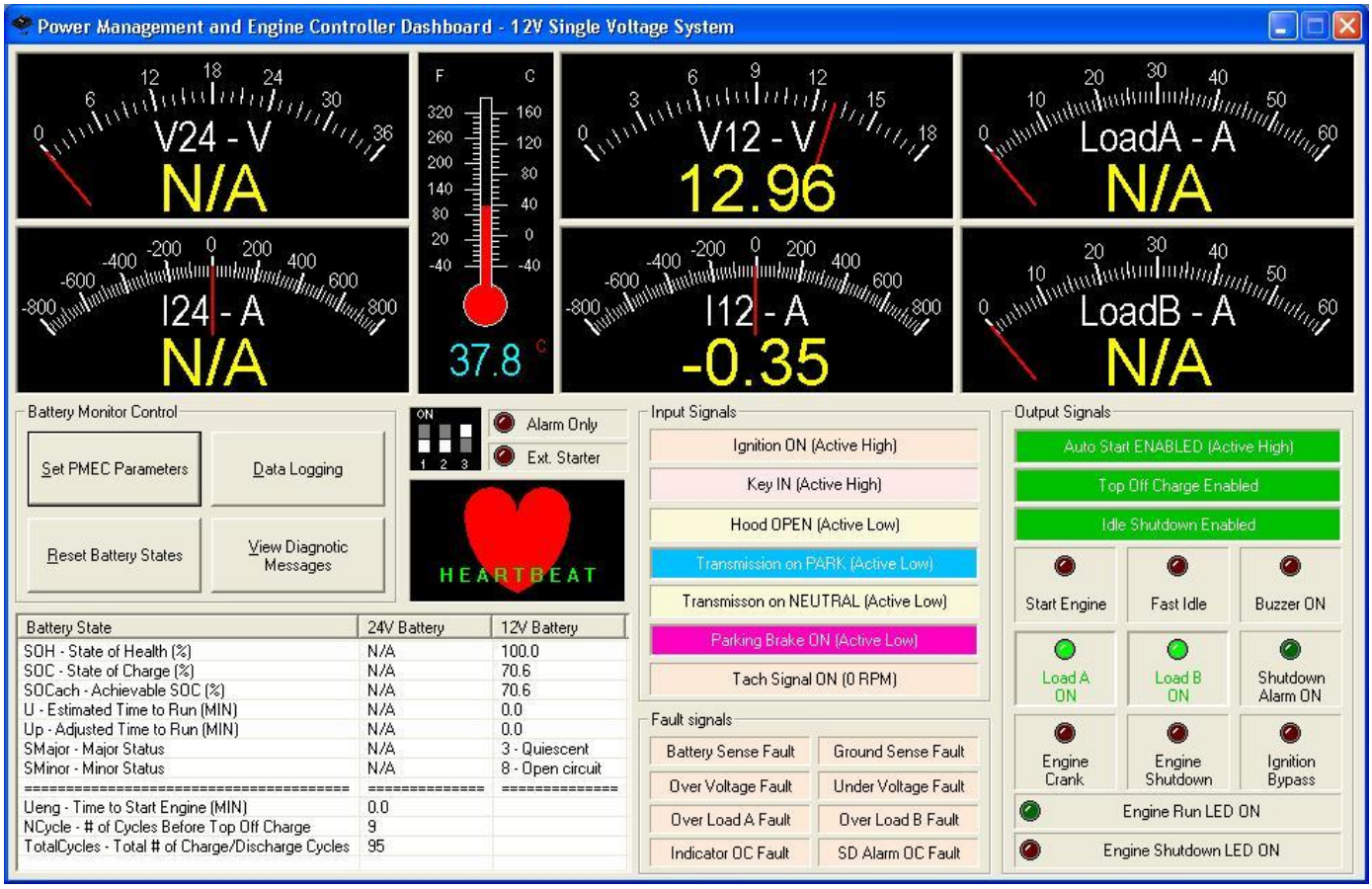
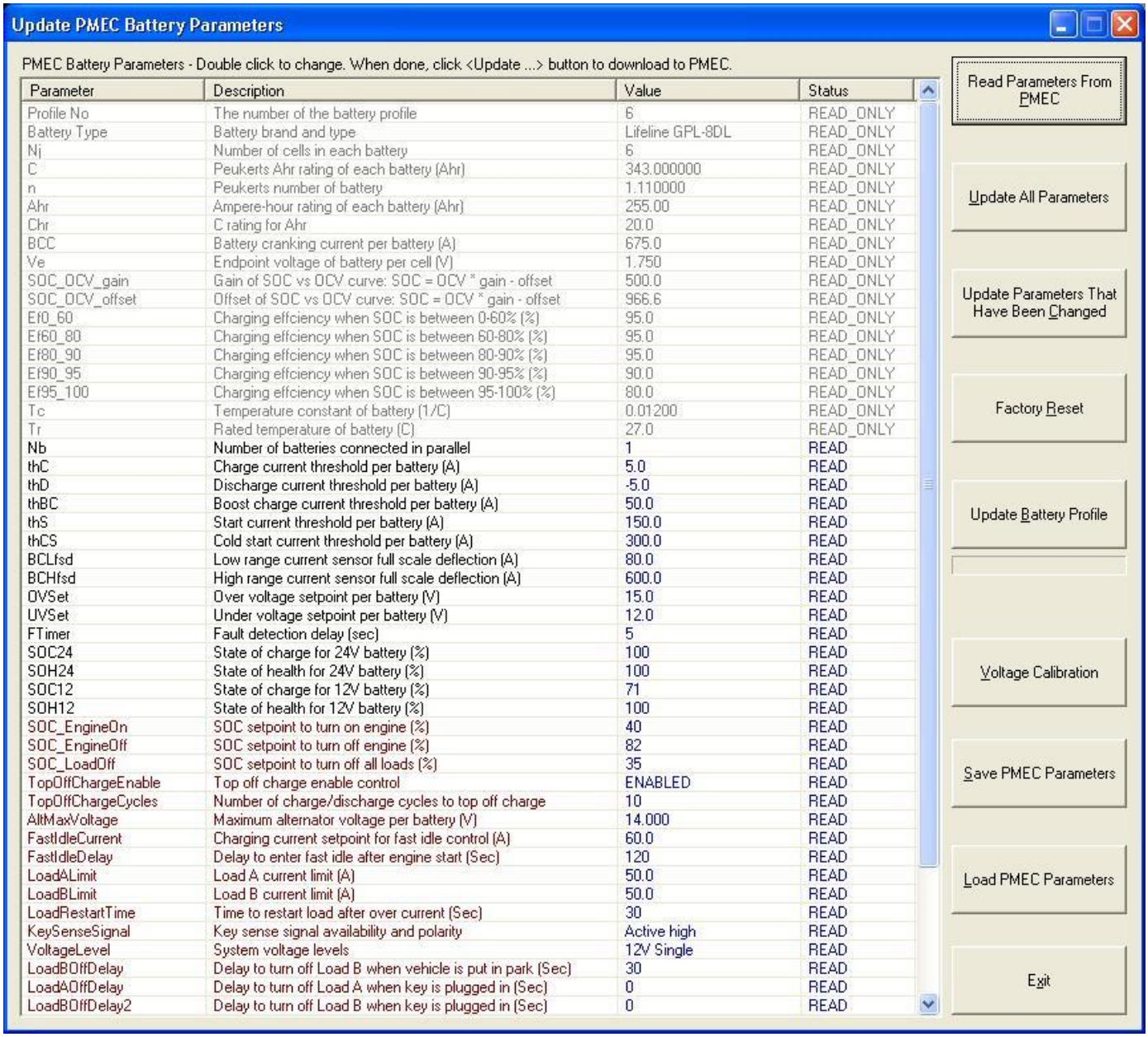


Figure 39. PMEC Dashboard

5.8.2 Update PMEC Battery Parameters Window

This window is provided for the user to update the battery and PMEC parameters if they differ from factory default values. Correct battery parameters are needed by the battery monitoring algorithm to accurately monitor battery status. Click the "Set Battery Parameters" button on the PMEC Dashboard to open the “Update PMEC Battery Parameters Dialog” as shown in Figure 40.



Parameter	Description	Value	Status
Profile No	The number of the battery profile	6	READ_ONLY
Battery Type	Battery brand and type	Lifeline GPL-8DL	READ_ONLY
Nj	Number of cells in each battery	6	READ_ONLY
C	Peukerts Ahr rating of each battery (Ahr)	343.000000	READ_ONLY
n	Peukerts number of battery	1.110000	READ_ONLY
Ahr	Ampere-hour rating of each battery (Ahr)	255.00	READ_ONLY
Chr	C rating for Ahr	20.0	READ_ONLY
BCC	Battery cranking current per battery (A)	675.0	READ_ONLY
Ve	Endpoint voltage of battery per cell (V)	1.750	READ_ONLY
SOC_OCV_gain	Gain of SOC vs OCV curve: SOC = OCV * gain - offset	500.0	READ_ONLY
SOC_OCV_offset	Offset of SOC vs OCV curve: SOC = OCV * gain - offset	966.6	READ_ONLY
Ef0_60	Charging effciency when SOC is between 0-60% (%)	95.0	READ_ONLY
Ef60_80	Charging effciency when SOC is between 60-80% (%)	95.0	READ_ONLY
Ef80_90	Charging effciency when SOC is between 80-90% (%)	95.0	READ_ONLY
Ef90_95	Charging effciency when SOC is between 90-95% (%)	90.0	READ_ONLY
Ef95_100	Charging effciency when SOC is between 95-100% (%)	80.0	READ_ONLY
Tc	Temperature constant of battery (1/C)	0.01200	READ_ONLY
Tr	Rated temperature of battery (C)	27.0	READ_ONLY
Nb	Number of batteries connected in parallel	1	READ
thC	Charge current threshold per battery (A)	5.0	READ
thD	Discharge current threshold per battery (A)	-5.0	READ
thBC	Boost charge current threshold per battery (A)	50.0	READ
thS	Start current threshold per battery (A)	150.0	READ
thCS	Cold start current threshold per battery (A)	300.0	READ
BCLfsd	Low range current sensor full scale deflection (A)	80.0	READ
BCHfsd	High range current sensor full scale deflection (A)	600.0	READ
OVSet	Over voltage setpoint per battery (V)	15.0	READ
UVSet	Under voltage setpoint per battery (V)	12.0	READ
FTimer	Fault detection delay (sec)	5	READ
SOC24	State of charge for 24V battery (%)	100	READ
SOH24	State of health for 24V battery (%)	100	READ
SOC12	State of charge for 12V battery (%)	71	READ
SOH12	State of health for 12V battery (%)	100	READ
SOC_EngineOn	SOC setpoint to turn on engine (%)	40	READ
SOC_EngineOff	SOC setpoint to turn off engine (%)	82	READ
SOC_LoadOff	SOC setpoint to turn off all loads (%)	35	READ
TopOffChargeEnable	Top off charge enable control	ENABLED	READ
TopOffChargeCycles	Number of charge/discharge cycles to top off charge	10	READ
AltMaxVoltage	Maximum alternator voltage per battery (V)	14.000	READ
FastIdleCurrent	Charging current setpoint for fast idle control (A)	60.0	READ
FastIdleDelay	Delay to enter fast idle after engine start (Sec)	120	READ
LoadALimit	Load A current limit (A)	50.0	READ
LoadBLimit	Load B current limit (A)	50.0	READ
LoadRestartTime	Time to restart load after over current (Sec)	30	READ
KeySenseSignal	Key sense signal availability and polarity	Active high	READ
VoltageLevel	System voltage levels	12V Single	READ
LoadBOffDelay	Delay to turn off Load B when vehicle is put in park (Sec)	30	READ
LoadAOffDelay	Delay to turn off Load A when key is plugged in (Sec)	0	READ
LoadBOffDelay2	Delay to turn off Load B when key is plugged in (Sec)	0	READ

Figure 40. Update PMEC Battery Parameters Window

A list box on the left side of the window shows all parameters used by the PMEC. The current value of each parameter can be read back by pressing the “Read Parameters From PMEC” button. Double click any parameter in the list that is not marked as “READ_ONLY” to change its value. When all changes are made, click “Update All Parameters” or “Update Parameters That Have Been Changed” to apply the changes to the PMEC. This will cause the dashboard to send several CAN messages to the PMEC for corresponding parameter changes. Please note that the user always needs to click either “Update All Parameters” or “Update Parameters That Have Been Changed” button to apply the changes to the PMEC.

The “READ_ONLY” parameters are related to a specific battery profile. They can only be changed altogether by uploading a different battery profile. To do this, click the “Update Battery Profile” button, a file selection dialog will be open to let user select the desired battery profile file (please contact Vanner for proper battery profile files for your application), as shown in Figure 41.

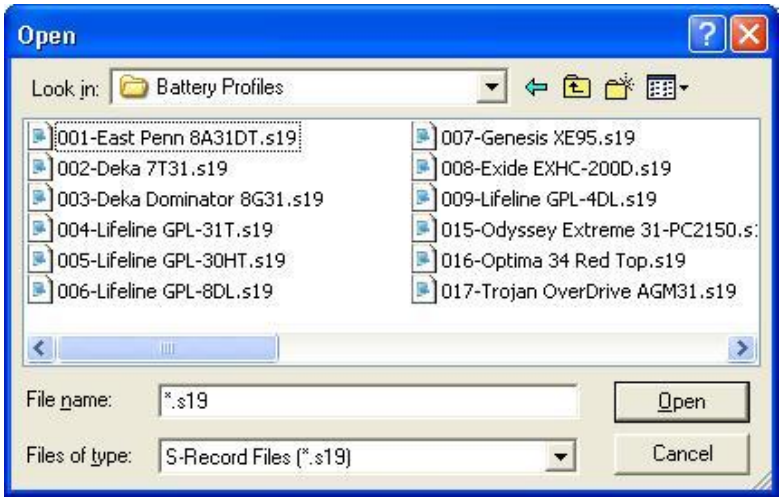
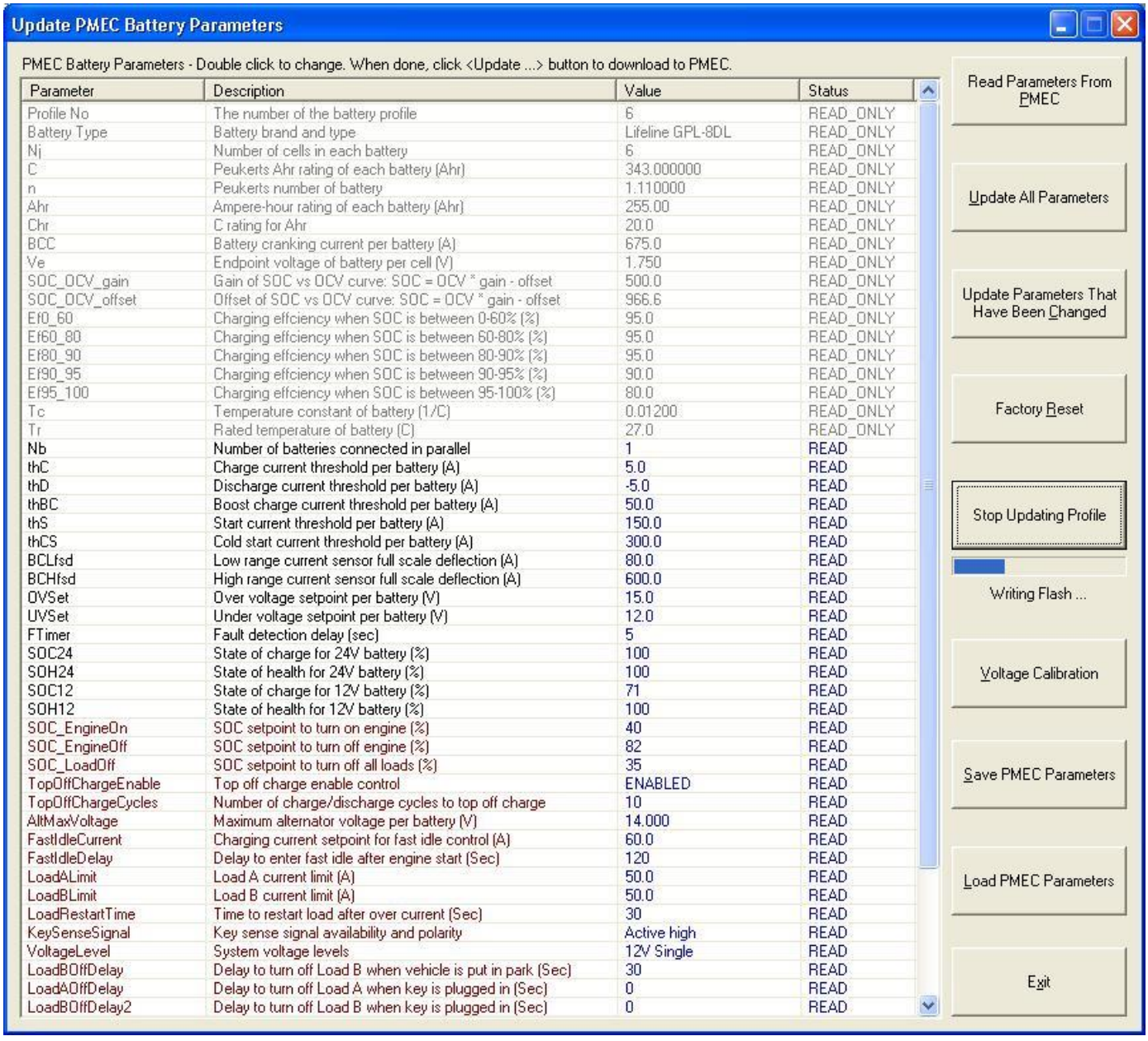


Figure 41. Battery Profile Selection Window

Once a battery profile is selected, the battery data stored in the file will be automatically sent to the PMEC. A status bar is displayed to show the progress, as show in Figure 42.



Parameter	Description	Value	Status
Profile No	The number of the battery profile	6	READ_ONLY
Battery Type	Battery brand and type	Lifeline GPL-8DL	READ_ONLY
Nj	Number of cells in each battery	6	READ_ONLY
C	Peukerts Ahr rating of each battery (Ahr)	343.000000	READ_ONLY
n	Peukerts number of battery	1.110000	READ_ONLY
Ahr	Ampere-hour rating of each battery (Ahr)	255.00	READ_ONLY
Chr	C rating for Ahr	20.0	READ_ONLY
BCC	Battery cranking current per battery (A)	675.0	READ_ONLY
Ve	Endpoint voltage of battery per cell (V)	1.750	READ_ONLY
SOC_OCV_gain	Gain of SOC vs OCV curve: SOC = OCV * gain - offset	500.0	READ_ONLY
SOC_OCV_offset	Offset of SOC vs OCV curve: SOC = OCV * gain - offset	966.6	READ_ONLY
Ef0_60	Charging effciency when SOC is between 0-60% (%)	95.0	READ_ONLY
Ef60_80	Charging effciency when SOC is between 60-80% (%)	95.0	READ_ONLY
Ef80_90	Charging effciency when SOC is between 80-90% (%)	95.0	READ_ONLY
Ef90_95	Charging effciency when SOC is between 90-95% (%)	90.0	READ_ONLY
Ef95_100	Charging effciency when SOC is between 95-100% (%)	80.0	READ_ONLY
Tc	Temperature constant of battery (1/C)	0.01200	READ_ONLY
Tr	Rated temperature of battery (C)	27.0	READ_ONLY
Nb	Number of batteries connected in parallel	1	READ
thC	Charge current threshold per battery (A)	5.0	READ
thD	Discharge current threshold per battery (A)	-5.0	READ
thBC	Boost charge current threshold per battery (A)	50.0	READ
thS	Start current threshold per battery (A)	150.0	READ
thCS	Cold start current threshold per battery (A)	300.0	READ
BCLfsd	Low range current sensor full scale deflection (A)	80.0	READ
BCHfsd	High range current sensor full scale deflection (A)	600.0	READ
OVSet	Over voltage setpoint per battery (V)	15.0	READ
UVSet	Under voltage setpoint per battery (V)	12.0	READ
FTimer	Fault detection delay (sec)	5	READ
SOC24	State of charge for 24V battery (%)	100	READ
SOH24	State of health for 24V battery (%)	100	READ
SOC12	State of charge for 12V battery (%)	71	READ
SOH12	State of health for 12V battery (%)	100	READ
SOC_EngineOn	SOC setpoint to turn on engine (%)	40	READ
SOC_EngineOff	SOC setpoint to turn off engine (%)	82	READ
SOC_LoadOff	SOC setpoint to turn off all loads (%)	35	READ
TopOffChargeEnable	Top off charge enable control	ENABLED	READ
TopOffChargeCycles	Number of charge/discharge cycles to top off charge	10	READ
AltMaxVoltage	Maximum alternator voltage per battery (V)	14.000	READ
FastIdleCurrent	Charging current setpoint for fast idle control (A)	60.0	READ
FastIdleDelay	Delay to enter fast idle after engine start (Sec)	120	READ
LoadALimit	Load A current limit (A)	50.0	READ
LoadBLimit	Load B current limit (A)	50.0	READ
LoadRestartTime	Time to restart load after over current (Sec)	30	READ
KeySenseSignal	Key sense signal availability and polarity	Active high	READ
VoltageLevel	System voltage levels	12V Single	READ
LoadBOffDelay	Delay to turn off Load B when vehicle is put in park (Sec)	30	READ
LoadAOffDelay	Delay to turn off Load A when key is plugged in (Sec)	0	READ
LoadBOffDelay2	Delay to turn off Load B when key is plugged in (Sec)	0	READ

Figure 42. Update PMEC Battery Parameters Window – Update Battery Profile

When all data is successfully loaded in the PMEC, a message box will pop up, as shown in Figure 43.

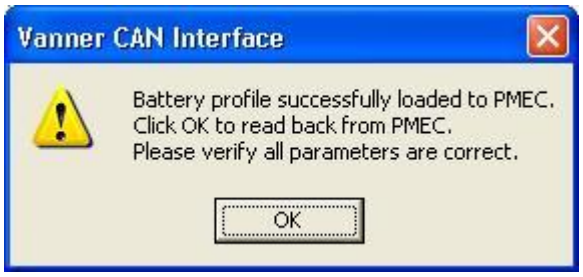


Figure 43. Update Battery Profile Message

Click “OK” to read all parameters from PMEC for the user to verify.

Caution: If any problem occurs when updating the battery profile, repeat above steps until a successful update is obtained. An incomplete profile update may have unexpected results in battery monitoring.

Two buttons, “Save PMEC Parameters” and “Load PMEC Parameters” provide function to save all parameters into a file and load it to dashboard later. This is helpful when you want to load the same parameters to multiple units.

Please be very cautious when changing PMEC parameters. Wrongly set parameters may result in unexpected performance of the PMEC unit. Normally this should only be done by PMEC system providers.

A "Factory Reset" button is provided to reset all parameters to factory default values. **Please note that all saved data from user input or from battery monitoring will be lost by resetting. The** battery profile will not be changed by a “Factory Reset”.

Another button, "Voltage Calibration", is used for factory calibration. This is a two-step procedure to calibrate voltage sensing. In step 1, accurate 28V or 14V voltage needs to be connected to the PMEC. In step 2, accurate 24V or 12V voltage needs to be connected to the PMEC. Voltage sensing gains and offsets will be calibrated from these values. Inaccurate voltages in any step will result in incorrect voltage calibration. **This function is reserved for Vanner production team only. Calibration results are saved in FRAM of PMEC which can be read at power up. Please note that "Factory Reset" will erase this data.**

5.8.3 PMEC Battery States Data Logging Window

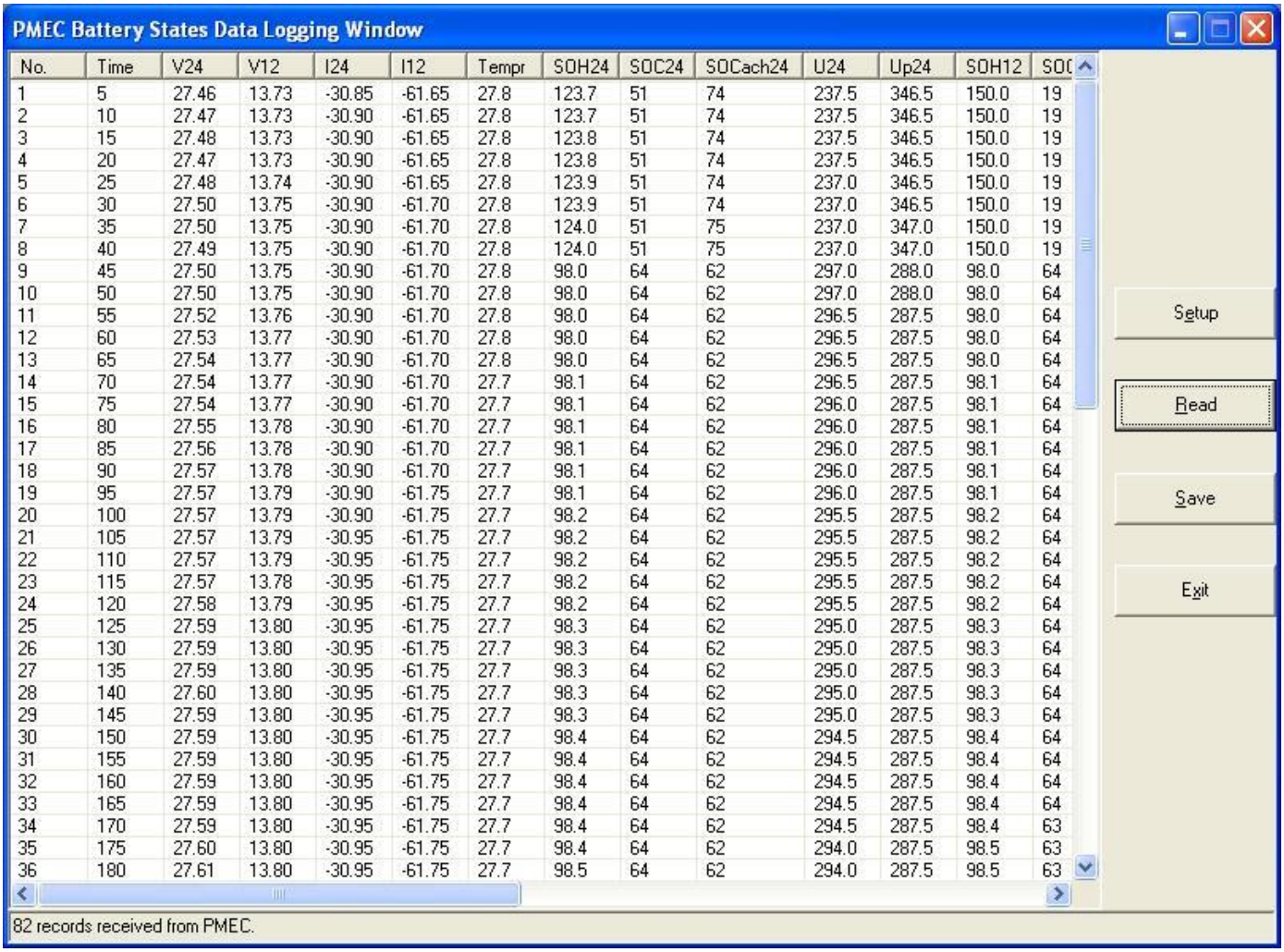
Battery and PMEC status information can be logged in two RAM chips (if populated) at a user-specified rate. The logged data will be lost if the ignition signal to the PMEC is turned off but it can be read out before that via CAN bus. The PMEC dashboard provides this reading function. Click the "Data Logging" button on the PMEC Dashboard to open the “PMEC Battery States Data Logging Window” as shown in Figure 44.

To read logged data, click the “Read” button and specify the number of data records the user wants to read. The maximum number of records that can be read is 16384.

Battery and PMEC status data read from the PMEC is displayed in a list box on the left of the window. The data can be saved to a text file by clicking the “Save” button. The text file can be imported later into Microsoft Excel for further analysis, or open in Vanner CAN Data Analyzer, as described in section 5.3.

Click the “Setup” button to specify the data logging speed (interval in seconds between two data records) and length (number of data records to log). The logging speed can be chosen from 1 record per second to 1 record per hour.

The corresponding logging interval is 1 through 3600 (seconds). The logging length can be 1 through 16384. Data logging will stop when the specified number of records is logged. The user can specify a length greater than 16384 to enable continuous data logging. Please note that even in continuous mode, a maximum of 16384 data records can be logged into the RAM chip. However, when this number is reached, new data will overwrite the old data to continue logging.



No.	Time	V24	V12	I24	I12	Tempr	SOH24	SOC24	SOCach24	U24	Up24	SOH12	SOC
1	5	27.46	13.73	-30.85	-61.65	27.8	123.7	51	74	237.5	346.5	150.0	19
2	10	27.47	13.73	-30.90	-61.65	27.8	123.7	51	74	237.5	346.5	150.0	19
3	15	27.48	13.73	-30.90	-61.65	27.8	123.8	51	74	237.5	346.5	150.0	19
4	20	27.47	13.73	-30.90	-61.65	27.8	123.8	51	74	237.5	346.5	150.0	19
5	25	27.48	13.74	-30.90	-61.65	27.8	123.9	51	74	237.0	346.5	150.0	19
6	30	27.50	13.75	-30.90	-61.70	27.8	123.9	51	74	237.0	346.5	150.0	19
7	35	27.50	13.75	-30.90	-61.70	27.8	124.0	51	75	237.0	347.0	150.0	19
8	40	27.49	13.75	-30.90	-61.70	27.8	124.0	51	75	237.0	347.0	150.0	19
9	45	27.50	13.75	-30.90	-61.70	27.8	98.0	64	62	297.0	288.0	98.0	64
10	50	27.50	13.75	-30.90	-61.70	27.8	98.0	64	62	297.0	288.0	98.0	64
11	55	27.52	13.76	-30.90	-61.70	27.8	98.0	64	62	296.5	287.5	98.0	64
12	60	27.53	13.77	-30.90	-61.70	27.8	98.0	64	62	296.5	287.5	98.0	64
13	65	27.54	13.77	-30.90	-61.70	27.8	98.0	64	62	296.5	287.5	98.0	64
14	70	27.54	13.77	-30.90	-61.70	27.7	98.1	64	62	296.5	287.5	98.1	64
15	75	27.54	13.77	-30.90	-61.70	27.7	98.1	64	62	296.0	287.5	98.1	64
16	80	27.55	13.78	-30.90	-61.70	27.7	98.1	64	62	296.0	287.5	98.1	64
17	85	27.56	13.78	-30.90	-61.70	27.7	98.1	64	62	296.0	287.5	98.1	64
18	90	27.57	13.78	-30.90	-61.70	27.7	98.1	64	62	296.0	287.5	98.1	64
19	95	27.57	13.79	-30.90	-61.75	27.7	98.1	64	62	296.0	287.5	98.1	64
20	100	27.57	13.79	-30.90	-61.75	27.7	98.2	64	62	295.5	287.5	98.2	64
21	105	27.57	13.79	-30.95	-61.75	27.7	98.2	64	62	295.5	287.5	98.2	64
22	110	27.57	13.79	-30.95	-61.75	27.7	98.2	64	62	295.5	287.5	98.2	64
23	115	27.57	13.78	-30.95	-61.75	27.7	98.2	64	62	295.5	287.5	98.2	64
24	120	27.58	13.79	-30.95	-61.75	27.7	98.2	64	62	295.5	287.5	98.2	64
25	125	27.59	13.80	-30.95	-61.75	27.7	98.3	64	62	295.0	287.5	98.3	64
26	130	27.59	13.80	-30.95	-61.75	27.7	98.3	64	62	295.0	287.5	98.3	64
27	135	27.59	13.80	-30.95	-61.75	27.7	98.3	64	62	295.0	287.5	98.3	64
28	140	27.60	13.80	-30.95	-61.75	27.7	98.3	64	62	295.0	287.5	98.3	64
29	145	27.59	13.80	-30.95	-61.75	27.7	98.3	64	62	295.0	287.5	98.3	64
30	150	27.59	13.80	-30.95	-61.75	27.7	98.4	64	62	294.5	287.5	98.4	64
31	155	27.59	13.80	-30.95	-61.75	27.7	98.4	64	62	294.5	287.5	98.4	64
32	160	27.59	13.80	-30.95	-61.75	27.7	98.4	64	62	294.5	287.5	98.4	64
33	165	27.59	13.80	-30.95	-61.75	27.7	98.4	64	62	294.5	287.5	98.4	64
34	170	27.59	13.80	-30.95	-61.75	27.7	98.4	64	62	294.5	287.5	98.4	63
35	175	27.60	13.80	-30.95	-61.75	27.7	98.4	64	62	294.0	287.5	98.5	63
36	180	27.61	13.80	-30.95	-61.75	27.7	98.5	64	62	294.0	287.5	98.5	63

Figure 44. PMEC Battery States Data Logging Window

5.8.4 PMEC Diagnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the PMEC. The user can also request DM1 message, Software ID, and Component ID information from the PMEC. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 45.

The DM1 messages are sent once per second if there are any faults detected by the PMEC. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the PMEC CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1PMEC05***", with two digits before ending '*' denoting the software version number (0.5 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***PMEC02***", with two digits before ending '*' denoting the hardware version number (0.2 for this example).

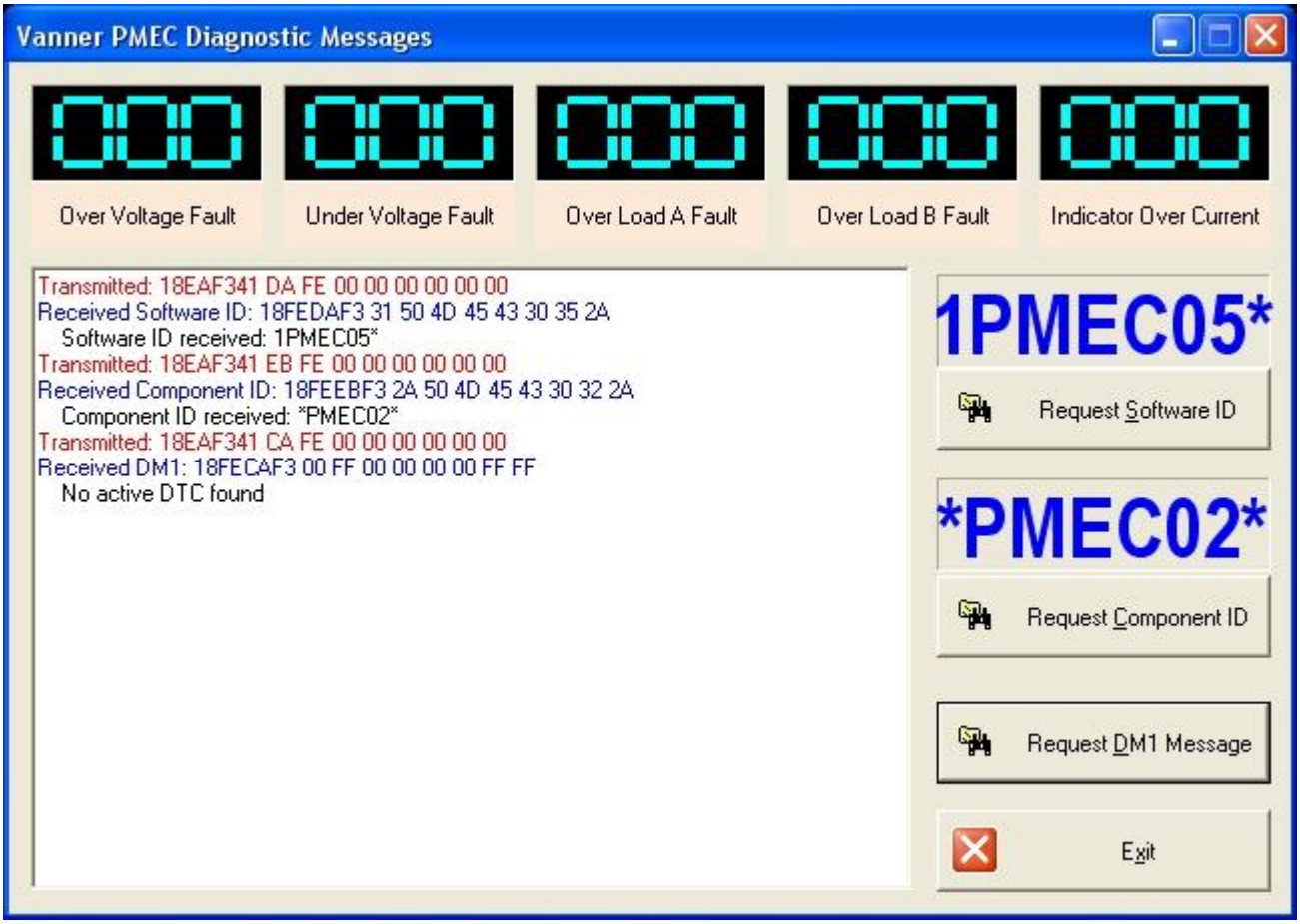
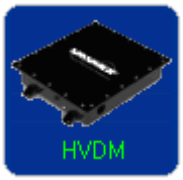


Figure 45. PMEC Diagnostic Messages Window

5.9 HVDM Dashboard



With this dashboard, the user can

- view the running status of the HVDM – high voltage distribution module, as well as fault signals
- view the voltage, and current, and temperature of the two output channels
- view relay status of the two output channels
- view diagnostic CAN messages
- simulate transmission of CAN control messages to operate HVDM if not connected to the vehicle CAN bus

5.9.1 HVDM Dashboard Main Window

Click the "HVDM" button in the Vanner CAN Interface main window to open the High Voltage Distribution Module Dashboard, as shown in Figure 46.

The top section of the window displays the voltage, current and temperature of the two output channels. Temperatures at the positive terminal and negative terminal are both measured but only the higher one is displayed.

The bottom left section shows the converter status and fault information. The corresponding light bar will be on when it is active.

The middle section shows the status of the relays in two output channels. The blue relay is on negative line, the red relay is on positive line. The red relay with a series resistor is the pre-charge relay.

The bottom section of the window shows the HVDM operating status and fault information. The HVDM output is controlled by CAN commands. Buttons are provided to simulate the CAN commands for testing of the HVDM offline. Click the "Out 1 or 2 ON/OFF" buttons to send the corresponding CAN command to the HVDM. Click “Send Command Continuously” to repeat sending CAN command once per second.

Caution: Do NOT try to send CAN control command from the dashboard if connected to the vehicle CAN bus. The messages sent from the dashboard may cause conflicts with the messages sent by the TCM (Transmission Control Module).

The “Check Temperature Sensors” button will send a special CAN message to HVDM, and the HVDM will send all six sensed temperature values back to dashboard. This is used to check if the sensors are working correctly. The temperature values will be displayed beside six terminals on the connection diagram for a short time then disappear. See Figure 47. When dashboard is connected to vehicle CAN bus, use this function with caution. Please contact bus OEM to make sure there’s no CAN PGN conflict with this message.

Please refer to the HVDM CAN Specification for details about HVDM control, status, and fault information.

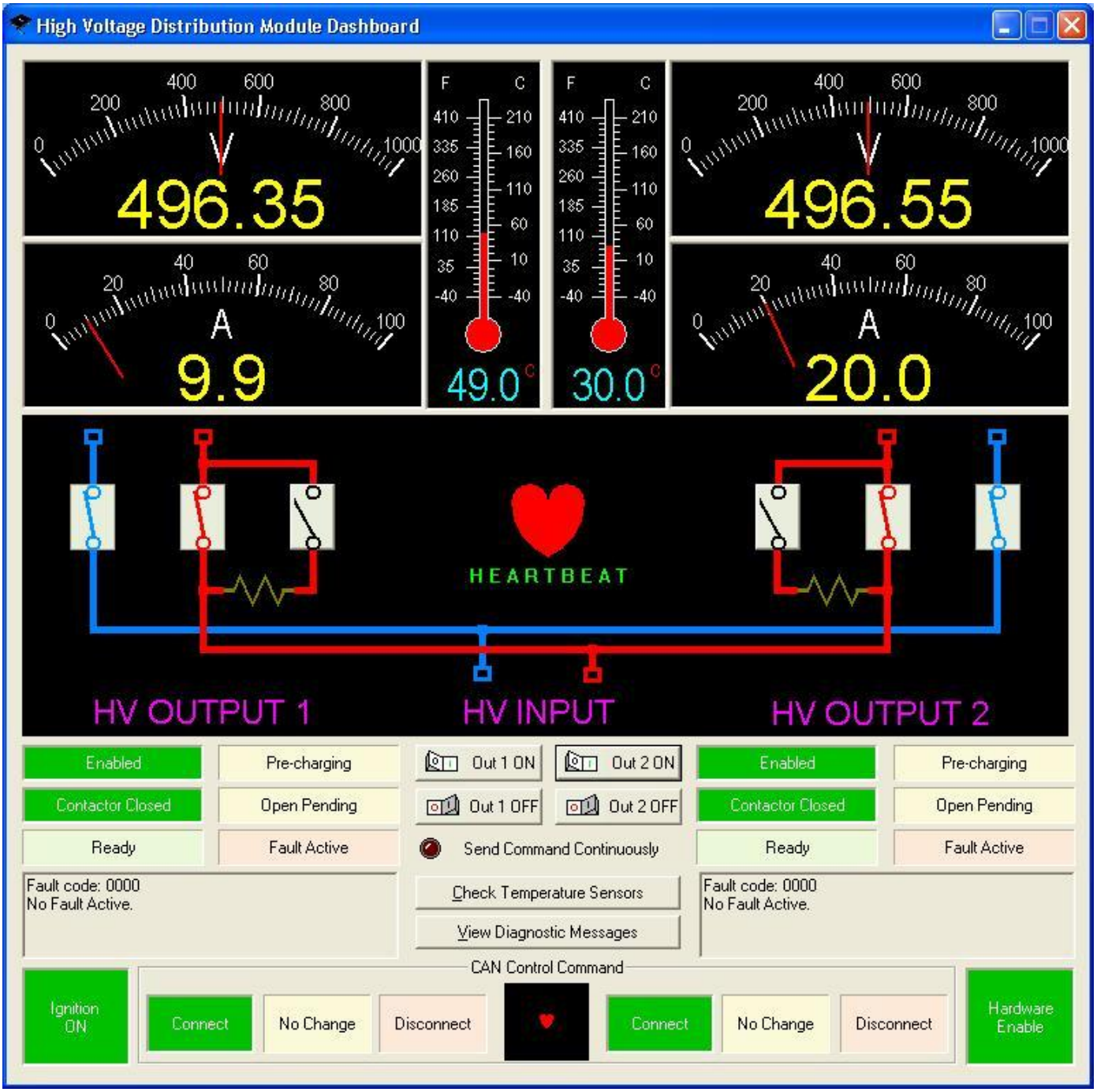


Figure 46. HVDM Dashboard

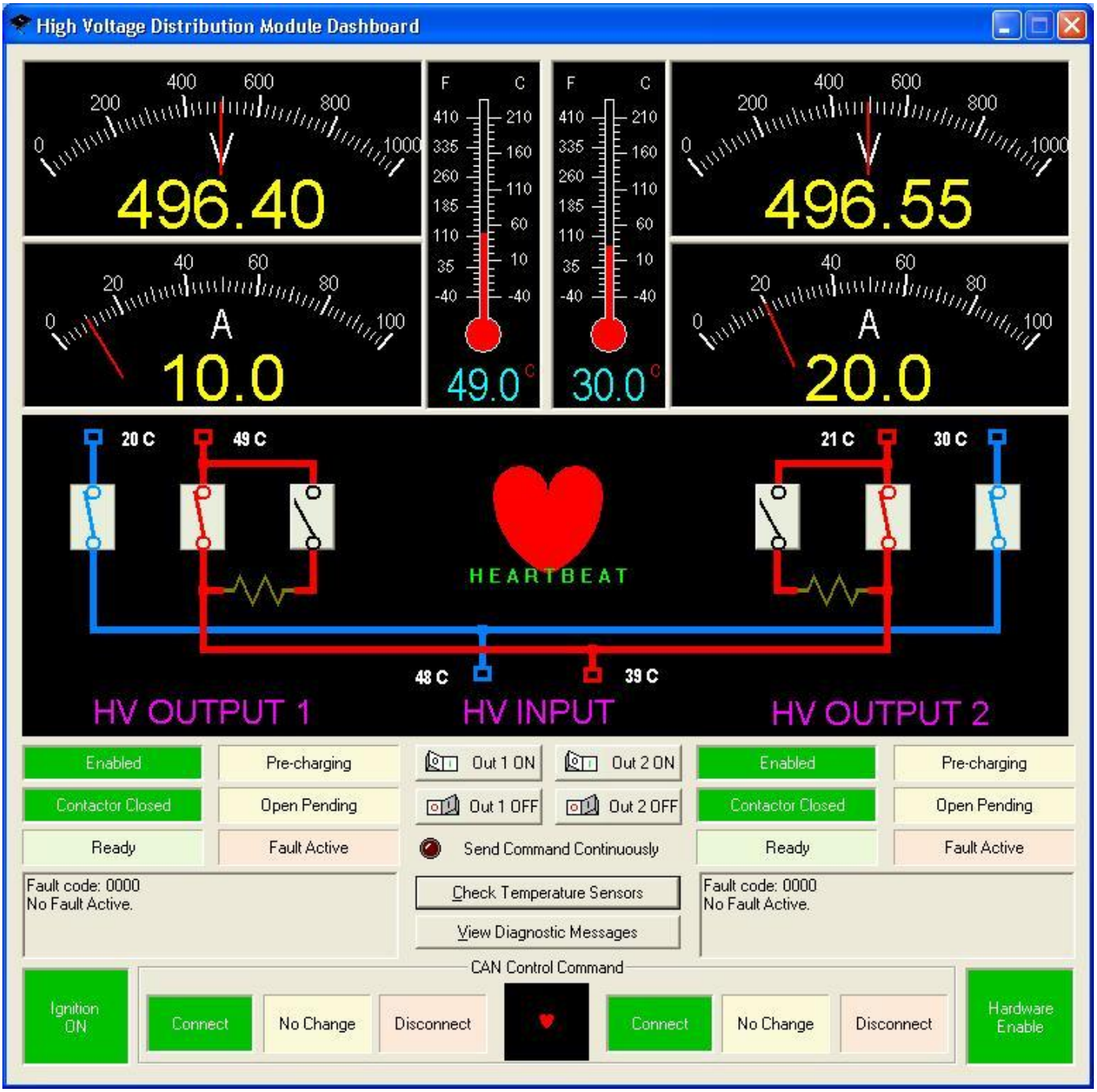


Figure 47. HVDM Dashboard with Temperature Values Displayed

5.9.2 HVDM Disgnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the HVDM. The user can also request DM1 message, Software ID, and Component ID information from the HVDM. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 48.

The DM1 messages are sent once per second if any faults are detected by the HVDM. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the HVDM CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1HVDM08***", with two digits before ending '*' denoting the software version number (0.8 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***HVDM02***", with two digits before ending '*' denoting the hardware version number (0.2 for this example).

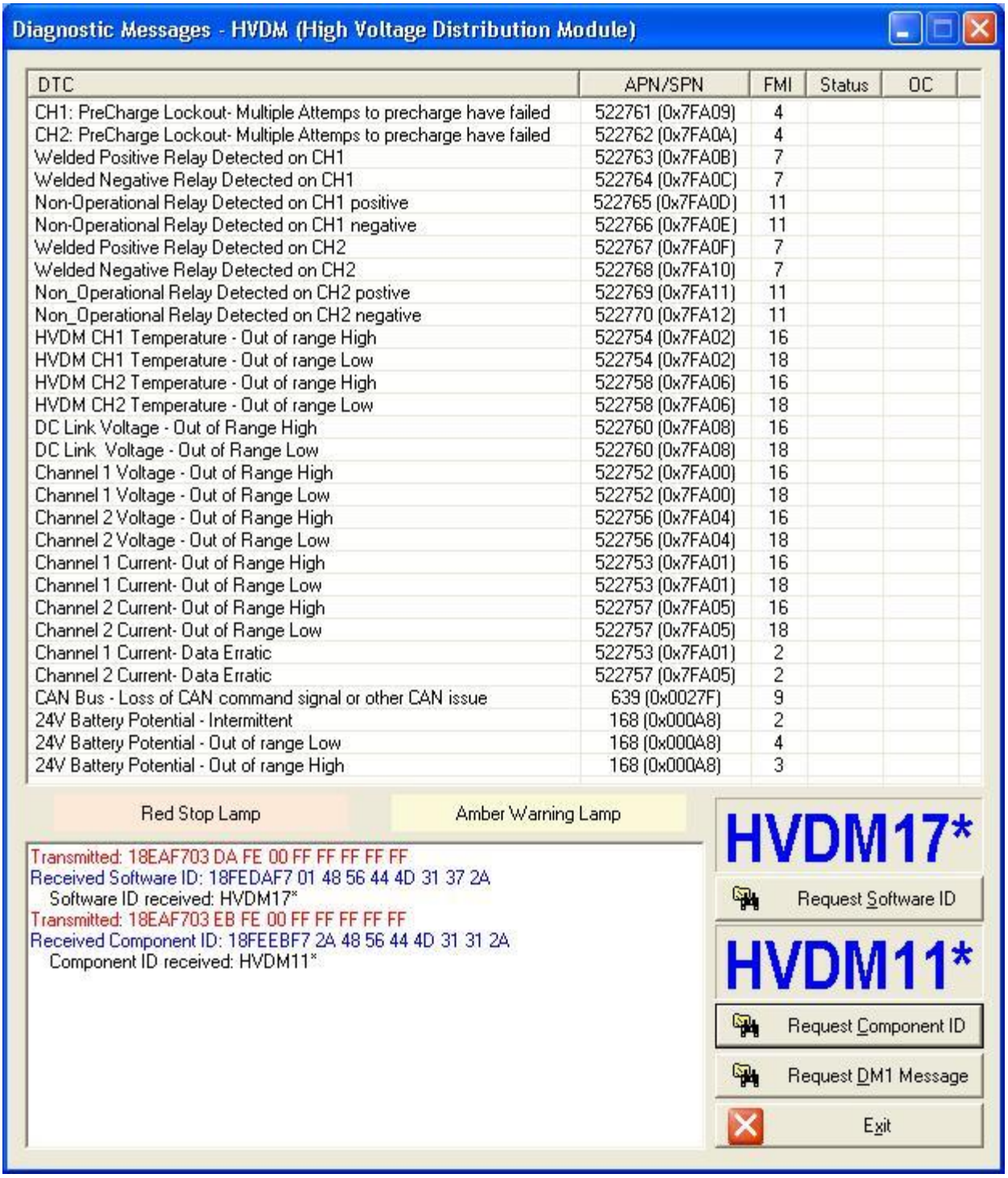
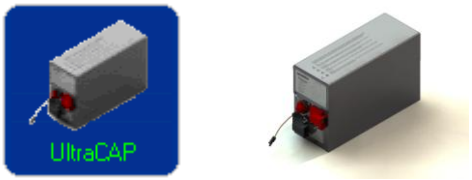


Figure 48. HVDM Diagnostic Messages Window

5.10 Ultracap Dashboard



With this dashboard, the user can

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

5.10.1 Ultracap Dashboard Main Window

Click the "Ultracap" button in the Vanner CAN Interface main window to open the 80kJ Bus Ultracap Dashboard, as shown in Figure 49.

The left section of the window displays the battery voltage, ultracap voltage, and pre-charge current. The temperature is shown in the middle, as well as the heartbeat. The heartbeat information is shown as a red “heart”. It will be beating if heartbeat messages are received regularly. The right section shows the ultracap status and fault information. The corresponding light bar will be on when it is active.

Figure 49. Ultracap Dashboard

5.10.2 Ultracap Disgnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the Ultracap. The user can also request DM1 message, Software ID, and Component ID information from the Ultracap. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 50.

The DM1 messages are sent once per second if any faults are detected by the HVDM. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the Ultracap CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button. The data returned will be in the format of "**1UCAP01***", with two digits before ending '*' denoting the software version number (0.1 for this example).

The component ID message is sent upon request by clicking the "Request Component ID" button. The data returned will be in the format of "***UCAP01***", with two digits before ending '*' denoting the hardware version number (0.1 for this example).

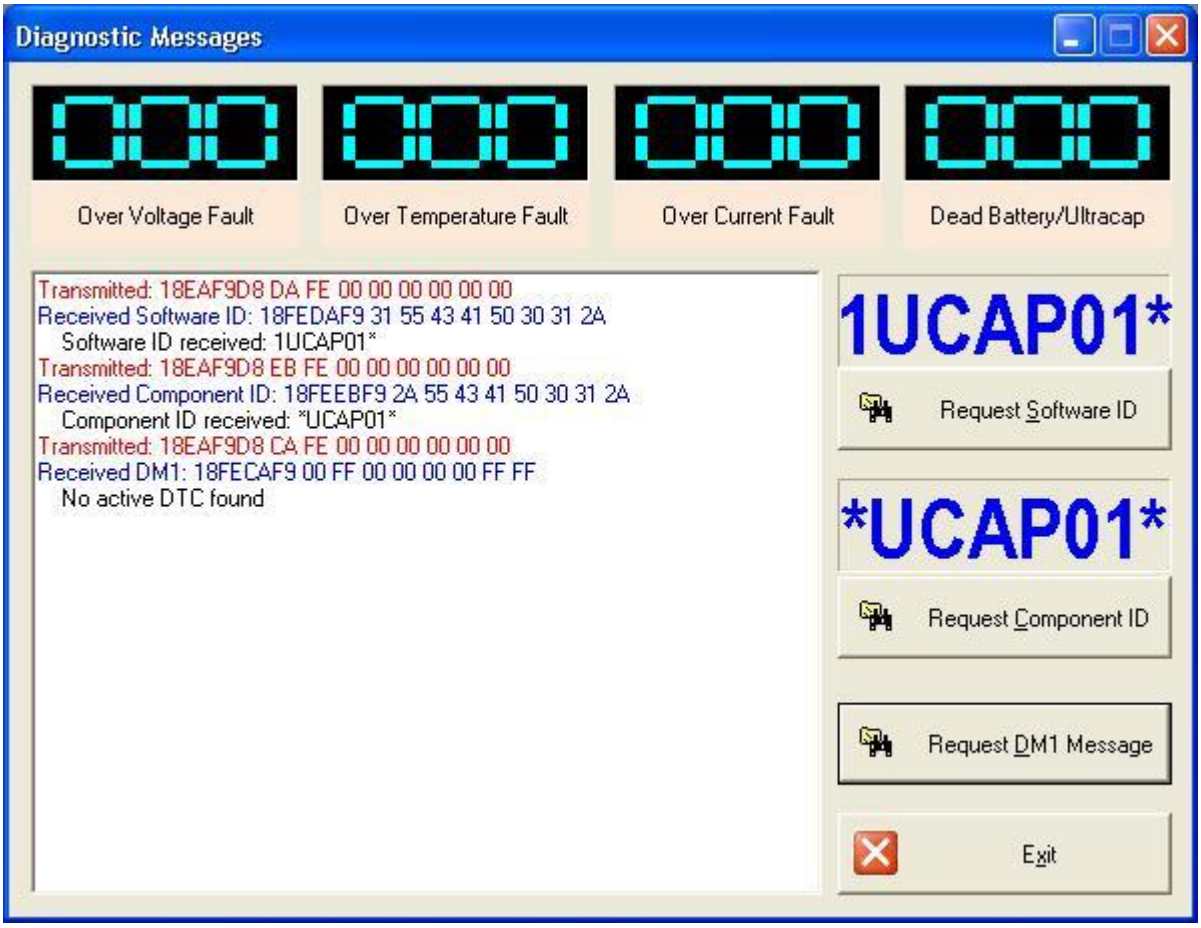
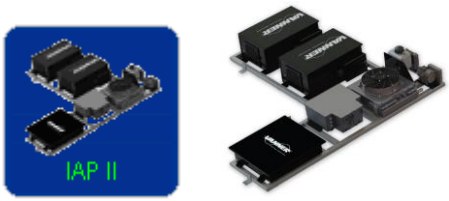


Figure 50. Ultracap Diagnostic Message Dialog

5.11 IAP II Dashboard



With this dashboard, the user can

- view the running status of the IAP (increased accessory power) II system
- view the voltage, and current of the individual modules
- view the details of each module by clicking the module button to open the module dashboard

5.11.1 IAP II Dashboard Main Window

Click the "IAP II" button in the Vanner CAN Interface main window to open the Increased Accessory Power II Dashboard, as shown in Figure 51.

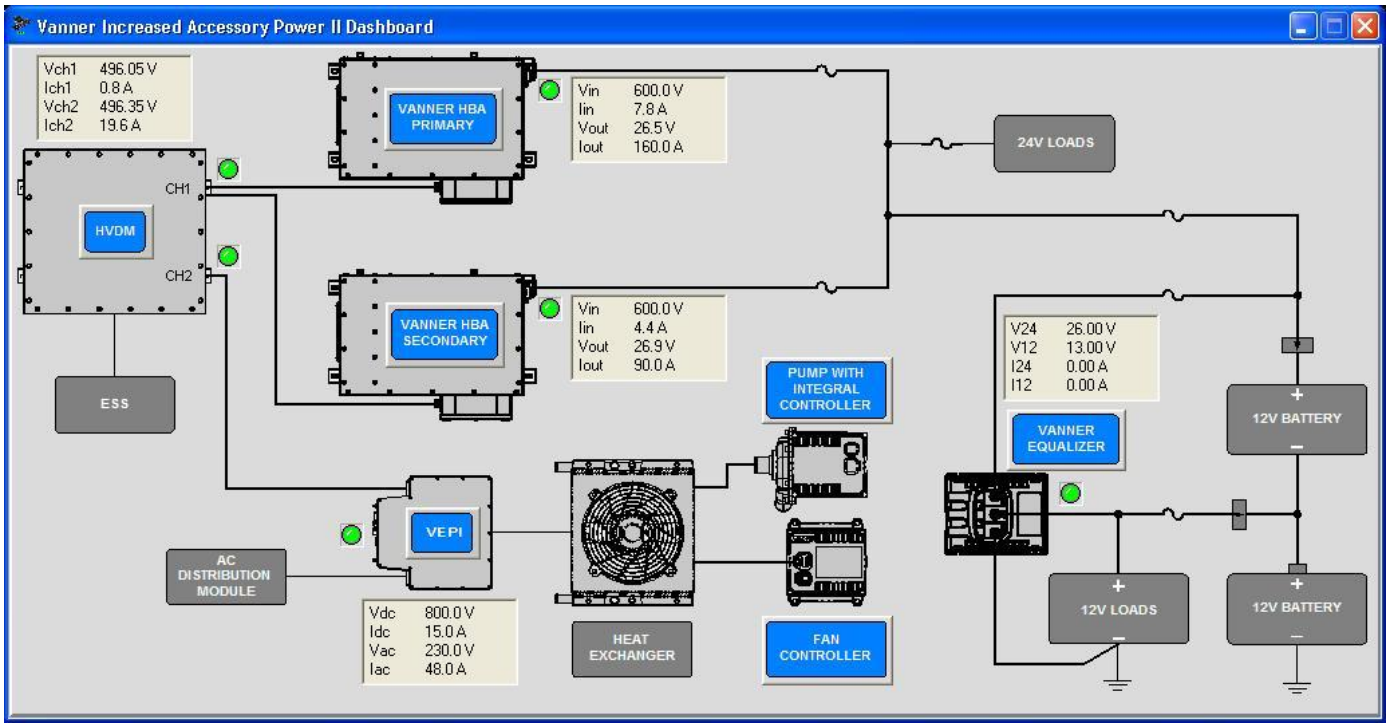
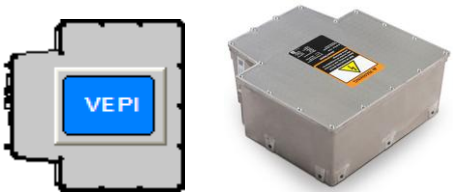


Figure 51. IAP II Dashboard

The main interface of the IAP II dashboard is a brief diagram of the system. There are four major components of the system: HVDM, HBA (primary and/or secondary), Equalizer and VEPI. The input/output voltage and current of each module is displayed beside the module block. A green/red LED is used to show the on/off status of the module. To view the details of each module, clock the corresponding blue button to open the module dashboard. Please note that VEPI dashboard can only be opened from within IAP II dashboard since it's an integral part of IAP II system.

5.12 VEPI Dashboard



With this dashboard, the user can

- view the running status of VEPI – Vanner exportable power inverter, as well as fault signals
- view the input/output voltages and currents, and temperatures of the control board and inverter
- display above information in curves
- save and open data curves
- set the secondary set points of the inverter
- view diagnostic CAN messages

5.12.1 VEPI Dashboard Main Window

Click the "IAP II" button in the Vanner CAN Interface main window to open the Increased Accessory Power II Dashboard, and then click the blue button titled “VEPI” to open Vanner Exportable Power Inverter dashboard, as shown in Figure 52.

The top section of the window displays the input/output voltages and currents, as well as temperatures of the control board (T_CTRL) and the inverter power stage T_INV).

The bottom left section shows the inverter status and fault information. The corresponding light bar will be on when it is active. Detailed fault information is sent as DM1 messages and can be viewed by clicking the “View Diagnostic Messages” button, as detailed in section 5.12.3.

The bottom middle section of the window shows other operating status of the inverter and a heartbeat that will be active when CAN messages are received from the inverter.

The bottom right section of the window shows inverter control buttons. Click “Turn On” button to send CAN-turn-on message to the inverter, and click “Turn Off” button to send CAN-turn-off message to the inverter.

Caution: Do NOT try to send CAN turn-on/off messages from the dashboard if it is connected to the vehicle CAN bus. The messages sent from the dashboard may cause conflicts with the CAN turn-on/off messages transmitted from the vehicle control unit.

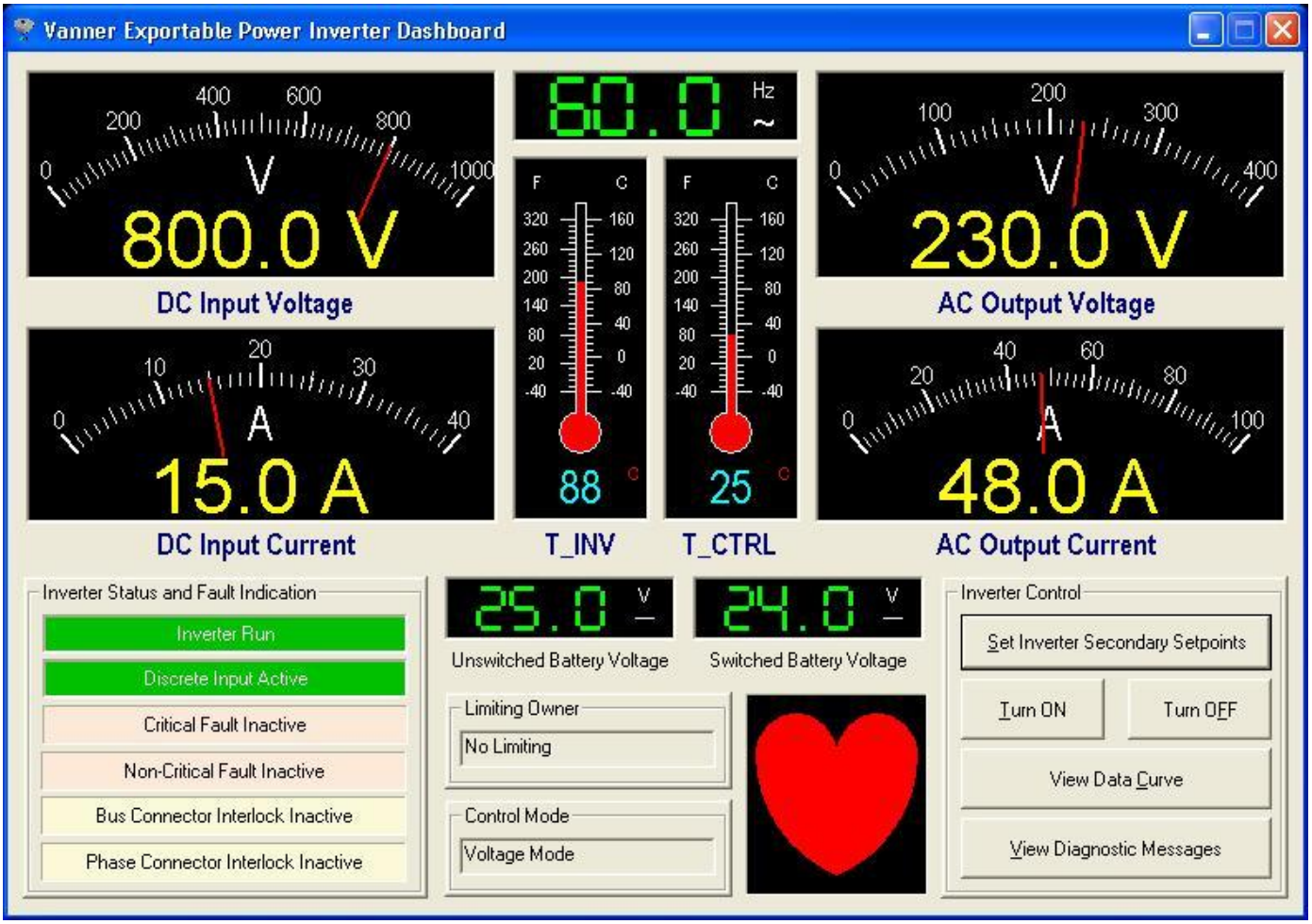


Figure 52. VEPI Dashboard

Some secondary set points including output voltage, current limit, and frequency of the inverter can be adjusted via CAN bus. Click the “Set Secondary Setpoints” button to open the Set Secondary Set Points window, as shown in Figure 53. Choose the desired set points and hit OK to send the corresponding CAN message to the inverter. The new set points will be stored in flash memory of the inverter so it will not be lost at power down.

Please note that the existing set points on the inverter are NOT read back via CAN bus. When the Set Secondary Set Points window is open, the factory default values are shown as reference. They don’t necessarily represent the actual settings on the inverter.

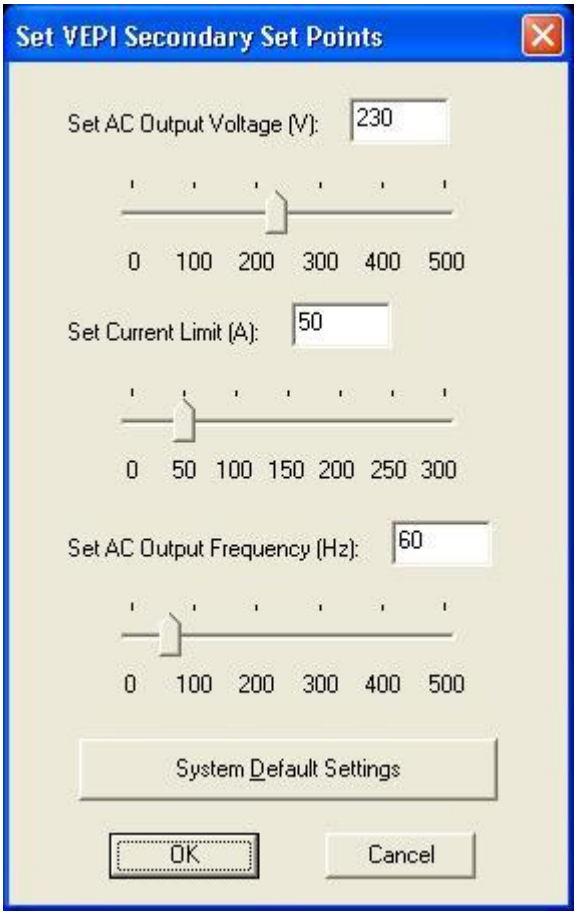


Figure 53. Set HVDC Parameters Window

5.12.2 VEPI Data Curves Window

The operating data of the VEPI can be displayed and recorded as data curves. Click the “View Data Curves” button on the VEPI dashboard to open the View Data Curve window as show in Figure 54.

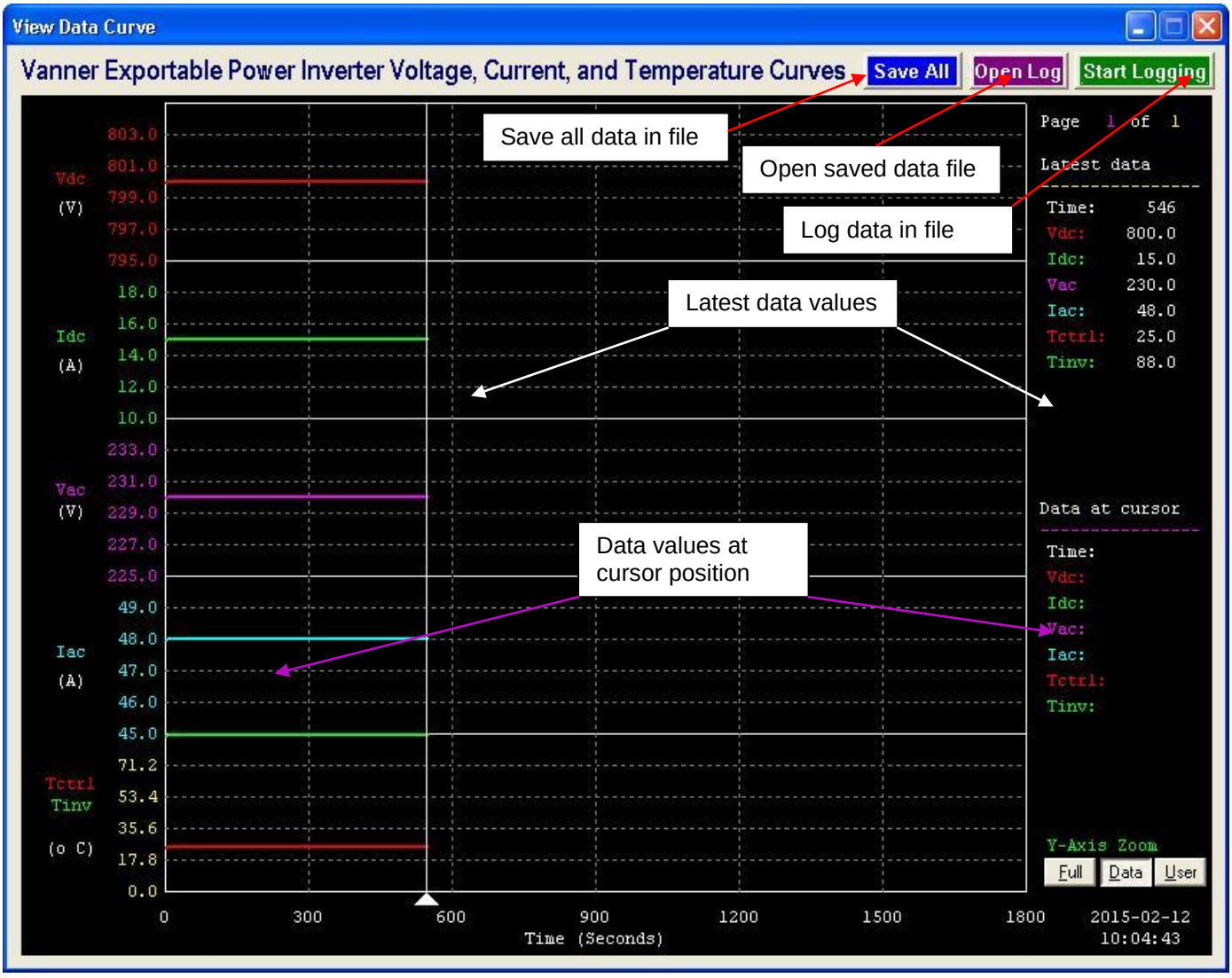


Figure 54. VEPI Data Curves Window – Real Time Data

The following operating data is displayed:

- `Vdc` – input DC bus voltage
- `Idc` – input DC current
- `Vac` – output AC voltage
- `Iac` – output AC current
- `Tctrl` – control board temperature
- `Tinv` – inverter power stage temperature

Data curves are displayed in pages. One page displays 30 minutes (1800 seconds) of data. Use the “Page Up” and “Page Down” keys to browse through pages.

The white vertical cursor bar indicates the latest data points. Curves on the right side of the cursor represent old data (if available) that will be overwritten by new data. (Data is overwritten graphically only. It can be saved continuously in a text file which is explained later in this section.)

To check data values at any given time, the user can move a pink cursor bar by hitting the arrow keys (left, right, up, and down). The user can also click the left mouse button inside the data curves window to position the cursor.

The Y-axis of the data curves can be scaled to three different levels for better viewing of the curves. Click the three buttons at the bottom right corner of the data curves window to change y-axis scaling settings:

- `Full` – the full possible range for each data curve will be used
- `Data` – maximum and minimum values of recorded data will be used
- `User` – User specified lower and upper ranges for each data curve will be used

The default full range for each data curve is as follows;

- `Vdc` – [0V, 1000V]
- `Idc` – [0A, 50A]
- `Vac` – [10V, 500V]
- `Iac` – [0A, 100A]
- `Tctrl, Tiv` – [-40^{o}C, 110^{o}C]

The data curves can also be logged into text files. Click the “Start Logging” button on the top right corner of the data curves window (see Figure 54) to start logging data. The button text will change to “Stop Logging” when logging is on. A green blinking message “Data Logging…” is also displayed at bottom left corner of the window. Click the button again to stop logging. The button text will change back to “Start Logging”. The saved data file can be opened later in data curves window by clicking the “Open File” button next to the “Start Logging” button. It can also be open and graphed in Vanner CAN Data Analyzer, as described in section 5.3. The “Save All” button will save all received data into a data log file.

When a saved data file is open, the data curve window will change slightly as shown in Figure 55. The latest data values portion is replaced by data file information and a button to “Close Data Curve File”. Other operations are still the same: use “Page Up” and “Page Down” keys to browse through pages; use arrow keys or mouse button to move pink cursor for data values; and scale the y-axis by clicking the “Full”, “Data”, “User” buttons.

Click the “Close Data Curve File” button to return to the real time data curves.

The data curves are recorded at a rate of every 3 seconds. If for any reason the new data is not received from the CAN bus within 3 seconds, there will be a gap (blank point) on the data curves. The latest data cursor (white) will keep scrolling to the right. A gap in the data curves indicates data lost in CAN communication.

Figure 55. VEPI Data Curves Window – Open Saved Data

5.12.3 VEPI Disgnostic Messages Window

The Diagnostic Message Window can be used to inspect Diagnostic Messages (DM1) sent from the VEPI. The user can also request DM1 message, Software ID, and Component ID information from the VEPI. Click the "View Diagnostic Messages" button to open the Diagnostic Messages Dialog as shown in Figure 56.

The DM1 messages are sent once per second if any faults are detected by the VEPI. If no fault is detected, DM1 messages are sent only upon request by clicking the "Request DM1 Message" button. In case of multiple faults, DM1 messages will come in BAM mode as detailed in the HVDM CAN Specification.

The software ID message is sent upon request by clicking the "Request Software ID" button.

The component ID message is sent upon request by clicking the "Request Component ID" button.

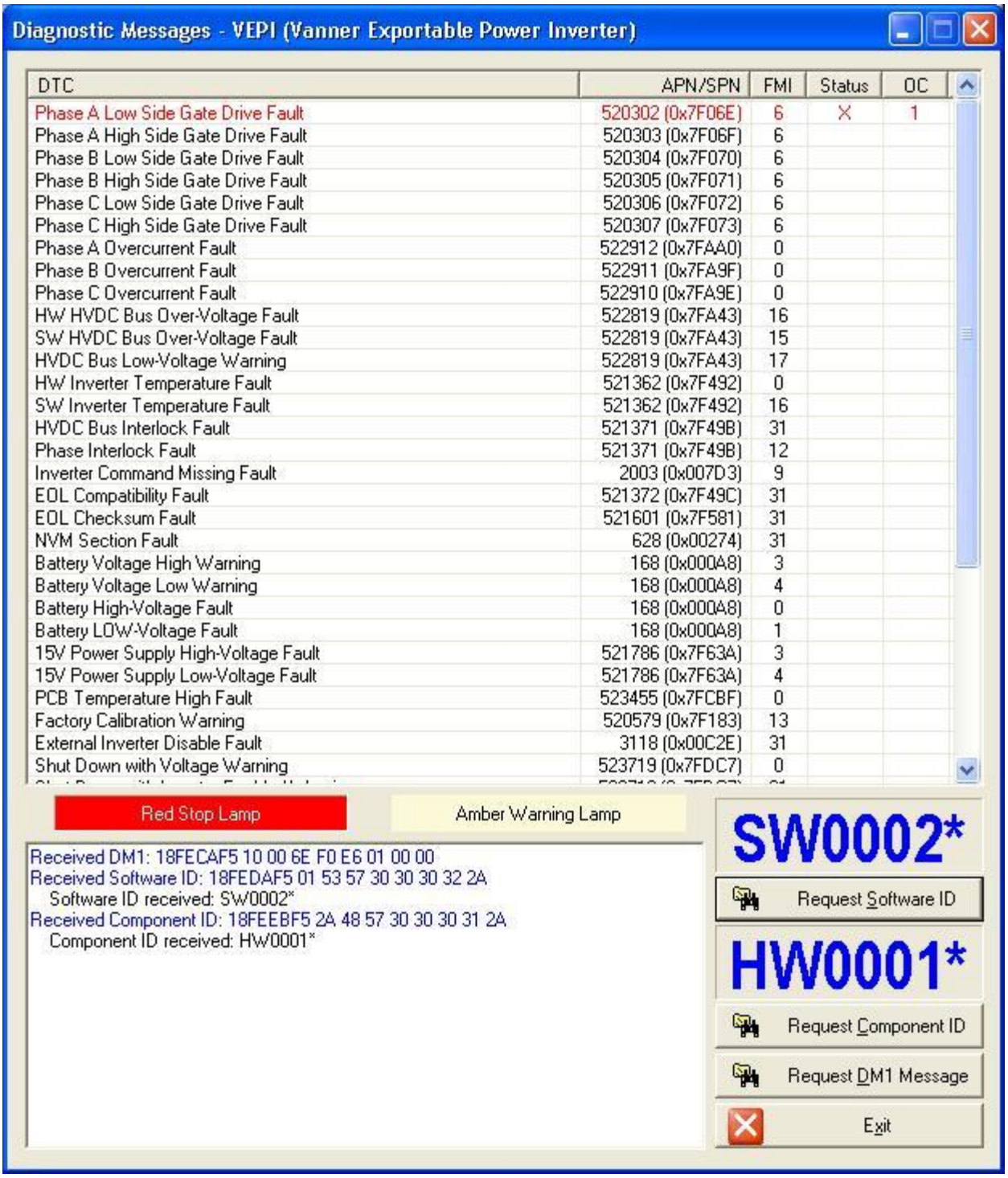


Figure 56. VEPI Diagnostic Messages Window

5.13 VannBus Simulator

With this dashboard, the user can simulate the operation of the master HBA, slave HBA, and equalizer separately. This is very helpful in production testing of the VannBus system since each unit can be tested independently without the existence of the other devices.

5.13.1 VannBus Simulator Main Window

Click the VannBus Simulator icon in the Vanner CAN Interface main window to open the VannBus System Simulator window, as shown in Figure 57.

The main window is divided into three sections: Master HBA, Slave HBA, and 80 Series Equalizer. Each section has a power switch to turn on/off the section. The OFF state is shown in Figure 57.

Click the power (on/off) switch to turn on each simulated device. When the equalizer is changed to ON state, it will run immediately and broadcast the relative CAN messages. However, for the master or slave HBA's, changing to on the ON state (IGN) only wakes up the unit. A CAN turn-on command (from the HBA dashboard) is needed to turn them into RUN mode. The HBA only broadcasts output voltage in the ON state. It broadcasts all other messages in the RUN state. This corresponds to the actual operation modes of the HBA.

The ON state of the VannBus simulator is shown in Figure 58.
The RUN state of the VannBus simulator is shown in Figure 59.

Please note each device can be turned on or off independently according to test requirements. For example, to test an actual HBA in slave operation mode, just turn on the simulated master HBA and equalizer unit.

At any time, the user can adjust the input/output voltage/current of each unit to meet test requirements. Since HBAs in master/slave mode can communicate and adjust the output voltage/currentl, you can also check the “Automatic Adjustment” option to let the simulator adjust the values for you.

Once the simulated devices are in RUN mode, the corresponding CAN message will be sent on CAN bus at the same rate as the real products. For devices under test, it will work as connected to a real CAN network with other real devices. This can be verified by checking the dashboard of the HBA and equalizer, as shown in Figure 60 and Figure 61. In the CAN message inspection and logging window (as shown in Figure 62), the user can view the CAN messages transmitted by the VannBus Simulator.

Caution: The VannBus Simulator is designed specifically for Vanner's Production Team to test HBAs in master/slave mode. When connecting to real CAN networks on vehicles, please DO NOT start this function module. Simulated CAN messages may have a negative impact on the hybrid control system.

Figure 57. VannBus Simulator Main Window – OFF State

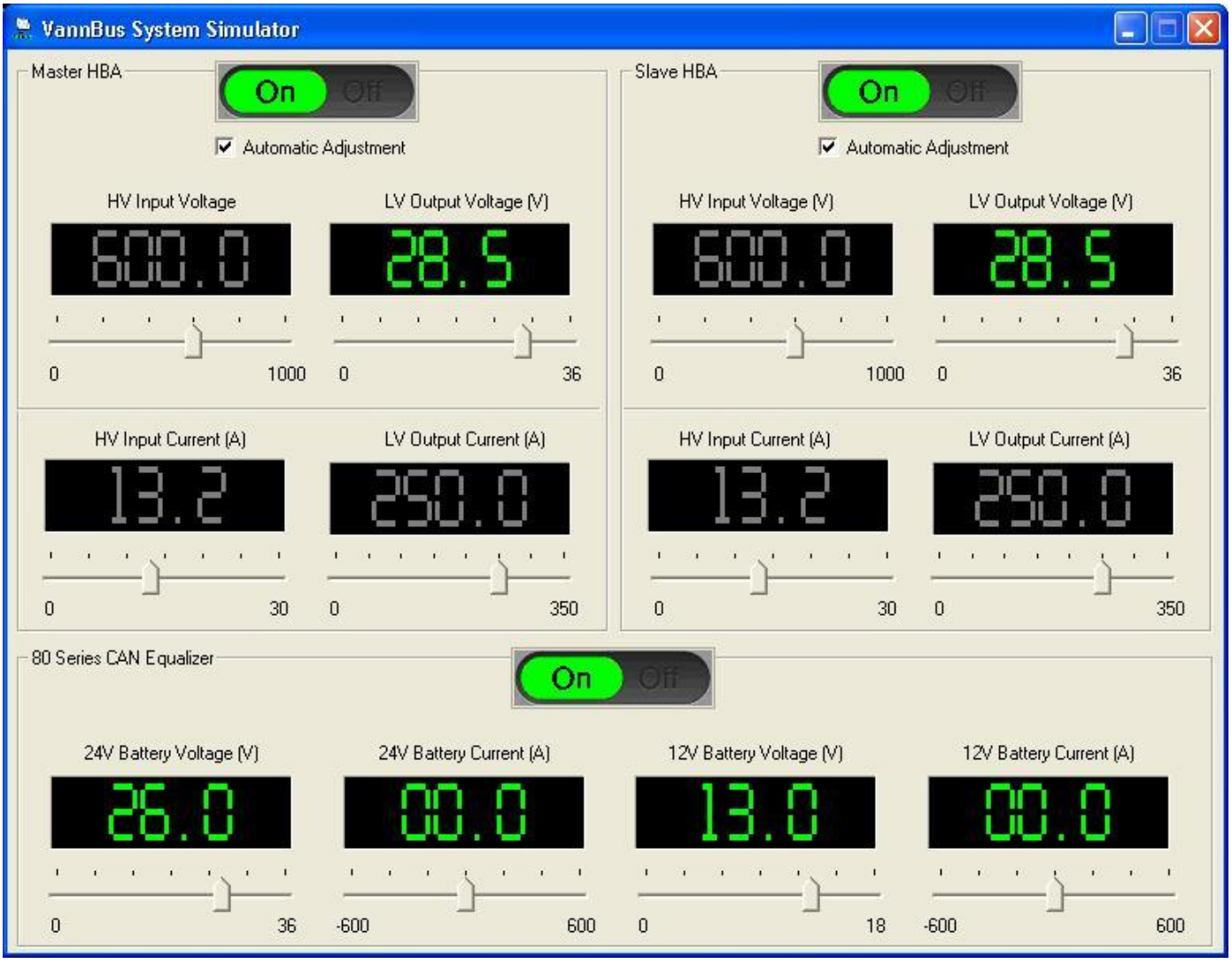


Figure 58. VannBus Simulator Main Window – ON State

Figure 59. VannBus Simulator Main Window – RUN State

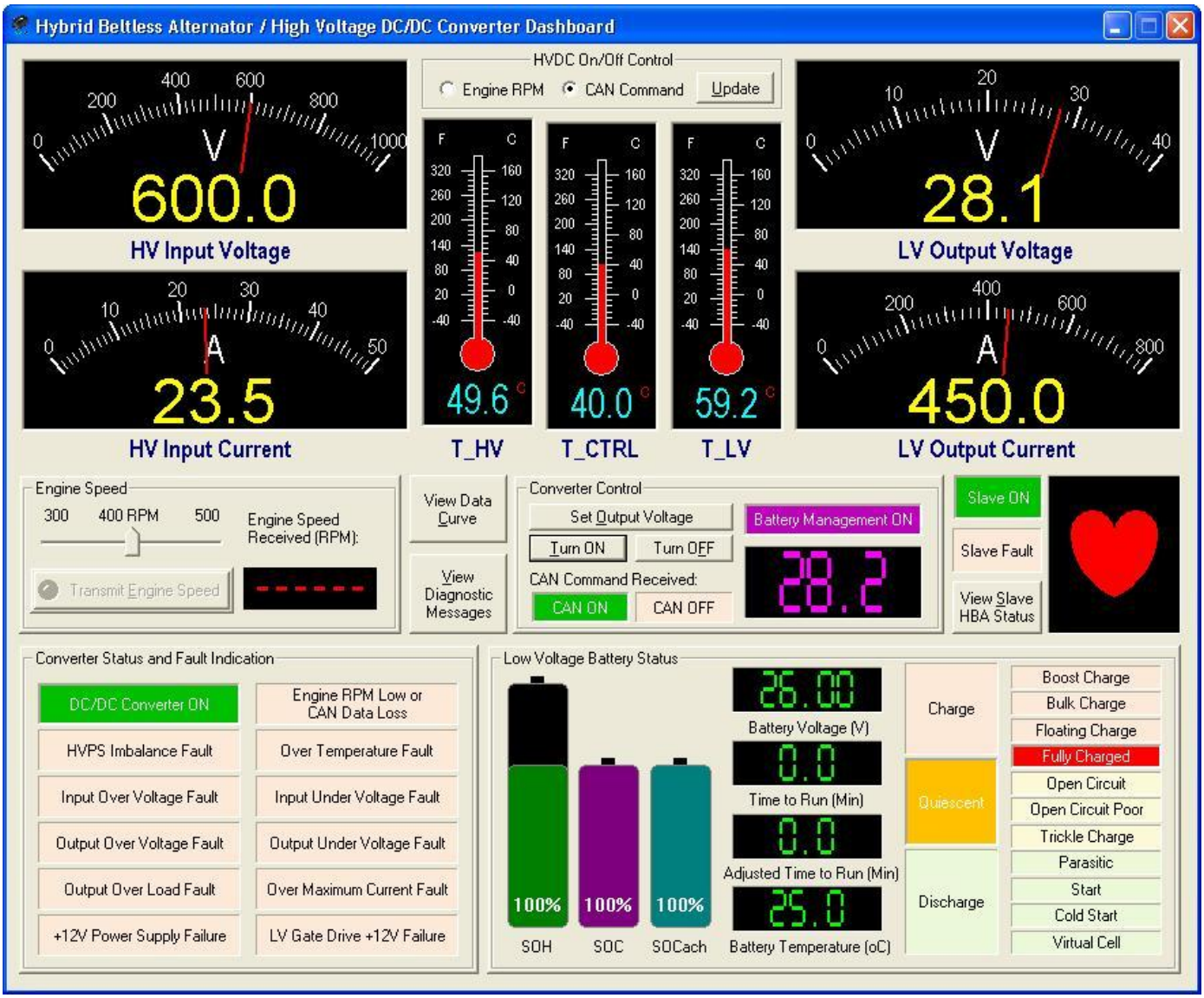


Figure 60. HBA Dashboard with VannBus Simulator Running

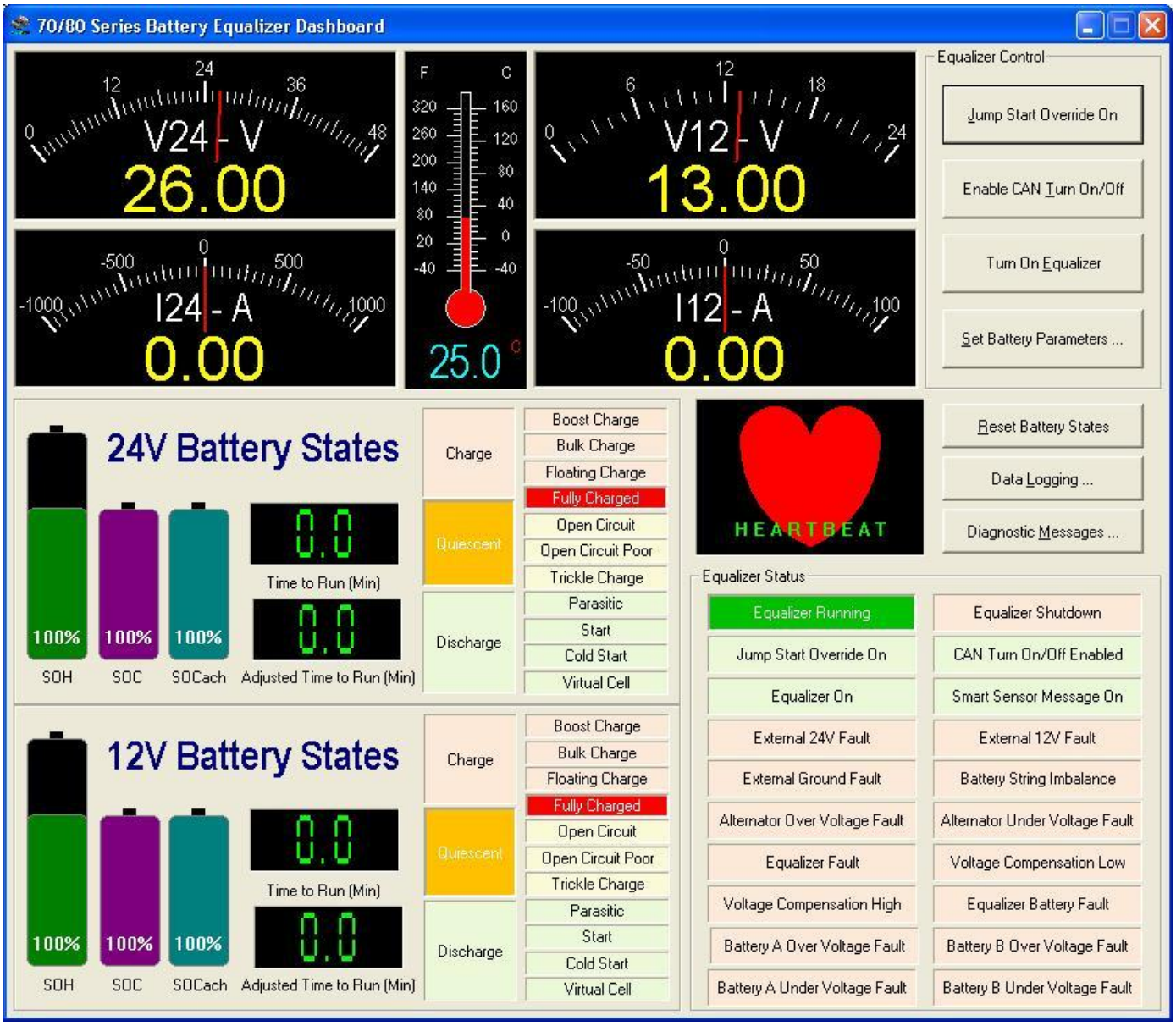


Figure 61. Equalizer Dashboard with VannBus Simulator Running

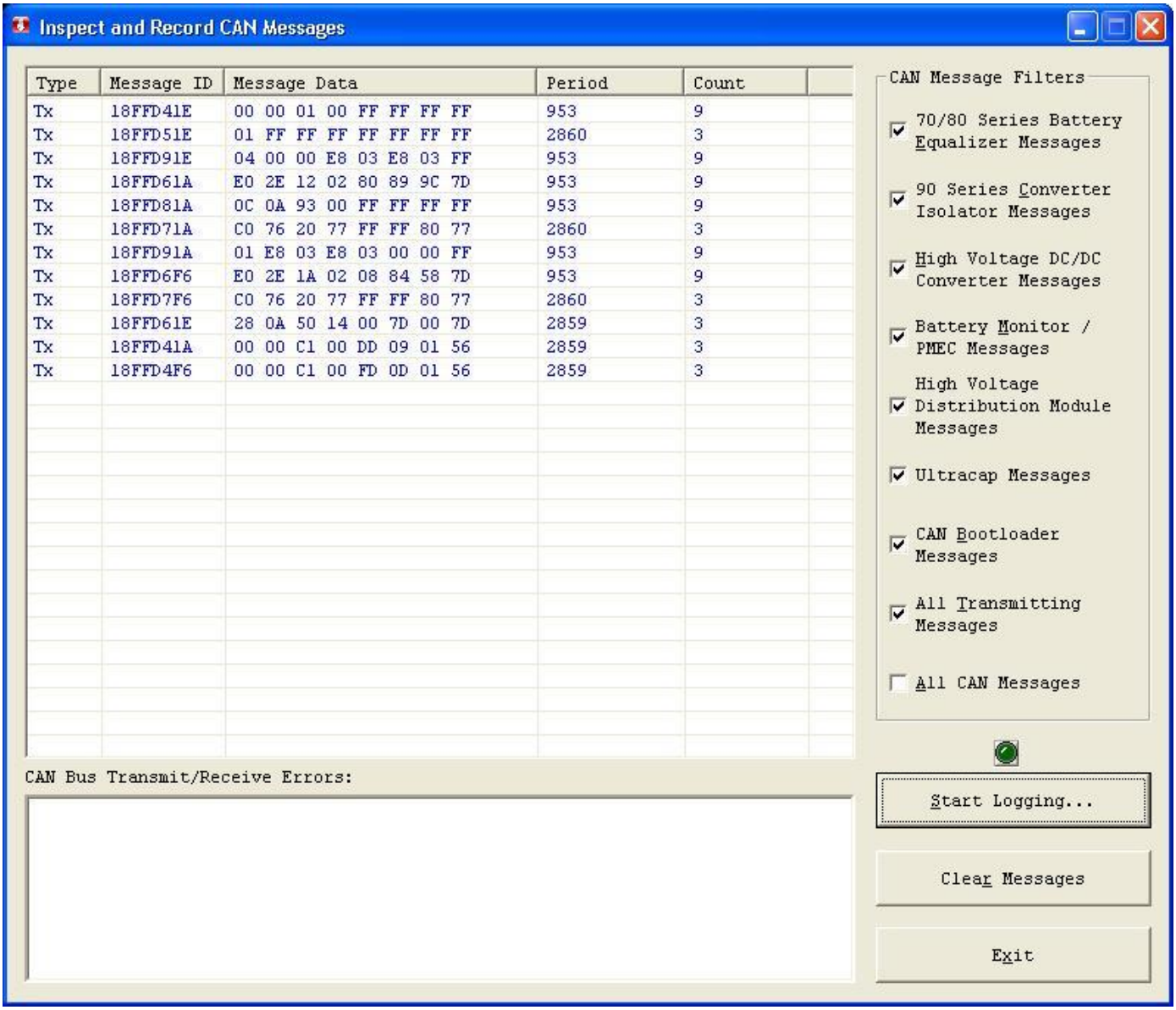


Figure 62. CAN Log Window with VannBus Simulator Running

5.14 CAN Bootloader

This function is provided to update the firmware in Vanner products via CAN bus. It removes the need to disassemble the products and program via JTAG programmers. Click the "CAN Bootloader" icon in the Vanner CAN Interface main window to open the CAN bootloader User Interface, as shown in Figure 63.

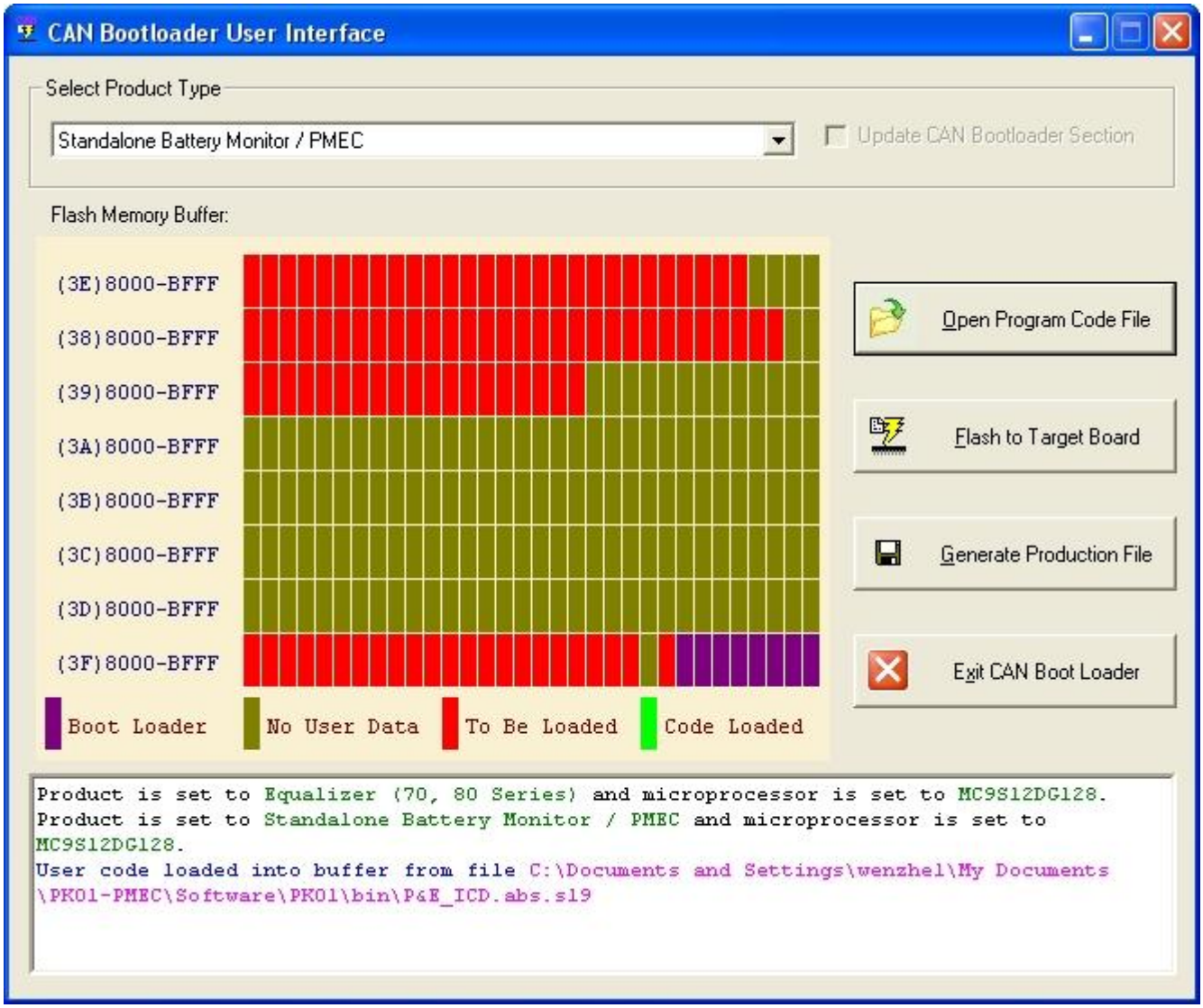


Figure 63. CAN Bootloader User Interface

Follow these steps to open the new firmware file and download it to the target unit. Make sure the target unit is powered up and connected to the CAN bus.

Step 1 - In the “Select Product Type” drop box, select the appropriate type of product to be updated.

Step 2 - Click the “Open Program Code File” button and browse to the new firmware code file and open it. The code will be read from the file and shown in “Flash Memory Buffer” as red blocks (Figure 63).

Step 3 - Click the “Flash to Target Board” button to start flashing new firmware to product. Blocks flashed successfully will change from red to green (Figure 64).

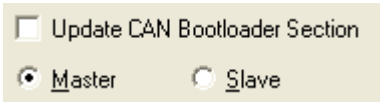
Step 4 - Wait until all red blocks turn green and a successful message is displayed at the bottom (Figure 64).

Step 5 - Close the CAN bootloader and switch to the product dashboard to verify heartbeat. Click the “Diagnostic Messages” button on the product dashboard to bring up the diagnostic messages window. Click the “Request Software ID” button to verify the correct software ID.

Step 6 - The target unit is now updated with new firmware and ready to go!

NOTE:

- In case of any errors in the above steps, simply repeat all steps from step 3. Repeat until a successful update is achieved.
- For the high voltage DC/DC converter (HVDC), the user needs to select between Master and Slave unit if dual-HBA configuration is used. Choose Master for single-HBA operation. There’s also an option to update the CAN bootloader section. Please check this option if the new firmware has different CAN bootloading code than existing firmware. Check it if the user is not sure if the CAN bootloading code is identical. However, please make sure power supplied to the target board and CAN communication remain reliable throughout this process. If any errors happen when updating the CAN bootloading section, the unit may not function properly and may not be able to support future CAN bootloading. Disassembling the unit and programming with specific emulator/ programmer will be necessary.



- For all other products, the CAN bootloading code is fixed and not allowed to be updated via CAN bus.
- A special button, “Generate Production File”, is reserved for Vanner engineering to generate a production-ready code file for direct and fast programming. This file combines the user code and the CAN bootloading code into one file. This function is not available for the HVDC. The CAN bootloading function is a part of the HVDC user code file so it is already production-ready.

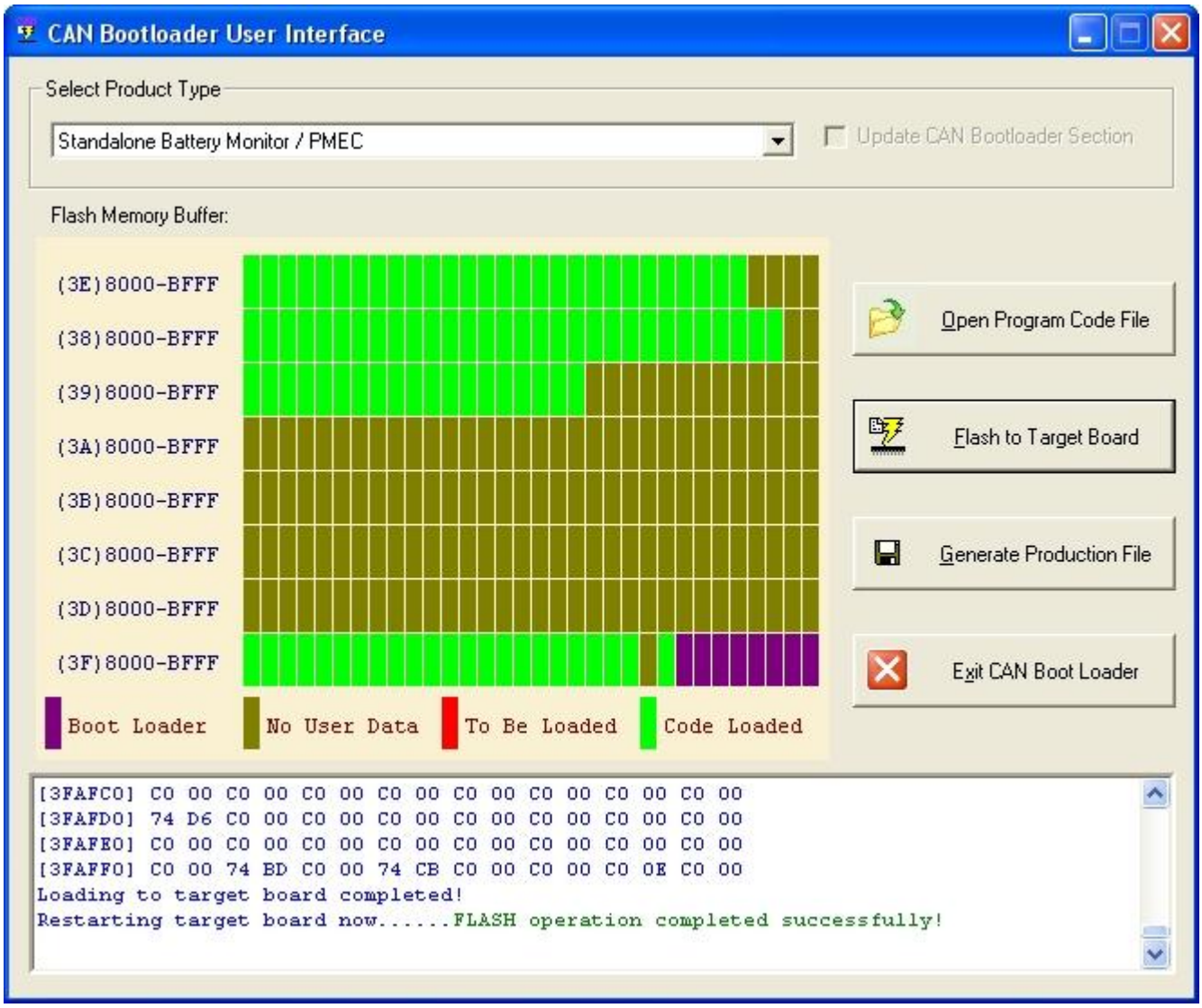


Figure 64. CAN Bootloader User Interface – Flash Operation Completed

6. Troubleshooting

Below is a list of errors that a user may encounter when using the Vanner CAN Interface. The possible reason and suggested solution is also given.

- Error: PCAN Initialization – Error : ILLHW
  Reason: No CAN adapter is connected to USB port or is recognized by computer.
  Solution: Connect PCAN or Vector CAN to computer USB port. Install correct driver software.

- Error: Failed to load PCAN DLL file
  Reason: Another software application is using PCAN adapter. Or a software application that used PCAN adapter is not properly shutdown.
  Solution: Stop the software application that is using PCAN. If error still exists, restart computer.

- Error: CAN communication lost after working for some time
  Reason: CAN adapter stopped working because of CAN bus errors or long time idling.
  Solution: Try clicking “Disconnect” button then clicking “Connect” button in main window. If problem still exists, try disconnecting CAN adapter from USB port then reconnecting.

- Error: Some CAN module buttons are grayed out in main window
  Reason: Corresponding modules are not activated by registration code.
  Solution: Try contacting Vanner for a new registration code that will activate the modules needed.

More questions? Please contact Vanner Inc. for technical support.

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