

# Battery Guard® 1000 (RV-C)

Part number: 00-01130-000



## Description:

This document is a guide for system integrators which provides the necessary information for communicating and interfacing with the Battery Guard® 1000. Included in this document is a description of the device's functionality and full list of supported DGN's regarding the communication and configuration of the Battery Guard® 1000.

The Battery Guard® 1000 communicates via CANbus utilizing the RV-C protocol. The device provides two separate parallel CANbus connections, one which provides continuous power and the other which provides switched power. The physical connectors used for the communicating on the RV-C network are 4-pin MiniFit connectors with the pin definitions listed in the table below:

<u>Pin</u>	<u>Description</u>
1	CAN H
2	CAN L
3	GND
4	PWR / SW PWR

The RV-C protocol defines the data rate for all transmitters shall be 250 kbits/s with a sample point rate being between the range of 85% to 90%. For more information on the physical layer of an RV-C network please refer to the RV-C specification provided on the RV-C website.

## RV-C Product Specifications

The Battery Guard® 1000 supports dynamic source addressing. As defined in the RV-C specification, the preferred dynamic address range is 0x90-0x9F.

Manufacturer Code: 0x69  
 Default Source Address: 0x8B  
 Product Definition: DC Disconnect

Note: The BG1000® RV-C will utilize two instances. One instance for the main disconnect and a second instance for the AUX disconnect.

Primary DC Disconnect Instance: 1 (Default)  
 Auxiliary DC Disconnect Instance: 105 (Default)



## Supported RV-C DGN's

**DGN** 1FED0h  
**Name** DC Disconnect Status  
**Description** Defines the state of the Battery Guard® 1000 primary and auxiliary disconnect.

Byte	Bit	Name	Data Type	Value Description
0	-	Instance	Uin8	0 – Invalid 1 – Main House Battery Disconnect 2 – Chassis Battery Disconnect 3 – House/Chassis Bridge 4 – Secondary House Battery 5- Generator Starter Battery 6-250 - Other
1	0 to 1	Circuit Status	bit	00b – Circuit is disconnected. 01b – Circuit is connected.
	2 to 3	Last Command	bit	00b – Disconnect circuit. 01b – Connect circuit.
	4 to 5	Bypass Detect	bit	Not Supported
2 to 3	-	DC Switched Voltage	Uin16	0 to 3212.5 Volts
4 to 7	-	DC Switched Current	Uin32	-2,000,000 to 2,221,081.2 Amps

**DGN** 1FECFh  
**Name** DC Disconnect Command  
**Description** Control message for disconnecting and reconnecting the Battery Guard® 1000 Primary and Auxiliary disconnects.

Byte	Bit	Name	Data Type	Value Description
0	-	Instance	Uin8	0 – Invalid 1 – Main House Battery Disconnect 2 – Chassis Battery Disconnect 3 – House/Chassis Bridge 4 – Secondary House Battery 5- Generator Starter Battery 6-250 - Other
1	0 to 1	Command	bit	00b – Disconnect Circuit. 01b – Connect Circuit.



**DGN** 1FFFDh

**Name** DC Source Status 1

**Description** Provides the voltage and current being drawn from the DC source the Battery Guard® 1000 is connected to.

Byte	Bit	Name	Data Type	Value Description
0	-	Instance	Uint8	0 – Invalid 1 - Main House Battery Bank 2 - Chassis Start Battery 3 - Secondary House Battery Bank 4 – Generator Starter Battery 5-250 - Other instances in the RV. 40 – Voltmeter/Ammeter
1	-	Device Priority	-	40 – Voltmeter/Ammeter
2 to 3	-	DC Voltage	Uint16	0 to 3212.5 Volts
4 to 7	-	DC Amperage	Uint32	-2,000,000 to 2,221,081.2 Amps

**DGN** 1FE9Fh

**Name** Generic Alarm Status

**Description** The alarm status indicates when the Battery Guard® 1000 is in a low voltage condition and will disconnect the primary/auxiliary load when the isolation delay timer has expired. When elapsed time equals the isolation delay value. The automatic disconnect will perform. This Status is also used for indicating charging voltage reconnect events.

Byte	Bit	Name	Data Type	Value Description
0	-	Instance	Uint8	1 – Impending Disconnect 2 – Impending Reconnect 3 – Impending Over Temp Cutoff 4 – Impending Over Current Cutoff
1	-	DSA	Uint8	139 – DC Disconnect
2	0 to 1	Alarm Triggered	bit	00b – Alarm is not Triggered. 01b – Alarm is Triggered
	2 to 3	Alarm Ready	bit	00b – Alarm condition is not being monitored. 01b – Alarm condition is being monitored.
	4 to 5	Alarm is Acknowledged	bit	00b – Alarm has not been acknowledged. 01b – Alarm has been triggered and acknowledged.
	6 to 7	Auto Reset	bit	Set permanently to 1
3 to 5	-	Elapsed Time	Uint16	Time in minutes since alarm triggered



**DGN** 1FE9Eh

**Name** Generic Alarm Command

**Description** Generic alarm command allows the user to acknowledge the alarm condition and disable alarm.

Byte	Bit	Name	Data Type	Value Description
0	-	Instance	Uint8	1 – Impending Disconnect 2 – Impending Reconnect 3 – Impending Over Temp Cutoff 4 – Impending Over Current Cutoff
1	-	DSA	Uint8	139 – DC Disconnect
2	0 to 1	-	-	Always 11b
	2 to 3	Ready Alarm	bit	00b – Stop Monitoring Alarm condition. 01b – Start Monitoring Alarm condition.
	4 to 5	Ack Alarm	bit	00b – No Action 01b – Acknowledge Alarm.
	6 to 7	Auto Reset	bit	Set Permanently to 1

**DGN** 17F00h

**Name** General Reset

**Description** General reset allows the user to perform a software reset, clear faults or put the Battery Guard® 1000 back into factory setting.

Byte	Bit	Name	Data Type	Value Description
0	0 to 1	Reboot	Bit	00b - No action 01b - Reboot
	2 to 3	Clear Faults	Bit	00b - No action 01b - Clear faults
	4 to 5	Reset Default	Bit	00b - No action 01b - Restore settings to default values
	6 to 7	Reset Stats	bit	Not Supported
1	0 to 1	Test Mode	bit	00b – Quit testing node 01b – Initiate testing node
	2 to 3	Restore OEM Settings	bit	Not Supported
	4 to 5	Reboot/Enter Bootloader Mode	bit	Not Supported



**DGN** 17B00h (Lower two bytes of DGN are destination address)

**Name** Instance Status

**Description** Reports all instances supported by the Battery Guard® 1000.

Byte	Bit	Name	Data Type	Value Description
0	-	Device Type	Uint8	DSA of the target device Instance.
1	-	Base Instance	Uint8	
2	-	Max Instance	Uint8	0xFF = Applies to single instance only.
3 to 4	-	Base Internal Address	Uint16	
5 to 6	-	Max Internal Address	Uint16	0xFFFF = Applies to single instance only
7	-	Reserved	Uint8	

**DGN** 17C00h (Lower two bytes of DGN are destination address)

**Name** Instance Assignment

**Description** The Instance Assignment provide a generalized method for configuring the instances used. The Battery Guard® 1000 only supports single instance updates. The Primary Disconnect has a base internal address is 0 and the Auxiliary Disconnect has a base internal address is 1. After successful instance assignment the device will respond with an Instance Status with the updated instance. If failed instance assignment the device will respond with a NACK message.

Byte	Bit	Name	Data Type	Value Description
0	-	Device Type	Uint8	DSA of the target device Instance.
1	-	Base Instance	Uint8	0 – Invalid 1 – Main House Battery Disconnect 2 – Chassis Battery Disconnect 3 – House/Chassis Bridge 4 – Secondary House Battery 5- Generator Starter Battery 6-250 - Other 0xFF = Send INSTANCE_STATUS for all Instances of the indicated device type. 0xFF = Applies to single instance only.
2	-	Max Instance	Uint8	0xFF = Applies to single instance only.
3 to 4	-	Base Internal Address	Uint16	
5 to 6	-	Max Internal Address	Uint16	0xFFFF = Applies to single instance only
7	-	Reserved	Uint8	



**DGN** 1EF00h (Lower two bytes of DGN is destination address)

**Name** Proprietary Message

**Description** The proprietary messages used by the Battery Guard® 1000 allows read and write access to configurable parameters within the device, the ability to calibrate the current sensing, read the disconnect/reconnect log and obtain firmware information.

Note: More on proprietary messaging described in the proprietary messaging section of this document.

Byte	Bit	Name	Data Type	Value Description
0	-	MFG Code	UInt8	0x69 – Intellitec Manufacturer Code
1	-	Function	UInt8	0x00 – Read Configuration 0x01 – Write Configuration 0x02 – Calibrate 0x03 – Read Log
2	-	Parameter	UInt8	Configurable parameter being addressed
3 to 4	-	Parameter Value	UInt16	Value of parameter define in Parameter Table
5 to 6	-	Reserved	UInt8	Value of log (upper bytes)
7	-	Reserved	UInt8	0x69 Manufacturer Code

**DGN** EA00h (Lower two bytes of DGN is destination address 0xFF for global)

**Name** Request for DGN

**Description** Request for a DGN allows the user to instantly obtain the status messages of the Battery Guard® 1000. Instead of waiting for the standard message timing, immediate information may be obtained. Supported Request include:

DC\_DISCONNECT\_STATUS  
DC\_SOURCE\_STATUS\_1  
PRODUCT\_IDENTIFICATION  
GENERIC\_CONFIG\_STATUS

Byte	Bit	Name	Data Type	Value Description
0 to 2	-	Desired DGN	UInt17	LSB in Byte 0
3	-	Instance	UInt8	0 - 253 - Instance desired, if multi-instanced. 0xFFh if not multi-instanced, or reports from all instances is desired.
4	-	Instance Bank or Secondary Instance	UInt8	Not supported
5 to 7	-	Reserved	UInt8	



**DGN** 1FECAh

**Name** Diagnostic Message

**Description** All devices compliant to this communication profile shall support the "DM\_RV" message. This message allows the communication of diagnostic information and general operating status. If there are no active faults, data bytes 2 to 5 shall be set to FFh. The DM\_RV is still broadcast, allowing other nodes to see its operating status.

Byte	Bit	Name	Data Type	Value Description
0	0 to 1	Operating Status	Uint2	0x00 – Disabled / Not operating
	2 to 3	Operating Status	Uint2	0x05 – Normal / On condition
	4 to 5	Yellow Lamp Status	Uint2	Indicates minor fault
	6 to 7	Red Lamp Status	Uint2	Indicates critical fault
1	-	DSA	Uint8	8Bh – default source address
2	-	SPN-MSB	Uint8	Refer to SPN section of document
3	-	SPN-ISB	Uint8	Refer to SPN section of document
4	5 to 7	SPN-LSB	Uint3	Refer to SPN section of document
	0 to 4	FMI	Uint5	Refer to SPN section of document
5	0 to 6	Occurrence Count	Uint7	0 – 126 counts
	7	Reserved	Bit1	Always 1
6	-	DSA Extension	Uint8	0xFF
7	0 to 3	Bank Select	Uint4	0xF

**DGN** 17D00h (Lower two bytes of DGN is destination address, must not be 0xFF)

**Name** Download

**Description** The Download Message allows the Battery Guard® 1000 to update its firmware in the field via bootloader. A windows-based application is provided to perform this task. For more information on the bootloader protocol please contact.



**DGN** 1FED8h

**Name** Generic Configuration Status

**Description** DGN provide valuable information regarding the firmware revision and date as well as the configuration number and revision.

Byte	Bit	Name	Data Type	Value Description
0		Manufacturer Code	Uint8	Manufacturer Code (LSB)
1	0-2	Manufacturer Code	Uint3	Manufacturer Code (MSB)
	3-7	Function Instance	Uint5	Function Instance
2	-	Function	Uint8	Function Code
3	-	Firmware Revision	Uint8	Firmware Revision
4	-	Configuration Type	Uint8	Configuration Type (LSB)
5	-	Configuration Type	Uint8	Configuration Type
6	-	Configuration Type	Uint8	Configuration Type (MSB)
7	-	Configuration Rev	Uint8	Configuration Revision

**DGN** 1FFF4h

**Name** Chassis Mobility Status

**Description** This message is only monitored by the Battery Guard 1000® and is used to collect the status of the ignition switch. This status is used to create an inhibit to prevent unwanted disconnecting when the vehicle is running.

Byte	Bit	Name	Data Type	Value Description
0-4	-	-	-	Not Supported
5	0-1	Ignition Switch	Bit2	Used to enable and disabled disconnect interlock.
		Status		
6-7	-	-	-	Not Supported





## Proprietary Messages

The Battery Guard® 1000 offers parameters that are configurable via RV-C network. This allows installers or users the ability to make changes to their module as they feel necessary. Byte 1 of the proprietary messages determines what function is being performed. 0x00 and 0x01 allow the reading and writing of these configurable parameters, respectively. The table below shows how to access each of these parameters, what the upper and lower bounds are and a description of how the parameter functions.

Byte[2]	Limits	Default Value	Description
0x00	12.5 >= Val >= 10.5	10.5 Volts	Primary Low Voltage Threshold is the voltage at which the device determines that the battery is getting too low and must perform a primary disconnect.
0x01	12.6 >= Val >= LVT	10.5 Volts	Primary Warning Threshold allows for a warning indication to occur prior to reaching the Low Voltage threshold. This is indicated on both the alarm output and via RV-C message.
0x02	300 >= Val >= 60	180 Seconds	Primary Isolation Delay is the delay the voltage must remain below the threshold before performing a primary disconnect.
0x03	14.2 >= Val > 12.5	13.3 Volts	Primary Reconnect Threshold is the voltage at which the device determines charging is occurring and will attempt to reconnect primary disconnect.
0x04	300 >= Val >= 60	60 Seconds	Primary Reconnect Delay is the delay the voltage must remain above the reconnect threshold before performing a primary reconnect.
0x05	12.5 >= Val > 9.0	9.5 Volts	Auxiliary Low Voltage Threshold is the voltage at which the device determines that the battery is getting too low and must perform an Auxiliary disconnect.
0x06	300 >= Val >= 60	60 Seconds	Auxiliary Isolation Delay is the delay the voltage must remain below the threshold before performing an auxiliary disconnect.
0x07	14.2 >= Val > 12.5	13.3 Volts	Auxiliary Reconnect Threshold is the voltage at which the device determines charging is occurring and will attempt to reconnect the auxiliary output.
0x08	300 >= Val >= 60	60 Seconds	Auxiliary Reconnect Delay is the delay the voltage must remain above the reconnect threshold before performing an auxiliary reconnect.
0x09	250 >= Val >= 1	0x01	DC Source Status 1 instance assignment. This value is typical set the same as the DC DISCONNECT instance value.
0x0A	See device priority	0x40	DC Source Status 1 device priority assignment allows integrators the ability to change the priority level when integrating with other devices that transmit DC Source Status 1.
0x10	1 >= Val >= 0	0x01	Inhibit Enabled – if true, the device will monitor “Ignition Switch Status” form the CHASSIS_MOBILITY_STATUS DGN. If “Ignition Switch Status” is true the device will not auto disconnect.
0x11	1 >= Val >= 0	0x01	Auto Disconnect Enable – if true, the device will perform auto disconnect routines as intended operation. If false, device will not perform auto disconnect routines.



Byte[2]	Limits	Default Value	Description
0xFA	N/A	N/A	Stores a user defined configuration number and revision. After completing the configuration process. Setting this value last will allow technicians the ability to retrieve these number and reference to configuration parameters.  Bytes[3-5] = Configuration Number LSB-MSB Byte[6] = Configuration Rev

**Note:** Values being address are represented as seconds for timing parameters and 100 of millivolts for voltage parameters (i.e. 12.1V = 121 or 79h).

If a read request is performed the Battery Guard® 1000 will echo the request but will fill byte[3] and byte[4] with the parameter value. An example of a read sequence of the Primary Low Voltage Threshold with a default value of 12.1V is described below.

Request:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x00	0x00	0xFF	0xFF	0xFF	0xFF	0x69

Battery Guard® 1000:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x00	0x00	0x79	0x00	0xFF	0xFF	0x69

On a write request the Battery Guard® 1000 will respond with an ACK if the value being assigned is valid and successfully save into the EEPROM. If either of these cases is not true, the device will respond with a NACK DGN. An example of a write request to change the low voltage threshold value of the Battery Guard 1000 to 11.5V is described below.

Request:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x01	0x00	0x73	0x00	0xFF	0xFF	0x69

Battery Guard® 1000:

ACK DGN

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x00	0x01	0xFF	0xFF	0xFF	0x00	0xEF	0x00



The calibration feature built into the Battery Guard® 1000 allows the ability to zero out the primary solenoid's current sensing. The calibration process is straight forward, simply remove any loads from the primary solenoid, ensure the solenoid is in the connected state and send the calibration message via RV-C. This will remove any offset in the positive or negative direction. The message to calibrate is expressed in the below message:

Requestor:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x02	0xFF	0xFF	0xFF	0xFF	0xFF	0x69

### Event Logging

The Battery Guard® 1000 logs the number of solenoid disconnects and reconnects. To access this information, a read log request must be sent. The log records 4 different events all of which are stored as 32-bit integers allowing for over 1,000,000 records for each event. The device will echo the request from the user and return the 32-bit value in byte[3]-byte[6], where byte[3] is the LSB and byte[6] is the MSB. The event index is listed in the table below:

Index	Event
0	Automatic Disconnect
1	Automatic Reconnect
2	Manual Disconnect
3	Manual Reconnect

The sequence for accessing the number of automatic reconnects is described below:

Request:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x03	0x01	0xFF	0xFF	0xFF	0xFF	0x69

Battery Guard® 1000:

Byte[0]	Byte[1]	Byte[2]	Byte[3]	Byte[4]	Byte[5]	Byte[6]	Byte[7]
0x69	0x03	0x01	0x40	0x42	0x0F	0x00	0x69

This result returned 1,000,000 automatic reconnect events.



Service Point Number \_\_\_\_\_

The Battery Guard® 1000 provide valuable diagnostic information via the DM\_RV DGN. It supports both Red Lamp and Yellow Lamp status. Critical events where the Battery Guard® 1000 is deemed in operable are indicated by Red Lamp Status and inhibits its operations. Status messages will continue to transmit but control messages will be ignored. These failures include the following:

1. Failed to Disconnect
2. Failed to Reconnect

Both failures are indicated using the same SPN and FMI. Which represents solenoid mechanical failure. To resume operation, the GENERAL RESET DGN must be used to clear the fault.

Non-critical events where the Battery Guard® 1000 is deemed operable with the fault are indicated by the Yellow Lamp Status. The Battery Guard® 1000 will operate as normal but will continue to indicate the failure until cleared by the GENERAL RESET DGN or a user reconnect. There is a safety delay built into the device if any of these events occur and the user will not be able to reconnect until the delay has expired. These failures include the following:

1. Primary Disconnect over current
2. Auxiliary Disconnect over current
3. Solenoid over temperature

Several SPN's are supported by the Battery Guard® 1000. The following table identifies the SPN and FMI values for each of the supported faults:

SPN MSB	SPN ISB	SPN LSB	FMI	Description
1	Instance	0	0x07	Failed to disconnect or reconnect
1	Instance	3	0x00	Solenoid Temperature
1	Instance	4	0x00	Contact Current

INTEGRATOR'S GUIDE



Available Product Literature and Guides:

Brochure:	53-01130-000
Product Specification:	53-01130-001
User's Guide:	53-01130-100
Installation and Applications:	53-01130-200
Integrator Guide:	53-01130-300

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