1 Scope

RV-C is a CAN-based communication profile for recreation vehicles. . It was developed by the Recreation Vehicle Industry Association (RVIA). RVIA, PO Box 2999, Reston, VA 20195-0999, United States of America, Tel. +1-703-620-6003.

2 Physical layer

2.1 General

2.1.1 Cable

The physical medium shall be unshielded twisted pair wire. The wires are defined in 2.1.1a.

Table 2.1.1a: Wire characteristics

Wire	Characteristics
Material	Stranded copper
Type	Main trunk: 18 to 24 AWG Drops: 16 to 24 AWG
Impedance	95 to 140 Ohm
Propagation delay (max)	5 ns/m
Twists (min)	25 /m

If the wires are not labeled, they shall be color-coded as defined in 2.1.1b.

Table 2.1.1b: Wire colour code

Code	CAN_H	CAN_L	PS-	PS+	SHIELD
Two Wire	White	Blue	-	-	-
Two Wire w/ Shield	White	Blue	-	-	Bare
Three Wire	White	Blue	Black	-	Bare
Four Wire	White	Blue	Black	Red	-
Five Wire	White	Blue	Black	Red	Bare
Alternative Colors	Yellow	Green			
	White	Black			

2.1.2 Bus length, termination and topology

The network topology is a linear bus, with drops of limited length. The wire type as defined in 2.1.2 shall determine the maximum bus length. Each drop shall extend to a single network node, and be no longer than 6 m.

NOTE The maximum length includes the lengths of all the drop cables.

Table 2.1.2: Bus Length

Length	No. of nodes	Minimum cable gauge
100m	<100	24 AWG
250m	<32	22 AWG
250m	<100	20 AWG

500m	<100	18 AWG
500m	<100	16 AWG

A "daisy chain" topology may be simulated if every node has an input and an output connection for the CAN signals. This is effectively equivalent to creating a zero-length drop. This technique may be mixed with ordinary drops if desired.

Both ends of the bus shall be terminated with a 120-Ohm resistor.

2.1.3 Data rate, signal levels and slope

The data rate for all transmitters shall be 250 kbit/s. The sample point shall be in the range of 85% to 90% of the bit-time (recommended location or the sample point is 3.5 µs). The signal levels are specified in 2.1.3.

Table 2.1.3: Signal level

State	Voltage
Dominant	CAN_H = 3.5 V, CAN_L = 1.5 V, Vdiff = 2.0 V
Recessive	CAN_H = 2.5 V, CAN_L = 2.5 V, Vdiff = 0.0 V

NOTE Some CAN transceivers provide options for "slope control", which slows the bit rise and fall times to reduce EMI. This practice creates unacceptable interoperability challenges and should be avoided.

2.1.4 Connectors

Network cable conductors shall be spliced or tapped and properly joined with connectors, pressure connectors or by soldering. Individual conductor insulation displacement attachments are not recommended. This protocol recommends that suggested connectors be used for the network trunk. A list of suggested connectors follows for the network trunk in Table 2.1.4a, but designers are free to use connectors according to their utility in their specific application. All trunk connectors should use standardized pin-out convention listed in Table 2.1.4a except for established circular connectors. If the standard pin-out convention is not used then the equipment or connectors must be labeled with the pin-outs used. The chassis routing should only use sealed connectors and the interior may use sealed or unsealed connectors. Connections to the network trunk cable should be direct or short drop cables connecting to network devices and should use connectors appropriate to the device manufacturer's products. Table 2.1.4b shows recommended trunk connectors.

Table 2.1.4a - Connector standard pin-out convention

PIN #	DESCRIPTION	
1 or A	CAN-H	
2 or B	CAN-L	
3 or C	PS- (or SHIELD)	OPTIONAL
4 or D	PS+	OPTIONAL
5 or E	SHIELD	OPTIONAL
…	OTHER(s)	OPTIONAL
Unless labeled or documented otherwise.		

Table 2.1.4b Trunk connectors

RV-C Connector recommendations	Figure	CONNECTOR PINOUTS

		CAN_H	CAN_L	PS-	PS+	Shield	N.C.
SEALED							
Automotive style 2 pin (Requires external network ground)	2.1.4a	1	2				
Automotive style 3 pin (Requires external network ground)	2.1.4b	A	B			C	
Automotive style 4 pin (Allows power over network)	2.1.4c	1	2	3	4		
Automotive/Marine/RV blade style (Allows power over network)	2.1.4d	1	2	3	4		
SEALED MARINE							
Circular Industrial/Marine style 5 pin (Allows power over network)	2.1.4e	4	5	3	2	1	
UNSEALED							
Pin & Socket 0.165" 4 pin (Allows power over network)	2.1.4f	1	2	3	4		

The end views are the mating sides of the connectors.

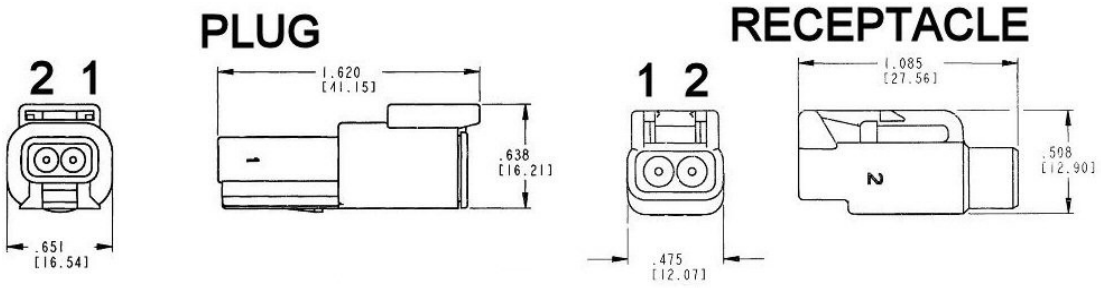


Figure 2.1.4a

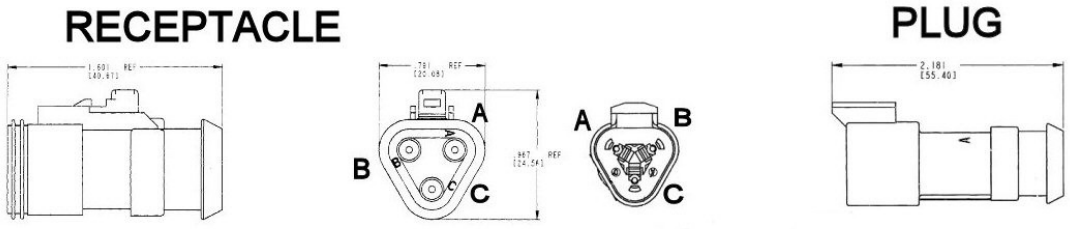


Figure 2.1.4b

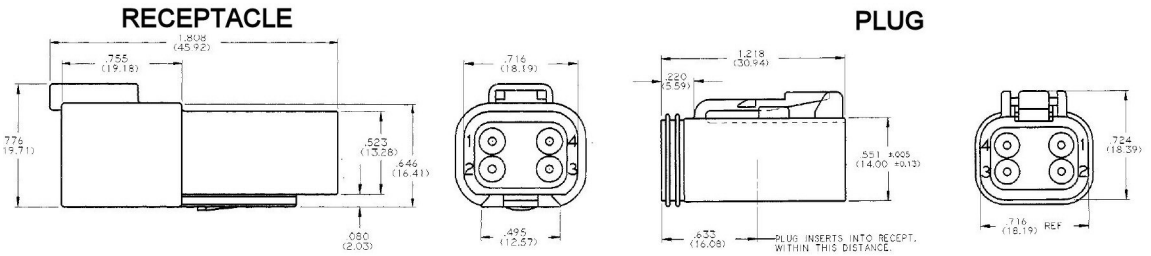


Figure 2.1.4c

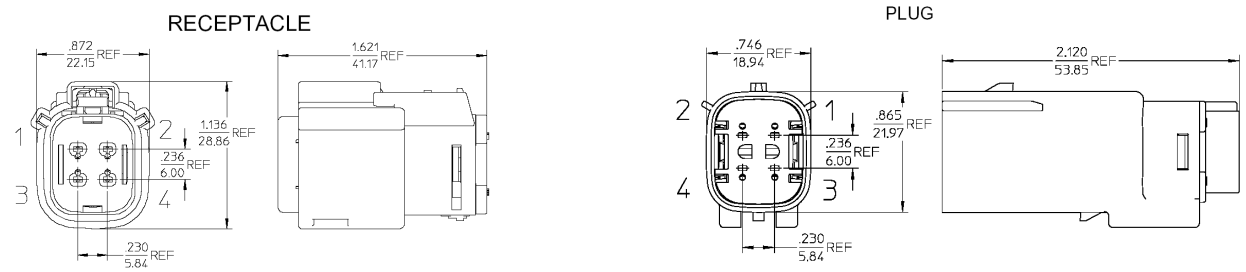


Figure 2.1.4d

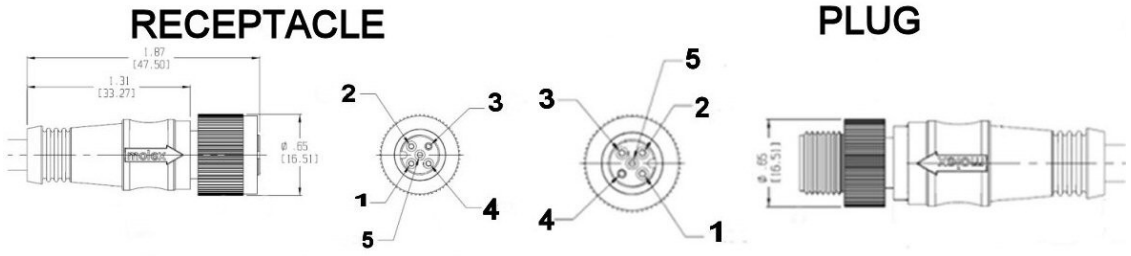


Figure 2.1.4e

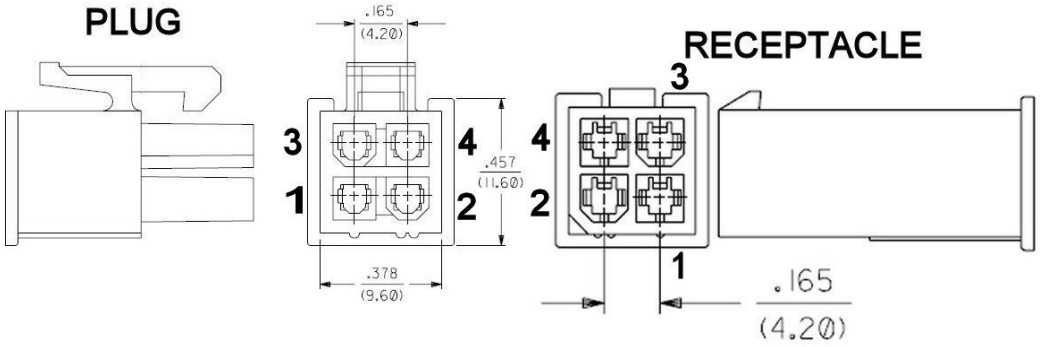


Figure 2.1.4f

2.1.5 Environmental standards

The definition of environmental features such as temperature, EMI, vibration, et cetera is not in the scope of this document.

2.2 Diagnostic Connector

A recreation vehicle equipped with a RV-C network shall be equipped with a standard connector specifically for the attachment of diagnostic tools. The connector shall be from the amp circular plastic connector (CPC) series, with 9 pins. A typical member designed for bulkhead mounting is Amp 206705-01 as shown in Figure 2.2. Any exact mechanic equivalent is acceptable.

Figure 2.2 — Diagnostic connector

Table 2.2 defines the pin assignments.

Table 2.2 — Pin assignment

Pin	Description
1	Power (12 VDC). This may be tapped by the diagnostic tool.
2	reserved
3	reserved
4	reserved
5	Ground
6	reserved
7	Shield (optional)
8	RV-C data (+) (CAN_H)
9	RV-C data (-) (CAN-L)

2.3 Network Power

Network power may be supplied over the network cable. Low power devices may be operated on network power within specified limits.

a) Devices must operate over the minimum voltage range of 9.0 to 16.0 Vdc that use the network cable power.

b) Device current not to exceed 200mA per node supplied from network cable power source.

c) Maximum current per conductor over network trunk cable according to wire gauge and network bus length shall not exceed in Table 2.3 and must comply with “ANSI/RVIA Standard for Low Voltage Systems in Conversion and Recreational Vehicles”.

d) Network devices operating on network power shall be electrically isolated and not connect PS- to RV ground.

e) Network devices and power supplies shall not degrade network performance and may not introduce noise, ripple or transients in excess of 250mVpp with a frequency of greater than 1 Hz and up to 15Vpp allowed with a frequency of less than 1 Hz.

f) Network power supplies shall limit the current per conductor size and length not to exceed the values in table 9.1.

g) Network power supplies shall have a nominal output voltage of 12.5 Vdc.

h) Network power supplies shall be able to be paralleled if current limited to fractions of the maximum network current capacity. Multiple power sources should be current mode outputs with a maximum voltage range of 12.5 +/- 3.5 Vdc. Paralleled power

supplies total currents shall not exceed the current in table 2.3.

i) Network power supply source(s) must bond PS- to RV chassis ground at power supply with a least 18 AWG wire or equivalent.

Table 2.3 — Total current over network cable for length (10% voltage drop per 12V conductor)

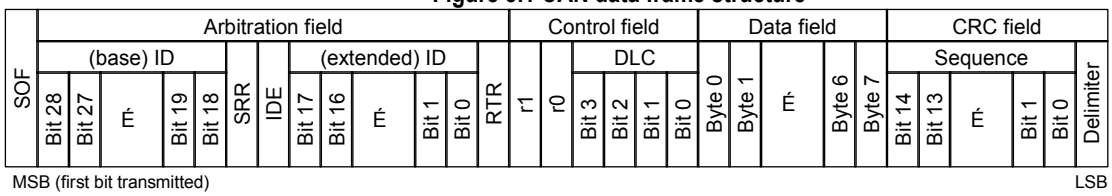
Gauge / Current	0.25 amp	0.5 amp	1 amp	2 amps	3 amps	4 amps	5 amps
24 AWG	56 m	28 m	14 m	-	-	-	-
22 AWG	89 m	44 m	22m	-	-	-	-
20 AWG	141 m	70 m	35 m	18 m	12 m	-	-
18 AWG	225 m	112 m	56 m	28 m	19 m	14 m	11 m
16 AWG	358 m	179 m	89 m	45 m	30 m	22 m	18 m
"-" Denotes not acceptable.							

3 Intermediate Layers

3.1 Data Frame Structure

Messages shall use only CAN data frames in extended frame format with a DLC of 8. CAN remote frames shall not be used. Figure 3.1 shows the structure of the CAN data frame in extended frame format.

Figure 3.1 CAN data frame structure



3.2 Network and Transport Layers

The network, transport, and application layer protocols shall use the base and extended ID field as well as the data field of the CAN data frame. The network, transport, and application layer message structure is defined in 3.2

Table 3.2: Structure of the network, transport, and application layer message

DLL fields		RV-C name (abbreviation)	Description
Name	Bit		
Base ID	28 to 26	Priority	111b – Lowest priority 000b – Highest priority
	25	Reserved	Always 0b
	24 to 18	Data Group Number - High	Identifies how the data packet should be parsed, possibly in combination with the DGN-Low
Extended ID	17 and 16		
	15 to 8	Data Group Number - Low	Either determines the target node for the message, or with the DGN-High determines how the data packet should be parsed.
	7 to 0	Source address (SA)	Shall be unique for each node
Data	64 to 0	Data	Defined in detail in the RV-C application profile specification

Due to the bus arbitration method used in the CAN data link layer protocol the use of the priority bits and the SA bits are limited. When two RV-C nodes attempt to transmit simultaneously, the priority bits determine which message will get on the bus first. All RV-C nodes shall have a unique source address, which is the tiebreaker-of-last-resort.

The network, transport, and application layer protocol demands that all RV-C nodes respond to certain messages. All messages

on the network shall conform to this specification.

3.2.1 Source addresses

3.2.1.1 Introduction

Every RV-C node shall have a unique source address to serve as a final tiebreaker during bus arbitration. The source address does not fully identify the RV-C node, and shall not be used by other RV-C nodes to interpret data from that node, except in matters of address claiming, proprietary messaging, and diagnostics.

Source addresses shall be assigned in one of two ways. RV-C node designers may choose to "hard wire" a standard address for the particular RV-C node type as defined in clause 3.2.1.2. Integrators shall take care to ensure that no two RV-C nodes using this technique are installed with the very same address.

A designer seeking greater flexibility may use the address claiming procedure, which dynamically assigns an SA when the RV-C node is powered up. The procedure is described in clause 3.3.

3.2.1.2 Predefined source addresses

A list of RV-C node types, the recommended static SA assignment and the starting SA for dynamic SA assignment (node claiming procedure) is given in Table 7.2 .

3.2.2 Data group number

The DGN identifies uniquely the parameter group. The data group is a set of signals that are transmitted in the same network, transport, and application layer message. The DGN shall be a 17-bit value that shall be built from the bits in the extended data from as indicated in Table 3.2.

NOTE All data will be explicitly assumed to have a single source, which is explicit in the assigned DGN. A common example of a datum that may have many sources is "DC system voltage". This reading may come from the battery charger, inverter, system monitor, and even from other components that have an analog-to-digital converter with a spare channel. But the protocol does not support the concept of a global "System voltage". Instead, each RV-C nodes may transmit the DC Voltage as part of one of the DGNs it transmits. There is no "DC system voltage" – only "DC Voltage @ Refrigerator", "DC voltage @ Inverter #1", and so on.

3.2.3 Data type definitions

The data field contains one or more signals or parameters. For each signal or parameter the type of data is assigned. Alphanumeric data shall be transmitted with the most significant byte first; other data consisting of 2 or more byte shall be transmitted least significant byte first.

Within the byte the bits are transmitted most significant bit first as shown in Table 3.2.3a.

Table 3.2.3a - Transfer syntax for bit sequences

Byte 0	Byte 1	Byte n (n = 2 to 7)
b7 to b0	b15 to b8	b8n-1 to b8n-8

The value ranges and value definitions for the data types are defined in Table 3.2.3b.

Table 3.2.3b – Standard data types

Description	Range	Size	Type	Value definition
Bit field	0 to 1	2 bit	bit	11b – Data not available 10b – Error 01b – On

Description	Range	Size	Type	Value definition
				00b – Off
Character	1 to 253	1 byte	char	255 – Data not available 254 – Out of range 0 – Reserved
Floating point, IEEE 754 double precision	Variable	8 byte	float64	7FFF FFFF FFFF FFFFh – Data not available 7FFF FFFF FFFF FFFEh – Out of range 7FFF FFFF FFFF FFFDh – Reserved
Floating point, IEEE 754 single precision	Variable	4 byte	float32	7FFF FFFFh – Data not available 7FFF FFFEh – Out of range 7FFF FFFDh – Reserved
Integer, 16 bit unsigned	0 to 65532	2 byte	uint16	65535 – Data not available 65534 – Out of range 65533 – Reserved NOTE LSB first
Integer, 32 bit 2's complement	-2147483,648 to +2147483644	4 byte	int32	2147483647 – Data not available 2147483646 – Out of range 2147483645 – Reserved NOTE LSB first
Integer, 32 bit unsigned	0 to 4294967292	4 byte	uint32	4294967295 – Data not available 4294967294 – Out of range 4294967293 – Reserved NOTE LSB first
Integer, 8 bit unsigned	0 to 252	1 byte	uint8	255 – Data not available 254 – Out of range 253 – Reserved

3.2.4 Network, transport, and application layer message types

3.2.4.1 Information sharing

Most RV-C nodes have associated with them a set of data, which it broadcasts on the network. For example, a generator transmits data on it loading, fuel consumption, AC amperage and voltage, coolant temperature, and so on. To accomplish this, messages may be defined and DGNs assigned to these messages. All information sharing may be accomplished through these pre-formatted messages.

Information sharing messages are generally set at priority 6. Exceptionally, higher priorities may be used for time-sensitive data (such as data used in mechanical controls). Information sharing messages requiring more than 8 data bytes are distributed to several network, transport, and application layer messages. Even if the RV-C node does not support every item in the packet, the entire packet shall be sent. Certain values are used to indicate that a particular datum is not supported or is not available at the moment.

Each RV-C node may have several messages associated with it. It is also possible that two RV-C nodes may "share" a message – each may transmit different data items from the same group.

Many data pages may be set to broadcast "on change" rather than on a schedule – that is, whenever certain data items change in value. Some may adjust their broadcast frequency according to whether the RV-C node is "active".

3.2.4.2 Information request

Most information request messages are broadcast repeatedly at a set rate, but sometimes a RV-C node may need to request a datum be transmitted immediately. To accomplish this, a RV-C node broadcasts a "request for DGN" message. All RV-C nodes that support that DGN are required to respond to such requests.

The request for DGN message is defined in Table 3.2.4.2a.

Table 3.2.4.2a - Request for DGN

Attribute	Value definition
DGN	EA00h
DGN-High	EAh
DGN-Low	Destination address or FFh (global)
Data length	3
Priority:	6
Broadcast rate	As needed
Data 0 to 2	Desired DGN (LSB first)

3.2.4.3 Acknowledgement

Certain messages require an Acknowledgment from the node they target. An ACK or NAK message is required in the following circumstances:

1. A Request for DGN is directed to a specific address, and the node at that address does not support that DGN. If the Request is directed globally then no NAK is required. If the DGN is supported, then the node shall not send an acknowledgment, but instead shall send the requested DGN.

2. A command DGN is broadcast that the node supports and for which an acknowledgment is indicated in the DGN definition . The node shall respond, either in a positive or a negative way. If the result is negative, an appropriate code shall be provided in the response.

If the definition of a command DGN contains more than one possible command, and a node sends a command that the receiving node does not support, the receiving node shall not send an acknowledgment. It shall only send an acknowledgment if the specific command is supported by the receiving node. For example, AWNING_COMMAND includes both a manual movement command byte and an automatic movement command byte. If an awning receives a DGN directing an automatic movement, but the device does not support that feature, it shall not send an acknowledgment. If it does support the feature but is prevented from acting (say, due to movement of the RV) then it shall send the acknowledgment, with an appropriate code indicating the problem.

The ACK/NAK DGN shall be sent as a destination-specific DGN, with DGN-Low equal to the address of the node that sent the original command or request. It should be noted that many legacy devices and devices designed for certain other protocols might send this DGN as a global DGN, with DGN-Low equal to 255 (0xFF).

Table 3.2.4.3a and b defines the acknowledgement.

Table 3.2.4.3a: Acknowledgement

Attribute	Value definition
DGN	E800h
DGN-High	E8h

DGN-Low	Destination Address, or FFh
Priority	6
Broadcast rate	As needed.

Table 3.2.4.3b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	
0	-	Acknowledgement Code	uint8	-	see Table 7.4
1	-	Instance	uint8	-	Instance of the transmitter, if multi-instanced. 0xFF if not multi-instanced.
2	0 to 3	Instance Bank	uint4	-	Instance Bank of transmitter, if multi-banked.
5 – 7	-	DGN Acknowledged	uint24	-	DGN being Acknowledged. LSB first.

The ACK/NAK DGN contains a data field containing the command DGN, and a field containing the response code (“ACK Code”). If the command is successfully implemented, the node shall place a 0 (zero) in the ACK Code field. (This is often referred to as an “ACK” message.) If the command cannot be implemented, the node shall indicate the nature of the failure by placing an appropriate code in this field. (This is often referred to as a “NAK” message.) The list of valid codes is provided in Table 7.4.

To provide greater detail, a ranges of codes is set aside that vary with the specific command DGN. These codes shall be set in the range 128-250, and documented with the DGN definition. Thus, the NAK code 250 may have a different meaning in response to a AWNING_COMMAND than to a GENERATOR_COMMAND.

Any non-zero code indicates that the command was not successfully completed.

3.2.4.4 Control message

Control messages are similar to information sharing messages, but are usually set at a higher priority. All control messages trigger a specific information sharing message in response, thus providing feedback to the controlling RV-C node. Often a control message will trigger a series of responses as the receiving RV-C node attempts to implement the command.

For example, a control panel may send a message to "command" the generator to start. The generator should immediately respond with a message indicating that the generator will attempt to start (or with a message indicating that the generator can't start). Once the generator has started, a second message should provide that feedback to the control panel.

In certain cases, controls may require acknowledgment in both directions. This is the case with many mechanical controls. Consider a hydraulic slide out and a control panel. In an "automatic" mode it is generally sufficient for the panel to send a control message to move the slide out. The mechanism should send two messages in response – an immediate message confirming that it is now moving the room, and a second message when it is complete. But in a "manual" mode, the control panel should repeat the message periodically (and the mechanism should respond to each again), thus providing assurance that the system is correctly following the user input. When the user is done, the control panel should send an explicit "stop" message. The frequency of these messages depends somewhat on the physical characteristics of the system and the consequences of an error. If the mechanism does not receive any message within the expected time, it should respond in the safest manner possible.

These control and response behaviours shall be defined, approved and documented by the RVIA technical subcommittee as part of the RV-C standard.

3.2.5 Diagnostics message

3.2.5.1 Introduction

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.

The broadcast rate of the DM-RV varies with the diagnostic status and other parameters. If a device is in a fault condition, the DM-RV shall be sent at a rate between 100 ms and 1000 ms, with the faster rate reserved for faults that might cause damage to other systems or compromise the safety of the occupants of the RV. If a device is not in a fault condition, the DM-RV is sent only on request, or every 5000 ms if the device has not broadcast any status information. Thus every device shall send at least one message every 5000ms – either a status PGN or a DM-RV.

Regardless of the diagnostic status, the device shall send a DM-RV upon request. The DM-RV is also to be broadcast within 1000 ms of when a previously broadcast fault is cleared.

Table 3.2.5.1a defines the DG definition and Table 3.2.5.1b defines the signal and parameter definition for the active diagnostic message ("DM_RV").

Table 3.2.5.1a — DG definition

DG attribute	Value
Name	DM_RV
DGN	1FECAh
Default priority	6
Maximum broadcast rate	100 ms where necessary for safety or to prevent damage. 1000 ms for other fault conditions.
Normal broadcast rate	On Change of Status
Minimum broadcast rate	5000 ms if no other status information has been sent by this device.
Number of frames	1
ACK requirements	None

Table 3.2.5.1b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	
0	0 to 1	Operating status	bit2	-	see 3.2.5.2
	2 to 3	Operating status	bit2		see 3.2.5.2
	4 to 5	Yellow Lamp status	bit2		see 3.2.5.3
	6 to 7	Red Lamp status	bit2		see 3.2.5.3
1	-	DSA	uint8	-	see 3.2.5.4
2	-	SPN-MSB	uint8	-	see 3.2.5.5
3	-	SPN-ISB	uint8	-	see 3.2.5.5
4	5 to 7	SPN-LSB	uint3	-	see 3.2.5.5
	0 to 4	FMI	uint5	-	see Error: Reference source not found
5	0 to 6	Occurrence count	uint7	-	7Fh if not available
	7	reserved	N/A	-	always 1
6	-	DSA extension	uint8	-	FFh — No DSA extension defined for product
7	0-3	Bank Select	uint4	-	0-13. For devices where bank selection is supported. 0xF otherwise.

3.2.5.2 Operating status

The DM_RV provides a simple way for devices to indicate their general operating status. Generally there are two broad types of nodes

- those that are simply ON or OFF (defined in Table 3.2.5.2a), such as a lamp, and those that have a degree of automation (defined in Table 3.2.5.2b), such as a climate control device or a charger.

Table 3.2.5.2a — Operating status for simple devices

Bit 0 and 1	Bit 2 and 3	Description
00b (OFF)	00b (standby)	Device is disabled and not operating. Generally a fault condition or the result of a manual override.
00b (OFF)	01b (active)	Device is disabled, but is running. Generally a fault conditions or the result of a manual override.
01b (ON)	00b (standby)	Device is not operating, but will accept commands to operate. This is the'normal' OFF condition.
01b (ON)	01b (active)	Device is operating and will accept command. This is the'normal' ON condition.

Table 3.2.5.2b — Operating status for intelligent devices

Bit 0 and 1	Bit 2 and 3	Description
00b (OFF)	00b (standby)	Device is disabled and not operating.
00b (OFF)	01b (active)	Device is disabled, but is running. Generally a fault condition or the result of a manual override.
01b (ON)	00b (standby)	Device is enabled, but is waiting for some conditions to be fulfilled before it will start running. EXAMPLE: A thermostat-controlled device may be waiting for the temperature to reach a set point.
01b (ON)	01b (active)	Device is enabled and running.

3.2.5.3 Fault status

The DM_RV provides a simple way for RV-C nodes to indicate the general fault status for the node. Every DM_RV includes bits for encoding whether the node is in a “Yellow” and/or a “Red” fault state. If either type of fault is indicated, the RV-C node shall broadcast the SPN and FMI identifying the fault in addition.

The DM_RV is considered the “last choice” for indicating a problem condition. If there are provisions in the RV-C protocol for indicating a problem other than through the DM_RV, then that alternative method shall be preferred.

EXAMPLE - An intelligent AC transfer switch uses the provisions in AC_STATUS_1 for indicating an Open Ground from a shore line, rather than send a DM_RV. In this case the transfer switch is working properly, and is not in a fault condition. The same might not apply to the output of a generator or inverter, since the open ground probably indicates a wiring problem within the RV.

The classification of faults into “Yellow” and “Red” is subjective. In general, “Yellow” faults usually refer to conditions that are manageable by the user or require little or no intervention. “Red” faults generally require a service technician or other substantial intervention. It is possible for both a Yellow and a Red condition to be active at the same time, if multiple faults are occurring simultaneously.

EXAMPLE - A low battery level to an inverter signal is a 'Yellow' fault.

3.2.5.4 Default Source Address (DSA)

The DSA is used by a device attempting to interpret the specific failure. Each device type has its own list of SPNs. The interpretation of the SPN requires inspecting the DSA.

To provide capacity for more devices than can be identified with the 8-bit DSA, the “Extended DSA” is defined. By default a device for which the Extended DSA is not defined shall use FFh (255) in the Extended DSA field. The Extended DSA is not used for Source Address assignment, and only serves to identify the device type in the diagnostic message.

NOTE - The system integrator takes care that only one statically addressed device with the same DSA and the same DSA extension, or the same DSA and different DSA extension is installed in a network.

3.2.5.5 Service Point Number (SPN)

The SPN encodes the specific feature, component or sub-component that has failed in a device. There do exist common SPNs (see Table 7.3), which are common for all device types, and specific SPNs which are specific for a device type and depend on the DSA of the device type.

Depending on whether the device is a single-instance or multiple -instance device the SPN is encoded differently. Single-instance devices have a 19-bit SPN identifier. Multiple-instance devices have an 11-bit SPN identifier and an 8-bit instance identifier.

Table 3.2.5.5 — SPN format

Data byte	Single instance device	Multiple instance device
MSB (Byte 3:Bits 0 to 7)	Most significant byte of the SPN	Most significant byte of the SPN 00h – Fault applies to all sub-device instances 01h-FAh – Fault applies to specific instance.
ISB (Byte 4)	Intermediate byte of the SPN	Instance on the device
LSB (Byte 5:Bits 5 to 7)	Least significant bits of the SPN	Least significant bits of the SPN

EXAMPLE

Byte 3 = 01h = 0000 0001b (SPN = 0000 0001 b)
Byte 4 = 03h = 0000 0011b
Byte 5 = C0h = 1100 0000b (SPN = 110b)

If Single instance device – SPN = 00 0001 0000 0011 110b = 081E= 2078h
If Multiple instance device - Instance = 3; SPN = 00 0001 110b = 000Eh = 15

3.2.5.6 Generic faults in multiple instance devices

SPN values of 00h to FFh are reserved for faults that are common to all RV-C devices. They refer to faults which are generic to all devices, e.g. faults in the communication itself or the microprocessor.

Multiple instance devices shall signal those faults without reference to the specific instance. The encoding of a single instance device shall apply for those faults on a multiple instance device.

3.2.5.7 Devices with multiple instances of sub-devices

Universal faults shall be signaled with the MSB set to 00h. Faults specific to the instance of a device shall have a MSB unequal to 00h, except generic faults (see 3.2.5.5).

NOTE The number of universal faults for a multiple instance device is limited to 2048 SPNs.

EXAMPLE A slide room controller has universal faults, e.g. the lack of a park brake signal, and instance specific faults, e.g. the slide room limit switch.

3.2.5.8 Failure mode identifier

The failure mode identifiers (FMI) are defined in Table Error: Reference source not found. The FMI is universal to all devices,

regardless of type.

Table Error: Reference source not found - Failure mode identifier

Value	Description
0	Datum value above normal range
1	Datum value below normal range
2	Datum value erratic or invalid
3	Short circuit to high voltage (or complete sensor input failure)
4	Short circuit to low voltage (or complete sensor input failure)
5	Open circuit, or output current below normal
6	Grounded circuit, or output current above normal
7	Mechanical device not responding
8	Datum value showing error of frequency, pulse width, or period
9	Datum not updating at proper rate
10	Datum value fluctuating at abnormal rate
11	Failure not identifiable
12	Bad intelligent RV-C node
13	Calibration required
14	"None of the above" (use sparingly!)
15	Datum valid but above normal operational range (least severe)
16	Datum valid but above normal operational range (moderately severe)
17	Datum valid but below normal operational range (least severe)
18	Datum valid but below normal operational range (moderately severe)
19	Received invalid network datum
20 to 30	reserved
31	Failure mode not available

3.2.5.9 Reporting multiple failures

A device is able to implement multiple functions, multiple instances of a single function, or a combination thereof. Such a device may have multiple errors at the very same time; a separate DM_RV for each function or for each instance shall be sent by the device.

A device with multiple instances of the same function may broadcast faults either by sending a separate DM_RV for each instance, or combining all faults in a multiple packet message.

NOTE 1 A device combining all faults in a multiple packet message is unable to signal the status of each instance independently, because only one operating status byte is sent for the entire message. This is appropriate where the instances are integral sub-system of the device. This is not appropriate where the instances have their own operating status.

EXAMPLE The legs of a transfer switch are instances, which are integral sub-systems of a device. A AC load switching device has instances, where each instance has its own status.

NOTE 2 A diagnostic device have to be careful in deciding when a fault is no longer active, because of the ambiguity

inherent in the handle of multiple instance devices. A device that transmits a DM_RV with both faults (Yellow and Red) set to zero and a particular DSA surely indicates that there are no faults for that function within the device. But there may be another device with the same function. A second SPN -RV from the same device and function does not necessarily mean the first fault is no longer active. Any diagnostic device that needs to track the appearance and disappearance of faults have to take advantage of the 1000 ms update rate of the DM_RV. The device have to use a timer to track the last appearance of the fault and the last appearance of a DM_RV from the source device.

3.2.5.10 Encoding multiple faults in a multiple packet message

A device with multiple faults from the same DSA may be signals the faults using a multiple packet message (see 8.7). In this case the SPN, FMI and occurrence count shall be transmitted for each subsequent fault. The operating status and DSA shall be sent once and shall apply to all encoded faults.

The use of a multiple packet message is optional. It is defined in Table 3.2.5.10. All attributes not listed shall be identical to the active diagnostic message (see 3.2.5.1b).

Table 3.2.5.10 — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Operating Status	uint8	-	see 3.2.5.2
1	-	DSA	uint8	-	see 3.2.5.4
First fault					
2	-	SPN-MSB	uint8	-	see 3.2.5.5
3	-	SPN-ISB	uint8	-	see 3.2.5.5
4	5 to 7	SPN-LSB	uint3	-	see 3.2.5.5
	0 to 4	FMI	uint5	-	see Error: Reference source not found
5	0 to 6	Occurrence count	uint7	-	7Fh if not available
	7	reserved	-	-	Always 1
6	-	DSA extension	uint8	-	FFh — No DSA extension defined for product
Second Fault					
7	-	SPN-MSB	uint8	-	see 3.2.5.5
8	-	SPN-ISB	uint8	-	see 3.2.5.5
9	5 to 7	SPN-LSB	uint3	-	see 3.2.5.5
	0 to 4	FMI	uint5	-	see Error: Reference source not found
10	0 to 6	Occurrence count	uint7	-	7Fh if not available
	7	reserved	-	-	always 1
11	-	DSA extension	uint8	-	FFh — No DSA extension defined for product
Subsequent faults					
n	-	SPN-MSB	uint8	-	see 3.2.5.5
n+1	-	SPN-ISB	uint8	-	see 3.2.5.5
n+2	5 to 7	SPN-LSB	uint3	-	see 3.2.5.5
	0 to 4	FMI	uint5	-	see Error: Reference source not found
n+3	0 to 6	Occurrence count	uint7	-	7Fh if not available
	7	reserved	-	-	always 1

n+4	-	DSA extension	uint8	-	FFh — No DSA extension defined for product

3.2.6 Proprietary messages

RV-C supports proprietary messages. The proprietary message is defined in Table 3.2.6.

Table 3.2.6: Proprietary message

Attribute	Value definition
DGN	EF00h
DGN-High	EFh
DGN-Low	Destination address, global messages (FFh) are not allowed
Priority	6, RV-C node may increase priority if appropriate.
Broadcast rate	As needed
Data 0 to 7	Manufacturer-specific

There are two main applications for this DGN: for advanced configuration (usually via a service tool), and for adding features to the protocol without publishing. Both should be handled with care. It is particularly important that the RV-C nodes involved properly identify each other and use the destination address properly to prevent other RV-C nodes from trying to parse their messages. (Consider that your message to calibrate a sensor may also be another manufacturer's message to run a slide room in).

NOTE 1 There is a complete lack of controls on this DGN. There is nothing in the protocol to protect RV-C nodes from incompatible messages. Therefore this DGN should be used very sparingly and carefully.

NOTE 2 A safe technique for using this method for advanced configuration is to begin any sequence with a "password" from the configuration tool. The RV-C node should ignore all proprietary messages until it receives the desired password. The password should "expire" eventually, so the when the configuration process ends the RV-C node stops parsing. Although it is possible to use this message to implement functionality without publishing the method, this technique is to be used only when the desired function is not supported in the published protocol.

3.2.7 Multi packet message

Data groups longer than eight bytes shall be sent using the multi-packet message protocol, which allows messages up to 1785 bytes. Each 'long message' is identified with a particular DGN, but the DGN definition is no longer limited to 8 data bytes. The method uses an initial packet to set up the transfer, followed by up to 255 data packets.

This technique has several severe limitations. There are no provisions for flow control. The receiving nodes do not communicate their readiness to receive data. The transmitter has no assurance that the data is being processed. There is no method for a receiver to request a specific packet. If the entire DGN is not received correctly the receiving node shall request the entire DGN again. A node shall only transmit one long message at a time, since data packets are not specifically identified in any way other than the packet number. And long messages are relatively slow, because of the 50 ms gap between data packets. Therefore long messages shall not be used for control and instrumentation purposes.

Long messages are implicitly required for the PRODUCT_ID, and are optionally used for the DM_RV DGN when multiple faults are active. They are used rarely in the Application profile; generally for configuration purposes where substantial tables have to be downloaded or uploaded.

3.2.7.1 Initial packet message

Table 3.2.7.1a defines the DG definition and Table 3.2.7.1b defines the signal and parameter definition for the initial packet message.

Table 3.2.7.1a - DG definition

DG attribute	Value
Name	INITIAL_PACKET
DGN	ECFFh
Default priority	Per Encapsulated DGN
Maximum broadcast rate	N/A
Normal broadcast rate	Per Encapsulated DGN
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 3.2.7.1b - Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	reserved	uint8	-	always 20h
1,2	-	Message length	uint16	bytes	Value range = 0 to 1785
3	-	Packet count	uint8	packets	FFh — 255 packets Note: Unlike most data fields, a 0xFF in this position is to be parsed and interpreted as 255 packets.
5	-	DGN	uint8	-	DGN transmitted (LSB)
6	-	DGN	uint8	-	DGN transmitted (ISB)
7	-	DGN	uint8	-	DGN transmitted (MSB)

3.2.7.2 Subsequent packet message

Table 3.2.7.2a defines the DG definition and Table 3.2.7.2b defines the signal and parameter definition for the subsequent packet message. Each subsequent data packet shall be separated by at least 50 ms to reduce bus traffic.

Table 3.2.7.2a — DG definition

DG attribute	Value
Name	DATA_PACKET
DGN	0EBFFh
Default priority	6
Maximum broadcast rate	50 ms
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 3.2.7.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	

0	-	Packet number	uint8	-	1 to 255
1to 7	-	Data	-	-	Encapsulated DGN data

3.2.8 Product identification message

The product identification message is a string of 8-bit single-byte coded graphic characters /ISO8859-1/ of arbitrary length. It is (usually) transmitted using the long-message protocol given above. (It is possible to use short IDs that are sent in one message).

NOTE Product identification is different than the ADDRESS_CLAIM described below. ADDRESS_CLAIM requires the identification information to be looked up in a table, which may not be available in the service tool or display node.

Table 3.2.8 defines the product identification message.

Table 3.2.8: Product identification message

Attribute	Value definition
DGN	65259 (FEEBh)
DGN-High	254
DGN-Low	235
Priority	6
Broadcast rate	On request
Data	8-bit single-byte coded graphic character text, with four field delimited by "*" Field 1: Make Field 2: Model Field 3: Serial number Field 4: Unit number (for products where the RV-C node is separate from the mechanical unit.)
NOTE All fields are optional, but the delimiting "*" is not. Examples: ACME*QX-125*A4323443**. INTERMEGACORP*FLUXMASTER 2000***. The minimal response would be ****.	

3.3 Address claiming procedure

3.3.1 Introduction

The RV-C node that has no assigned SA address may use the node claiming procedure to get an unique SA address.

3.3.2 Source Address claiming

The RV-C node requesting dynamically an SA begins with an address request message. Every RV-C node shall be able to respond to the address request message with an address claimed message. RV-C nodes that are "hard wired" to an SA shall respond to the address request in order to prevent a dynamically addressed RV-C node from taking its address. A dynamically addressed RV-C node will try addresses until it finds one unclaimed. Once it finds an unclaimed address, it sends the address claimed message.

Table 3.3.2a defines the address request message.

Table 3.3.2a: Address request message

Attribute	Value definition

DGN	EA00h
DGN-High	EAh
DGN-Low	Address desired
Priority:	6
Data length	3
Broadcast rate	As needed
Source address	254 (no address has been claimed)
Data 0	0
Data 1	238
Data 2	0
NOTE It will be seen that that this is just an ordinary request for DGN EE00h, but directed at a particular address.	

Table 3.3.2b defines the address claimed message.

Table 3.3.2b - Address claimed

Attribute	Value definition
DGN	EE00h
DGN-High	EEh
DGN-Low	00h
Piority	6
Broadcast rate	On request only
Source address	Assigned SA
Data 0 to 7	"ADDRESS_CLAIM" (8-byte identifier, see clause 3.3.3)

In order to reduce the possibility of mis-configured RV-C nodes (ending up with the very same SA), RV-C nodes used in the same network should try to claim different SAs. RV-C nodes should start with the address given for its RV-C node type in Table 7.2. The RV-C node shall not attempt to claim an address that might be used by a statically addressed RV-C node. If an address is already claimed, the RV-C node shall try the next address lower, and thus count downwards.

The ADDRESS_CLAIM field as described in clause 3.3.3 is used to determine the priority of RV-C nodes in address claiming. RV-C nodes with a higher priority ADDRESS_CLAIM field may "take" an address from a lower priority RV-C node. Statically addressed RV-C nodes may keep their address. Dynamically addressed RV-C nodes shall yield to static RV-C nodes, or to dynamic RV-C nodes with a higher priority ADDRESS_CLAIM field .

An RV-C node with dynamic addresses shall monitor network traffic and if they see another RV-C node using its address and it has a higher priority ADDRESS_CLAIM field it shall automatically run through the procedure and claim a new address.

3.3.3 ADDRESS_CLAIM field

The ADDRESS_CLAIM field is used as a method of uniquely identifying RV-C nodes during the address claiming procedure and for network troubleshooting. When two or more nodes attempt to claim the same source address, the ADDRESS_CLAIM field is

used for arbitration. The ADDRESS_CLAIM field should be treated as an eight byte value with the “Arbitrary Address Capable” bit being the most significant bit. This ensures statically addressed nodes will always have the highest priority.

The ADDRESS_CLAIM field is defined in Table 3.3.3.

Table 3.3.3: ADDRESS_CLAIM field

Byte	Bit	Name	Description
0	0 to 7	Serial number (LSB)	Optional. Required if multiple nodes from the same manufacturer may be present on the network.
1	0 to 7	Serial number	
2	0 to 4	Serial number (MSB)	
	5 to 7	Manufacturer code (LSB)	Required. Code obtained from SAE or RVIA.
3	0 to 7	Manufacturer code	
4	0 to 2	Node instance	For devices implementing multiple RV-C nodes (normally 0)
	3 to 7	Function instance	Optional, intended to allow multiple instances of the same RV-C node, normally 0
5	0 to 7	Compatibility Field	Optional, normally 0
6	0	Reserved	Always 0
	1 to 7	Compatibility Field	Optional, normally 0
7	0 to 3	Compatibility Field	Optional, normally 0
	4 to 6	Compatibility Field	Always 0
	7	Arbitrary address capable	Required. 1 – Node supports address claiming 0 – Node uses a fixed source address

3.3.4 Manufacturer-Specific ADDRESS_CLAIM Request

The purpose of this PGN is to facilitate manufacturers in building a cross reference table of their own or other manufacturers' devices without using a global request for Address Claim. Only nodes whose Manufacturer Code matches the 11 bit value in bytes 0-1 should respond.

Table 3.3.4a defines the PG attributes. The signal and parameter attributes are found in Table 3.3.4b

Table 3.3.4a – PG definition

PG attribute	Value
Name	MFG_SPECIFIC_CLAIM_REQUEST
PGN	1FED6h

Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ADDRESS CLAIMED MESSAGE (0EEFFh)

Table 3.3.4 – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 2	Manufacturer Code	uint3	-	LSb Manufacturer Code in NAME field
1	-	Manufacturer Code	uint8	-	MSb Manufacturer Code in NAME field

4 Conformance requirements

4.1 Required messages

Every RV-C node compliant to this communication profile shall support the features indicated in Table 4.1

Table 4.1 – Required DGNs

ADDRESS_CLAIM	Node must transmit DGN on request, and if dynamically addressed, must honor higher-priority ADDRESS_CLAIM values.	See 3.3
PRODUCT_ID	Must transmit on request.	See 3.2.8
DM_RV	Must transmit per specifications.	See 3.2.5
Multi packet messages	Required for transmission of PRODUCT_ID	See 3.2.7
DGN_REQUEST	Must process requests per specification.	See 3.2.4.2

5 RV-C Device Definitions

5.1 Introduction

The RV-C application profile describes the communication behaviour of several devices. The RV-C devices are described by attributes as shown in Table 5.1.

Table 5.1 - RV-C device definition

Device attribute	Value
Category	{<Name>}
Default Source Address	{<number>}
Dynamic Address Range	{<number> to <number>}
Instance	{single, multi-instance}

5.2 Data Groups

RV-C signals and parameters are transmitted in data groups (DG) that fit into a single CAN message. Each DG is assigned a unique Data Group Number (DGN), which in turn is divided into several parts, as described in Table 3.2.

The DG is defined by the DG attributes as shown in Table 5.2a. Signals and parameters mapped into a DG are defined by the signal and parameter attributes as shown in Table 5.2b.

Table 5.2a — DG definition

Attribute	Value
Name	{<NAME>}
DGN	{00000h to 1FFFFh}
Default priority	{<number>}
Maximum broadcast rate	{<number> ms}
Normal broadcast rate	{<number> ms}
Minimum broadcast rate	{<number> ms}
Number of frames	{<number>}
ACK requirements	{none, <condition>}

Table 5.2b - Data Parameter Definition

Byte	Bit	Name	Data type	Unit	Value definition
{0 to 7}	{0 to 7}	{<name>}	{<e.g. uint8, uint16, bit, char, etc.>}	{<e.g. m, Hz, V, etc.>}	{<detailed description>}

5.3 Standard Physical Units

Table 5.3 defines the basic data scales for different physical units.

Table 5.3 - Basic data scale definition

Unit	Data type	Min	Max	Precision	Special values
%	uint8	0	125	0.5%	-
Instance	uint8	0	250		0 — all
°C	uint8	-40	210	1 °C	-
	uint16	-273	1735	0.03125 °C	-
V	uint8	0	250	1 V	-
	uint16	0	3212.5	0.050 V	-
A	uint8	0	250	1 A	-
	uint16	-1600	1612.5	0.05 A	0 A = 0x7D00
	uint32	–2,000,000.000A	2,221,081.200A	0.001 A	0A = 0x77359400

6 RV-C Devices

6.1 AC point

6.1.1 Introduction

The AC points may be implemented in several devices. All devices that report the generation or demand for AC power use the following formats to describe the AC power use at their input, output, or measurement point (see Table 6.1.1).

Table 6.1.1 — AC point definition

Device attribute	Value
Category	Common DG format
Default Source Address	N/A
Dynamic Address Range	N/A
Instance	Multi-instance

The DGs defined in the following clauses supply a common format to simplify the interpretation of AC information.

The instance field differs in interpretation according to the device type. The meaning of the instance field is defined within each device description.

Devices that support one AC_STATUS message are not required to support the others.

6.1.2 AC point page 1

Table 6.1.2a defines the DG attributes, and Table 6.1.2b defines the signal and parameter attributes.

Table 6.1.2a — DG definition

DG attribute	Value
Name	AC_STATUS_1
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	N/A

Table 6.1.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1 to 2	-	RMS voltage	uint16	V	see Table 5.3
3 to 4	-	RMS current	uint16	A	see Table 5.3

5 to 6	-	Frequency	uint16	Hz	Precision = 1/128 Hz Value range = 0 to 500 Hz
7	0 to 1	Fault – open ground	bit2	-	00b — no fault 01b — open ground fault detected
	2 to 3	Fault – open neutral	bit2	-	00b — no fault 01b — open neutral fault detected
	4 to 5	Fault – reverse polarity	bit2	-	00b — no fault 01b — reverse polarity fault detected
	6 to 7	Fault – ground current	bit2	-	00b — no fault 01b — ground current fault detected

6.1.3 AC point page 2

Table 6.1.3a defines the DG attributes, and Table 6.1.3b defines the signal and parameter attributes.

Table 6.1.3a — DG definition

DG attribute	Value
Name	AC_STATUS_2
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	N/A

Table 6.1.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1 to 2	-	Peak voltage	uint16	V	see Table 5.3
3 to 4	-	Peak current	uint16	A	see Table 5.3
5 to 6	-	Ground current	uint16	A	see Table 5.3
7	-	Capacity	uint8	A	see Table 5.3 This generally shall indicate the size of the breaker on the circuit. In demand applications it may indicate the peak current requirements for the device.

6.1.4 AC point page 3

Table 6.1.4a defines the DG attributes, and Table 6.1.4b defines the signal and parameter attributes.

Table 6.1.4a — DG definition

DG attribute	Value
Name	AC_STATUS_3
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	

Table 6.1.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1	0 to 1	Waveform	Bit	-	00b — sine wave 01b — not a true sine wave This shall apply to inverters with “modified” or “quasi” sine wave outputs.
	2 to 5	Phase status	bit4	-	0000b - No complementary leg 0001b - In phase (240 VAC not available) 0010b - 180 Degrees out of phase (240 VAC available) 0011b - Phase relationship is variable 1110b - Error 1111b - No data
2 to 3	-	Real power	uint16	W	Precision = 1 W Value range = 0 to 65530 W
4 to 5	-	Reactive power	int16	VAr	Precision = 1 VAr Value range = -32000 to +33530 VAr Offset = +768 Negative values are “lagging”, positive values are “leading”.
6	-	Harmonic distortion	uint8	%	see Table 5.3
7	-	Complementary Leg	uint8	-	Instance of complementary leg (see Phase status)

6.1.5 AC Point Page 4

Table 6.1.5a defines the DG attributes, and Table 6.1.5b defines the signal and parameter attributes.

Table 6.1.5a — DG definition

DG attribute	Value
Name	AC_STATUS_4
DGN	N/A
Default priority	N/A

Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	N/A

Table 6.1.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1	-	Voltage fault	uint8	-	0 - Voltage OK 1 - Extremely low voltage 2 - Low voltage 3 - High voltage 4 - Extremely high voltage 5 = Open Line 1 Detected 6 = Open Line 2 Detected
2	0 to 1	Fault – Surge protection	bit	-	00b - No fault 01b - Surge fault detected (Service request for surge protector)
	2 to 3	Fault – High frequency	bit	-	00b - No fault 01b - Frequency over high limit
	4 to 5	Fault – Low frequency	bit	-	00b - No fault 01b - Frequency below low limit
	6 to 7	Bypass mode active	bit	-	00b - Normal mode 01b - Bypass mode (Circuit protection is overridden)
3	0 to 3	Qualification Status	uint4	-	0 – Unqualified (No AC present) 1 – Unqualified (Bad AC) 2 – Waiting to Qualify 3 – Qualifying 4 – Qualified (Good AC)

6.1.6 AC Point Fault Control Status

This is one of two DGs that define the fault control for an AC Point. Table 6.1.6a defines the DG attributes, and Table 6.1.6b defines the signal and parameter attributes.

Table 6.1.6a — DG definition

DG attribute	Value
Name	AC_CONFIGURATION_STATUS_1
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A

Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.1.6b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1	-	Extreme low voltage level	uint8	V	see Table 5.3
2	-	Low voltage level	uint8	V	see Table 5.3
3	-	High voltage level	uint8	V	see Table 5.3
4	-	Extreme high voltage level	uint8	V	see Table 5.3
5	-	Qualification time	uint8	s	Precision = 1 s Max = 0 to 250 s
6	0 to 1	Bypass mode	bit	-	00b — Normal Mode 01b — Bypass Mode Circuit Protection is off

6.1.7 AC Point Fault Control Status 2

One of two DGNs that define the fault control for an AC Point. Table 6.1.7a defines the DG attributes, and Table 6.1.7b defines the signal and parameter attributes.

Table 6.1.7a — DG definition

DG attribute	Value
Name	AC_CONFIGURATION_STATUS_2
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.1.7b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	The interpretation depends on the device.
1	-	High frequency limit	uint8	Hz	Precision = 1 Hz Value Range = 0 to 250 Hz
2	-	Low frequency limit	uint8	Hz	Precision = 1 Hz

					Value Range = 0 to 250 Hz

6.1.8 AC Point Fault Control Configuration Command

The format is identical to AC_CONFIG_STATUS_1 and AC_CONFIG_STATUS_2. Note that changing the configuration of one AC Point may affect other AC Points on the same device. The target device should respond with the AC_CONFIG_STATUS for every affected AC Point. Table 6.1.8 defines the DG attributes.

Table 6.1.8 — DG definition

DG attribute	Value
Name	ACFAULT_CONFIGURATION_COMMAND_1 ACFAULT_CONFIGURATION_COMMAND_2
DGN	N/A
Default priority	N/A
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	N/A
ACK requirements	ACK, AC_CONFIG_STATUS_1 /2

6.2 General Purpose Data Groups

6.2.1 General Purpose Reset

A general purpose reset supplies a method of resetting a device on the network. Like the Proprietary DG, it is directed at a specific source address. Nodes are not required to support this DGN.

If Reset to Default Settings is indicated, the node should also respond with the appropriate configuration status DGNs. Table 6.2.1a defines the DG attributes, and Table 6.2.1b defines the signal and parameter attributes.

Table 6.2.1a — DG definition

DG attribute	Value
Name	GENERAL_RESET
DGN	17F00h DGN-Low - Destination Address
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK

Table 6.2.1b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
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 to default settings	bit	-	00b - No action 01b - Restore settings to default values
	6 to 7	Reset Statistics	bit	-	00b - No action 01b – Reset Communication Status Statistics (see 6.6)
1	0 to 1	Test Mode	bit	-	00b – Quit Testing Mode 01b – Initiate Testing Mode

6.2.2 Download

If a block of data must be transferred that is longer than 1785 bytes, or requires a more robust protocol than the multipacket message format provided for general use, the data can be sent using a block of DGNs reserved for the purpose. These transfers are always source and destination specific.

The specific data transfer format is not specified. Nodes may use proprietary protocols of any kind, according to their specific application. Typically the protocol will involve some sort of responses from the destination node. These responses shall also use this DGN series, with the destination being the origin of the data block.

Table 6.2.2 - DG Definition

DG Attribute	**Value**
Name	DOWNLOAD
DGN	0x17D00 DGN-Low = Destination Address. Must not be 255 (0xFF).
Default Priority	7
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	N/A
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

6.2.3 Virtual Terminal

A virtual terminal host is a useful tool for troubleshooting. An RV-C node can serve as a text server which can be accessed by

any text terminal that supports the same protocol. The specific node features do not have to be known to the terminal, making this a particularly effective technique to use with complicated nodes that may have a variety of configurations.

RV-C reserves a block of DGNs for the purpose of transporting text between an RV-C terminal and a server. Typically the terminal is a PC service tool being operated by a technician, while the server is an RV-C node. The protocol simply bridges ASCII text between the devices, with no provisions for flow control, acknowledgment, or data validation. It is not recommended for routine communication between nodes.

The DGN is always used in the destination-specific form. A global destination is not supported. This is true for both devices that are interacting.

Table 6.2.3a - DG Definition

DG Attribute	Value
Name	TERMINAL
DGN	0x17E00 DGN-Low = Destination Address. Must not be 255 (0xFF).
Default Priority	7
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	N/A
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

Table 6.2.3b - Signal and parameter definition

Byte 0-7	ASCII Character	uint8	ASCII text. If a message contains fewer than eight characters, the unused data bytes should be filled with values of 255 (0xFF).

6.2.4 Instance Assignment

Many multi-instanced devices require a method of assigning a specific Instance or set of Instances for RV-C messaging. The INSTANCE_ASSIGNMENT and INSTANCE_STATUS DGNs provide a generalized method for configuring the instances used by a device.

Devices are not required to support instance assignment via RV-C. Some aspects of Instance Assignment is necessarily proprietary, and specific product knowledge is generally required to use these DGNs.

Both DGNs are destination-specific. The DGN-Low of the DGN indicates the source address of the target of the message.

Table 6.2.4a – DG Definition

DG Attribute	Value
Name	INSTANCE_ASSIGNMENT
DGN	0x17C00 DGN-Low = Destination Address.

	Must not be 255 (0xFF).
Default Priority	7
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	N/A
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	ACK/NAK INSTANCE_STATUS

Table 6.2.4b – Signal and Parameter Definition

Byte	Name	Data Type	Definition
0	Device Type	uint8	DSA of the target device Instance.
1	Base Instance	uint8	0xFF = Send INSTANCE_STATUS for all Instances of the indicated device type.
2	Max Instance	uint8	0xFF = Update single instance only.
3 to 4	Base Internal Address	uint16	0xFFFF = Do not change assignment but send INSTANCE_STATUS for indicated Instances.
5 to 6	Max Internal Address	uint16	
7	Reserved	uint8	

A multi-function device may support multiple DSA values. For example, a climate control device may include a thermostat, air conditioners, and furnace instances that might be assigned independently. This would require multiple uses of this DGN, with different DSA values for each device type.

If a device supports multiple instances of a particular type, it may be configured in one of two ways. If a contiguous block of instances is desired, the Base and Max Instance fields define the block. Or, the instances can be assigned one at a time by setting the Max Instance field to 255 (0xFF), or equal to the Base Instance.

The most common use of this DGN is to assign Instances to a device. For example, to assign climate control zones to a thermostat. It can also be used to set the Instance values used in commands sent by a control panel, or Instances monitored by a display or control. The format does not change, even though conceptually the two cases are diametrically opposite. For example, a keypad might be configurable to control an Awning. This DGN can be used to set which Awning Instance the keypad shall control.

The Internal Address fields are defined by the node designer. If the device supports only a single instance of the indicated type these fields could be left blank (i.e. 0xFFFF) at the option of the node designer. If the device supports multiple instances of the indicated type, these fields identify how the RV-C Instance will be mapped to the internal resource. It cannot be assumed that the Internal Addresses follow any particular numbering scheme. The Internal Address could be from a numeric sequence, but they could be a memory address, resource identifier, or table index. Their interpretation is a proprietary feature of the device.

As an example, consider a keypad (with source address 0xA0) that is programmed to control four DC loads, an awning, and a generator. The designer has chosen to maintain the configuration information in a serial EEPROM, which is addressed by the bit. For programming convenience the designer has chosen to make the Internal Address value correspond to the actual bit

addresses in the EEPROM. The first 32 bits are used for the door lock Instance values, the next 8 bits are used for the awning Instance values. Since the Generator is not an instanced device, no memory is required nor any configuration message.

Then the following messages would assign the DC Loads (DSA 0x83) to a block from 4 to 7, and the Awning (DSA 0x82) to Instance 3. (All data values are in hexadecimal.)

DGN: 17CA0 Data: 83 04 07 00 00 1F 00 FF (DC Loads 4-7 at addresses 0-31)

DGN: 17CA0 Data: 82 03 FF 20 00 FF FF FF (Awning 3 at address 32)

The node designer could have defined the Internal Address differently, and in the case of the Awning Instance eliminated the field altogether.

The target node must respond with an ACK or NAK. In addition, it shall respond with one or more INSTANCE_STATUS messages. If a Base Instance and/or Max Instance is indicated, the INSTANCE_STATUS shall report the instance data for the indicated Instances. If no Base Instance is indicated, one or more INSTANCE_STATUS packets shall be broadcast indicating the status of all Instances of that type.

Table 6.2.4c – DG Attributes

DG Attribute	Value
Name	INSTANCE_STATUS
DGN	0x17B00 DGN-Low = Destination Address. Must not be 255 (0xFF).
Default Priority	7
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	N/A
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

Table 6.2.4d – Signal and Parameter Definition

Byte	Name	Data Type	Definition
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	

This DGN is only sent in response to a INSTANCE_ASSIGNMENT DGN, and is always sent to a specific destination, the source of the INSTANCE_ASSIGMENT message.

6.3 Generic Configuration Status

6.3.1 Introduction

This DGN provides a method of checking the configuration status of complex devices. It is intended to allow devices to compare their configuration with compatible devices on the network, and indicate that their configuration is invalid or out-of-date. A configuration master can request this DGN to determine the configuration status of all applicable devices, and if a device determines that its configuration file is not valid, it will transmit this DGN periodically to indicate that it needs to be configured.

6.3.2 Generic Configuration Status

Table 6.3.2a defines the DG attributes and Table 6.3.2b defines the signal and parameter attributes.

Table 6.3.2a – DG Definition

DG attribute	Value
Name	GENERIC_CONFIGURATION_STATUS
DGN	1FED8h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	Every 2000 ms when configuration required Or on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.3.2b - Signal and parameter definition

Byte	Bit	Name	Description
0		Manufacturer Code (LSB)	Manufacturer Code. (Same as in field from NAME DGN)
1	0-2	Manufacturer Code (MS bits)	
	3-7	Function Instance	Function instance. (Same as in field from NAME DGN)
2		Function	Function code. (Same as in field from NAME DGN)
3		Firmware Revision	Manufacturer specific firmware revision number.
4		Configuration Type (LSB)	Manufacture specific configuration type. A configuration type of FFFFFF indicates an invalid configuration.
5		Configuration Type	
6		Configuration Type (MSB)	
7		Configuration Revision	Manufacturer specific configuration revision number. Configuration master can use this to determine if a node's configuration file is up to date.

6.4 Time and Date

6.4.1 Introduction

Since many nodes may have a clock and be capable of broad casting time and date information, a scheme has been devised to ensure that only one clock is broadcasting at a time. The highest priority clock shall be considered the "official" system time, and

other clocks should synchronize their actions according to that time. All devices that report or set time and date use the following formats (see Table 6.4.1).

Table 6.4.1 — Date and Time definition

Device attribute	Value
Category	Multi-source DG format
Default Source Address	N/A
Dynamic Address Range	N/A
Instance	N/A

6.4.2 System Date and Time Status

This DG establishes the date and time to be used by all nodes. Any unit capable of broadcasting this DGN may serve as the system time “master”. Upon initialization to the network, the node should wait for 3 seconds before beginning broadcasting. If it acknowledges any other node broadcasting this DGN with a Source Address higher than its own, the node should stop broadcasting this DGN. It should resume broadcasting if at any time three seconds passes without this message being seen.

When a node receives this message from another node, it should set its own clock to match. Table 6.4.2a defines the DG attributes, and Table 6.4.2b defines the signal and parameter attributes.

Table 6.4.2a — DG definition

DG attribute	Value
Name	DATE_TIME_STATUS
DGN	1FFFFh
Default priority	6
Maximum broadcast rate	1000 ms
Normal broadcast rate	1000 ms
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.4.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Year	uint8	Year	Precision = 1 year Offset = 2000 AD Value range = 2000 to 2250
1	-	Month	uint8	month	1 – January, 2 – February , . . . , 12 - December
2	-	Date	uint8	day	Precision = 1 day Value range = 0 to 31
3	-	Day of week	uint8	-	1 – Sunday, 2 – Monday, . . . , 7 - Saturday
4	-	Hour	uint8	h	Precision = 1 h

					Value range = 0 to 23 0 - 12:00 AM 12 – 12:00 Noon 23 – 11:00 PM This shall be in Local Time
5	-	Minute	uint8	min	Precision = 1 min Value range = 0 to 59
6	-	Second	uint8	s	Precision = 1 s Value range = 0 to 59
7	-	Time zone	uint8	h	0 - Greenwich Mean Time 4 - Eastern Daylight Time 5 - Eastern Standard Time 7 - Pacific Daylight Time 8 - Pacific Standard Time 0 - Western European Time 22 - Central European Summer Time

6.4.3 Set System Date and Time Command

This command forces all clocks to set to a specific date and time. It is typically used to indicate a user setting. It could also be used by a node that has access to a more accurate clock (e.g. a GPS). In the latter case, the node should send this only if it observes the “master” clock sending DATA_TIME_STATUS messages that have a variance of more than two seconds.

This message can also indicate a change in time zone if all fields are set to a value of 255 except Hour and Time Zone.

Table 6.4.3 defines the DG attributes. The signal and parameter attributes are identical to DATE_TIME_STATUS (see Table 6.4.2b).

Table 6.4.3 — DG definition

DG attribute	Value
Name	SET_DATE_TIME_COMMAND
DGN	1FFFEh
Default priority	5
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK Nodes shall not respond with DATE_TIME_STATUS unless acting as the system time “master”.

6.5 DC Source

6.5.1 Introduction

A DC source typically refers to a bank of batteries, but may indicate another source of DC voltage such as a fuel cell. These DGs are not specifically associated with any particular product, but may be broadcast by any device that monitors the condition of that

DC Source. This could be a battery monitoring node, a charger, or some other node with a voltmeter capability. Only the highest priority (which is presumably the most accurate) such device should be broadcasting the DGN at any given time. The following formats apply (see Table 6.5.1).

Table 6.5.1 — DC source definition

Device attribute	Value
Category	Multi-source DG format
Default Source Address	N/A
Dynamic Address Range	N/A
Instance	Multi-instance

Each instance shall have its own “master”. A device may be a master for one instance, but not all instances of a connected device.

When a DC monitoring device initiates on the network it should wait 2 seconds before beginning transmission of these message types. If a higher priority device is transmitting these DGNs, it should not transmit. After no transmission of these DGNs by any device, a device may begin transmission. While transmitting these DGNs, if another device of higher priority begins transmission the lower priority device should stop transmission. If within two seconds after transmission from a higher priority device, messages transmitted from a lower priority device should be ignored. If any of the three DGNs are produced, it applies as though all three DGNs were received. A node may not support all three DGNs, but if it is the highest priority node it shall be the only node broadcasting even if another node supports the missing DGN. This ensures that all the DC Source information currently being broadcast is coming from the same measurement source.

If two devices have the same published priority, the device with the higher source address shall have priority.

A global request for these DGNs should trigger all measurement devices that support them to transmit, regardless of whether they are the current “master”.

6.5.2 DC Source Status 1

Table 6.5.1a defines the DG attributes, and Table 6.5.1b defines the signal and parameter attributes.

Table 6.5.1a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_1
DGN	1FFFDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms
Minimum broadcast rate	Special
Number of frames	1
ACK requirements	None

Table 6.5.1b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	0 – Invalid

					1 - Main House Battery Bank 2 - Chassis Start Battery 3 - Secondary House Battery Bank There may be other instances in the RV. The numbering of other instances is arbitrary, not determined by this document.
1	-	Device priority	uint8	-	120 - Battery SOC device 100 – Inverter/Charger 80 – Charger 60 – Inverter 40 – Voltmeter/Ammeter 20 – Voltmeter Designers should consider making this value configurable.
2 to 3	-	DC voltage	uint16	V	see Table 5.3
4 to 7	-	DC current	uint32	A	see Table 5.3

6.5.3 DC Source Status 2

The Instance and Priority are the same format as DC_SOURCE_STATUS_1. Table 6.5.3a defines the DG attributes, and Table 6.5.3b defines the signal and parameter attributes.

Table 6.5.3a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_2
DGN	1FFFCh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms
Minimum broadcast rate	Special
Number of frames	1
ACK requirements	None

Table 6.5.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see 6.5.2
1	-	Device priority	uint8	-	see 6.5.26.5.6
2 to 3	-	Source temperature	uint16	°C	see Table 5.3

4	-	State of charge	uint8	%	see Table 5.3 For batteries, this shall indicate the approximate amount of energy remaining in the battery bank, relative to its current full capacity. For sources such as a solar panel, this shall indicate its current potential output relative to its maximum potential output.
5 to 6	-	Time remaining	uint16	min	The expected amount of time before the state of charge reaches 0. Generally applicable to batteries or DC sources that require fuel.

6.5.4 DC Source Status 3

The Instance and Priority are the same format as DC_SOURCE_STATUS_1. Table 6.5.4a defines the DG attributes, and Table 6.5.4b defines the signal and parameter attributes.

Table 6.5.4a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_3
DGN	1FFFBh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms
Minimum broadcast rate	Special
Number of frames	1
ACK requirements	None

Table 6.5.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see 6.5.2
1	-	Device priority	uint8	-	see 6.5.2
2	-	State of health	uint8	%	see Table 5.3 The expected remaining lifetime of the source, relative to the total expected lifetime. Typically applied to batteries.
3 to 4	-	Capacity remaining	uint16	A•h	Precision = 1 A•h Value range = 0 to 65530 A•h The current remaining capacity of the source. Typically applied to batteries.
5	-	Relative capacity	uint8	%	see Table 5.3 The capacity remaining, relative to total capacity when fully charged. Typically applied to batteries.

6 to 7	-	AC RMS ripple	uint16	mV	Precision = 1 mV Value range = 0 to 65530 mV The total measured AC Ripple detected on the DC bus.

6.5.5 DC Source Status 4

Table 6.5.5a defines the DG attributes, and Table 6.5.5b defines the signal and parameter attributes.

Optionally used by charging sources who are able to receive direction from an associated DC source (battery BMS) as to what the charging goal should be. In its simplest application, charging sources will work towards the Desired Volts and Amps for the DC Source (e.g.battery) and disregard which ''state' the system is in.

This will be send out every 5000mS, or as needed (e.g.: when the desired charge mode state is changed,)

Table 6.5.5a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_4
DGN	1FEC9h
Default priority	6
Maximum broadcast rate	100ms
Normal broadcast rate	On Change
Minimum broadcast rate	5000ms
Number of frames	1
ACK requirements	None

Table 6.5.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see table 6.5.2b
1	-	Device priority	uint8	-	see table 6.5.2b
2	-	Desired charge state	uint8	-	Specifies the desired charging state of associated charging sources. 0 – Undefined, charging source decides (Default) 1 – Do not charge 2 – Bulk 3 – Absorption 4 – Overcharge 5 – Equalize 6 – Float 7 – Constant voltage / Current (Note that the same values are used when charging devices report their charge state status)
3 to 4	-	Desired DC voltage	uint16	V	see Table 5.3

					The desired voltage the battery is targeting during charging.
5 to 6	-	Desired DC current	uinit16	A	see Table 5.3 The desired maximum acceptance current the battery is targeting from all charging sources during charging.
7	0 to 3	Battery Type	uint4	-	0 – Flooded 1 – Gel 2 – AGM 3 – Lithium-Iron-Phosphate 13-29 – Reserved for Vendor-defined proprietary types.

6.5.6 DC Source Status 5

Table 6.5.6a defines the DG attributes, and Table 6.5.6b defines the signal and parameter attributes.

This DGN provides support for high-precision measurement of voltage.

Table 6.5.6a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_5
DGN	1FEC8h
Default priority	6 in normal operation 2 when over-voltage or fluctuating voltage conditions are active.
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms in normal operation 100 ms when over-voltage or fluctuating voltage conditions are active.
Minimum broadcast rate	Special
Number of frames	1
ACK requirements	None

Table 6.5.6b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see table 6.5.2b
1	-	Device priority	uint8	-	see table 6.5.2b
2 to 5	-	HP DC voltage	uint32	V	Precision = 0.001 V
6 to 7	-	DC Voltage Rate of Change (dV/dT)	uint16	mV/s	Precision = 1 mV/s 0 = -32000 mV/s 32000 = 0 mV/s

					65530 = 33530 mV/s (Max)

dV/dT allows communication of moderately short-term transient events which charging sources need to respond to. Examples would include the removal of a large DC load causing a sudden raise in voltage (load dump). If such events, or other events (over voltage, excess Amps, etc) pose risk to the health of the battery, the priority of messages as well as the transmission rate, may be increased.

6.5.7 DC Source Status 6

Table 6.5.7a defines the DG attributes, and Table 6.5.7b defines the signal and parameter attributes.

Provides signaling and safety of battery bank by indicating upper and lower operational limits, as well as conditions out of operational bounds. Battery Manager will also trip safety disconnects when safety limits are reached. This DG is to support needed protection around LiFePO4 chemistry; typically a BMS will alert the world that limits are close and some action should be taken. If no action is taken the BMS may take positive actions to disconnected the battery bank, protecting it from conditions which may cause damage to the bank, and/or safety concerns in the physical environment.

Table 6.5.7a — DG definition

DG attribute	Value
Name	DC_SOURCE_STATUS_6
DGN	1FEC7
Default priority	6
Maximum broadcast rate	100ms
Normal broadcast rate	On Change
Minimum broadcast rate	5000ms
Number of frames	1
ACK requirements	None

Table 6.5.7b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see table 6.5.2b
1	-	Device priority	uint8	-	see table 6.5.2b
2	0 to 1	High Voltage Limit Status	bit	-	00b - Not reached 01b - Limit reached Indicates whether DC Source (e.g. battery) has reached its upper operation voltage limit and charging sources should terminate.
	2 to 3	High Voltage Disconnect Status	bit	-	00b - Connected 01b - Charge bus disconnected. Indicates whether the DC Source has been disconnected due to reaching its upper operation voltage limit.
	4 to 5	Low Voltage Limit Status	bit	-	00b - Not reached 01b - Limit reached

					Indicates whether DC Source (e.g. battery) has reached its lower operation voltage limit and charging sources should terminate.
	6 to 7	Low Voltage Disconnect Status	bit	-	00b - Connected 01b - Charge bus disconnected Indicates whether the DC Source has been disconnected due to reaching its lower operation voltage limit.

6.6 Communication Status

6.6.1 Introduction

Communication status provides a standard way for devices to transmit data network standing. They may be used for troubleshooting communication problems. These are not required to be supported by all nodes. The following formats apply (see Table 6.6.1).

Table 6.6.1 — Communication status definition

Device attribute	Value
Category	Multi-source DG format
Default Source Address	N/A
Dynamic Address Range	N/A
Instance	N/A

These DGNs are transmitted only on request, typically by a service tool. However, a node that does not transmit any other message on a regular basis (for example, a data logging device) may elect to send one of these every 5000 ms to provide a “heartbeat”.

Note that these DGNs have no explicit method of identifying the type or instance of the transmitter. The Source Address must be examined to identify the sender.

6.6.2 Communication Status 1

Table 6.6.2a defines the DG attributes, and Table 6.6.2b defines the signal and parameter attributes. All counts are from node power-on.

Table 6.6.2a — DG definition

DG attribute	Value
Name	COMMUNICATION_STATUS_1
DGN	1FFFAh
Default priority	7
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.6.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0 to 3	-	Timer count	uint32	ms	Precision = 1 ms Value range = 0 to 4,221,081.200 ms The number of ms since the node powered up.
4 to 5	-	Receive error count	uint16	-	The number of errors encountered receiving incoming CAN messages.
6 to 7	-	Transmit error count	uint16	-	The number of errors encountered transmitting CAN messages.

6.6.3 Communication Status 2

Table 6.6.2a defines the DG attributes, and Table 6.6.2b defines the signal and parameter attributes. All counts are from node power-on.

Table 6.6.2a — DG definition

DG attribute	Value
Name	COMMUNICATION_STATUS_2
DGN	1FFF9h
Default priority	7
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.6.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0 to 3	-	Transmitted frames count	uint32	-	The number of CAN packets transmitted by this node.
4 to 7	-	Received frames count	uint32	-	The number of CAN packets received by this node.

6.6.4 Communication Status 3

Table 6.6.4a defines the DG attributes, and Table 6.6.4b defines the signal and parameter attributes. All counts are from node power-on.

Table 6.6.4a — DG definition

DG attribute	Value
Name	COMMUNICATION_STATUS_3
DGN	1FFF8h

Default priority	7
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.6.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0 to 1	-	Bus-off error count	uint16	-	The number of bus-off errors detected.
2 to 3	-	Receive frames dropped count	uint16	-	The number of receive frames dropped.
4 to 5	-	Transmit frames dropped count	uint16	-	The number of transmit frames dropped.

6.7 Proprietary DGNs

6.7.1 Introduction

The standard requires no limits on the use of the Proprietary DGN for node-specific configuration, monitoring, and control. However, since many different products have similar requirements in this area, a group of special applications are recommended for node builders to use. This will make it easier to provide multi-purpose service and configuration tools. The following formats apply (see Table 6.7.1).

Table 6.7.1 — Proprietary DGNs definition

Device attribute	Value
Category	Special
Default Source Address	N/A
Dynamic Address Range	N/A
Instance	N/A

6.7.2 Password Validation

Some operations may require a password before access will be granted to certain features. When a node refuses a command due to lack of authorization, the recipient shall send a Proprietary DGN (DGN_High = 239, DGN-Low = Destination Address) with the first byte set to 0 and the other bytes set to 255.

The node shall respond with an eight-byte "challenge", again using the Proprietary DGN with the Destination being the Source Address of the node attempting the control. The data bytes in this challenge may be pseudo-random numbers. The controlling node then shall send a "response". The response shall be a packet with the first byte set to 0, and the rest of the packet consisting of values determined 1by the challenge . The node then shall respond with an ACK, with the ACK value indicating whether the password was accepted.

By using a challenge-response system, it makes it very difficult for a third node listening in to determine the formula for the password. Even a simple combination of XOR masks and bit shifts would require observing a huge number of transactions to decipher. More elaborate formulae are possible, including virtually unbreakable public-key schemes.

6.7.3 Instance and Address Assignment

The configuration of many types of nodes includes the assignment of Instance codes and source addresses.

Table 6.7.3a defines the DG attributes, and Table 6.7.3b defines the signal and parameter attributes. All counts are from node power-on. The first byte contains a mode value for determining how the remaining bytes are to be interpreted.

Table 6.7.3a — DG definition

DG attribute	Value
Name	Special Application – proprietary DGN
DGN	1EF00h DGN-Low = Destination Address
Default priority	7
Maximum broadcast rate	N/A
Normal broadcast rate	N/A
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK

Table 6.7.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Operation	uint8	-	0 — Password (see 4.6.2) 1 — Set source address 2 — Set instance 3 — Set secondary instance
1	0 to 1	Permanence	bit	-	00b — Temporary 01b — Permanent

If Operation = 1

Byte	Bit	Name	Data type	Unit	Value definition
2	-	Source address	uint8	-	

If Operation = 2

Byte	Bit	Name	Data type	Unit	Value definition
2	-	Internal instance	uint8	-	If the node contains only one instance this value shall be ignored.
3	-	Public instance	uint8	-	This Instance value that shall be reported by the node.

If Operation = 3

Byte	Bit	Name	Data type	Unit	Value definition

2	-	Internal instance	uint8	-	If the node contains only one instance this value shall be ignored.
3	-	Public association	uint8	-	This refers to a secondary association, for example, each Instance of a Battery Charger is associated with a DC Source. This operation shall set that Instance.

6.8 Standardized Subnetworking (Obsolete)

6.8.1 Introduction

The Standardized Subnetworking DGNs have been removed from the specification. The 1FF9Eh and 1FF9Dh DGNs and the 1EF00h block are available for future assignment for other purposes.

6.9 Water heater

6.9.1 Introduction

The DGs defined in the following clauses support all types of water heaters – typically LP gas, often with electrical elements, and occasionally with diesel burners. Although a single heater is normal, multiple instances are supported. The following formats apply (see Table 6.9.1).

Table 6.9.1 — Water heater definition

Device attribute	Value
Category	Appliances
Default Source Address	101, 102
Dynamic Address Range	208 to 223
Instance	Multi-instance

6.9.2 Water heater status

This DG provides the general water heater status. Table 6.9.2a defines the DG attributes, and Table 6.9.2b defines the signal and parameter attributes.

Table 6.9.2a — DG definition

DG attribute	Value
Name	WATERHEATER_STATUS
DGN	1FFF7h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.9.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	0 – all 1 to 250 - Instance number
1	-	Operating modes	uint8	-	0 – off 1 – combustion 2 – electric 3 - gas/electric (both) 4 - automatic (electric if available, otherwise combustion 5 - test combustion (forced on) 6 - test electric (forced on)
2 to 3	-	Set point temperature	uint16	°C	see Table 5.3 The desired water temperature.
4 to 5	-	Water temperature	uint16	°C	see Table 5.3 The actual water temperature.
6	0 to 1	Thermostat status	bit	-	00b - set point met 01b - set point not met (heat is being applied)
	2 to 3	Burner status	bit	-	00b – off 01b - AC element is active
	4 to 5	AC element status	bit	-	00b - no fault 01b - open neutral fault detected
	6 to 7	High temperature limit switch status	bit	-	00b - limit switch not tripped 01b - limit switch tripped (unit disabled)
7	0 to 1	Failure to ignite status	bit	-	00b - no failure 01b - device has failed to ignite (user intervention required)
	2 to 3	AC power failure status	bit	-	00b - AC power present 01b - AC power not present
	4 to 5	DC power failure status	bit	-	00b - DC power present 01b - DC power not present
	6 to 7	Reserved	-	-	

6.9.3 Water Heater Command

This DGN provides external control of the water heater. Table 6.9.3 defines the DG attributes. The signals and attributes are identical to WATERHEATER_STATUS (see Table 6.9.2b).

An instance of zero indicates that the settings should be applied to all water heater instances. Values of 255 (or 65535) indicate that the particular datum should not be changed. Note that generally only the Operating Mode and Set Point are configurable through this command.

Table 6.9.3 — DG definition

DG attribute	Value
Name	WATERHEATER_COMMAND
DGN	1FFF6h

Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, WATERHEATER_STATUS

6.9.4 Service Points

The SPNs follow the general method for multi-instance products. Faults are reported with the Instance in the Intermediate Byte (ISB) and a non-zero value in the Most Significant Byte (MSB). It is assumed that all Instances are independent nodes. The Least Significant Bits (LSb) may vary.

Table 6.9.4 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Set Point Temperature
1	Instance	1	Water Temperature
1	Instance	2	Thermostat
1	Instance	3	Burner
1	Instance	4	AC Element
1	Instance	5	DC Power
1	Instance	6	Igniter
1	Instance	7	AC Power
2	Instance	0	Primary High Temp Limit Switch
2	Instance	1 to 7	Additional High Temp Limit Switches

6.10 Gas Sensors

6.10.1 Introduction

These DGs cover all types of gas detectors generally found in RVs - LP Gas, CO, and Smoke.

The DGs defined in the following clauses support all types of water heaters - typically LP gas, often with electrical elements, and occasionally with diesel burners. Although a single heater is normal, multiple instances are supported. The following formats apply (see Table 6.10.1).

Table 6.10.1 — Gas sensors definition

Device attribute	Value
Category	Appliances
Default Source Address	120 to 125
Dynamic Address Range	208 to 223

Instance	Multi-instance

Multiple source addresses are allocated, but detectors are identified by the Instance in each DGN. This is a multi -instance DGN, and a combination detector would broadcast using multiple Instance identifiers. There is no way to identify the physical location of a detector from the Instance or the Source Address.

6.10.2 Sensor Status

This communicates user intentions, along with the temperature readings. Table 6.10.2a defines the DG attributes, and Table 6.10.2b defines the signal and parameter attributes.

Table 6.10.2a — DG definition

DG attribute	Value
Name	GAS_SENSOR_STATUS
DGN	1FFF5h
Default priority	2
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.10.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3
1	-	Type	uint8	-	1 — CO 2 — LP Gas 3 — Smoke
2 to 3	-	PPM	uint16	ppm	Precision = 1 ppm Value range = 0 to 65530 ppm
4	0 to 1	Alarm	bit	-	00b — No alarm 01b — Alarm
	2 to 3	Warning	bit	-	00b — No alarm 01b — Warning (less serious than Alarm)
	4 to 5	DC supply failure	bit	-	00b — No failure 01b — DC supply failure
	6 to 7	sensor failure	bit	-	00b — No failure 01b — Sensor failure

6.10.3 Service Points

The SPNs follow the general method for multi-instance products (see Table 59). Faults are reported with the Instance in the Intermediate Byte (ISB) and a non-zero value in the Most Significant Byte (MSB). In the case of a single node controlling multiple instances an ISB of zero indicates the fault applies to the central controller. The Least Significant bits (LSb) may vary.

Table 6.10.3 — Service Points

MSB	LSB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Sensor
1	Instance	1	Annunciator

6.11 Chassis Motion

6.11.1 Introduction

These DGs describe a method that allows components to monitor the motion of the RV, and control its mobility. Although SAE J1939 offers some of this functionality of these DGNs, it does not include a way to immobilize the chassis, and is not universally available. More detailed information on chassis components such as the engine and transmission should be handled through SAE J1939 emulation. The following formats apply (see Table 6.11.1).

Table 6.11.1 — Chassis motion definition

Device attribute	Value
Category	Chassis
Default Source Address	252
Dynamic Address Range	144 to 159
Instance	Single

6.11.2 Chassis Mobility Status

This DG can be queried by any device that needs to know whether the RV is in motion or immobilized. Table 6.11.2a defines the DG attributes, and Table 6.11.2b defines the signal and parameter attributes.

Table 6.11.2a — DG definition

DG attribute	Value
Name	CHASSIS_MOBILITY_STATUS
DGN	1FFF4h
Default priority	4
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.11.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0 to 1	-	Engine RPMs	uint16	rpm	Precision = 0.125 rpm Value Range = 0 to 8191.625 rpm

					65534 – Error 65535 - Unknown
2 to 3	-	Vehicle speed	uint16	kph	Precision = 1/256 kph Value Range = 0 to 255 kph 65534 - Error 65535 - Unknown
4	0 to 1	Park brake status	bit	-	00b - Park Brake Released. Coach is free to roll 01b - Park Brake Engaged. Coach is immobilized
	2 to 3	Transmission lock status	bit	-	00b - Transmission is not locked 01b - Transmission is locked (shall not go into gear)
	4 to 5	Engine lock status	bit	-	00b - Engine is free to start 01b - Engine is locked
5	0 to 1	Ignition switch status	bit	-	00b - Off 01b - On
	2 to 4	Accessory switch status	bit	-	00b - Off 01b - On
6		Transmission Current Gear	byte	-	124 = Reverse 1 125 = Neutral 126 = Forward 1 127 = Forward 2 etc. 251 = Park (Note: Most heavy transmissions do not have a 'Park', but are parked in Neutral.)
7		Transmission Gear Selected	byte	-	Same format as Current Gear

6.11.3 Chassis Mobility Command

Any device that wishes to immobilize the RV (e.g. to prevent it being driven while an awning is extended) shall use this command. First, the device should issue this command before extending and must monitor for the acknowledgment. Secondly, the device must respond to any request for this DGN, and properly report whether it still wants the chassis system locked. Third, it should send the command again to unlock the chassis after retracting. (The same principle applies to the other interlocks supported here).

The device implementing the DG should monitor the incoming commands and keep a list of devices that have requested a lock. Before releasing a lock, it should broadcast a request for this DGN and compare the results with the list in memory. The chassis device shall be careful not to completely trust either method - a locking device may be off-line, and thus not respond to the request for the DGN or fail to send the unlocking command.

Table 6.11.3a defines the DG attributes, and Table 6.11.3b defines the signal and parameter attributes.

Table 6.11.3a — DG definition

DG attribute	Value
Name	CHASSIS_MOBILITY_COMMAND
DGN	1FFF3h

Default priority	4
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.11.3b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	0 to 1	Park brake command	bit	-	00b - Please release chassis 01b - Please immobilize chassis 10b – Error 11b - Do not care about immobilizer status Note that the command 00b is an active request to release the immobilizer (e.g. Park brake). In contrast, the value 11b indicates the node does not need the immobilizer to be in either state.
	2 to 3	Park brake user override	bit	-	00b - Normal priority 01b - Override 10b - Error 11b - N/A This should only be used to implement a emergency override, under the control of the user (typically in a diagnostic or troubleshooting mode.)
1	0 to 1	Transmission command	bit	-	00b - Please release transmission 01b - Please prevent transmission from engaging 10b – Error 11b - Do not care about transmission status. Note that the command 00b is an active request, as above.
	2 to 3	Transmission lock user override	bit	-	00b - Normal priority 01b - Override 10b - Error 11b - N/A This should only be used to implement an emergency override, under the control of the user (typically in a diagnostic or troubleshooting mode.)

2	0 to 1	Engine lock command	bit	-	00b - Please release engine. 01b - Please prevent engine from starting 10b - Error 11b - Do not care about engine status. Note that a 00b command is an active request, as above.
	2 to 4	Engine lock user override	bit	-	00b - Normal priority 01b - Override 10b - Error 11b - N/A This should only be used to implement a emergency override, under the control of the user (typically in a diagnostic or troubleshooting mode.)

6.11.4 Service Points

These are the allowable Service Points for this DGN (see Table 6.11.4).

Table 6.11.4 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Engine RPMs
257	Vehicle Speed
258	Park Brake
259	Transmission Lock
260	Engine Lock
261	Ignition Switch
262	Accessory Switch

6.12 Active Air Suspension

6.12.1 Introduction

These DGNs describe an RV -specific suspension system - an active air suspension (AAS). It generally works in conjunction with an air leveling system, but is active while the vehicle is in motion to adjust ride height according to road conditions. The following formats apply (see Table 6.12.1).

Table 6.12.1 — Active air suspension definition

Device attribute	Value
Category	Chassis
Default Source Address	126
Dynamic Address Range	144 to 159
Instance	Single

6.12.2 Air Suspension Configuration Status

This DGN reports the configuration of the AAS. Table 6.12.2a defines the DG attributes, and Table 6.12.2b defines the signal and parameter attributes. If there is only a single front ride height control, then it is reported as the Left Front and the Right Front sensor will report No Data.

Table 6.12.2a — DG definition

DG attribute	Value
Name	AAS_CONFIG_STATUS
DGN	1FFF2h
Default priority	3
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.12.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value Definition
0	-	Left front sensor mode	uint8	%	see Table 5.3 0 — Completely dumped
1	-	Right front sensor mode	uint8	%	see Table 5.3 0 — Completely dumped
2	-	Right rear sensor mode	uint8	%	see Table 5.3 0 — Completely dumped
3	-	Left rear sensor mode	uint8	%	see Table 5.3 0 — Completely dumped
4	-	Height correction threshold time	uint8	min	Precision = 1 min Value range = 0 to 250 min
5	-	Solenoid on time	uint8	ms	Precision = 5 ms Value range = 0 to 1250 ms

6.12.3 Air Suspension Command

This DGN reports the configuration of the AAS. Table 6.12.3a defines the DG attributes. The signal and parameter attributes have the same format as AAS_CONFIG_STATUS (see Table 6.12.2b).

Table 6.12.3a — DG definition

DG attribute	Value
Name	AAS_COMMAND
DGN	1FFF1h
Default priority	3

Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, AAS_STATUS

6.12.4 Air Suspension Status

This DGN is the heartbeat for the AAS controller. Table 6.12.4a defines the DG attributes, and Table 6.12.4b defines the signal and parameter attributes.

Table 6.12.4a — DG definition

DG attribute	Value
Name	AAS_STATUS
DGN	1FFF0h
Default priority	4
Maximum broadcast rate	1000ms
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.12.4b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	0 to 1	AAS Operating Status	bit	-	00b - Off 01b - On
	2 to 5	AAS Mode	uint4	-	0000b - Normal 0001b - Fly Mode 0010b – Reset 1110b – Error 1111b - NA
1	-	Left front sensor mode	uint8	%	see Table 5.3 0 — Full Dump (0%) 200 – Full Raise (100%)
2	-	Right front sensor mode	uint8	%	see Table 5.3 0 — Full Dump (0%) 200 – Full Raise (100%)
3	-	Right rear sensor mode	uint8	%	see Table 5.3 0 — Full Dump (0%) 200 – Full Raise (100%)

4	-	Left rear sensor mode	uint8	%	see Table 5.3 0 — Full Dump (0%) 200 – Full Raise (100%)
5	0 to 1	Tag axle position	bit	-	00b – Tag Axle Position Down 01b – Tag Axle Position Up

6.12.5 Air Suspension Sensor Status

This DG reports the status of the AAS sensors. If there is only a single front ride height control, then it is reported as the Left Front and the Right Front sensor will report No Data. Table 6.12.5a defines the DG attributes, and Table 6.12.5b defines the signal and parameter attributes.

Table 6.12.5a — DG definition

DG attribute	Value
Name	AAS_SENSOR_STATUS
DGN	1FFEFh
Default priority	3
Maximum broadcast rate	1000 ms
Normal broadcast rate	On Change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.12.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 1	Left front sensor status - Low ride	bit	-	00b - Under set point 01b - Over set point
	2 to 3	Left front sensor Status - Medium ride	bit	-	00b - Under set point 01b - Over set point
	4 to 5	Left front sensor status - High ride	bit	-	00b - Under set point 01b - Over set point
	6 to 7	Left front sensor transition	bit	-	00b – No Transition 01b – Transition was made (low->high or high->low)
1	0 to 1	Left front quadrature encoder status - ChannelA	bit	-	00b - 0 01b - 1
	2 to 3	Left front quadrature encoder status - Channel B	bit	-	00b - 0 01b - 1
2	0 to 1	Right front sensor status - Low ride	bit	-	00b - Under set point 01b - Over set point
	2 to 3	Right front sensor status - Medium ride	bit	-	00b - Under set point 01b - Over set point

	4 to 5	Right front sensor status - High ride	bit	-	00b - Under set point 01b - Over set point
	6 to 7	Right front sensor transition	bit	-	00b – No Transition 01b – Transition was made (low->high or high->low)
3	0 to 1	Right front quadrature encoder status - ChannelA	bit	-	00b - 0 01b - 1
	2 to 3	Right front quadrature encoder status - Channel B	bit	-	00b - 0 01b - 1
	4 to 5	Steering sensor quadrature encoder status – Channel A	bit	-	00b - 0 01b - 1
	6 to 7	Steering sensor quadrature encoder status – Channel B	bit	-	00b - 0 01b - 1
4	0 to 1	Left rear sensor status - Low ride	bit	-	00b - Under set point 01b - Over set point
	2 to 3	Left rear sensor status - Medium ride	bit	-	00b - Under set point 01b - Over set point
	4 to 5	Left rear sensor status - High ride	bit	-	00b - Under set point 01b - Over set point
	6 to 7	Left rear sensor transition	bit	-	00b – No Transition 01b – Transition was made (low->high or high->low)
5	0 to 1	Left rear quadrature encoder status - ChannelA	bit	-	00b – 0 01b - 1
	2 to 3	Left rear quadrature encoder status - Channel B	bit	-	00b – 0 01b - 1
6	0 to 1	Right rear sensor status - Low ride	bit	-	00b - Under set point 01b - Over set point
	2 to 3	Right rear sensor status - Medium ride	bit	-	00b - Under set point 01b - Over set point
	4 to 5	Right rear sensor status - High ride	bit	-	00b - Under set point 01b - Over set point
	6 to 7	Right rear sensor transition	bit	-	00b – No Transition 01b – Transition was made (low->high or high->low)
7	0 to 1	Right rear quadrature encoder status - ChannelA	bit	-	00b – 0 01b - 1

	2 to 3	Right rear quadrature encoder status - Channel B	bit	-	00b – 0 01b - 1

6.12.6 Air Suspension Pressure Status

This DG reports the air pressures within the suspension. Table 6.12.6a defines the DG attributes, and Table 6.12.6b defines the signal and parameter attributes.

Table 6.12.6a – DG definition

DG attribute	Value
Name	SUSPENSION_AIR_PRESSURE_STATUS
PGN	1FED1h
Default priority	3
Maximum broadcast rate	N/A
Normal broadcast rate	100 ms
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.12.6b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0		Suspension System Supply Pressure	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
1		Steer Axle, Left Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
2		Steer Axle, Right Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
3		Drive Axle, Left Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
4		Drive Axle, Right Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
5		Tag Axle, Left Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa
6		Tag Axle, Right Air Spring	uint8	kPa	Precision = 8kPa Value Range = 0 to 2000kPa

6.12.7 Service Points

These are the allowable Service Points for this DGN (see Table 6.12.7).

Table 6.12.7— Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Left Front Sensor Mode
257	Right Front Sensor Mode
258	Right Rear Sensor Mode
259	Left Rear Sensor Mode
260	Height Correction Threshold Time
261	Solenoid On Time
262	AAS Mode
263	Left Front Sensor - Low Ride
264	Left Front Sensor - Medium Ride
265	Left Front Sensor - High Ride
266	Left Front Quadrature Encoder - Channel A
267	Left Front Quadrature Encoder - Channel B
268	Right Front Sensor - Low Ride
269	Right Front Sensor - Medium Ride
270	Right Front Sensor - High Ride
271	Right Front Quadrature Encoder - Channel A
272	Right Front Quadrature Encoder - Channel B
273	Left Rear Sensor - Low Ride
274	Left Rear Sensor - Medium Ride
275	Left Rear Sensor - High Ride
276	Left Rear Quadrature Encoder - Channel A
277	Left Rear Quadrature Encoder - Channel B
278	Right Rear Sensor - Low Ride
279	Right Rear Sensor - Medium Ride
280	Right Rear Sensor - High Ride
281	Right Rear Quadrature Encoder - Channel A
282	Right Rear Quadrature Encoder - Channel B

6.13 Leveling System Control Panel

6.13.1 Introduction

These DGs provide user control for an RV leveling system. It is monitored by both the air and the conventional leveling systems. The following formats apply (see Table 6.13.1).

Table 6.13.1 — Leveling system control panel definition

Device attribute	Value
Category	Mechanical Components
Default Source Address	81
Dynamic Address Range	176 to 191
Instance	Single

6.13.2 Leveling Control Command

This is the primary DGN command for controlling the leveling systems. The Operating Mode determines the nature of the command. When a manual mode is chosen (#4 or #6), the remainder of the DGN must be analyzed to determine which jacks or bags are being controlled. In the other modes the rest of the DGN is ignored.

There are two general methods for levellers to be addressed. In a conventional four-point system, they are labelled left-front, right-front, left-rear, and right-rear. In a bi-axis system, units move in pairs and are labelled front, rear, left, and right. In three-point system they are front, left rear, and right rear.

Table 6.13.2a defines the DG attributes, and Table 6.13.2b defines the signal and parameter attributes.

Table 6.13.2a — DG definition

DG attribute	Value
Name	LEVELING_CONTROL_COMMAND
DGN	1FFEEh
Default priority	3
Maximum broadcast rate	100 ms when manually controlling the system
Normal broadcast rate	on change
Minimum broadcast rate	No minimum
Number of frames	1
ACK requirements	ACK, LEVELING_CONTROL_STATUS

Table 6.13.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition

0	-	Operating mode	uint8	-	0 – Inactive 1 - Suspension raise (all bags) started 2 - Suspension dump (all bags) started 3 - Store started (store jacks/go to ride height) 4 - Manual air leveling 5 - Automatic air leveling started 6 - Start deploy kick-down jacks 7 - Manual hydraulic leveling 8 - Automatic hydraulic leveling started 9 - Kneel started (dump front bags only) 71 - Manual hydraulic leveling - Four point 72 - Manual hydraulic leveling - Biax mode 73 - Manual hydraulic leveling - 3 point mode
1	0 to 1	Lower - Left rear (four point) - Rear (bi-axis) - Left rear (three point)	bit	-	00b - No action 01b - Lower
	2 to 3	Raise - Left rear (four point) - Rear (bi-axis) - Left rear (three point)	bit	-	00b - No action 01b - Raise
	4 to 5	Lower - Right front (four point) - Front (bi-axis) - N/A (three point)	bit	-	00b - No action 01b - Lower
	6 to 7	Raise - Right front (four point) - Front (bi-axis) - N/A (three point)	bit	-	00b - No action 01b - Raise
2	0 to 2	Lower - Right rear (four point) - Right (bi-axis) - Right rear (three point)	bit	-	00b - No action 01b - Lower
	2 to 3	Raise - Right rear (four point) - Right (bi-axis) - Right rear (three point)	bit	-	00b - No action 01b - Raise
	4 to 5	Lower - Left front (four point) - Left (bi-axis) - Front (three point)	bit	-	00b - No action 01b - Lower
	6 to 7	Raise - Left front (four point) - Left (bi-axis) - Front (three point)	bit	-	00b - No action 01b - Raise

6.13.3 Service Points

These are the allowable Service Points for this DGN (see Table 6.13.3).

Table 6.13.3 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Keypad

6.14 Leveling System Controller

6.14.1 Introduction

These DGs provide an interface for the controller for an RV leveling system. It may include an integrated control panel. No provisions have been made for two leveling controllers in the system. The protocol as defined only allows a single controller that has both air and hydraulic modes. The following formats apply (see Table 6.14.1).

Table 6.14.1 — Leveling system controller definition

Device attribute	Value
Category	Mechanical Components
Default Source Address	81 for Controller Only 82 for Hydraulic System 83 for Air System
Dynamic Address Range	176 to 191
Instance	Single

6.14.2 Leveling Control Status

This is the primary status response for controlling leveling systems. The addressing of the jacks or bags follows the convention in LEVELING_CONTROL_COMMAND. Note that the Air and Hydraulic levelers share this DGN when reporting their status. The first byte indicates whether the Lower/Raise operations in subsequent bytes refer to air or hydraulic actions. Table 6.14.2a defines the DG attributes, and Table 6.14.2b defines the signal and parameter attributes.

Table 6.14.2a — DG definition

DG attribute	Value
Name	LEVELING_CONTROL_STATUS
DGN	1FFEDh
Default priority	3
Maximum broadcast rate	1000 ms when system active
Normal broadcast rate	On change
Minimum broadcast rate	100 ms when system active
Number of frames	1
ACK requirements	None

Table 6.14.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0		Operating mode	uint8	-	0 - Inactive 1 - Suspension raise (all bags) started 2 - Suspension dump (all bags) started 3 - Store started (store jacks/go to ride height) 4 - Manual air leveling. 5 - Automatic air leveling started 6 - Start deploy kick-down jacks 7 - Manual hydraulic leveling 8 - Automatic hydraulic leveling started 9 - Kneel started (dump front bags only) 71 - Manual hydraulic leveling - Four point 72 - Manual hydraulic leveling - Biax mode 73 - Manual hydraulic leveling - 3 point mode
1	0 to 1	Hydraulic stabilization status	bit	-	00b - Hydraulic stabilization not in process 01b - Automatic stabilization in process
	2 to 3	Air leveling sleep mode	bit	-	00b - Air leveling in active mode 01b - Air leveling in sleep mode (Unit shall awaken periodically to re-level RV)
	4 to 5	Air re-leveling mode	bit	-	00b - Re-leveling not active 01b - Air re-leveling in process
2	0 to 1	Excessive slope initial warning	bit	-	00b - No warning 01b – Warning (excessive slope prevents leveling; unit shall try again later)
	2 to 3	Excessive slope final warning	bit	-	00b - No warning 01b – Warning (excessive slope prevents leveling; no further attempt shall be made)
	4 to 5	Leveling system master warning	bit	-	00b - No warning 01b - Warning
3	0 to 1	Lower - Left rear (four point) - Rear (bi-axis) - Left rear (three point)	bit	-	00b - No action 01b - In process
	2 to 3	Raise - Left rear (four point) - Rear (bi-axis) - Left rear (three point)	bit	-	00b - No action 01b - In process
	4 to 5	Lower - Right front (four point) - Front (bi-axis) - N/A (three point)	bit	-	00b - No action 01b - In process

	6 to 7	Raise - Right front (four point) - Front (bi-axis) - N/A (three point)	bit	-	00b - No action 01b - In process
4	0 to 1	Lower - Right rear (four point) - Right (bi-axis) - Right rear (three point)	bit	-	00b - No action 01b - In process
	2 to 3	Raise - Right rear (four point) - Right (bi-axis) - Right rear (three point)	bit	-	00b - No action 01b - In process
	4 to 5	Lower - Left front (four point) - Left (bi-axis) - Front (three point)	bit	-	00b - No action 01b - In process
	6 to 7	Raise - Left front (four point) - Left (bi-axis) - Front (three point)	bit	-	00b - No action 01b - In process

6.14.3 Hydraulic Jacks Status

This is the primary status response for controlling the leveling systems. The addressing of the jacks or bags follows the convention in LEVELING_CONTROL_COMMAND. The Auxiliary Jack provisions enable the addressing of more than four jacks, which occasionally occurs in some unusual applications. Table 6.14.3a defines the DG attributes, and Table 6.14.3b defines the signal and parameter attributes.

Table 6.14.3a — DG definition

DG attribute	Value
Name	LEVELING_JACK_STATUS
DGN	1FFECh
Default priority	3
Maximum broadcast rate	1000 ms when system active
Normal broadcast rate	on change
Minimum broadcast rate	50 ms when system active
Number of frames	1
ACK requirements	None

Table 6.14.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition

0	0 to 3	Jack type	uint4	-	0 - Conventional Hydraulic 1 - Kick-Down
	4 to 7	Number of jacks	uint4	-	
1	0 to 2	Extension - Left rear (four point) - Left rear (three point)	bit	-	00b - No Action 01b - Jack is Extended. Coach is not safe to move.
	2 to 3	Extension - Right front (four point) - N/A (three point)	bit	-	00b - No Action 01b - Jack is Extended. Coach is not safe to move.
	4 to 5	Extension - Right rear (four point) - Right rear (three point)	bit	-	00b - No Action 01b - Jack is Extended. Coach is not safe to move.
	6 to 7	Extension - Left front (four point) - Front (three point)	bit	-	00b - No action 01b - Jack is extended. Coach is not safe to move.
2	0 to 1	Extension - Auxiliary jack #1	bit	-	00b - No action 01b – Jack is extended. Coach is not safe to move.
	2 to 3	Extension - Auxiliary jack #2	bit	-	00b - No action 01b – Jack is extended. Coach is not safe to move.
	4 to 5	Extension - Auxiliary jack #3	bit	-	00b - No action 01b – Jack is extended. Coach is not safe to move.
	6 to 7	Extension - Auxiliary jack #4	bit	-	00b - No action 01b – Jack is extended. Coach is not safe to move.
3	0 to 1	Stability - Left rear (four point) - Left rear (three point)	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	2 to 3	Stability - Right front (four point) - N/A (three point)	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	4 to 5	Stability - Right rear (four point) - Right rear (three point)	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	6 to 7	Stability - Left front (four point) - Front (three point)	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.

4	0 to 1	Stability - Auxiliary jack #1	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	2 to 3	Stability - Auxiliary jack #2	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	4 to 5	Stability - Auxiliary jack #3	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.
	6 to 7	Stability - Auxiliary jack #4	bit	-	00b - No action 01b - Pressure detected. Jack is bearing weight on the ground.

6.14.4 Level Sensor Status

Level sensors may be analog or simple switches. Instancing is optional for Level Sensors. Some systems may have a single sensor, in which case Byte 7 can be filled with FFh. Table 6.14.4a defines the DG attributes, and Table 6.14.4b defines the signal and parameter attributes.

Table 6.14.4a — DG definition

DG attribute	Value
Name	LEVELING_SENSOR_STATUS
DGN	1FFEBh
Default priority	3
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	50 ms when system active
Number of frames	1
ACK requirements	None

Table 6.14.4b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value Definition
0	0 to 1	Vehicle attitude – Driver side	bit	-	00b - Side is at or above level 01b - Side is below level
	2 to 3	Vehicle attitude – Front	bit	-	00b - Side is at or above level 01b - Side is below level
	4 to 5	Vehicle attitude – Passenger side	bit	-	00b - Side is at or above level 01b - Side is below level
	6 to 7	Vehicle attitude – Rear	bit	-	00b - Side is at or above level 01b - Side is below level
1 to 2	-	Pitch	uint16	Deg	Precision = 1/128 Deg Offset = –200 Deg Value range = –200 to 300 Deg

					Negative = Driver side is low Positive = Driver side is high 0 = Level
3 to 4	-	Roll	uint16	Deg	Precision = 1/1 28 Deg 0ffset = –200 Deg Value range = –200 to 300 Deg Negative = Nose is low Positive = Nose is high 0 = Level
5 to 6	-	Secondary Pitch	uint16	Deg	Precision = 1/128 Deg Offset = –200 Deg Value range = –200 to 300 Deg Negative = Driver side is low Positive = Driver side is high 0 = Level
7	-	Instance	uint8	-	Sensor Instance, if multiple sensors are installed. 0xFF otherwise.

6.14.5 Hydraulic Pump Status

The hydraulic pump may also be used for slide room control. Table 6.14.5a defines the DG attributes, and Table 6.14.5b defines the signal and parameter attributes.

Table 6.14.5a — DG definition

DG attribute	Value
Name	HYDRAULIC_PUMP_STATUS
DGN	1FFEAh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	200 ms
Number of frames	1
ACK requirements	None

Table 6.14.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 1	Pump manifold high pressure switch	bit	-	00b - Switch is inactive 01b - Maximum pressure is attained
	2 to 3	Pump manifold minimum pressure switch	bit	-	00b - Switch is inactive 01b - Minimum operating pressure attained
	4 to 5	Pump manifold low fluid switch	bit	-	00b - Switch is inactive 01b - Low fluid level detected

	6 to 7	Pump Run Status	bit	-	00b - Pump is not running 01b - Pump is running
1	0 to 1	Pump Direction	bit	-	00b - Pump is running forwards 01b - Pump is reversed, or a reversing valve is active
2 to 3	-	Voltage	uint16	V	see Table 5.3
4	-	Current	uint8	A	see Table 5.3
5	-	Motor temperature	uint8	°C	see Table 5.3

6.14.6 Hydraulic Pump Command

The hydraulic pump may also be used for slide room control. Table 6.14.6a defines the DG attributes, and Table 6.14.6b defines the signal and parameter attributes.

Table 6.14.6a — DG definition

DG attribute	Value
Name	HYDRAULIC_PUMP_COMMAND
DGN	1FEBCh
Default priority	6
Maximum broadcast rate	100 ms when commanding pump on
Normal broadcast rate	on change
Minimum broadcast rate	No minimum
Number of frames	1
ACK requirements	ACK, HYDRAULIC_PUMP_STATUS

Table 6.14.6b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 1	Pump Run	bit	-	00b - Command Pump Off 01b - Command Pump On
	2 to 3	Pump Direction	bit	-	00b - Pump to run forwards 01b - Pump to run reversed, or a reversing valve is activated

6.14.7 Air Leveling Status

This is the air leveling equivalent to the hydraulic jack status above. Table 6.14.7a defines the DG attributes, and Table 6.14.7b defines the signal and parameter attributes.

Table 6.14.7a — DG definition

DG attribute	Value
Name	LEVELING_AIR_STATUS

DGN	1FFE9h
Default priority	3
Maximum broadcast rate	1000 ms when system active
Normal broadcast rate	on change
Minimum broadcast rate	50 ms when system active
Number of frames	1
ACK requirements	None

Table 6.14.7b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	0 to 1	Air bag pressure - Left rear (four point) - Left rear (three point)	bit	-	00b - Pressure OK 01b - Low air pressure detected
	2 to 3	Air bag pressure - Right front (four point) - N/A (three point)	bit	-	00b - Pressure OK 01b - Low air pressure detected
	4 to 5	Air bag pressure - Right rear (four point) - Right rear (three point)	bit	-	00b - Pressure OK 01b - Low air pressure detected
	6 to 7	Air bag pressure - Left front (four point) - Front (three point)	bit	-	00b - Pressure OK 01b - Low air pressure detected
1	0 to 1	Tag axle air pressure - Left	bit	-	00b - Pressure OK 01b - Low air pressure detected
	2 to 3	Tag axle air pressure - Right	bit	-	00b - Pressure OK 01b - Low air pressure detected
2	0 to 1	System air pressure	bit	-	00b - Pressure OK 01b - Low air pressure detected

6.14.8 Service Points

These are the allowable Service Points for this DGN (see Table 6.14.8).

Table 6.14.8 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Jack Extension Sensor - Left Rear
257	Jack Extension Sensor - Right Front
258	Jack Extension Sensor - Right Rear

259	Jack Extension Sensor - Left Front (four point) / Front (three point)
260	Jack Extension Sensor - Auxiliary Jack #1
261	Jack Extension Sensor - Auxiliary Jack #2
262	Jack Extension Sensor - Auxiliary Jack #3
263	Jack Extension Sensor - Auxiliary Jack #4
264	Jack Stability Sensor - Left Rear
265	Jack Stability Sensor - Right Front
266	Jack Stability Sensor - Right Rear
267	Jack Stability Sensor - Left Front (four point) / Front (three point)
268	Jack Stability Sensor - Auxiliary Jack #1
269	Jack Stability Sensor - Auxiliary Jack #2
270	Jack Stability Sensor - Auxiliary Jack #3
271	Jack Stability Sensor - Auxiliary Jack #4
272	Vehicle Attitude Sensor
273	Pitch

SPN	Description
274	Roll
275	Secondary Pitch
276	Hydraulic Pump manifold high pressure switch
277	Hydraulic Pump manifold minimum pressure switch
278	Hydraulic Pump manifold low fluid switch
279	Hydraulic Pump Run Status
280	Hydraulic Pump Motor Voltage
281	Hydraulic Pump Motor Current
282	Hydraulic Pump Motor Temperature
284	Air Bag Pressure Sensor – Left Rear
285	Air Bag Pressure Sensor – Right Front (four point)
286	Air Bag Pressure Sensor – Right Rear
287	Air Bag Pressure Sensor – Left Front (four point) / Front (three point)
288	Tag Axle Air Pressure Sensor – Left
289	Tag Axle Air Pressure Sensor – Right
290	System Air Pressure Sensor
291	Air Compressor Run Status

6.15 Slide Room

These DGs contains control information for the slide rooms, including generator and step slides. Convention numbers room slides beginning with room 1 at the driver's side front and increments counter clockwise to room 4 at passenger side front. Exceptions to this convention occur when there are fewer than 4 rooms. For example: If there are 3 rooms but there is no passenger side rear room, the passenger side front is room 3 rather than room 4. The following formats apply (see Table 91).

Table 6.15 — Slide room definition

Device attribute	Value
Category	Mechanical Components
Default Source Address	84 to 87
Dynamic Address Range	176 to 191
Instance	Multiple

6.15.1 Slideout Status

Many of the status items in the DGN are data items that may be derived from other nodes on the network. For example, the Brake Status here may be derived from the Park Brake Status from CHASSIS_MOBILITY_STATUS. The specific meaning here is that the slide is prevented from moving because it believes that the park brake is not set. Other nodes should consult the CHASSIS_MOBILITY_STATUS to determine whether the brake is actually set, not this DGN. Table 6.15.1a defines the DG attributes, and Table 6.15.1b defines the signal and parameter attributes.

Table 6.15.1a — DG definition

DG attribute	Value
Name	SLIDE_STATUS
DGN	1FFE8h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change 100 ms when slide is in motion.
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.15.1b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	1 - Room 1 2 - Room 2 3 - Room 3 4 - Room 4 5 – Generator 6 – Step 7 - Step cover
1	-	Motion	uint8	-	0 - No motion 1 – Extending 2 - Retracting
2	-	Position	uint8	%	see Table 5.3 0 – Retracted 200 - 100% Extended Products that only know that the slide is neither in nor out shall report 50%.
3	0 to 1	Lock status	bit	-	00b - Slide is secured 01b - Slide is not secured
	2 to 3	Unlock status	bit	-	00b - Slide is unlocked and ready to move 01b - Slide is not unlocked and shall not be moved
	5 to 6	User lock status	bit	-	00b - User lock is not activated (Slide is OK to move) 01b - User lock is activated (Slide shall not move)
	6 to 7	Brake status	bit	-	00b - All motor brake are not locked 01b - One or more motor brake is locked
4	0 to 1	Park brake	bit	-	00b - Slide may move

					01b - Slide shall not move because of park brake status
	2 to 3	Leveling jacks	bit	-	00b - Slide may move 01b - Slide shall not move because of leveler status
	4 to 5	Ignition key	bit	-	00b - Slide may move 01b - Slide shall not move because of ignition status
	6 to 7	Air seal	bit	-	00b - Slide may move 01b - Slide shall not move because of air seal status
5	0 to 1	Low voltage	bit	-	00b - Slide may move 01b - Slide shall not move because of low voltage status

6.15.2 Slideout Command

This DGN triggers slide actions. The Direction of Movement command to Extend or Retract must be repeated every 100ms to keep the slide in motion. If a longer gap occurs, the slide should stop automatically for safety. The Direction of Movement to Stop does not need to be repeated, but it should be sent to stop the motion.

Table 6.15.2a defines the DG attributes, and Table 6.15.2b defines the signal and parameter attributes.

Table 6.15.2a — DG definition

DG attribute	Value
Name	SLIDE_COMMAND
DGN	1FFE7h
Default priority	3
Maximum broadcast rate	N/A
Normal broadcast rate	on change 100 ms when slide is in motion
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, SLIDE_STATUS

Table 6.15.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	1 - Room 1 2 - Room2 3 - Room3 4 - Room4 5 - Generator

					6 - Step 7 - Step cover
1	0 to 1	User lock	bit	-	00b - Release user lock 01b - Set user lock
	2 to 3	Air seal deflate	bit	-	00b – Off 01b - Begin deflation
	4 to 5	Air seal vacuum	Bit	-	00b - Off 01b - Begin evacuation
	6 to 7	Mechanical lock	Bit	-	00b - Disengage lock 01b - Engage lock
2	-	Direction of movement	uint8	-	0 - Stop 1 - Extend 2 - Retract

6.15.3 Slide Sensor Status

If the slide has sensors to detect its position and the status of various locks and switches, this is the DGN to report that information. Table 6.15.3a defines the DG attributes, and Table 6.15.3b defines the signal and parameter attributes.

Table 6.15.3a — DG definition

DG attribute	Value
Name	SLIDE_SENSOR_STATUS
DGN	1FFE6h
Default priority	6
Maximum broadcast rate	500 ms when slide is in motion
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.15.3b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	1 - Room 1 2 - Room2 3 - Room3 4 - Room4 5 - Generator 6 - Step 7 - Step cover
1	0 to 1	Slide lock limit switch -	bit	-	00b - Slide is not locked

		Upper front			01b - Slide is locked
	2 to 3	Slide lock limit switch - Upper rear	bit	-	00b - Slide is not locked 01b - Slide is locked
	4 to 5	Slide lock limit switch - Lower front	bit	-	00b - Slide is not locked 01b - Slide is locked
	6 to 7	Slide lock limit switch - Lower rear	bit	-	00b - Slide is not locked 01b - Slide is locked
2	0 to 1	Slide unlock limit switch – Upper front	bit	-	00b - Slide is not unlocked 01b - Slide is unlocked
	2 to 3	Slide unlock limit switch - Upper rear	bit	-	00b - Slide is not unlocked 01b - Slide is unlocked
	4 to 5	Slide unlock limit switch - Lower front	bit	-	00b - Slide is not unlocked 01b - Slide is unlocked
	6 to 7	Slide unlock limit switch - Lower rear	bit	-	00b - Slide is not unlocked 01b - Slide is unlocked
3	0 to 1	Slide retraction limit switch - Upper front	bit	-	00b - Slide is not retracted 01b - Slide is retracted
	2 to 3	Slide retraction limit switch - Upper rear	bit	-	00b - Slide is not retracted 01b - Slide is retracted
	4 to 5	Slide retraction limit switch - Lower front	bit	-	00b - Slide is not retracted 01b - Slide is retracted
	6 to 7	Slide retraction limit switch - Lower rear	bit	-	00b - Slide is not retracted 01b - Slide is retracted
4	0 to 1	Slide extension limit switch - Upper front	bit	-	00b - Slide is not extended 01b - Slide is extended
	2 to 3	Slide extension limit switch - Upper rear	bit	-	00b - Slide is not extended 01b - Slide is extended
	4 to 5	Slide extension limit switch - Lower front	bit	-	00b - Slide is not extended 01b - Slide is extended
	6 to 7	Slide extension limit switch - Lower rear	bit	-	00b - Slide is not extended 01b - Slide is extended
5	0 to 1	Retractable floor limit switch - Up	bit	-	00b - Retractable floor is not up 01b - Retractable floor is up
	2 to 3	Retractable floor limit switch - Down	bit	-	00b - Retractable floor is not retracted 01b - Retractable floor is retracted

6	0 to 1	Air seal vacuum switch	bit	-	00b - Air seal is not evacuated 01b - Air seal is evacuated

6.15.4 Slide Motor Status

Electric slides may have multiple motors. This DGN provides status information about them. Table 6.15.4a defines the DG attributes, and Table 6.15.4b defines the signal and parameter attributes.

Table 6.15.4a — DG definition

DG attribute	Value
Name	SLIDE_MOTOR_STATUS
DGN	1FFE5h
Default priority	6
Maximum broadcast rate	500 ms when slide is in motion
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.15.4b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	1 - Room 1 2 - Room2 3 - Room3 4 - Room4 5 - Generator 6 - Step 7 - Step cover
1 to 2	-	Voltage	uint16	V	see Table 5.3
3	-	Current – Motor 1	uint8	A	see Table 5.3
4	-	Current – Motor 2	uint8	A	see Table 5.3
5	-	Current – Motor 3	uint8	A	see Table 5.3
6	-	Current – Motor 4	uint8	A	see Table 5.3

6.15.5 Service Points

As with other multi-instance items, SPNs assigned to a specific instance are coded with a nonzero value in the Most Significant byte (MSB) and the Instance in the Intermediate Significant byte (ISB). These are the allowable Service Points for this DGN (see Table 6.15.5). The least significant bits (LSb) may vary.

Table 6.15.5 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-

			FFh are Standard SPNs – see Table 7.3
0	32	0	User Lock
0	32	1	(Unused)
0	32	2	Park Brake
0	32	3	Leveling Jacks
0	32	4	Ignition Key
0	32	5	Voltage
1	Instance	0	Motion
1	Instance	1	Position
1	Instance	2	Lock Status
1	Instance	3	Unlock Status
1	Instance	4	Air Seal
2	Instance	0	Slide Lock Limit Switch – Upper Front
2	Instance	1	Slide Lock Limit Switch – Upper Rear
2	Instance	2	Slide Lock Limit Switch – Lower Front
2	Instance	3	Slide Lock Limit Switch – Lower Rear
3	Instance	0	Slide Unlock Limit Switch – Upper Front
3	Instance	1	Slide Unlock Limit Switch – Upper Rear
3	Instance	2	Slide Unlock Limit Switch – Lower Front
3	Instance	3	Slide Unlock Limit Switch – Lower Rear
4	Instance	0	Slide Retraction Limit Switch – Upper Front
4	Instance	1	Slide Retraction Limit Switch – Upper Rear
4	Instance	2	Slide Retraction Limit Switch – Lower Front
4	Instance	3	Slide Retraction Limit Switch – Lower Rear
5	Instance	0	Slide Extension Limit Switch – Upper Front
5	Instance	1	Slide Extension Limit Switch – Upper Rear
5	Instance	2	Slide Extension Limit Switch – Lower Front
5	Instance	3	Slide Extension Limit Switch – Lower Rear
6	Instance	0	Retractable Floor Limit Switch – Up
6	Instance	1	Retractable Floor Limit Switch – Down
6	Instance	2	Air Seal Vacuum Switch
7	Instance	0	Current – Motor 1
7	Instance	1	Current – Motor 2
7	Instance	2	Current – Motor 3
7	Instance	3	Current – Motor 4
8	Instance	0	Motor Brake – Motor 1
8	Instance	1	Motor Brake – Motor 2

8	Instance	2	Motor Brake – Motor 3
8	Instance	3	Motor Brake – Motor 4
9	Instance	0	Voltage
9	Instance	1	Motor Brake Control

6.16 Furnace

6.16.1 Introduction

The furnace is a primary source of comfort heat in the RV. Heat elements that are part of an air conditioning unit are supported under Air Conditioner. Table 6.16.1 defines the furnace DGs.

Table 6.16.1 — Furnace definition

Device attribute	Value
Category	Comfort systems
Default Source Address	94 to 96
Dynamic Address Range	192 to 207
Instance	Multiple

Multiple source addresses are allocated, but furnaces are identified by the Instance in each DGN. These correspond to “zones” in the general terminology. There is no set definition for the location of each zone in a coach.

The furnace generally operates in an “automatic” mode, consulting the thermostat assigned to the same Instance for the necessary temperature and user input data. The mode may be overridden for diagnostic purposes, or as part of a larger climate control scheme.

Systems that use multiple heat exchangers with a single combustion unit should report as multiple instances. Each heat exchanger reports as a “furnace”, with the fan speed set appropriately and the heat output level being that of the central combustion unit. Commands to set the heat output level for any instance should be applied to the central unit.

6.16.2 Furnace Status

This is the general furnace status DGN. Table 6.16.2a defines the DG attributes, and Table 6.16.2b defines the signal and parameter attributes.

Table 6.16.2a — DG definition

DG attribute	Value
Name	FURNACE_STATUS
DGN	1FFE4h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.16.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	0 to 1	Operating mode	bit	-	00b — Automatic 01b — Manual (Furnace shall ignore thermostat information.)
	2 to 7	Heat source	uint6	-	0 — Combustion 1 — AC power primary 2 — AC power secondary 3 — Engine heat
2	-	Circulation fan speed	uint8	%	see Table 5.3 One-speed fans shall use 0% and 100%. Two-speed fans shall use 0%, 50%, and 100%.
3	-	Heat output level	uint8	%	see Table 5.3
4	-	Dead band	uint8	°C	Precision = 0,1 °C Value range = 0,0 to 25,0 °C This is the amount over and under the set point that the furnace will tolerate. A larger value reduces cycling.
5	-	Second stage dead band	uint8	°C	Precision = 0,1 °C Value range = 0,0 to 25,0 °C This is the amount over the set point that will trigger a second stage (“high power”), if available on the furnace.

6.16.3 Furnace Command

This DGN allows external control of the furnace. The format is identical to FURNACE_STATUS. An Instance of Zero indicates that the settings should be applied to all furnace instances. Values of 255 indicate that the particular datum should not be changed. Table 6.16.3 defines the DG attributes, and Table 6.16.2b defines the signal and parameter attributes.

Table 6.16.3 — DG definition

DG attribute	Value
Name	FURNACE_COMMAND
DGN	1FFE3h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, FURNACE_STATUS

6.16.4 Service Points

The SPNs follow the general method for multi-instance products. Faults are reported with the Instance in the Intermediate Byte (ISB) and a non-zero value in the Most Significant Byte (MSB). In the case of a single node controlling multiple instances (for example, a hydronic heat system with multiple heat exchangers) an ISB of zero indicates the fault applies to the central controller. These are the allowable Service Points for this DGN (see Table 6.16.4).

Table 6.16.4 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Fan
1	Instance	1	Heat Source – Combustion
1	Instance	2	Heat Source – Primary AC
1	Instance	3	Temperature
1	Instance	4	Heat Source – Secondary AC
1	Instance	5	Heat Source – Engine Heat

6.17 Thermostat

6.17.1 Introduction

The furnace is a primary user input to the climate control. This device accepts no commands and takes no explicit actions. Instead, the furnace and air conditioners receive the thermostat DGN and take action according to their own programming. Of course, the thermostat may be physically part of some other device, including the furnace.

The Instances correspond directly to the Instances of the furnace and air conditioners. The following formats apply (see Table 6.17.1).

Table 6.17.1 — Thermostat definition

Device attribute	Value
Category	Comfort systems
Default Source Address	88 to 93
Dynamic Address Range	192 to 207
Instance	Multiple

Multiple source addresses are allocated, but thermostats are identified by the Instance in each DGN. These correspond to “zones” in the general terminology. There is no set definition for the location of each zone in a coach.

6.17.2 Thermostat Status 1

This communicates user intentions. Table 6.17.2a defines the DG attributes, and Table 6.17.2b defines the signal and parameter attributes.

Table 6.17.2a — DG definition

DG attribute	Value
Name	THERMOSTAT_STATUS_1

DGN	1FFE2h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.17.2b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	0 to 3	Operating mode	bit4	-	0000b — Off 0001b — Cool 0010b — Heat 0011b — Auto heat/Cool 0100b — Fan only
	4 to 5	Fan mode	bit	-	00b — Auto 01b — On Note that this is different than the “Fan Only” above. This forces the fan to be on all the time, but allows the heat and cool turn on and off according to the Operating Mode.
	6 to 7	Schedule mode	bit	-	00b — Disabled 01b — Enabled If enabled, the set point will change according to a programmed schedule.
2	-	Fan speed	uint8	%	see Table 5.3 One-speed fans shall interpret any nonzero value as “On”.
3 to 4	-	Setpoint temp – Heat	uint16	Deg C	see Table 5.3
5 to 6	-	Setpoint temp – Cool	uint16	Deg C	see Table 5.3

6.17.3 Thermostat Status 2

This communicates user intentions. Table 6.17.3a defines the DG attributes, and Table 6.17.3b defines the signal and parameter attributes.

Table 6.17.3a — DG definition

DG attribute	Value
Name	THERMOSTAT_STATUS_2
DGN	1FEFAh
Default priority	6

Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.17.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Current schedule instance	uint8	-	see Table 5.3 Indicates which schedule instance is currently active.
2	-	Number of schedule instances	uint8	-	Indicates total capacity for schedule instances.

6.17.4 Thermostat Command 1

This DGN allows a device to communicate user intentions to a thermostat. For example, the thermostat device may be a wall thermostat with its own user interface. These two DGNs would allow a service tool or second display device to make settings at that thermostat. Table 6.17.4a defines the DG attributes, and Table 6.17.2b defines the signal and parameter attributes.

Table 6.17.4a — DG definition

DG attribute	Value
Name	THERMOSTAT_COMMAND_1
DGN	1FEF9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, THERMOSTAT_STATUS_1

6.17.5 Thermostat Command 2

This DGN provides several methods to manual adjustment the set point. If Schedule Mode is Enabled while the setpoint is manual adjusted, the setpoint will change with the next scheduled change. If Schedule Mode is Disabled, then the setpoint will not change. Some thermostats may automatically revert to the original setpoint after a period of time. This behavior is not specifically addressed in this DGN.

To put the thermostat in a “Storage” mode, this DGN should be used in conjunction with THERMOSTAT_COMMAND_1 and the Schedule Mode should be set to Disabled. To force the thermostat to resume the scheduled mode the Current Schedule Instance should be set to 251. For example, when brin ging the thermostat out of Storage (Instance 250), the Instance should be set to 251. The thermostat should check its schedule and choose the appropriate Instance (e.g. “Wake”) accordingly. Table 6.17.5a

defines the DG attributes, and Table 6.17.5b defines the signal and parameter attributes.

Table 6.17.5a — DG definition

DG attribute	Value
Name	THERMOSTAT_COMMAND_2
DGN	1FEF8h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, THERMOSTAT_STATUS_2

Table 6.17.5b— Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Current schedule instance	uint8	-	see Table 5.3 251 — Reset to “current” instance. Shall Force the unit into the indicated mode.

6.17.6 Thermostat Scheduling - Introduction

These DGs allow the programming of scheduled changes in the Setpoints. Note that each “Zone” Instance may have several Schedule Instances.

There is no specific process to coordinate the schedules across multipl e zones. If a single thermostat handles all zones, it is the designer's decision whether to have all zones follow the same schedule. If there are multiple thermostats, each will have its own schedule.

Schedule Instances indicate that specific changes in set points will occur at specific times. Although terminology such as “Sleep” and “Wake” are defined, there is no enforcement of these conventions. There are no provisions for adjusting the schedule for the day of the week. If the user desired to have a different schedule for Saturday than for the rest of the week, different Instances must be programmed for that day.

A request for these DGNs should result in the reporting of all Schedule Instances available for the device.

6.17.7 Thermostat Schedule Status 1

Table 6.17.7a defines the DG attributes, and Table 6.17.7b defines the signal and parameter attributes.

Table 6.17.7a — DG definition

DG attribute	Value
Name	THERMOSTAT_SCHEDULE_STATUS_1
DGN	1FEF7h
Default priority	6
Maximum broadcast rate	N/A

Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.17.7b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Schedule mode instance	uint8	-	see Table 5.3 0 — “Sleep” 1 — “Wake” 2 — “Away” 3 — “Return” 4 to 249 — Additional Instances 250 — Storage
2	-	Start hour	uint8	h	Precision = 1 h Value range = 0 to 23 0 - 12:00 AM 12 – 12:00 Noon 23 – 11:00 PM This shall be in Local Time
3	-	Start minute	uint8	min	Precision = 1 min Value range = 0 to 59
4 to 5	-	Setpoint temp - Heat	uint16	Deg C	see Table 5.3
6 to 7	-	Setpoint temp - Cool	uint16	Deg C	see Table 5.3

6.17.8 Thermostat Schedule Status 2

Table 6.17.8a defines the DG attributes, and Table 6.17.8b defines the signal and parameter attributes.

Table 6.17.8a— DG definition

DG attribute	Value
Name	THERMOSTAT_SCHEDULE_STATUS_2
DGN	1FEF6h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.17.8b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Schedule mode Instance	uint8	-	see Table 5.3 0 — “Sleep” 1 — “Wake” 2 — “Away” 3 — “Return” 4 to 249 — Additional Instances 250 — Storage
2	0 to 1	Sunday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
	2 to 3	Monday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
	4 to 5	Tuesday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
	6 to 7	Wednesday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
3	0 to 2	Thursday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
	2 to 3	Friday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day
	4 to 5	Saturday	bit	-	00b - Not scheduled for this day 01b - Schedule applies to this day

6.17.9 Thermostat Schedule Command 1

There are two DGNs defined for thermostat schedule command. Generally, changing the set points for the currently active schedule instance will not change the actual set points active at the moment. To trigger that change, a THERMOSTAT_COMMAND_2 should be sent immediately after the change, with Current Schedule Instance set appropriately.

Table 6.17.9 defines the DG attributes. The format for the signal and parameter attributes is identical to THERMOSTAT_SCHEDULE_STATUS_1 (see Table 6.17.7b).

Table 6.17.9 — DG definition

DG attribute	Value
Name	THERMOSTAT_SCHEDULE_COMMAND_1
DGN	1FEF5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1

ACK requirements	ACK, THERMOSTAT_SCHEDULE_STATUS_1

6.17.10 Thermostat Schedule Command 2

Table 6.17.10 defines the DG attributes. The format for the signal and parameter attributes is identical to THERMOSTAT_SCHEDULE_STATUS_1 (see Table 6.17.8b). Changing the schedule will not change the current set points until a THERMOSTAT_COMMAND_2 is sent (typically with the Instance set to 251).

Table 6.17.10 — DG definition

DG attribute	Value
Name	THERMOSTAT_SCHEDULE_COMMAND_2
DGN	1FEF4h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, THERMOSTAT_SCHEDULE_STATUS_2

6.17.11 Ambient Temperature

This communicates the temperature readings. Table 6.17.11a defines the DG attributes, and Table 6.17.11b defines the signal and parameter attributes.

Table 6.17.11a — DG definition

DG attribute	Value
Name	THERMOSTAT_AMBIENT_STATUS
DGN	1FF9Ch
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.17.11b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1 to 2	-	Ambient temp	uint16	Deg C	see Table 5.3

6.17.12 Service Points

The SPNs follow the general method for multi-instance products. Faults are reported with the Instance in the Intermediate Byte (ISB) and a non-zero value in the Most Significant Byte (MSB). In the case of a single node controlling multiple instances an ISB of zero indicates the fault applies to the central controller. These are the allowable Service Points for this DGN (see Table 6.17.12).

Table 6.17.12 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Set Point Temperature - Cool
1	Instance	1	Set Point Temperature - Heat
1	Instance	2	Ambient Temperature

6.18 Air Conditioner

6.18.1 Introduction

The Air Conditioner is the primary cooling device in the RV, and may also include a heat pump or other heating element. Like the furnace, the AC monitors the output of the thermostat to determine whether to blow, heat, or cool. The Instance corresponds to the same Instances for the furnace and thermostat. Thus it is highly likely that there is an AC Instance 1 and a Furnace Instance 1, which would roughly correspond to the same zone within the RV. The following formats apply (see Table 6.18.1).

Table 6.18.1 — Air conditioner definition

Device attribute	Value
Category	Comfort systems
Default Source Address	103 to 106
Dynamic Address Range	192 to 207
Instance	Multiple

Multiple source addresses may be allocated, but thermostats are identified by the Instance in each DGN. These correspond to “zones” in the general terminology. There is no set definition for the location of each zone in a coach.

6.18.2 Air Conditioner Status

This DG communicates the air conditioner status. Table 6.18.2a defines the DG attributes, and Table 6.18.2b defines the signal and parameter attributes.

Table 6.18.2a — DG definition

DG attribute	Value
Name	AIR_CONDITIONER_STATUS
DGN	1FFE1h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change

Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.18.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Operating mode	uint8	-	0 - Automatic 1 - Manual (AC will ignore thermostat information.)
2	-	Max fan speed	uint8	%	see Table 5.3 Used to control the fan speed for power-sharing purposes. See Fan Speed below.
3	-	Max air conditioning output level	uint8	%	see Table 5.3 Used to control the compressor output for power-sharing purposes. See A/C Output Level below.
4	-	Fan speed	uint8	%	see Table 5.3 One-speed fans should use 0% and 100%. Two-speed fans should use 0%, 50%, and 100%.
5	-	Air conditioning output level	uint8	%	see Table 5.3
6	-	Dead band	uint8	°C	Value range = 0 to 25.0 °C Precision = 0.1 °C This is the amount over and under the set point that the AC will tolerate. A larger value reduces cycling.
7	-	Second stage dead band	uint8	°C	Value range = 0 to 25.0 °C Precision = 0.1 °C This is the amount over the set point that will trigger a higher A/C output.

6.18.3 Air Conditioner Command

This DGN allows external control of the air conditioner. Table 6.18.3 defines the DG attributes. The signal and parameter attributes are identical to AIR_CONDITIONER_STATUS (see Table 6.18.2b). An Instance of Zero indicates that the settings should be applied to all AC instances. Values of 255 indicate that the particular datum should not be changed.

Table 6.18.3 — DG definition

DG attribute	Value
Name	AIR_CONDITIONER_COMMAND
DGN	1FFE0h
Default priority	6

Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, AIR_CONDITIONER_STATUS

6.18.4 Heat Pump Status

Note that the Heat Pump typically shares the fan with the Air Conditioner. Control of the fan is through AIR_CONDITIONER_STATUS and AIR_CONDITIONER_CONTROL. Table 6.18.4a defines the DG attributes, and Table 6.18.4b defines the signal and parameter attributes

Table 6.18.4a — DG definition

DG attribute	Value
Name	HEAT_PUMP_STATUS
DGN	1FF9Bh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.18.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Instance	uint8	-	see Table 5.3 Corresponds to “Zones” in user terminology.
1	-	Operating mode	uint8		0 - Automatic 1 - Manual (AC will ignore thermostat information.)
2	-	Max heat output level	uint8	%	see Table 5.3 Used to control the output level for power-sharing purposes.
3	-	Heat output level	uint8	%	see Table 5.3
4	-	Dead band	uint8	Deg C	Value range = 0 to 25.0 Deg C Precision = 0.1 Deg C This is the amount over and under the set point that the heater will tolerate. A larger value reduces cycling.
5	-	Second stage dead band	uint8	Deg C	Value range = 0 to 25.0 Deg C Precision = 0.1 Deg C This is the amount over the set point that will

					trigger a higher A/C output.

6.18.5 Heat Pump Command

This DGN allows external control of the heat pump. Table 6.18.5 defines the DG attributes. The signal and parameter attributes are identical to HEAT_PUMP_STATUS (see Table 6.18.4b). An Instance of Zero indicates that the settings should be applied to all instances. Values of 255 indicate that the particular datum should not be changed.

Table 6.18.5 — DG definition

DG attribute	Value
Name	HEAT_PUMP_COMMAND
DGN	1FF9Ah
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, HEAT_PUMP_STATUS

6.18.6 Service Points

The SPNs follow the general method for multi-instance products. Faults are reported with the Instance in the Intermediate Byte (ISB) and a non-zero value in the Most Significant Byte (MSB). These are the allowable Service Points for this DGN (see Table 6.18.6).

Table 6.18.6 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Fan
1	Instance	1	Compressor
1	Instance	2	Heat Source
1	Instance	3	Temperature
1	Instance	4	Outside Air Sensor
1	Instance	5	Coil Sensor
1	Instance	6	No AC Available
1	Instance	7	Defrosting
2	Instance	0	Subnet Communication
2	Instance	1	Heat Configuration
2	Instance	2	Dehumidifier Configuration

6.19 Generator

6.19.1 Introduction

The generator is typically the primary on-board AC power supply for the RV and powered by gasoline, LP gas, or diesel. The following formats apply (see Table 6.19.1).

Table 6.19.1 — Generator definition

Device attribute	Value
Category	Power components
Default Source Address	64
Dynamic Address Range	128 to 143
Instance	Unique

6.19.2 AC Output Introduction

The Generator reports the AC output using the standard AC Point formats (see 6.1). The Instance field is defined in Table 6.19.2. Note that each of these DGNs may have to be transmitted multiple times to provide information on each line.

Table 6.19.2 — Instance field definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 3	Output Instance	bit4	-	For most generators, always 1
	4 to 7	Line	bit4	-	1 — Line 1 2 — Line 2

6.19.3 AC Output Page 1

Table 6.19.3 defines the DG attributes, and Table 6.19.2 defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_1 (see Table 6.1.2).

Table 6.19.3 — DG definition

DG attribute	Value
Name	GENERATOR_AC_STATUS_1
DGN	1FFDFh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when generator running
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.19.4 AC Output Page 2

Table 6.19.4 defines the DG attributes, and Table 6.19.2 defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_1 (see Table 6.1.3).

Table 6.19.4 — DG definition

DG attribute	Value
Name	GENERATOR_AC_STATUS_2
DGN	1FFDEh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when generator running
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.19.5 AC Output Page 3

Table 6.19.5 defines the DG attributes, and Table 6.19.2 defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_3 (see Table 6.1.4).

Table 6.19.5 — DG definition

DG attribute	Value
Name	GENERATOR_AC_STATUS_3
DGN	1FFDDh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when generator running
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.19.6 AC Output Page 4

Table 6.19.6 defines the DG attributes, and Table 6.19.2 defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_4 (see Table 6.5.4).

Table 6.19.6 — DG definition

DG attribute	Value
Name	GENERATOR_AC_STATUS_4
DGN	1FF94h
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when generator running
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.19.7 AC Fault Configuration Status and Command

Fault Control configuration and status DGNs are defined for the generator. These DGNs follow the format of ACFAULT_CONFIGURATION_STATUS_1, ACFAULT_CONFIGURATION_STATUS_2, ACFAULT_CONFIGURATION_COMMAND_1, and ACFAULT_CONFIGURATION_COMMAND_2. Instances are defined as above.

The status DGNs are broadcast on request. The command DGNs should be acknowledged with an ACK and the corresponding status DGN.

6.19.8 DC Output Introduction

A generator which outputs DC reports the status of its DC functions and outputs with a series of generator-specific DGNs. It may also report using the DC Source Status DGNs, as appropriate. It is possible for a generator to have both AC and DC outputs. When reporting DC output, the generator uses an Instance field as defined in Table 6.19.8. Note that each of these DGNs may have to be transmitted multiple times to provide information on each line.

Table 6.19.8 — Instance field definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Output Instance	uint8	-	For most generators, always 1

6.19.9 DC Output Status

Table 6.19.9a defines the DG attributes and Table 6.19.9b defines the signal and parameter attributes.

Table 6.19.9a — DG definition

DG attribute	Value
Name	GENERATOR_DC_STATUS_1
DGN	1FEC6h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	5000 ms or on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.19.9b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8		see Table 6.19.8
1 to 2	-	Charge voltage	uint16	V	see Table 5.3 Control voltage: The voltage desired to be delivered to the battery.
3 to 4	-	Charge current	uint16	A	see Table 5.3 Control current: The current desired to be delivered to the battery.

5	-	Charge current percent of maximum	uint8	%	see Table 5.3 Control current as a percent of the maximum.
6	-	Operating state	uint8	-	Specifies the current operating state of the DC Generator for the identified DC source. See table 6.5.5b

6.19.10 Generator DC Configuration Status

This DG provides configuration information for the DC Generator. Table 6.19.10a defines the DG attributes and Table 6.19.10b defines the signal and parameter attributes.

Table 6.19.10a — DG definition

DG attribute	Value
Name	GENERATOR_DC_CONFIGURATION_STATUS
DGN	1FEC5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.19.10b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	See Table 6.19.8
1	-	Charging algorithm	uint8	-	See Table 6.21.9b
3	0 to 1	Battery sensor present	bit	-	00b — No battery temperature sensor in use 01b — Sensor is present and active
3	2 to 3	Linkage mode	bit	-	01b – Independent 10b – Linked to DC Source Indicates that operation is linked to a DC source which reports through the DC_SOURCE_STATUS DGNs.
3	4 to 7	Battery type	uint4	-	see table 6.5.5b
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
6 to 7	-	Maximum charging current	uint16	A	see Table 5.3

6.19.11 Generator DC Command

This command enables or disables the DC generator output. Note that Enabling/Disabling the DC generator does not necessarily start or stop the generator. See 6.19.18, Generator Command, and 6.36.3, Generator Demand Command. Table 6.19.11a defines the DG attributes and Table 6.19.11b defines the signal and parameter attributes.

Table 6.19.11a — DG definition

DG attribute	Value
Name	GENERATOR_DC_COMMAND
DGN	1FEC4h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DC_STATUS

Table 6.19.11b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 6.19.8
1	-	DC output status	uint8	-	0 — Disable DC generator DC output 1 — Enable DC generator DC output 2 — Start equalization
2	0 to 1	Default state on power- up	bit	-	00b — DC output disabled on power-up 01b — DC output enabled on power-up

6.19.12 Generator DC Configuration Command

This DGN is applicable when Instance indicates a Generator supporting DC output and is used to provide configuration information to the generator.. Table 6.19.12a defines the DG attributes and Table 6.19.12b defines the signal and parameter attributes.

Table 6.19.12a — DG definition

DG attribute	Value
Name	GENERATOR_DC_CONFIGURATION_COMMAND
DGN	1FEC3h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DC_CONFIGURATION_STATUS

Table 6.19.12b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 6.19.8
1	-	Charging algorithm	uint8	-	see 6.21.9b
3	0 to 1	Battery sensor present	bit	-	00b — No battery temperature sensor in use 01b — Sensor is present and active
3	2 to 3	Linkage mode	bit	-	00b – Independent 01b – Linked to DC Source Indicates that operation is linked to a DC source which reports through the DC_SOURCE_STATUS DGNs.
3	4 to 7	Battery type	uint4	-	see table 6.5.5b
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
6 to 7	-	Maximum charging current	uint16	A	see Table 5.3

6.19.13 Generator DC Equalization Status

This describes the status of the Equalization process. Table 6.19.13a defines the DG attributes and Table 6.19.13b defines the signal and parameter attributes. This DGN is normally broadcast only during the equalization process.

Table 6.19.13a — DG definition

DG attribute	Value
Name	GENERATOR_DC_EQUALIZATION_STATUS
DGN	1FEC2h
Default priority	6
Maximum broadcast rate	5000 ms if active
Normal broadcast rate	1000 if active
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.19.13b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 6.19.8
1 to 2	-	Time remaining	uint16	min	Precision = 1 min Value range = 0 to 65 530 min
3	0 to 1	Pre-charging status	Bit	-	00b — Pre-charging is not in process 01b — Generator is charging the batteries to prepare for equalization

6.19.14 Generator DC Equalization Configuration Status

This describes configuration information for the Equalization mode of a DC generator. Table 6.19.14a defines the DG attributes and Table 6.19.14b defines the signal and parameter attributes.

Table 6.19.14a — DG definition

DG attribute	Value
Name	GENERATOR_DC_EQUALIZATION_CONFIGURATION_STATUS
DGN	1FEC1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.19.14b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 6.19.8
1 to 2	-	Equalization voltage	uint16	V	see Table 5.3
3 to 4	-	Equalization time	uint16	min	Precision = 1 min Value range = 0 to 65 530 min

6.19.15 Generator DC Equalization Configuration Command

This changes the configuration information for the Equalization mode of a DC Generator. Table 6.19.15 defines the DG attributes. The signal and parameter attributes have the same format as GENERATOR_DC_EQUALIZATION_CONFIGURATION_STATUS (see Table 6.19.14b).

Table 6.19.15 — DG definition

DG attribute	Value
Name	GENERATOR_DC_EQUALIZATION_CONFIGURATION_COMMAND
DGN	1FEC0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DC_EQUALIZATION_CONFIGURATION_STATUS

6.19.16 Generator Status 1

This DGN describes the physical status of the generator. Table 6.19.16a defines the DG attributes, and Table 6.19.16b defines the signal and parameter attributes.

Table 6.19.16a — DG definition

DG attribute	Value
Name	GENERATOR_STATUS_1
DGN	1FFDCh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	1000 ms when running 5000 ms when not running On change to Status field
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.19.16b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	-	Status	uint8	-	0 – Stopped 1 – Preheat 2 – Cranking 3 – Running 4 – Priming 5 – Fault 6 – Engine run only 7 - Test mode 8 - Voltage adjust mode 9 - Fault bypass mode 10 - Configuration mode All other values reserved
1 to 4	-	Engine run time	uint32	min	Number of minutes logged on genset.
5	-	Engine load	uint8	%	see Table 5.3 Indicates the current engine load as a percent of capacity. Does not necessarily correspond to current output.
6 to 7	-	Start battery voltage	uint16	V	see Table 5.3

6.19.17 Generator Status 2

This DGN describes the physical status of the generator. Table 6.19.17a defines the DG attributes, and Table 6.19.17b defines the signal and parameter attributes.

Table 6.19.17a — DG definition

DG attribute	Value
Name	GENERATOR_STATUS_2
DGN	1FFDBh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	1000 ms when running 5000 ms when not running.
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.19.17b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 1	Temperature shutdown switch	bit	-	00b - Temperature shutdown not active 01b - Temperature shutdown active (Genset shall not run)
	2 to 3	Oil pressure shutdown switch	bit	-	00b - Oil pressure shutdown not active 01b - Oil pressure shutdown active (Genset shall not run)
	4 to 5	Oil level switch	bit	-	00b - Oil level switch not active 01b - Low oil level detected
	6 to 7	Caution light	bit	-	00b - Caution light not active 01b - Caution light on
1	-	Eng coolant temperature	uint8	°C	see Table 5.3
2	-	Eng oil pressure	uint8	kPa	Precision = 4 kPa Value range = 0 to 1000 kPa (145.04 PSI)
3 to 4	-	Engine RPM	uint16	RPM	Precision = 0.125 rpm Value range = 0 to 8191.25 rpm
5 to 6	-	Fuel rate	uint16	lph	Precision = 0.05 lph (liter per hour) Value range = 0 - 3212.5 lph

6.19.18 Generator Command

This DG command starts and stops the generator. Table 6.19.18a defines the DG attributes, and Table 6.19.18b defines the signal and parameter attributes.

Table 6.19.18a — DG definition

DG attribute	Value
Name	GENERATOR_COMMAND
DGN	1FFDAh
Default priority	6

Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_STATUS_1

Table 6.19.18b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Command	uint8	-	0 – Stop 1 – Start 2 - Manual prime 3 - Manual preheat Normally prime and preheat are handled automatically by the controller.

6.19.19 Generator Starter Configuration

This is DG is primarily used by modules that control an otherwise “dumb” generator, although it could be directly supported by a generator's ECM. Table 6.19.19a defines the DG attributes, and Table 6.19.19b defines the signal and parameter attributes.

Table 6.19.19a — DG definition

DG attribute	Value
Name	GENERATOR_START_CONFIG_STATUS
DGN	1FFD9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.19.19b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value definition
0	-	Generator type	uint8	-	Indicates the inputs used to control the generator. 1 — Run/Crank inputs (Run input shall be held on to run. Crank input shall energize the starter.) 2 — Crank/Glow & Stop inputs (No run input is required. One input shall energize the starter, the other shall stop the generator and may energize the preheat.)

					3 — Preheat/Start input and Prime/Stop input 4 — Single On/Off input
1	-	Generator pre-crank time	uint8	s	Precision = 1 s Value range = 0 to 250 s Indicates the amount of time the preheat will be energized before cranking.
2	-	Generator max crank time	uint8	s	Precision = 1 s Value range = 0 to 250 s Indicates the maximum amount of time the starter will be energized in one attempt.
3	-	Generator stop time	uint8	s	Precision = 1 Sec Value range = 0 to 250 s Indicates the amount of time the stop signal will be triggered to stop the generator.

6.19.20 Generator Starter Configuration Command

Table 146 defines the DG attributes. The signal and parameter attributes are identical to GENERATOR_START_CONFIG_STATUS (see Table 6.19.19b). A value of 255 in any position indicates that the value should not be changed.

Table 6.19.20 — DG definition

DG attribute	Value
Name	GENERATOR_START_CONFIG_COMMAND
DGN	1FFD8h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_START_CONFIG_STATUS

6.19.21 Service Points

These are the allowable Service Points for this Device (see Table 6.19.21a).

Table 6.19.21a — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Engine Run Time
257	Engine Load
258	Start Battery Voltage
259	Temperature Shutdown Switch

260	Oil Pressure Shutdown Switch
261	Oil Level Switch
262	Caution Light
263	Eng Coolant Temperature
264	Eng Oil Pressure
265	Engine RPM
266	Fuel Rate
267	Generator Type
268	Generator Pre-crank Time
269	Generator Max Crank Time
270	Generator Stop Time
271	Fuel Pump
272	Preheat
273	Starter
274	Generic temperature
275	Generic fault
276	Governor actuator
277	Starter solenoid
278	Governor actuator duty cycle
279	Cutoff switch
280	PMA (generator) sense
281	DC sense
282	Cranking speed
283	Inverter temperature
284	Engine stop
285	Ambient temperature
286	Pre-heat relay
287	Fuel pump relay
288	Start relay
289	Engine Coolant Level
290	Alternator

The SPNs defined in Table 6.19.21b apply to the AC output, and thus may have several instances. The 19-bit SPN is divided into three sections, the Most Significant Byte (MSB), the Intermediate Byte (ISB), and the Least Significant Bits (LSb). The ISB indicates the Instance of the AC Output that is suspect. If the problem is global to all instances, the ISB is 0.

Table 6.19.21b — Service Points

MSB	ISB	LSb	Description

1	Instance	0	RMS AC Voltage
1	Instance	1	RMS AC Current
1	Instance	2	AC Frequency
1	Instance	3	Open AC Ground
1	Instance	4	Open AC Neutral
1	Instance	5	Reverse AC Polarity
1	Instance	6	AC Ground Fault
1	Instance	7	Peak AC Voltage
2	Instance	0	Peak AC Current
2	Instance	1	AC Ground Current
2	Instance	2	Real AC Power
2	Instance	3	Reactive AC Power
2	Instance	4	AC Harmonic Distortion
2	Instance	5	DC Voltage
2	Instance	6	DC Current
2	Instance	7	Reverse DC Polarity
3	Instance	0	Peak DC Voltage
3	Instance	1	Peak DC Current
3	Instance	2	Real DC Power
3	Instance	3	DC Harmonic Distortion

6.20 Inverter

6.20.1 Introduction

The Inverter converts DC power into AC power. It is often combined with a Charger, in which case the node shall support the Charger DGN. There may be more than one inverter; two inverters are common.

In the case of a combination Inverter/Charger, the unit shall use the same instance number for both. Due to the prevalence of combination units, no Inverter shall share an instance with a Charger unless they are a combination unit.

The format is defined in Table 6.20.1.

NOTE The DC Source Instance does not correspond to the Inverter or Charger Instance.

Table 6.20.1 — Inverter definition

Device attribute	Value
Category	Power components
Default Source Address	66, 67
Dynamic Address Range	128 to 143
Instance	Multiple

6.20.2 AC Status

An inverter may have several AC inputs and outputs, which are reported using the AC Point Status formats. The Instance field is defined in Table 6.20.2.

Table 6.20.2 — Instances

Byte	Bit	Name	Data Type	Unit	Value description
0	0 to 4	Instance	bit4	-	0000- not used b 1110 - not used
	4 to 5	Line	bit	-	00b - Line 1 01b - Line 2
	6 to 7	Input / Output	bit	-	00b - Input 01b - Output

If there are multiple inverters on the network, they should not share Instance values. Furthermore, this instance does not necessarily correspond to the Instance used to identify the inverter in the other inverter DGNs. A single inverter may support multiple AC Point Instances, and a single node may include multiple inverters.

Note that each of these DGNs may have to be transmitted multiple times to provide information on each line.

6.20.3 AC Output Page 1

Table 6.20.3 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_1 (see Table 6.1.2).

Table 6.20.3 — DG definition

DG attribute	Value
Name	INVERTER_AC_STATUS_1
DGN	1FFD7h
Default priority	6
Maximum broadcast rate	500 ms
Normal broadcast rate	100 ms
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.20.4 AC Output Page 2

Table 6.20.4 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_2 (see Table 6.1.3).

Table 6.20.4 — DG definition

DG attribute	Value
Name	INVERTER_AC_STATUS_2
DGN	1FFD6h
Default priority	6
Maximum broadcast rate	500 ms

Normal broadcast rate	100 ms
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.20.5 AC Output Page 3

Table 6.20.5 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_3 (see Table 6.1.4).

Table 6.20.5 — DG definition

DG attribute	Value
Name	INVERTER_AC_STATUS_3
DGN	1FFD5h
Default priority	6
Maximum broadcast rate	500 ms
Normal broadcast rate	100 ms
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.20.6 AC Output Page 4

Table 6.20.6 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_4 (see Table 6.1.5).

Table 6.20.6 — DG definition

DG attribute	Value
Name	INVERTER_AC_STATUS_4
DGN	1FF8Fh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.20.7 AC Fault Configuration Status and Command

Fault Control configuration and status DGNs are defined for the inverter. These DGNs follow the formats as indicated in the following table.

Table 6.20.7 - DG Reference

Name	DGN	Format	Table
INVERTER_ACFAULT_CONFIGURATION_STATUS_1	1FF8Eh	AC_CONFIGURATION_STATUS_1	6.1.6

Name	DGN	Format	Table
INVERTER_ACFAULT_CONFIGURATION_STATUS_2	1FF8Dh	AC_CONFIGURATION_STATUS_2	6.1.7
INVERTER_ACFAULT_CONFIGURATION_COMMAND_1	1FF8Ch	ACFAULT_CONFIGURATION_COMMAND_1	6.1.8
INVERTER_ACFAULT_CONFIGURATION_COMMAND_2	1FF8Bh	ACFAULT_CONFIGURATION_COMMAND_2	6.1.8

The status DGNs are broadcast on request. The command DGNs should be acknowledged with an ACK and the corresponding status DGN.

6.20.8 Inverter Status

Table 6.20.8a defines the DG attributes and Table 6.20.8b defines the signal and parameter attributes.

Table 6.20.8a — DG definition

DG attribute	Value
Name	INVERTER_STATUS
DGN	1FFD4h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms or On Change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.20.8b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3
1	-	Status	uint8	-	0 - Disabled 1 - Invert 2 - AC passthru 3 - APS Only 4 - Load sense (Unit is waiting for a load.) 5 - Waiting to Invert
2	0 to 1	Battery temperature sensor present	bit	-	00b - No battery temperature sensor in use 01b - Sensor is present and active
	2 to 4	Load sense enabled	bit	-	00b - Load sense disabled 01b - Load sense enabled

The “Waiting to Invert” status indicates that the inverter is enabled but is not yet actually producing AC power due to an initialization or qualification process or timer being incomplete.

6.20.9 Inverter Command

This command DGN starts or stops the inverter. Note that “enabling” the inverter does not necessarily enable the unit to convert power. The inverter may instead go into AC Pass-Through or Load Sense mode.

Table 6.20.9a defines the DG attributes and Table 6.20.9b defines the signal and parameter attributes.

Table 6.20.9a— DG definition

DG attribute	Value
Name	INVERTER_COMMAND
DGN	1FFD3h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, INVERTER_STATUS

Table 6.20.9b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 - Inverter instance
1	0 to 1	Inverter enable	bit	-	00b - Disable 01b - Enable inverter
	2 to 3	Load sense enable	bit	-	00b - Disable load sense 01b - Enable load sense
	4 to 5	Pass-through enable	bit	-	00b - Disable pass-through 01b - Enable pass-through
2 to 6	-	Reserved			
7	0 to 1	Inverter enable on startup	bit	-	00b - Inverter is disabled on startup 01b - Inverter is enabled on startup
	2 to 3	Load sense enable on startup	bit	-	00b - Load sense is disabled on startup 01b - Load sense is enabled on startup
	4 to 5	AC pass-through enable on startup	bit	-	00b - Pass-through is disabled on startup 01b - Pass-through is enabled on startup

6.20.10 Inverter Configuration Status 1

This is the first of two DGNs describe configuration information for the Inverter. Table 6.20.10a defines the DG attributes and Table 6.20.10b defines the signal and parameter attributes.

Table 6.20.10a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_STATUS_1

DGN	1FFD2h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.20.10b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8		1 to 13 — Inverter Instance
1 to 2	-	Load sense power threshold	uint16	W	Precision= 1 W Value range = 0 to 65 530 W This is the load required to exit Load Sense mode and enter Inverting Mode.
3 to 4	-	Load sense interval	uint16	s	Precision= 0.5 s Value range = 0 to 3 125 s This is the frequency of load sense checks.
5 to 6	-	DC source shutdown voltage – Minimum	uint16	V	see Table 5.3
7	0 to 1	Inverter enable on startup	bit	-	00b - Inverter is disabled on startup 01b - Inverter is enabled on startup
	2 to 3	Load sense enable on startup	bit	-	00b - Load sense is disabled on startup 01b - Load sense is enabled on startup
	4 to 5	AC Pass-through enable on startup	bit	-	00b - Pass-through is disabled on startup 01b - Pass-through is enabled on startup

6.20.11 Inverter Configuration Status 2

This is the second of two DGNs that describe configuration information for the Inverter. Table 6.20.11a defines the DG attributes and Table 6.20.11b defines the signal and parameter attributes.

Table 6.20.11a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_STATUS_2
DGN	1FFD1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1

ACK requirements	None

Table 6.20.11b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance
1 to 2	-	DC source shutdown voltage - Maximum	uint16	V	see Table 5.3
3 to 4	-	DC source warning voltage - Minimum	uint16	V	see Table 5.3
5 to 6	-	DC source warning voltage - Maximum	uint16	V	see Table 5.3

6.20.12 Inverter Configuration Status 3

This is the third of three DGNs that describe configuration information for the Inverter. Table 6.20.12a defines the DG attributes and Table 6.20.12b defines the signal and parameter attributes.

Table 6.20.12a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_STATUS_3
DGN	1FECEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.20.12b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance
1 to 2	-	DC Source shutdown delay	uint16	s	Precision = 0.5 s Value range = 0 to 3125 s
3	-	Stack Mode	uint8	-	0 – Stand-alone 1 – Master 2 – Slave 3 – Line 2 Master (for series stacking)

6.20.13 Inverter Configuration Command 1

This DGN allow changes in the Inverter configuration. Table 6.20.13a defines the DG attributes and Table 6.20.13b defines the signal and parameter attributes.

Table 6.20.13a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_COMMAND_1
DGN	1FFD0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, INVERTER_CONFIGURATION_STATUS_1

Table 6.20.13b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance
1 to 2	-	Load sense power threshold	uint16	W	see 4.19.10
3 to 4	-	Load sense interval	uint16	s	see 4.19.10
5 to 6	-	DC source shutdown voltage – Minimum	uint16	V	see 4.19.10

6.20.14 Inverter Configuration Command 2

This DGN allow changes in the Inverter configuration. Table 6.20.14a defines the DG attributes and Table 6.20.14b defines the signal and parameter attributes.

Table 6.20.14a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_COMMAND_2
DGN	1FFCFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, INVERTER_CONFIGURATION_STATUS_2

Table 6.20.14b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance

1 to 2	-	DC source shutdown voltage – Maximum	uint16	V	see 4.19.11
3 to 4	-	DC source warning voltage – Minimum	uint16	V	see 4.19.11
5 to 6	-	DC source warning voltage – Maximum	uint16	V	see 4.19.11

6.20.15 Inverter Configuration Command 3

This DGN allow changes in the Inverter configuration. Table 6.20.15a defines the DG attributes and Table 6.20.15b defines the signal and parameter attributes.

Table 6.20.15a — DG definition

DG attribute	Value
Name	INVERTER_CONFIGURATION_COMMAND_3
DGN	1FECDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, INVERTER_CONFIGURATION_STATUS_3

Table 6.20.15b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance
1 to 2	-	DC Source shutdown delay	uint16	s	Precision = 0.5 s Value range = 0 to 3125 s
3	-	Stack Mode	uint8	-	0 – Stand-alone 1 – Master 2 – Slave 3 – Line 2 Master (for series stacking)

6.20.16 Inverter Statistics

This is a multi-frame DGN with information intended primarily for diagnostic purposes. Table 6.20.16a defines the DG attributes and Table 6.20.16b defines the signal and parameter attributes.

Table 6.20.16a — DG definition

DG attribute	Value
Name	INVERTER_STATISTIC_STATUS
DGN	1FFCEh

Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	4
ACK requirements	None

Table 6.20.16b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter Instance
1to 2	-	Number of DC under voltage detections	uint16	-	
3 to 4	-	Number of inverter AC output over-loads	uint16	-	
5 to 6	-	Number of times load sense has been engaged	uint16	-	
7 to 8	-	Lowest DC voltage	uint16	V	see Table 5.3
9 to 10	-	Highest DC voltage	uint16	V	see Table 5.3
11 to 12	-	Lowest AC input voltage	uint1 6	V	see Table 5.3
13 to 14	-	Highest AC input voltage	uint16	V	see Table 5.3
15 to 16	-	Lowest AC output voltage	uint16	V	see Table 5.3
17 to 18	-	Highest AC output voltage	uint16	V	see Table 5.3
19 to 27	-	Reserved		-	

6.20.17 Internal Auxiliary Power Supply Status

The Auxiliary Power Supply is a secondary DC-DC power supply that is typically used to power external control panels and peripherals. There may be multiple instances within the node, and the Instance field identifies to which power supply is being referred. This Instance is not unique on the network. Products must examine the Source Address to associate the APS Instance with an Inverter Instance. (Note that there is not necessarily a direct correlation. A single node may contain multiple inverters and a single APS, or vice-versa.)

If this DGN is requested, the node should respond with one message for each Instance it contains. Table 6.20.17a defines the DG attributes and Table 6.20.17b defines the signal and parameter attributes.

Table 6.20.17a — DG definition

DG attribute	Value
Name	INVERTER_APS_STATUS
DGN	1FFCDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request

Minimum broadcast rate	N/A
Number of frames	4
ACK requirements	None

Table 6.20.17b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3 Instance within the Inverter, not the Inverter Instance.
1	-	Total instance count	uint8	-	Total number of APS units within the Inverter.
2 to 3	-	Voltage	uint16	-	see Table 5.3
4 to 5	-	Current	uint16	-	see Table 5.3
6	-	Temperature	uint8	-	see Table 5.3

6.20.18 Internal High Voltage DC Bus Status

The same Instance scheme used in the above APS DGN is used for the DC Bus. Therefore there is not necessarily a direct association between Inverter Instance and DC Bus Instance.

Table 6.20.18 defines the DG attributes. The signal and parameter attributes have the same format as INVERTER_APS_STATUS (see Table 6.20.17b).

Table 6.20.18 — DG definition

DG attribute	Value
Name	INVERTER_DCBUS_STATUS
DGN	1FFCCh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

6.20.19 Internal Offline Power Supply Status

An Offline Power Supply is an AC-DC power supply which works like the APS to power peripherals and internal components. The same Instance scheme used in the above APS DGN is used for the DC Bus. Therefore there is not necessarily a direct association between Inverter Instance and DC Bus Instance.

Table 6.20.19 defines the DG attributes. The signal and parameter attributes have the same format as INVERTER_APS_STATUS (see Table 6.20.17b).

Table 6.20.19 — DG definition

DG attribute	Value
Name	INVERTER_OPE_STATUS

DGN	1FFCBh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

6.20.20 Inverter DC Status

Table 6.20.20a defines the DG attributes and Table 6.20.20b defines the signal and parameter attributes. Note that the Inverter may also be broadcasting similar data under the DC Source Status DGN. However, in systems with more than one inverter the DC Source Status amperage will clearly differ from the amperage shown here. And even in systems with a single inverter, the DC Source Status amperage will likely differ considerably due to other loads in the DC system.

Table 6.20.20a — DG definition

DG attribute	Value
Name	INVERTER_DC_STATUS
DGN	1FEE8h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	5000 ms on request
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.20.20b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter instance
1 to 2	-	DC Voltage	uint16	V	see Table 5.3
3 to 4	-	DC Amperage	uint16	A	see Table 5.3 As measured at the Inverter.

6.20.21 Inverter Temperature Status

Table 6.20.21a defines the DG attributes and Table 6.20.21b defines the signal and parameter attributes.

Table 6.20.21a — DG definition

DG attribute	Value
Name	INVERTER_TEMPERATURE_STATUS
DGN	1FEBDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	500 ms or On Change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.20.21b — Signal and parameter definition

Byte	Bit	Name	Data Type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Inverter instance
1 to 2	-	FET Temperature	uint16	°C	see Table 5.3
3 to 4	-	Transformer Temperature	uint16	°C	see Table 5.3

6.21 Charger (Converter)

6.21.1 Introduction

A Converter changes AC power into DC power. A Charger is a sophisticated version of the Converter, and typically includes such features as multi-stage battery charging. It is often combined with an Inverter, in which case the node should support the Inverter DGNs as well. There may be more than one charger; two chargers are common.

In the case of a combination Inverter/Charger, the unit should use the same instance number for both. Due to the prevalence of combination units, no Charger should share an instance with an Inverter unless they are a combination unit.

Note that the DC Source Instance does not correspond to the Inverter or Charger Instance. The following formats apply (see Table 6.21.1).

Table 6.21.1 — Charger definition

Device attribute	Value
Category	Power components
Default Source Address	74, 75
Dynamic Address Range	128 to 143
Instance	Multiple

6.21.2 AC Status

A charger will have AC inputs, which are reported using the same DGNs as the Inverter AC Status. If the charger is part of an Inverter/Charger package, the AC Input can be the same as the Inverter AC Inputs. In this case the Instance could be the same. Otherwise, the Charger Instances should be unique among the Charger and Inverter AC Points. The Instance field is defined in the same manner as the Inverter AC Instances.

The only distinction is that the Charger AC Status is only transmitted every 5000 ms when the charger is not actively charging. If the charger is part of an inverter/charger, the data does not have to be transmitted twice.

6.21.3 AC Input Page 1

Table 6.21.3 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_1 (see Table 6.1.2).

Table 6.21.3 — DG definition

DG attribute	Value
Name	CHARGER_AC_STATUS_1
DGN	1FFCAh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 me when charging 5000 ms when inactive
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.21.4 AC Input Page 2

Table 6.21.4 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_2 (see Table 6.1.3).

Table 6.21.4 — DG definition

DG attribute	Value
Name	CHARGER_AC_STATUS_2
DGN	1FFC9h
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 me when charging 5000 ms when inactive
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.21.5 AC Input Page 3

Table 6.21.5 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_3 (see Table 6.1.4).

Table 6.21.5 — DG definition

DG attribute	Value
Name	CHARGER_AC_STATUS_3

DGN	1FFC8h
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 me when charging 5000 ms when inactive
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.21.6 AC Input Page 4

Table 6.21.6 defines the DG attributes. The signal and parameter attributes are the same as AC_STATUS_4 (see Table 6.1.5).

Table 6.21.6 — DG definition

DG attribute	Value
Name	CHARGER_AC_STATUS_4
DGN	1FF8Ah
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 me when charging 5000 ms when inactive
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.21.7 AC Fault Configuration Status and Command

Fault Control configuration and status DGNs are defined for the charger. Fault Control configuration and status DGNs are defined for the inverter. These DGNs follow the formats as indicated in the following table.

Table 6.20.7 - DG Reference

Name	DGN	Format	Table
CHARGER_ACFAULT_CONFIGURATION_STATUS_1	1FF89h	AC_CONFIGURATION_STATUS_1	6.1.6
CHARGER_ACFAULT_CONFIGURATION_STATUS_2	1FF88h	AC_CONFIGURATION_STATUS_2	6.1.7
CHARGER_ACFAULT_CONFIGURATION_COMMAND_1	1FF87h	ACFAULT_CONFIGURATION_COMMAND_1	6.1.8
CHARGER_ACFAULT_CONFIGURATION_COMMAND_2	1FF86h	ACFAULT_CONFIGURATION_COMMAND_2	6.1.8

The status DGNs are broadcast on request. The command DGNs should be acknowledged with an ACK and the corresponding status DGN.

6.21.8 Charger Status

The charger status DGN describes the general operating status of the Charger on a particular DC Source (Battery Bank). Table 6.21.8a defines the DG attributes and Table 6.21.8b defines the signal and parameter attributes.

Table 6.21.8a — DG definition

DG attribute	Value
Name	CHARGER_STATUS
DGN	1FFC7h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	5000 ms or on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.21.8b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8		1 to 13 - Charger Instance
1 to 2	-	Charge voltage	uint16	V	see Table 5.3 Control voltage: The voltage desired to be delivered to the battery.
3 to 4	-	Charge current	uint16	A	see Table 5.3 Control current: The current desired to be delivered to the battery.
5	-	Charge current percent of maximum	uint8	%	see Table 5.3 Control current as a percent of the maximum.
6	-	Operating state	uint8	-	Specifies the current operating state of the charger for the identified DC source. See Table 6.5.5b for values.
7	0 to 1	Default state on power- up	bit	-	00b - Charger disabled 01b - Charger enabled
7	2 to 3	Auto recharge enable	bit	-	00b – Auto recharge disabled 01b – Auto recharge enabled Auto recharge reinitializes charging if battery voltage drops below a certain voltage
7	4 to 7	Force charge	bit	-	0 – Charging is not forced 1 – Force charge to bulk 2 – Force charge to float

6.21.9 Charger Configuration

This DG provides configuration information for the Charger. Table 6.21.9a defines the DG attributes and Table 6.21.9b defines the signal and parameter attributes.

Table 6.21.9a — DG definition

DG attribute	Value

Name	CHARGER_CONFIGURATION_STATUS
DGN	1FFC6h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.21.9b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 - Charger Instance
1	-	Charging algorithm	uint8	-	The algorithm currently being applied to the battery. 0 - Constant voltage 1 - Constant current 2 – 3-Stage 3 – 2-Stage 4 – Trickle 249 - Custom algorithm #2 250 - Custom algorithm #1
2	-	Charger mode	uint8	-	Configuration of charger modes to allow multiple chargers on one battery. 0 - Stand-alone 1 – Primary 2 – Secondary 3 – Linked to DC Source
3	0 to 1	Battery sensor present	bit	-	00b - No Battery Temperature sensor in use. 01b - Sensor is present and active.
3	2 to 3	Charger Installation Line	bit	-	00b - Line 1 01b - Line 2 Indicates which line the charger has been installed on in the coach distribution panel.
3	4 to 7	Battery type	uint4	-	See table 6.5.5b
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
6 to 7	-	Maximum charging current	uint16	A	see Table 5.3 Note that the precision does not match the precision of the same datum in CHARGER_CONFIGURATION_COMMAND

6.21.10 Charger Command

This command starts or stops the charger. Note that Enabling the charger does not necessarily start the unit to converting power. Table 6.21.10a defines the DG attributes and Table 6.21.10b defines the signal and parameter attributes.

Table 6.21.10a — DG definition

DG attribute	Value
Name	CHARGER_COMMAND
DGN	1FFC5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_STATUS

Table 6.21.10b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1to 13 — Charger instance
1	-	Status	uint8	-	0 — Disable 1 — Enable charger 2 — Start equalization
2	0 to 1	Default state on power- up	bit	-	00b — Charger disabled on power-up 01b — Charger enabled on power-up
2	2 to 3	Auto recharge enable	bit	-	00b – Auto recharge disabled 01b – Auto recharge enabled Auto recharge reinitializes charging if battery voltage drops below a certain voltage
2	4 to 7	Force charge	uint4	-	0 – Cancel forcing 1 – Force charge to bulk 2 – Force charge to float

6.21.11 Charger Configuration Command

This DGN provides changes in the Charger configuration. Table 6.21.11a defines the DG attributes and Table 6.21.11b defines the signal and parameter attributes.

Placing a No Data (255, 65 535) in a field will cause that setting to be ignored. Thus it is possible to adjust any single setting without changing any others.

Table 6.21.11a — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_COMMAND
DGN	1FFC4h
Default priority	6

Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_CONFIGURATION_STATUS

Table 6.21.11b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1	-	Charging algorithm	uint8	-	see 6.21.9
2	-	Charger mode	uint8	-	see 6.21.9
3	0 to 1	Battery sensor present	bit	-	00b — No battery temperature sensor in use 01b — Sensor is present and active
3	2 to 3	Charger Installation Line	bit	-	00b - Line 1 01b - Line 2 Indicates which line the charger has been installed on in the coach distribution panel.
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
6	0 to 3	Battery type	uint4	-	see 6.21.9
6	4 to 7	Reserved			
7	-	Maximum charging current	uint8	A	see Table 5.3 Note that the precision does not match the precision of the same datum in CHARGER_CONFIGURATION_STATUS

6.21.12 Charger Configuration Status 2

This DGN supplements CHARGER_CONFIGURATION_STATUS. Table 6.21.12a defines the DG attributes and Table 6.21.12b defines the signal and parameter attributes. Typically, Maximum Charge Current = Battery Bank Size * Charge Rate Limit * Max Charge as Percent. However, specific implementations do not necessarily allow the configuration of all of these parameters.

Table 6.21.12a — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_STATUS_2
DGN	1FF96h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1

ACK requirements	None

Table 6.21.12b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1	-	Maximum charge current as percent	uint8	Pct	see Table 5.3 see notes above
2	-	Charge rate limit as percent of bank size	uint8	Pct	see Table 5.3 see notes above
3	-	Shore Breaker Size	uint8	A	see Table 5.3
4	-	Default Battery Temperature	uint8	°C	see Table 5.3 May be used in the absence of a battery temperature sensor on the charger
5 to 6	-	Recharge Voltage	uint16	V	see Table 5.3 Charger may initiate charging when battery drains past this value

6.21.13 Charger Configuration Command 2

This changes the configuration information for the Charger. Table 6.21.13 defines the DG attributes. The signal and parameter attributes have the same format as CHARGER_CONFIGURATION_STATUS_2 (see Table 6.21.12b).

Table 6.21.13 — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_COMMAND_2
DGN	1FF95h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_CONFIGURATION_STATUS_2

6.21.14 Charger Configuration Status 3

This DGN supplements CHARGER_CONFIGURATION_STATUS. Table 6.21.14a defines the DG attributes and Table 6.21.14b defines the signal and parameter attributes.

Table 6.21.14a — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_STATUS_3
DGN	1FECCh
Default priority	6

Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.21.14b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1 to 2	-	Bulk Voltage	uint16	V	see Table 5.3
3 to 4	-	Absorption Voltage	uint16	V	see Table 5.3
5 to 6	-	Float Voltage	uint16	V	see Table 5.3
7	-	Temperature Compensation Constant	uint8	mV/K	0 – 250 mV/K Magnitude of charging voltage adjustment due to temperature

6.21.15 Charger Configuration Command 3

This changes the configuration information for the Charger. Table 6.21.15 defines the DG attributes. The signal and parameter attributes have the same format as CHARGER_CONFIGURATION_STATUS_3 (see Table 6.21.15b).

Table 6.21.15 — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_COMMAND_3
DGN	1FECBh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_CONFIGURATION_STATUS_3

6.21.16 Charger Configuration Status 4

This DGN supplements CHARGER_CONFIGURATION_STATUS. Table 6.21.16a defines the DG attributes and Table 6.21.16b defines the signal and parameter attributes.

Table 6.21.16a — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_STATUS_4
DGN	1FEBFh

Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.21.16b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1 to 2	-	Bulk Time	uint16	min	Precision = 1 minute Value range = 0 to 65530 minutes
3 to 4	-	Absorption Time	uint16	min	Precision = 1 minute Value range = 0 to 65530 minutes
5 to 6	-	Float Time	uint16	min	Precision = 1 minute Value range = 0 to 65530 minutes

6.21.17 Charger Configuration Command 4

This changes the configuration information for the Charger. Table 6.21.17 defines the DG attributes. The signal and parameter attributes have the same format as CHARGER_CONFIGURATION_STATUS_3 (see Table 6.21.17b).

Table 6.21.17 — DG definition

DG attribute	Value
Name	CHARGER_CONFIGURATION_COMMAND_4
DGN	1FEBEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_CONFIGURATION_STATUS_4

6.21.18 Charger Equalization Status

This describes the status of the Equalization process. Table 6.21.18a defines the DG attributes and Table 6.21.18b defines the signal and parameter attributes. This DGN is normally broadcast only during the equalization process.

Table 6.21.18a — DG definition

DG attribute	Value
Name	CHARGER_EQUALIZATION_STATUS
DGN	1FF99h

Default priority	6
Maximum broadcast rate	5000 ms if active
Normal broadcast rate	1000 if active
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.21.18b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1 to 2	-	Time remaining	uint16	min	Precision = 1 min Value range = 0 to 65 530 min
3	0 to 1	Pre-charging status	Bit	-	00b — Pre-charging is not in process 01b — Charger is charging the batteries to prepare for equalization

6.21.19 Equalization Configuration Status

This describes configuration information for the Equalization mode of the Charger. Table 6.21.19a defines the DG attributes and Table 6.21.19b defines the signal and parameter attributes.

Table 6.21.19a — DG definition

DG attribute	Value
Name	CHARGER_EQUALIZATION_CONFIGURATION_STATUS
DGN	1FF98h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.21.19b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 to 13 — Charger instance
1 to 2	-	Equalization voltage	uint16	V	see Table 5.3
3 to 4	-	Equalization time	uint16	min	Precision = 1 min Value range = 0 to 65 530 min

6.21.20 Equalization Configuration Command

This changes the configuration information for the Equalization mode of the Charger. Table 6.21.20 defines the DG attributes. The signal and parameter attributes have the same format as CHARGER_EQUALIZATION_CONFIGURATION_STATUS (see Table 6.21.19b).

Table 6.21.20 — DG definition

DG attribute	Value
Name	CHARGER_EQUALIZATION_CONFIGURATION_COMMAND
DGN	1FF97h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, CHARGER_EQUALIZATION_CONFIGURATION_STATUS

6.21.21 Internal Auxiliary Power Supply Status

The Charger reports the status of its APS in the same manner as an Inverter. In the case of an Inverter/Charger, the data is transmitted only once per APS. See 6.20.17.

6.21.22 Internal High Voltage DC Bus Status

The Charger reports the status of its HV DC Bus in the same manner as an Inverter. In the case of an Inverter/Charger, the data is transmitted only once per HV DC Bus. See 6.20.18.

6.21.23 Internal Offline Power Supply Status

The Charger reports the status of its HV DC Bus in the same manner as an Inverter. In the case of an Inverter/Charger, the data is transmitted only once per HV DC Bus. See 6.20.19.

6.21.24 Service Points

The SPNs defined in Table 6.21.24a shall apply to the Inverter and Charger.

Table 6.21.24a — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	DC Voltage
1	Instance	1	DC Current
1	Instance	2	Battery Temperature
1	Instance	3	DC Source State of Charge
1	Instance	4	DC Source State of Health
1	Instance	5	DC Source Capacity

1	Instance	6	DC Source AC Ripple
1	Instance	7	AC Backfeed
2	Instance	0	FET #1 Temperature
2	Instance	1	FET #2 Temperature
3	Instance	0	DC Bulk Capacitor Temperature
3	Instance	1	Transformer Temperature
3	Instance	2	Ambient Temperature
3	Instance	3	Battery Charger Timeout
3	Instance	4	Battery Equalization
3	Instance	5	DC Bridge
3	Instance	6	Transfer Relay
3	Instance	7	Stacking Configuration
4	Instance	0	Stacking Communication
4	Instance	1	Stacking Sync Clock

The SPNs defined in Table 6.21.24b shall apply to the AC input or output, and thus may have several instances. The 19-bit SPN is divided into three sections, the Most Significant Byte (MSB), the Intermediate Byte (ISB), and the Least Significant Bits (LSb). The ISB indicates the Instance of the AC Point that is suspect . If the problem is global to all instances, the ISB is 0.

Table 6.21.24b — Service Points

MSB	ISB	LSb	Description
81h	Instance	0	RMS Voltage
81h	Instance	1	RMS Current
81h	Instance	2	Frequency
81h	Instance	3	Open Ground
81h	Instance	4	Open Neutral
81h	Instance	5	Reverse Polarity
81h	Instance	6	Ground Fault
81h	Instance	7	Peak Voltage
82h	Instance	0	Peak Current
82h	Instance	1	Ground Current
82h	Instance	2	Real Power
82h	Instance	3	Reactive Power
82h	Instance	4	Harmonic Distortion
82h	Instance	5	AC Phase Status

The SPNs defined in Table 6.21.24c shall apply to the APS, DC Bus, and OPS. As with the AC Input and Output, the ISB indicates the Instance of the internal component. The MSB indicates the type of component, and the LS Bits indicate the specific failed item. If the problem is global to all instances, the ISB is Zero. If the problem is global to all instances, the ISB is 0.

Table 6.21.24c — Service Points

MSB	ISB	LSb	Description
84h – APS 85h – OPS 86h - DC Bus	Instance	0	Voltage
84h – APS 85h – OPS 86h - DC Bus	Instance	1	Current
84h – APS 85h – OPS 86h - DC Bus	Instance	2	Temperature

6.22 Generic AC Source

6.22.1 AC Output Introduction

When measuring AC power from a Generator, Inverter, or Transfer Switch, specific DGNs are defined. AC from other sources, such as the Shore Cord, is reported as a Generic AC Source. The following formats apply (see Table 6.22.1a).

Table 6.22.1a — Generic AC Source definition

Device attribute	Value
Category	Power components
Default Source Address	139
Dynamic Address Range	128 to 143
Instance	Multiple

AC output is reported using the standard AC Point formats (see Section 6.1). The Instance field is defined in Table 6.22.1b. Note that each of these DGNs may have to be transmitted multiple times to provide information on each line.

Table 6.22.1b — Instance field definition

Byte	Bit	Name	Data type	Unit	Value definition
0	0 to 3	Instance	bit4	-	1 — Shore Power
	4 to 7	Line	bit4	-	1 — Line 1 2 — Line 2

6.22.2 AC Output Page 1

Table 6.22.2 defines the DG attributes, and Table 6.22.1b defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_1 (see Table xx).

Table 6.22.2 — DG definition

DG attribute	Value
Name	GENERIC_AC_STATUS_1
DGN	1FEBBh
Default priority	6

Maximum broadcast rate	None
Normal broadcast rate	500 ms when AC active
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.22.3 AC Output Page 2

Table 6.22.3 defines the DG attributes, and Table xx defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_1 (see Table xx).

Table 6.22.3 — DG definition

DG attribute	Value
Name	GENERIC_AC_STATUS_2
DGN	1FEBAh
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when AC active
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.22.4 AC Output Page 3

Table 6.22.4 defines the DG attributes, and Table 6.22.1b defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_3 (see Table xx).

Table 6.22.4 — DG definition

DG attribute	Value
Name	GENERIC_AC_STATUS_3
DGN	1FEB9h
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when AC active
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.22.5 AC Output Page 4

Table 6.22.5 defines the DG attributes, and Table 6.22.1b defines the instance. The remaining signal and parameter of the data is defined as AC_STATUS_4 (see Table XX).

Table 6.22.5 — DG definition

DG attribute	Value
Name	GENERIC_AC_STATUS_4
DGN	1FEB8h
Default priority	6
Maximum broadcast rate	None
Normal broadcast rate	500 ms when AC active
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

6.22.6 AC Fault Configuration Status and Command

Fault Control configuration and status DGNs are defined for the generator. These DGNs follow the format of ACFAULT_CONFIGURATION_STATUS_1, ACFAULT_CONFIGURATION_STATUS_2, ACFAULT_CONFIGURATION_COMMAND_1, and ACFAULT_CONFIGURATION_COMMAND_2. Instances are defined as above.

The status DGNs are broadcast on request. The command DGNs should be acknowledged with an ACK and the corresponding status DGN.

DGN	Hex	Decimal
GENERIC_ACFAULT_CONFIGURATION_STATUS_1	1FEB7h	130743
GENERIC_ACFAULT_CONFIGURATION_STATUS_2	1FEB6h	130742
GENERIC_ACFAULT_CONFIGURATION_COMMAND_1	1FEB5h	130741
GENERIC_ACFAULT_CONFIGURATION_COMMAND_2	1FEB4h	130740

6.23 Generic AC Load

6.23.1 Introduction

These DGNs are for an AC circuit. The function of the circuit is not explicit in the DGN - there is generally no way to identify the purpose of a circuit in RV-C. The following formats apply (see Table 6.23.1).

Table 6.23.1 — Generic AC definition

Device attribute	Value
Category	Power components
Default Source Address	137
Dynamic Address Range	128 to 143
Instance	Multiple

Each circuit is identified with an Instance from 1 to 250. In practice multiple instances are likely to be contained in a single controller. These DGNs include provisions for automatic load management. Load management may also be implemented independently by using the manual modes provided in the DGNs.

Static addressing is discouraged in this product.

6.23.2 AC Load Status

This should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.23.2a defines the DG attributes and Table 6.23.2b defines the signal and parameter attributes.

Loads can be assigned to groups, which is a mechanism to allow global changes to multiple loads. There are up to seven groups, and a load may belong to more than one group or no group.

Table 6.23.2a — DG definition

DG attribute	Value
Name	AC_LOAD_STATUS
DGN	1FFBFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.23.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 - Invalid
1	-	Group	uint8	bitmap	One bit is assigned to each of seven groups. Highest bit is not used to indicate a group. If 0, the other bits refer to the groups. 0 in any other position indicates the load is a member of the corresponding group. If the high bit is a 1, the remainder should not be interpreted as group indicators. 00000000b - All groups 11111111b - No data
2	-	Operating status	uint8	%	see Table 5.3 If not dimmable, report 100%. 252 - Load delay active
3	0 to 1	Operating mode	bit	-	00b - Automatic (Load may be shed or activated without user intervention) 01b – Manual (Status shall not change without additional commands)

	2 to 3	Variable level capability	bit	-	00b - Not variable 01b - Variable
	4 to 7	Priority	uint4	-	0000b - Highest priority 1101b - Lowest priority 1110b - Error 1111b - No data This determines the order in which loads shall be shed or added. Low priority loads shall be shed first and restored last.
4	-	Delay	uint8	s	Precision = 1 s Value range = 0 to 250 s The time to elapse after an on command before the load is activated.
5	-	Demanded current	uint8	A	see Table 5.3 The maximum anticipated amperage demanded by the load.
6 to 7	-	Present current	uint16	A	see Table 5.3

6.23.3 AC Load Status 2

This should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.23.3a describes the DG attributes and Table 6.23.3b defines the signal and parameter attributes.

Table 6.23.3a – DG definition

DG attribute	Value
Name	AC_LOAD_STATUS_2
DGN	1FEDDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.23.3b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250.
1	0 to 1	Lock Status	Bit2	-	00b – Load is unlocked 01b – Load is locked 11b – Lock command is not supported

					When locked the, instance will ignore certain commands until an unlock command is received.
	2 to 3	Overcurrent Status	Bit2	-	00b – Load is not in overcurrent 01b – Load is in overcurrent 11b – Overcurrent status is unavailable or not supported
	4 to 5	Override Status	Bit2	-	00b – External override is inactive 01b – External override is active 11b – Override status is unavailable or not supported When the override is active, the output has been physically changed by a user outside of the device.
	6 to 7	Enable Status	Bit2	-	00b – Load is enabled 01b – Load is disabled 11b – Enable status is unavailable or not supported When the disable is active, it has been set through an external signal input.
2	-	Last Command	uint8		Indicates the last command (function) executed by this instance. This is the last command executed by the AC_LOAD_COMMAND (See 6.23.4) See Table 6.23.3c below for a list of possible commands.
3	0 to 1	Interlock Status	Bit2		00b – Interlock command is not active 01b – Interlock command is active 11b – Interlock command is not supported
4-7	-	Reserved			

Table 6.23.3c – Commands Possible for "Last Command"

Command	Description
0x00 – Set Level	Set output level directly to the 'desired level'
0x01 – ON	Set output on directly to 100%
0x02 – ON Delay	Set output on directly to 100% delayed by the value in 'Delay'
0x03 – OFF	Set output off directly to 0%. This can be delayed by the value in 'Delay' if greater then 0.
0x04 – Stop	If ON, set output directly to 0%. If flash is active, stop the flash and set output to off.
0x05 – Toggle	Toggle output between 0% and 'desired value'.
0x06 – Memory OFF	Store current output state to Master Memory Value for the instance and the set directly to 0%.
0x21 – Lock	When received, certain commands for this instance will be ignored until an 'Unlock' is received.
0x22 – Unlock	When received, removes lock condition for instance allowing all other commands to be recognized.
0x31 – Flash	Alternately set the output to 0% and 100%.

6.23.4 AC Load Command

Table 6.23.4a defines the DG attributes and Table 6.23.4b defines the signal and parameter attributes.

If multiple loads are changed, for example by using a group function, then each load should report AC_LOAD_STATUS. If all loads are on the same controller, then only a single ACK is required. Otherwise each controller affected should send one ACK.

Table 6.23.4a — DG definition

DG attribute	Value
Name	AC_LOAD_COMMAND
DGN	1FFBEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, AC_LOAD_STATUS

Table 6.23.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — All loads, regardless of group 255 — All loads in indicated groups
1	-	Group	uint8	bitmap	see Table 6.23.2b If bit 7 = 1 and bit 6 = 0, it is a node group. Node groups support more then seven groups where multiple groups cannot be select in one command. This is required to handle the physical grouping of multiple control instances within one node. 10000001 – Node Group 1 10111111 – Node Group 63 11111111 – For non-group commands
2	-	Desired Level	uint8	%	see Table 5.3 The load shall set its level to the lowest level equal to or greater than this value. Thus a load that is not capable of intermediate levels shall interpret any value greater 0 as “On”. A product with two levels shall treat 0.5% to 50% as 50%, 50.5% to 100% as 100%. A value of 250 = Toggle the load On/Off A value of 251 selects the Master Memory Value. A value of 253 represents Fault OFF. A value of 254 represents ERROR.
3	0 to 1	Desired Operating Mode	bit2		00b – Automatic 01b – Manual (This load will not be shed or added automatically.)
	2 to 3	Interlock	bit2	-	00b – no Interlock active 01b – Interlock A 10b – Interlock B

					A command message with either interlock A or B set will not be activated until an identical message is received from a different source with the opposing interlock set.
	4 to 7	Priority	uint4	-	0000b – Highest Priority 1101b – Lowest Priority 1110b – Error 1111b – No Data This determines the order in which loads shall be shed or added. Low priority loads shall be shed first and restored last.
4	-	Command	uint8		See Table 6.23.4c for command descriptions.
5	-	Delay/Duration	uint8	Sec	Number of seconds to wait before executing command (for delayed commands) or the number of seconds of duration for the specified command (for duration commands) before reverting to previous state. Max 240 seconds. Additional minute increment values: 241 = 5 min 242 = 6 min . . . 250 = 14 min For Duration Commands: A value of 0 indicates a momentary command (instance will revert to previous state after 100 ms (0.1 seconds) if another command is not received). A value of 255 indicates continuous duration.
6 to 7		Reserved			

Table 6.23.4c – Supported Command Descriptions

Command	Lock Support	Description
0x00 – Set Level (delay)	Yes	Set output level directly to the ‘desired level’
0x01 – ON (duration)	Yes	Set output on directly to 100%
0x02 – ON (delay)	Yes	Set output on directly to 100% delayed by the value in ‘Delay’
0x03 – OFF (delay)	Yes	Set output off directly to 0%. This can be delayed by the value in ‘Delay’ if greater then 0.
0x04 – Stop	No	If ON, set output directly to 0%. If flash is active, stop the flash and set output to off.
0x05 – Toggle	Yes	Toggle output between 0% and ‘desired value’.
0x06 – Memory OFF	Yes	Store current output state to Master Memory Value for the instance and the set directly to 0%.
0x11 – Ramp Brightness	Yes	Ramp brightness to ‘desired level’.

0x12 – Ramp Toggle	Yes	Toggle brightness between 0% and 'desired level' each time received.
0x13 – Ramp Up	Yes	Ramp brightness up from current brightness until either at 100% or a 'Stop' is received.
0x14 – Ramp Down	Yes	Ramp brightness down from current brightness until either lowest brightness is reached or a 'Stop' is received.
0x15 – Ramp Up/Down	Yes	Ramp brightness down to lowest level. Then start ramping up until 100% is reached. This continues until a 'Stop' is received.
0x16 – Increment One Level	Yes	Increase output one level to a maximum of 100%.
0x17 – Decrement One Level	Yes	Decrease output one level to a minimum of 0%.
0x21 – Lock	-	When received, certain commands for this instance will be ignored until an 'Unlock' is received.
0x22 – Unlock	-	When received, removes lock condition for instance allowing all other commands to be actuated.
0x31 – Flash	Yes	Alternately set the output to 0% and 100%. Delay/Duration value sets the flash period in seconds.
0x32 – Flash Momentary	Yes	Flash output alternately to 0% and 100% once or continue only while the command is being repeated at least once every 2 seconds. Otherwise, flashing will stop.

If a node does not support some of the above commands, it must return a NACK – Command Not Supported. All nodes supporting this DGN should support command 0x00 at a minimum.

6.23.5 Service Points

As with most multiple instance devices, if the Most Significant Byte is zero the Intermediate Byte provides the Instance associated with the failure. These are the allowable Service Points for this DGN (see Table 6.23.5).

Table 6.23.5 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Current
1	Instance	1	Operating Status
1	Instance	2	Variable Control

6.24 Generic DC Load

6.24.1 Introduction

The DGN describes a DC circuit. The function of the circuit is not explicit in the DGN - there is generally no way to identify the purpose of a circuit in RV-C. The following formats apply (see Table 6.24.1).

Table 6.24.1 — Generic DC load definition

Device attribute	Value
Category	Power components
Default Source Address	131

Dynamic Address Range	128 to 143
Instance	Multiple

The DGNs and schemes are identical to the AC Load DGNs. Each circuit is identified with an Instance from 1 to 250, which are independent of the AC Instances.

Static addressing is discouraged in this product.

6.24.2 DC Load Status

This DGN should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.24.2 defines the DG attributes. The signal and parameter attributes are the same as AC_LOAD_STATUS (see Table 6.23.2b), including the group mechanism. Note that the groups are also independent of the AC Load groups.

Table 6.24.2 — DG definition

DG attribute	Value
Name	DC_LOAD_STATUS
DGN	1FFBDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

6.24.3 DC Load Status 2

This should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.24.3a describes the DG attributes and Table 6.24.3b defines the signal and parameter attributes.

Table 6.24.3a – DG definition

DG attribute	Value
Name	DC_LOAD_STATUS_2
DGN	1FEDCh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.24.3b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250.
1	0 to 1	Lock Status	Bit2	-	00b – Load is unlocked 01b – Load is locked 11b – Lock command is not supported When locked the, instance will ignore certain commands until an unlock command is received.
	2 to 3	Overcurrent Status	Bit2	-	00b – Load is not in overcurrent 01b – Load is in overcurrent 11b – Overcurrent status is unavailable or not supported
	4 to 5	Override Status	Bit2	-	00b – External override is inactive 01b – External override is active 11b – Override status is unavailable or not supported When the override is active, the output has been physically changed by a user outside of the device.
	6 to 7	Enable Status	Bit2	-	00b – Load is enabled 01b – Load is disabled 11b – Enable status is unavailable or not supported When the disable is active, it has been set through an external signal input.
2	-	Last Command	uint8		Indicates the last command (function) executed by this instance. This is the last command executed by the DC_LOAD_COMMAND (DGN 1FFBC). See Table 6.24.3c below for a list of possible commands.
3	0 to 1	Interlock Status	Bit2		00b – Interlock command is not active 01b – Interlock command is active 11b – Interlock command is not supported
4-7	-	Reserved			

Table 6.24.3c – Commands Possible for "Last Command"

Command	Description
0x00 – Set Level	Set output level directly to the 'desired level'
0x01 – ON	Set output on directly to 100%
0x02 – ON Delay	Set output on directly to 100% delayed by the value in 'Delay'
0x03 – OFF	Set output off directly to 0%. This can be delayed by the value in 'Delay' if greater then 0.
0x04 – Stop	If ON, set output directly to 0%. If flash is active, stop the flash and set output to off.
0x05 – Toggle	Toggle output between 0% and 'desired value'.
0x06 – Memory OFF	Store current output state to Master Memory Value for the instance and the set directly to 0%.
0x21 – Lock	When received, certain commands for this instance will be ignored until an 'Unlock' is received.
0x22 – Unlock	When received, removes lock condition for instance allowing all other commands to be recognized.

0x31 – Flash	Alternately set the output to 0% and 100.

6.24.4 DC Load Command

Table 6.24.4a defines the DG attributes. The signal and parameter attributes are given in Table 6.24.4b.

Table 6.24.4 — DG definition

DG attribute	Value
Name	DC_LOAD_COMMAND
DGN	1FFBCh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, DC_LOAD_STATUS

Table 6.24.4b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — All loads, regardless of group 255 — All loads in indicated groups
1	-	Group	uint8	bitmap	see Table 6.23.2b If bit 7 = 1 and bit 6 = 0, it is a node group. Node groups support more then seven groups where multiple groups cannot be select in one command. This is required to handle the physical grouping of multiple control instances within one node. 10000001 – Node Group 1 10111111 – Node Group 63 11111111 – For non-group commands
2	-	Desired Level	uint8	%	see Table 5.3 The load shall set its level to the lowest level equal to or greater than this value. Thus a load that is not capable of intermediate levels shall interpret any value greater 0 as “On”. A product with two levels shall treat 0.5% to 50% as 50%, 50.5% to 100% as 100%. A value of 250 = Toggle the load On/Off A value of 251 selects the Master Memory Value.
3	0 to 1	Desired Operating Mode	bit		00b – Automatic 01b – Manual (This load will not be shed or added automatically.)
	2 to 3	Interlock	bit	Bitmap	Bit 0 – Interlock A Bit 1 – Interlock B A command message with either interlock bit set to ‘1’ will

					not be activated until an identical message is received from a different source with the opposing interlock bit set to '1'.
	4 to 7	Reserved			
4	-	Command	uint8		See Table 6.25.1c below for command descriptions.
5	-	Delay/Duration	uint8	Sec	Number of seconds to wait before executing command (for delayed commands) or the number of seconds of duration for the specified command (for duration commands) before reverting to previous state. Max 240 seconds. Additional minute increment values: 241 = 5 min 242 = 6 min . . . 250 = 14 min For Duration Commands: A value of 0 indicates a momentary command (instance will revert to previous state after 2 seconds if another command is not received). A value of 255 indicates continuous duration.
6 to 7		Reserved			

Table 6.24.4c – Command Descriptions

Command	Description
0x00 – Set Level (delay)	Set output level directly to the 'desired level'
0x01 – ON (duration)	Set output on directly to 100%
0x02 – ON (delay)	Set output on directly to 100% delayed by the value in 'Delay'
0x03 – OFF (delay)	Set output off directly to 0%. This can be delayed by the value in 'Delay' if greater then 0.
0x04 – Stop	If ON, set output directly to 0%. If flash is active, stop the flash and set output to off.
0x05 – Toggle	Toggle output between 0% and 'desired value'.
0x06 – Memory OFF	Store current output state to Master Memory Value for the instance and the set directly to 0%.
0x21 – Lock	When received, certain commands for this instance will be ignored until an 'Unlock' is received.
0x22 – Unlock	When received, removes lock condition for instance allowing all other commands to be actuated.
0x31 – Flash	Alternately set the output to 0% and 100%.

If a node does not support some of the above commands, it must return a NAK – Command Not Supported. All nodes supporting this DGN should support command 0x00 at a minimum.

6.24.5 Service Points

As with most multiple instance devices, if the Most Significant Byte is zero the Intermediate Byte provides the Instance associated with the failure. These are the allowable Service Points for this DGN (see Table 6.24.5).

Table 6.24.5 — Service Points

MSB	ISB	LS Bits	Description

0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Current
1	Instance	1	Operating Status
1	Instance	2	Variable Control

6.25 DC Dimmer Load

6.25.1 Introduction

This device is a variation of the DC Load, and includes data specific to dimmable lights. The function of the circuit is not explicit in the DGN – there is generally no way to identify the purpose of a circuit in RV-C. The following formats apply (see Table 6.25.1).

Table 6.25.1 — DC dimmer load definition

Device attribute	Value
Category	Power components
Default Source Address	131
Dynamic Address Range	128 to 143
Instance	Multiple

Each circuit is identified with an Instance from 1 to 250. Of course in practice multiple instances are likely to be contained in a single controller. The Instance is independent of the AC Load and DC Load instances. Thus an RV may have 250 AC Loads, 250 DC Loads, and 250 Dimmable Loads.

Static addressing is discouraged in this product.

6.25.2 DC Dimmer Status 1

This DGN should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.25.2a defines the DG attributes and Table 6.25.2b defines the signal and parameter attributes.

Unlike other loads, these products are not treated in groups. The On and Off duration control blinking. To turn a unit off, set the master brightness to zero.

Table 6.25.2a — DG definition

DG attribute	Value
Name	DC_DIMMER_STATUS_1
DGN	1FFBBh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.25.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Invalid
1	-	Master brightness	uint8	%	see Table 5.3
2	-	Red brightness	uint8	%	see Table 5.3
3	-	Green brightness	uint8	%	see Table 5.3
4	-	Blue brightness	uint8	%	see Table 5.3
5	0 to 3	On duration	bit4	s	Precision - 1 s Value range - 0 to 14 s 0 - Always on
	4 to 7	Off duration	bit4	s	Precision - 1 s Value range - 0 to 14 s 0 - “One Shot” - Switch shall activate once, then stay off.

6.25.3 DC Dimmer Status 2

Table 6.25.3a defines the DG attributes and Table 6.25.3b defines the signal and parameter attributes. Burnt lights are not reported under the DM-RV, but through this DGN.

Table 6.25.3 — DG definition

DG attribute	Value
Name	DC_DIMMER_STATUS_2
DGN	1FFBAh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change of fault fields
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.25.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Invalid
1	-	Master current	uint8	A	see Table 5.3
2	-	Red current	uint8	A	see Table 5.3
3	-	Green current	uint8	A	see Table 5.3
4	-	Blue current	uint8	A	see Table 5.3
5	0 to 1	Master fault	bit	-	00b — No fault 01b — Burnt bulb

	2 to 3	Red fault	bit	-	00b — No fault 01b — Burnt bulb
	4 to 5	Green fault	bit	-	00b — No fault 01b — Burnt bulb
	6 to 7	Blue fault	bit	-	00b — No fault 01b — Burnt bulb

6.25.4 DC Dimmer Status 3

This DGN should not be used with the Multi-Packet protocol. If multiple switches are to be reported, each should be reported in its own packet. Table 6.25.4a defines the DG attributes and Table 6.25.4b defines the signal and parameter attributes.

Table 6.25.4a – DG Definition

DG attribute	Value
Name	DC_DIMMER_STATUS_3
DGN	1FEDAh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change, as required
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.25.4b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250.
1	-	Group	uint8	bitmap	Indicates group membership. One bit is assigned to each of seven groups. Highest bit is not used to indicate a group. If 0, t he other bit s refer to the groups. 0 in any other position indicates the load is a member of the corresponding group. 01111110 – Group 1 01111101 – Group 2 00000000b- All groups 11111111b- No data
2	-	Operating Status (Brightness)	uint8	%	See Table 5.3 251 = Value is changing (ramp command) 252 = Output is Flashing
3	0 to 1	Lock Status	Bit2	-	00b – Load is unlocked 01b – Load is locked 11b – Lock command is not supported When locked the, instance will ignore certain commands until an unlock command is received.

	2 to 3	Overcurrent Status	Bit2	-	00b – Load is not in overcurrent 01b – Load is in overcurrent 11b – Overcurrent status is unavailable or not supported
	4 to 5	Override Status	Bit2	-	00b – External override is inactive 01b – External override is active 11b – Override status is unavailable or not supported When the override is active, the output has been physically changed by a user outside of the device.
	6 to 7	Enable Status	Bit2	-	00b – Load is enabled. 01b – Load is disabled. 11b – Enable status is unavailable or not supported When the disable is active, it has been set through an external signal input.
4	-	Delay/Duration	uint8	Sec	Number of seconds remaining in a delayed or duration command. Max 240 seconds. 0 = delay/duration has expired 240 = 240 or more seconds remaining (as in the case of the minute increment values) 253 = out of range (more then 240 seconds remaining) 255 = no delay/duration active
5	-	Last Command	uint8		Indicates last command (function) executed by this instance. This is the last command executed by the DC_DIMMER_COMMAND_2 See Table 6.25.4c below for a list of possible commands.
6	0 to 1	Interlock Status	Bit2		00b – Interlock command is not active 01b – Interlock command is active 11b – Interlock command is not supported
	2 to 3	Load Status	Bit2		00b – Operating status is zero. 01b – Operating status is non-zero or flashing, except it will be zero if the output is ramping down with a terminal value of zero.
	4 to 7	Reserved			Reserved
7	-	Reserved			

Table 6.25.4c – Commands Possible for "Last Command"

Command	Description
0x00 – Set Brightness	Set Dimmer brightness directly to the 'desired level'
0x01 – ON	Set Dimmer brightness directly to 100%
0x02 – ON Delay	Set Dimmer brightness directly to 100% delayed by the value in 'Delay'
0x03 – OFF	Set Dimmer brightness directly to 0%.
0x04 – Stop	If ON, set brightness directly to 0%. If ramp is active, stop the brightness at its current setting.
0x05 – Toggle	Toggle brightness between 0% and 'desired value'.

0x06 – Memory OFF	Store current brightness to Master Memory Value for the instance and the set directly to 0%.
0x11 – Ramp Brightness	Ramp brightness to ‘desired level’.
0x12 – Ramp Toggle	Toggle brightness between 0% and ‘desired level’ each time received.
0x13 – Ramp Up	Ramp brightness up from current brightness until either at 100% or a ‘Stop’ is received.
0x14 – Ramp Down	Ramp brightness down from current brightness until either lowest brightness is reached or a ‘Stop’ is received.
0x15 – Ramp Up/Down	Ramp brightness down to lowest level. Then start ramping up until 100% is reached. This continues until a ‘Stop’ is received.
0x21 – Lock	When received, certain commands for this instance will be ignored until an ‘Unlock’ is received.
0x22 – Unlock	When received, removes lock condition for the instance allowing all other commands to be recognized.
0x31 – Flash	Alternately set the output to 0% and 100%. Continue to flash until a ‘Stop’ is received.
0x32 – Flash Momentary	Flash output alternately to 0% and 100% once or continue only while the command is being repeated. Otherwise, flashing will stop.

6.25.5 DC Dimmer Command

Table 6.25.5 defines the DG attributes. The signal and parameter attributes have the same format that DC_DIMMER_STATUS_1 (see Table 6.25.2b).

If multiple loads are changed by using Instance 0 then each load should report DC_LOAD_STATUS. If all loads are on the same controller, then only a single ACK is required. Otherwise each controller affected should send one ACK.

Table 6.25.5 — DG definition

DG attribute	Value
Name	DC_DIMMER_COMMAND
DGN	1FFB9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, DC_DIMMER_STATUS_1

6.25.6 DC Dimmer Command 2

Table 6.25.6a defines the DG attributes. The signal and parameter attributes are found in Table 6.25.6b.

Table 6.25.6a – DG definition

DG attribute	Value
Name	DC_DIMMER_COMMAND_2
DGN	1FEDBh

Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, DC_DIMMER_STATUS_2

Table 6.25.6b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Instance number the command applies to. Valid = 1 to 250. Set to 0xFF for group commands.
1	-	Group	uint8	bitmap	see Table 6.23.2a If bit 7 = 1 and bit 6 = 0, it is a node group. Node groups support more then seven groups where multiple groups cannot be select in one command. This is required to handle the physical grouping of multiple control instances within one node. 10000001 – Node Group 1 10111111 – Node Group 63 11111111 – For non-group commands
2	-	Desired Level (Brightness)	uint8	%	See Table 5.3 250 selects the Dimmed Memory Value 251 selects the Master Memory Value
3	-	Command	uint8		See Table 6.25.4c for a list of possible commands and explanations.
4	-	Delay/Duration	uint8	Sec	Number of seconds to wait before executing command or the number of seconds of duration for the specified command (for duration commands) before reverting to previous state. Max 240 seconds. Additional minute increment values: 241 = 5 min 242 = 6 min . . . 250 = 14 min For Duration Commands: A value of 0 indicates a momentary command (instance will revert to previous state after 100 ms (0.1 seconds) if another command is not received). A value of 255 indicates continuous duration.
5	0 to 1	Interlock	Bit2	-	00b – no Interlock active 01b – Interlock A 10b – Interlock B A command message with either interlock A or B set will not be activated until an identical message is received from a

					different source with the opposing interlock set.
	2 to 7	Reserved			
6 to 7	-	Reserved			

6.25.7 Service Points

As with most multiple instance devices, if the Most Significant Byte is 0 the Intermediate Byte provides the Instance associated with the failure. These are the allowable Service Points for this DGN (see Table 6.25.7).

Table 6.25.7 — Service Points

MSB	ISB	LS Bits	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Current - Master
1	Instance	1	Current - Red
1	Instance	2	Current - Green
1	Instance	3	Current - Blue
2	Instance	0	Operating Status
3	Instance	0	Variable Control - Master
3	Instance	1	Variable Control - Red
3	Instance	2	Variable Control - Green
3	Instance	3	Variable Control - Blue

6.26 Digital Inputs

6.26.1 Introduction

This could mean a momentary, rocker, push-button, or any other kind of simple discrete input. The following formats apply (see Table 6.26.1).

Table 6.26.1 — Digital inputs definition

Device attribute	Value
Category	Controls and displays
Default Source Address	68
Dynamic Address Range	144 to 159
Instance	Multiple

Status addressing is highly discouraged.

A switch or switch panel can be implemented in RV-C two method – “passively” or “actively”. In an “active” implementation, the switch node sends a DC_LOAD_COMMAND or similar command, directing the load with no intermediary. In a “passive” implementation, the switch sends an INPUT_STATUS DGN, which is read by the target device or an intermediary, and that device acts appropriately. Implementations may be mixed. Active implementations are generally preferred, since they allow more

flexibility and complex actions.

6.26.2 Digital Input Status

Inputs are identified with an Instance, which may not correspond with any Load Instance. (In fact, a network may have many Inputs and no Loads, or vice-versa.) Table 6.26.2a defines the DG attributes and Table 6.26.2b defines the signal and parameter attributes.

Momentary switches should broadcast every 100 ms when they are active, and again when the switch is released. Other types should broadcast only on change.

Table 6.26.2a — DG definition

DG attribute	Value
Name	DIGITAL_INPUT_STATUS
DGN	1FFB8h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.26.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Invalid
1	-	Position	uint8	-	0 — Off 1 — On If multi-position, then this value shall indicate the position, with 0 always “Off”.
2	0 to 1	Configuration – Momentary	bit	-	0 — Conventional 1 — Momentary
3	-	Number of positions	uint8	-	0, 1 — Invalid
4	0 to 3	Bank Select	uint4	-	0 - 13 Each bank will support up to 250 instances. 0xF – Banking not supported in this installation

6.26.3 Service Points

As with most multiple instance devices, if the Most Significant Byte (MSB) is zero the Intermediate Byte (ISB) provides the Instance associated with the failure. Table 6.26.3 lists the Service Points.

Table 6.26.3 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3

1	Instance	0	Switch

6.27 Generic Indicator

6.27.1 Introduction

These DGNs apply to commands that drive and control user indicators. This command can be sent from any device on the network to specify what the indicator should display. An example of this use could be a single illuminated indicator, a tell-tale cluster, or status display on a switch panel, etc.

The following formats apply (see Table 6.27.1).

Table 6.27.1 – Generic Indicator definition

Device attribute	Value
Category	Controls & Displays
Default Source Address	68
Dynamic Address Range	128-143
Instance	Multiple

Static addressing is discouraged in this product.

6.27.1.1 Generic Indicator Status

Table 6.27.1.1a defines the DG attributes and Table 6.27.1.1b defines the signal and parameter attributes.

Table 6.27.1.1a– DG Definition

DG attribute	Value
Name	GENERIC_INDICATOR_STATUS
DGN	1FED7h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change, as required
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.27.1.1b - Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Indicator instance targeted by this command. 1-250 = valid instance

					0 = all instances 255 = no instances (use for group command)
1	-	Group	uint8	bitmap	Indicates group membership. Bits 0 to 6 correspond to groups 1 to 7. A zero in one of these seven bits indicates that the command applies to that group. Bit 7 must be zero for a group command 01111110 – Group 1 01111101 – Group 2 11111111 – For non-group commands
2	-	Brightness	uint8	%	See Table 5.3. Ignored if not used by specified function.
3	0 to 3	Bank Select	uint4	uint4	0 - 13 Each bank will support up to 250 instances, An additional bank will allow support for up to 3500 instances. 0xF – Banking not supported in this installation
4	-	Delay/Duration	uint8	Sec	Number of seconds remaining in a delayed or duration command. Max 240 seconds. 0 = delay/duration has expired 253 = out of range (more then 240 seconds remaining) 255 = no delay/duration active
5	0 to 1	LED1 Status	Bit2		00 = LED1 is off 01 = LED1 is on
	2 to 3	LED2 Status	Bit2		00 = LED2 is off 01 = LED2 is on
	4 to 7	Reserved			
6	-	Last Command	uint8	-	Indicates last command (function) executed by this instance. This is the last command executed by the GENERIC_INDICATOR_COMMAND (See 6.27.2)
7	-	Reserved			

6.27.2 Generic Indicator Command

Table 6.27.2a defines the DG attributes and Table 6.27.2b defines the signal and parameter attributes.

Table 6.27.2a – DG Definition

DG attribute	Value
Name	GENERIC_INDICATOR_COMMAND
DGN	1FED9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed (source determined)

Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERIC_INDICATOR_STATUS

Table 6.27.2b - Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Indicator instance targeted by this command. 1-250 = valid instance 0 = all instances 255 = no instances (use for group command)
1	-	Group	uint8	bitmap	Bits 0 to 6 correspond to groups 1 to 7. A zero in one of these seven bits indicates that the command applies to that group. Bit 7 must be zero for a group command 01111110 – Group 1 01111101 – Group 2 11111111 – For non-group commands
2	-	Brightness	uint8	percent	Indicator brightness level in percent. 0-200 = 0-100% in 0.5% increments. Ignored if not used by specified function. See Table 4.
3	0 to 3	Bank Select	uint4	Bitmap	0 - 13 Each bank will support up to 250 instances, An additional bank will allow support for up to 3500 instances. 0xF – Banking not supported in this installation
4	-	Duration	uint8	Sec	Number of seconds of duration for the specified command, after which the instance will revert to its previous state. Max 240 seconds. Additional minute increment values: 241 = 5 min 242 = 6 min . . . 250 = 14 min 255 = Continuous command 0 = momentary command (revert to previous state if command is not repeated at least once every 2 seconds).
5	-	Reserved			
6	-	Function	uint8	-	0x00 – Set Brightness for both LED1 and LED2 (See below) 0x01 – LED1 Off, LED2 Off 0x02 – LED1 On, LED2 Off 0x03 – LED1 Off, LED2 On 0x04 – LED1 On, LED2 On 0x11 – Ramp Brightness from current value to new value specified in byte 2. 0x33 – Flash Alternate (alternate between LED1 on and LED on)

7	-	Reserved			

The set brightness command controls the general brightness of both indicator LEDs, but does not affect whether the LEDs are actually On or Off. This should be seen like a dimmer control for the indicators.

6.28 DC Motor Control

6.28.1 Introduction

This group of DGN's applies to devices that drive and control generic DC motor loads. The following formats apply (see Table 6.28.1).

Table 6.28.1 – DC Motor Control definition

Device attribute	Value
Category	Power components
Default Source Address	138
Dynamic Address Range	128-143
Instance	Multiple

Static addressing is discouraged in this product.

6.28.2 DC Motor Control Status

The following table (Table 6.28.2a) defines the DG attributes and Table 6.28.2b defines the signal and parameter attributes.

Table 6.28.2a – DG Definition

DG attribute	Value
Name	DC_MOTOR_CONTROL_STATUS
DGN	1FEE0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change or as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.28.2b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250.
1	-	Group	uint8	bitmap	Indicates group membership. One bit is assigned to each of seven groups. Highest bit is not used to indicate a group. If

					0, t he other bit s refer to the groups. 0 in any other position indicates the load is a member of the corresponding group. 01111110 – Group 1 01111101 – Group 2 00000000 - All groups 11111111 – No Data
2	-	Operating Status (Motor Duty)	uint8	%	See Table 5.3
3	0 to 1	Lock Status	Bit2	-	00b – Load is unlocked 01b – Load is locked 11b – Lock command is not supported When locked, the instance will ignore certain commands until an unlock command is received.
	2 to 3	Motor Status	Bit2	-	00b — Neither 'Forward' nor 'Reverse' output is on. 01b — either 'Forward' or 'Reverse' output is on (Motor active in either direction)
	4 to 5	Forward Status	Bit2	-	00b — 'Forward' output not on 01b — 'Forward' output is on
	6 to 7	Reverse Status	Bit2	-	00b — 'Reverse' output not on 01b — 'Reverse' output is on
4	-	Duration	uint8	Sec	Number of seconds remaining in Duration command. Max = 240 seconds 0 = delay/duration expired 1 – 239 = seconds remaining 240 = 240 or more seconds remaining 255 = no delay/duration active
5	-	Last Command	uint8		Indicates last command (function) executed by this instance. This is the last command executed by the DC_MOTOR_CONTROL_COMMAND (DGN 1FEE1). See Table 6.28.2c below for a list of possible commands.
6	0 to 1	Overcurrent Status	Bit2	-	00b — load output not in overcurrent 01b — load output has drawn overcurrent 11b – Overcurrent status is unavailable or not supported
	2 to 3	Override Status	Bit2	-	00b – External override is inactive 01b – External override is active 11b – Override status is unavailable or not supported When the override is active, the output has been physically changed by a user outside of the device.
	4 to 5	Disable1 Status	Bit2	-	00b — Disable 1 is not active 01b — Disable 1 is active 11b – Disable 1 is not supported When disable 1 is active, it has been set through an external signal input.
	6 to 7	Disable2 Status	Bit2	-	00b — Disable 2 is not active

					01b — Disable 2 is active 11b – Disable 2 is not supported When disable 2 is active, it has been set through an external signal input.
7	-	Reserved			

Table 6.28.2c – Commands Possible for "Last Command"

Command	Description
0x04 – Stop	If motor is active in either direction, immediately stop it.
0x81 – Forward	Turn motor on in the "Forward" direction for specified duration (Controller may enforce a dead time for direction reversal)
0x41 – Reverse	Turn motor on in the "Reverse" direction for specified duration (Controller may enforce a dead time for direction reversal)
0x85 - Toggle Forward	If motor is off, turn on in the forward direction for specified duration. If motor is on in forward direction, stop it. If motor is on in reverse direction, stop it and turn on in forward direction (Controller may enforce a dead time for direction reversal).
0x45 - Toggle Reverse	If motor is off, turn on in the reverse direction for specified duration. If motor is on in reverse direction, stop it. If motor is on in forward direction, stop it and turn on in reverse direction (Controller may enforce a dead time for direction reversal).
0x10 – Tilt	Output motor in the "Forward" direction in small increments for fine tuning.
0x21 – Lock	Lock instance preventing certain commands from affecting it until an "Unlock" command is received.
0x22 – Unlock	Unlock an instance that is currently locked.

6.28.3 DC Motor Control Command

The following table (Table 6.28.3a) defines the DG attributes. The signal and parameter attributes are found in Table 6.28.3b.

Table 6.28.3a – DG Definition

DG attribute	Value
Name	DC_MOTOR_CONTROL_COMMAND
DGN	1FEE1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, DC_MOTOR_CONTROL_STATUS

Table 6.28.3b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250. 0xFF for group commands.

1	-	Group	uint8	bitmap	see Table 203 [external doc reference] If bit 7 = 1 and bit 6 = 0, it is a node group. Node groups support more then seven groups where multiple groups cannot be selected in one command. This is required to handle the physical grouping of multiple control instances within one node. 10000001 – Node Group 1 10011111 – Node Group 31 (max for this mode) 11111111 – For non-group commands
2	-	Operating Status (Motor Duty)	uint8	%	See Table 5.3
3	-	Command	uint8	Bitmap	0x04 – Stop 0x81 – Forward 0x41 – Reverse 0x85 – Toggle Forward 0x45 – Toggle Reverse 0x10 – Tilt 0x21 – Lock 0x22 – Unlock See table 6.28.2c above for an explanation of each command. If a node does not support some of the above commands, it must return a NACK – Command Not Supported.
4	-	Duration	uint8	Sec	Number of seconds to enable motor for before stopping. Range: 1 to 240 seconds Additional minute increment values: 241 = 5 min 242 = 6 min . . . 250 = 14 min 255 = Continuous command 0 = momentary command. This command will only turn on the channel for 2 seconds. However, if the message is repeated with a period less than 2 seconds, the channel will stay on indefinitely. Duration is ignored if not supported by specified command
5	-	Interlock	uint8	Bitmap	Bit 0 – Interlock A Bit 1 – Interlock B A command message with either interlock bit set to ‘1’ will not be activated until an identical message is received from a different source with the opposing interlock bit set to ‘1’. Bit 2-7 – Reserved
6-7	-	Reserved			

6.29 Tank Sensors

6.29.1 Introduction

This may be a single module monitoring multiple tanks, or multiple modules. The following formats apply (see Table 6.29.1). The Instances in these DGNs are specifically identified with particular tanks.

Table 6.29.1 — Tank sensors definition

Device attribute	Value
Category	Sensors
Default Source Address	72, 73
Dynamic Address Range	160 to 175
Instance	Multiple

6.29.2 Tank Status

This DGN outputs the tank level. Table 6.29.2a defines the DG attributes and Table 6.29.2b defines the signal and parameter attributes.

The Relative Tank Level is reported as a fraction, thus communicating the precision with which the sensors should be reported. This prevents a digital display from reporting “87.5%” and leaving the consumer with the impression of accuracy to three digits when the tank level sensor only reports in eighths.

When this DGN is requested, the node shall send one packet for each existing tank. This will be done by sending separate packets, not by using the Multi -Packet protocol.

Table 6.29.2a — DG definition

DG attribute	Value
Name	TANK_STATUS
DGN	1FFB7h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.29.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Fresh water 1 — Black waste (If only one waste tank is present, it shall be reported as Black.) 2 — Gray waste 3 — LPG 16 — Second fresh water 17 — Second black waste 18 — Second gray waste 19 — Second LPG
1	-	Relative level	uint8	-	Level = Relative level / Resolution

2	-	Resolution	uint8	-	-
3 to 4	-	Absolute level	uint16	l (Liter)	Precision = 1l Value range = 0 to 65 530 l
5 to 6	-	Tank size	uint16	l (Liter)	Precision = 1l Value range = 0 to 65 530 l

6.29.3 Tank Calibration

This DGN allows the calibration of the water tank sensors by defining the current level. Typically, the user would empty the tank and send this message with a level of zero, then fill the tank and send the message again with a level of "full". Some tanks may support calibrating to intermediate values, as well.

Table 6.29.3a defines the DG attributes and Table 6.29.3b defines the signal and parameter attributes.

Tank systems that use this calibration method should automatically convert the precision values. For example, if Level = 1 and Precision = 1, it should properly interpret this as 100% full, regardless of the inherent precision of the sensors.

Table 6.29.3a — DG definition

DG attr ibute	Value
Name	TANK_CALIBRATION_COMMAND
DGN	1FFB6h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, TANK_STATUS

Table 6.29.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Fresh water 1 — Black waste (If only one waste tank is present, it shall be reported as Black.) 2 — Gray waste 3 — LPG 16 — Second fresh water 17 — Second black waste 18 — Second gray waste 19 — Second LPG
1	-	Relative level	uint8	-	Level = Relative Level / Resolution
2	-	Resolution	uint8	-	
3 to 4	-	Absolute level	uint16	l (Liter)	Precision = 1l Value range = 0 to 65 530 l
5 to 6	-	Tank size	uint16	l (Liter)	Precision = 1 l

					Value range = 0 to 65 530 l

6.29.4 Tank Geometry

This DGN is for tank sensor systems that require the tank geometry to be configured into the system to be accurate. Since tanks are not always rectangular, sensors that measure a linear depth may require this information. Also, sensor technologies that are non-linear may require some sort of similar calibration. But not all tank systems will use these DGNs. This set of DGNs is used in conjunction with the Tank Geometry Configuration DGNs.

Table 6.29.4a defines the DG attributes and Table 6.29.4b defines the signal and parameter attributes.

The report consists of a table of values, each entry of which corresponds to a specific tank level. The meaning of the data value itself is not defined. It conceivably could be a linear measurement, pressure level, ADC count – whatever might be appropriate for the specific application.

Table 6.29.4a — DG definition

DG attribute	Value
Name	TANK_GEOMETRY_STATUS
DGN	1FFB5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as request
Minimum broadcast rate	N/A
Number of frames	Depends on table size
ACK requirements	None

Table 6.29.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 — Fresh water 1 — Black waste (If only one waste tank is present, it shall be reported as Black.) 2 — Gray waste 3 — LPG 16 — Second fresh water 17 — Second black waste 18 — Second gray waste 19 — Second LPG
1	-	Number of entries	uint8	-	Level = Relative level / Resolution
2	-	Point 1 – Level	uint8	-	
3	-	Point 1 – Precision	uint8	-	
4 to 5	-	Point 1 – Table value	uint16	-	Application specific interpretation
6	-	Point 2 – Level	uint8	-	
7	-	Point 2 – Precision	uint8	-	
8 to 9	-	Point 2 – Table value	uint16	-	Application specific interpretation

Additional table entries may follow in the same format. The number of entries is limited by the maximum message length to 394.

6.29.5 Tank Geometry Configuration

This DGN sets the Tank Geometry. Table 6.29.5 defines the DG attributes. The signal and parameter attributes format is the same as TANK_GEOMETRY_STATUS (see Table 6.29.4b). It is not defined in the protocol how the receiving node should handle partial table entries.

Table 6.29.5 — DG definition

DG attribute	Value
Name	TANK_GEOMETRY_COMMAND
DGN	1FFB4h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	Depends on table size
ACK requirements	ACK, TANK_GEOMETRY_STATUS

6.29.6 Service Points

As with all multi-instance nodes, if the Most Significant Byte is non-zero, the Intermediate Byte contains the Instance. Table 6.29.6 lists the Service Points.

Table 6.29.6 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Absolute Level
1	Instance	1	Tank Size
1	Instance	2	Geometry Table

6.30 Water Pump

6.30.1 Introduction

Implicit in this protocol is that there is a single water pump supplying the RV. It could also be used by a pressure sensor on the fresh water system. The following formats apply (see Table 6.30.1).

Table 6.30.1 — Water pump definition

Device attribute	Value
Category	Appliances
Default Source Address	127
Dynamic Address Range	208 to 223

Instance	Single

6.30.2 Water Pump Status

Table 6.30.2a defines the DG attributes and Table 6.30.2b defines the signal and parameter attributes.

Table 6.30.2a — DG definition

DG attrib ute	Value
Name	WATER_PUMP_STATUS
DGN	1FFB3h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.30.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Operating status	bit	-	00b — Pump off 01b — Pump on (standby or running)
	2 to 3	Pump status	bit	-	00b — Pump not running 01b — Pump running
	4 to 5	Water hookup detected	bit	-	00b — RV is hooked to outside water source 01b — RV is not hooked up
1 to 2	-	Current system pressure	uint16	Pa	Precision = 100 Pa = 0.0145 PSI Value range = 0 to 6 553 200 Pa (0 to 950.214 PSI)
3 to 4	-	Pump pressure setting	uint16	Pa	Precision = 100 Pa = 0.0145 PSI Value range = 0 to 6 553 200 Pa (0 to 950.214 PSI)
5 to 6	-	Regulator pressure setting	uint16	Pa	Precision = 100 Pa = 0.0145 PSI Value range = 0 to 6 553 200 Pa (0 to 950.214 PSI)
7	-	Operating current	uint8	A	see Table 5.3

6.30.3 Water Pump Command

Table 6.30.3a defines the DG attributes and Table 6.30.3b defines the signal and parameter attributes.

Table 6.30.3a — DG definition

DG attribute	Value

Name	WATER_PUMP_COMMAND
DGN	1FFB2h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, WATER_PUMP_STATUS

Table 6.30.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Command	bit	-	00b - Turn pump off 01b - Turn pump on (standby)
1 to 2		Pump pressure setting	uint16	Pa	Precision = 100 Pa = 0,0145 PSI Value range = 0 to 6 553 200 Pa (0 to 950,214 PSI)
3 to 4		Regulator pressure setting	uint16	Pa	Precision = 100 Pa = 0,0145 PSI Value range = 0 to 6 553 200 Pa (0 to 950,214 PSI)

6.30.4 Service Points

Table 6.30.4 lists the allowable Service Points.

Table 6.30.4 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Pump
257	Water Hookup
258	System Pressure
259	Pump Pressure Setting
260	Regulator Pressure Setting
261	Operating Power

6.31 AutoFill

6.31.1 Introduction

The AutoFill device diverts water to the Fresh Water Tank when water is available from the hookup. Once the tank is full it then closes the diversion valve. The following formats apply (see Table 6.31.1). This is usually implemented as part of a tank sensor device.

Table 6.31.1 — Autofill definition

Device attribute	Value

Category	Appliances
Default Source Address	128
Dynamic Address Range	208 to 223
Instance	Single

6.31.2 AutoFill Status

Table 6.31.2a defines the DG attributes and Table 6.31.2b defines the signal and parameter attributes.

Table 6.31.2a — DG definition

DG attribute	Value
Name	AUTOFILL_STATUS
DGN	1FFB1h
Default priority	6
Maximum broadcast rate	5000 ms when active
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.31.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Operating status	bit	-	00b - AutoFill off 01b - AutoFill on
	2 to 3	Valve status	bit	-	00b - Diverter valve closed 01b - Valve open
	4 to 7	Last operation	bit4	-	0000b – Still running 0001b - Successful fill 0010b - Fill timed out 0011b - Fill manually aborted 0100b - Fill aborted due to error

6.31.3 AutoFill Command

Table 6.31.3a defines the DG attributes and Table 6.31.3b defines the signal and parameter attributes.

Table 6.31.3a — DG definition

DG attribute	Value
Name	AUTOFILL_COMMAND
DGN	1FFB0h
Default priority	6

Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, AUTOF ILL_STATUS

Table 6.31.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Command	bit	-	00b - Stop AutoFill 01b - Start AutoFill
	2 to 3	Manual valve control	bit	-	00b - Close valve manually 01b - Open valve Either ends the AutoFill.

6.31.4 Service Points

Table 6.31.4 lists the allowable Service Points.

Table 6.31.4 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Valve
257	Water Supply
258	Fresh Water Tank

6.32 Waste Dump

6.32.1 Introduction

These DGs apply to an electronically controlled waste dump system. The following formats apply (see Table 6.32.1).

Table 6.32.1 — Waste dump definition

Device attribute	Value
Category	Appliances
Default Source Address	128
Dynamic Address Range	208 to 223
Instance	Single

6.32.2 Waste Dump Status

Table 6.32.2a defines the DG attributes and Table 6.32.2b defines the signal and parameter attributes.

Table 6.32.2a — DG definition

DG attribute	Value
Name	WASTEDUMP_STATUS
DGN	1FFAFh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.32.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Valve status - Black	bit	-	00b - Closed 01b - Open
	2 to 3	Valve status - Gray	bit	-	00b – Closed 01b - Open
	4 to 5	Safety lock	bit	-	00b - Off (valves are free to open) 01b - On (valves shall not open)
1	-	Sewer hose status - Position	uint8	%	see Table 5.3 0 - Fully retracted 200 – 100%, Fully extended (ready to dump)
2	-	Sewer hose status - Motion	uint8	-	0 - No motion 1 – Extending 2 - Retracting
3	0 to 1	Flush status - Black	bit	-	00b – Closed 01b - Flushing
	2 to 3	Flush status - Gray	bit	-	00b – Closed 01b - Flushing
	4 to 5	Tank additive - Black	bit	-	00b - Additive required 01b - Additive delivered Typically the additive required value indicates that the tank has been dumped, but the automatic additive dispenser has not yet been triggered.
	6 to 7	Tank additive - Gray	bit	-	00b - Additive required 01b - Additive delivered
4	0 to 3	Automatic dumping mode - Black	bit4	-	0000b - Manual 0001b - Automatic 0010b - Automatic, with additive
4	4 to 7	Automatic dumping mode- Gray	bit4	-	0000b - Manual 0001b - Automatic 0010b - Automatic, with additive

5	-	Automatic dumping level - Black	uint8	%	see Table 5.3 Percent tank level which will trigger an automatic dump. 0 - Always open
6	-	Automatic dumping level -Gray	uint8	%	see Table 5.3 Percent tank level, which will trigger an automatic dump. 0 - Always open

6.32.3 Waste Dump Command

Table 6.32.3a defines the DG attributes and Table 6.32.3b defines the signal and parameter attributes.

Table 6.32.3a — DG definition

DG attribute	Value
Name	WASTEDUMP_COMMAND
DGN	1FFAEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, WASTE_DUMP_STATUS

Table 6.32.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Command - Black tank	uint8	-	0 - Close dump valve 1 - Open dump valve 2 - Stop tank flush 3 - Start tank flush 4 - Dispense additive 5 - Start Automatic Dump Cycle
1	-	Command - Gray tank	uint8	-	0 - Close dump valve 1 - Open dump valve 2 - Stop tank flush 3 - Start tank flush 4 - Dispense additive 5 - Start Automatic Dump Cycle
2	-	Command - Hose extension	uint8	-	0 - Stop extension/retraction. 1 - Begin extension. 2 - Begin retraction.
3	-	AutoDump command - Black	uint8	-	0 - End automatic mode 1 - Start automatic mode, no additive 2 - Start automatic mode, with additive

4	-	AutoDump command - Gray	uint8	-	0 - End automatic mode 1 - Start automatic mode, no additive 2 - Start automatic mode, with additive
5	-	AutoDump level - Black	uint8	%	see Table 5.3 Percent tank level, which will trigger an automatic dump. 0 - Always open
6	-	AutoDump level - Gray	uint8	%	see Table 5.3 Percent tank level, which will trigger an automatic dump. 0 - Always open

6.32.4 Service Points

Table 6.32.4 lists the allowable Service Points.

Table 6.32.4 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Black Dump Valve
257	Gray Dump Valve
258	Hose Extension Air Valve
259	Local Control Panel
260	Remote Control Unit
261	Remote Control Receiver
262	Sewer Hose
263	Black Tank Data Source
264	Gray Tank Data Source
265	Tank Additive Dispenser

6.33 Transfer Switch

6.33.1 Introduction

A transfer switch controls the input to a single AC output - typically two legs which may or may not be in phase.

RV-C supports up to six transfer switches, each with up to six inputs and one output of one or two legs. If additional output points are needed, then each should be considered a separate transfer switch. If only one transfer switch is installed, it should use Instance #1 by default. The following formats apply (see Table 6.33.1).

Table 6.33.1 — Transfer switch definition

Device attribute	Value
Category	Power components
Default Source Address	79
Dynamic Address Range	128 to 143

Instance	Multiple

6.33.2 AC Status

These three DGNs broadcast the state of the AC power in and out of the transfer switch. One set of DGNs should be sent for each line and leg. Of course, not all switches will support all three DGNs - only the supported DGNs should be broadcast.

Only the active input line should be broadcast each 500 ms. The inactive inputs should be broadcast only every 5000 ms, plus when the DGN is requested.

Table 6.33.2a defines the DG attributes and Table 6.33.2b defines the Instance field. The remaining fields for the four DGNs follow the format of the four AC Point Status DGNs. See tables 6.1.2b, 6.1.3b, 6.1.4b, and 6.1.5b.

Table 6.33.2a — DG definition

DG attribute	Value
Name	ATS_AC_STATUS_1, ATS_AC_STATUS_2, ATS_AC_STATUS_3, ATS_AC_STATUS_4
DGN	1FFADh, 1FFACh, 1FFABh, 1FF85h
Default priority	3
Maximum broadcast rate	5000 ms
Normal broadcast rate	500 ms when active
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.33.2b — Instance Field

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 2	Transfer Switch instance	bit3	-	000b - Invalid 111b - Invalid (no data)
	3	Input/Output type	bit	-	0 - Input 1 - Output
	4 to 6	Source	bit3	-	000b - Primary (for inputs, typically generator) 001b - Secondary 111b - Invalid (no data)
	7	Leg	bit	-	0 - Leg1 1 - Leg2

6.33.3 AC Fault Configuration Status and Command

Fault Control configuration and status DGNs are defined for the transfer switch. These DGNs follow the formats as indicated in the following table.

Table 6.20.7 - DG Reference

Name	DGN	Format	Table
ATS_ACFAULT_CONFIGURATION_STATUS_1	1FF84h	AC_CONFIGURATION_STATUS_1	6.1.6
ATS_ACFAULT_CONFIGURATION_STATUS_2	1FF83h	AC_CONFIGURATION_STATUS_2	6.1.7
ATS_ACFAULT_CONFIGURATION_COMMAND_1	1FF82h	ACFAULT_CONFIGURATION_COMMAND_1	6.1.8
ATS_ACFAULT_CONFIGURATION_COMMAND_2	1FF81h	ACFAULT_CONFIGURATION_COMMAND_2	6.1.8

The status DGNs are broadcast on request. The command DGNs should be acknowledged with an ACK and the corresponding status DGN.

If configuring one AC instance affects the configuration of other instances within the ATS, the node should respond with status information for all affected instances.

6.33.4 ATS Status

This DGN shows which source is currently active. Table 6.33.4a defines the DG attributes and Table 6.33.4b defines the signal and parameter attributes. The Instance corresponds to the ATS Instance of the ATS_AC_STATUS DGN Instances.

Table 6.33.4a — DG definition

DG attribute	Value
Name	ATS_STATUS
DGN	1FFAAh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.33.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 - Invalid 1 to 6 - Valid instances
1	-	Source in use	uint8	-	0 - Primary 0 to 6 - Valid sources 253 - No source active
2	0 to 1	Mode	bit	-	00b - Automatic 01b - Manual

6.33.5 ATS Command

This DGN forces the transfer switch to a certain source, or releases it to automatically select.

The Instance corresponds to the ATS Instance of the ATS_AC_STATUS DGN Instances. The Source in Use corresponds to the Source bits of that Instance field as well. If the Mode is set to Automatic, the Source to Use is ignored.

Table 6.33.5a defines the DG attributes and Table 6.33.5b defines the signal and parameter attributes. The Instance corresponds

to the ATS Instance of the ATS_AC_STATUS DGN Instances.

Table 6.33.5a — DG definition

DG attribute	Value
Name	ATS_COMMAND
DGN	1FFA9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.33.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 - Invalid 1 to 6 - Valid instances
1	-	Source to use	uint8	-	0 - Primary 0 to 6 - Valid sources 253 - No source active
2	0 to 1	Mode	bit	-	00b - Automatic 01b - Manual

6.33.6 Service Points

The Intermediate Byte of the SPN indicates the Instance of the component with a fault. For the ATS this is the Transfer Switch Instance only. Note that the AC power faults are not reported with the DM-RV. The DM-RV is reserved for failures of the ATS components. Table 6.33.6 lists the allowable Service Points.

Table 6.33.6 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0 to 6	Contactor. LSB indicates the input affected.
1	Instance	0 to 6	Contactor Neutral. LSB indicates the input affected.

6.34 Weather Station

6.34.1 Introduction

This describes any cluster of sensors to describe ambient outdoor conditions. The following formats apply (see Table 6.34.1).

Table 6.34.1 — Weather station definition

Device attribute	Value

Category	Sensors
Default Source Address	80
Dynamic Address Range	160 to 175
Instance	Single

6.34.2 Weather Status 1

The location of the Alternative Air Temperature is undefined, and is typically a storage bay or indoor temperature. Table 6.34.2a defines the DG attributes and Table 6.34.2b defines the signal and parameter attributes.

Table 6.34.2a — DG definition

DG attribute	Value
Name	WEATHER_STATUS_1
DGN	1FFA5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	5000 ms
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.34.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0 to 1	-	Exterior air temperature	uint16	°C	see Table 5.3
2 to 3	-	Alternative air temperature	uint16	°C	see Table 5.3
4 to 5	-	Absolute air pressure	uint16	mBar	Precision = 0.1 mBar Value range = 0 to 65 530 mBar
6	-	Relative humidity	uint8	%	see Table 5.3

6.34.3 Weather Status 2

Table 6.34.3a defines the DG attributes and Table 6.34.3b defines the signal and parameter attributes.

Table 6.34.3a — DG definition

DG attribute	Value
Name	WEATHER_STATUS_2
DGN	1FFA4h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	5000 ms
Minimum broadcast rate	N/A

Number of frames	1
ACK requirements	None

Table 6.34.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Wind speed	uint8	kph	Precision = 1 kph Value range = 0 to 250 kph
1to 2		Wind direction	uint16	Deg	Precision = 1/128 Deg Value range = 00to 360 0 - North 90 - East 180 -South 270 - West
3	-	Solar intensity	uint8	kLux	Precision = 1 kLux Value range = 0 to 250 kLux
4	-	Rain intensity	uint8	%	see Table 5.3 NOTE No standard scale is referred to.

6.34.4 Altimeter Status

The altimeter commonly uses the absolute air pressure reading and adjusts it to obtain a “corrected” air pressure reading and an altitude. This type of altimeter often has to be adjusted by the user.

Table 6.34.4a defines the DG attributes and Table 6.34.4b defines the signal and parameter attributes.

The Basis Pressure is the value used to calculate the altitude. The “standard” air pressure at sea level is approximately 1013 mBar. An absolute air pressure reading of 980 mBar could result on a Compensated Pressure reading of 1013 and a Altitude Basis of 980, or a Compensated Pressure of 980 and a Altitude Basis of 1013 (sea level) , depending on the user input or last known altitude. (Of course it could be somewhere in between.)

Table 6.34.4a — DG definition

DG attribute	Value
Name	ALTIMETER_STATUS
DGN	1FFA3h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	5000 ms
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.34.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0 to 1	-	Altitude compensated air	uint16	mBar	Precision = 0.1 mBar

		pressure			Value range = 0 to 65 530 mBar
2 to 3	-	Basis air pressure for altitude	uint16	mBar	Precision = 0.1 mBar Value range = 0 to 65 530 mBar
4 to 5	-	Altitude	uint16	m	Precision = 0.1 m Offset = -500m Value range = -500 to 6 053,0 m

6.34.5 Altimeter Adjustment

This DGN allows the user to adjust the altimeter.

Table 6.34.5a defines the DG attributes and Table 6.34.5b defines the signal and parameter attributes. The first field determines the action and all of which adjust the basis and corrected pressures reported by the altimeter. They do not affect the absolute pressure reported in WEATHER_STATUS_1.

Table 6.34.5a — DG definition

DG attribute	Value
Name	ALTIMETER_COMMAND
DGN	1FFA2h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, ALTIMETER_STATUS

Table 6.34.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Command	uint16	mBar	0 - Set to sea level 1 - Set altitude compensated pressure 2 - Set altitude basis pressure 3 - Increment altitude basis pressure (decrements altitude) 4 - Decrement altitude basis pressure (increments altitude)
1 to 2	-	Value	uint16	mBar	Precision = 0.1 mBar Value range = 0 to 65 530 mBar

6.34.6 Weather Sensor Calibration

This DGN allows the user to calibrate the weather sensors. Table 6.34.6 defines the DG attributes. The signal and parameter attributes are defined the same as WEATHER_STATUS_1 (see Table 6.34.2b).

Table 6.34.6 — DG definition

DG attribute	Value

Name	WEATHER_CALIBRATE_COMMAND
DGN	1FFA1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, WEATHER_STATUS_1

6.34.7 Service Points

Table 6.34.7 lists the Service Points.

Table 6.34.7 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Temperature Sensor
257	Alternative Temperature Sensor
258	Humidity Sensor
259	Barometric Pressure Sensor
260	Wind Speed Sensor
261	Wind Direction Sensor
262	Rain Sensor
263	Solar Sensor

6.35 Compass

6.35.1 Introduction

The following formats apply (see Table 6.35.1).

Table 6.35.1 — Compass definition

Device attribute	Value
Category	Sensors
Default Source Address	134
Dynamic Address Range	160 to 175
Instance	Single

6.35.2 Compass Bearing

Table 6.35.2a defines the DG attributes and Table 6.35.2b defines the signal and parameter attributes. Electronic magnetic compasses are generally calibrated by driving the coach in a circle to allow the sensor to determine the affect of magnetic materials in the RV. The compass is put into a “calibration” mode and automatically exits when the circle is complete. In some

cases the compass cannot calibrate, and the calibration mode will report as 2 (Error).

Table 6.35.2a — DG definition

DG attribute	Value
Name	COMPASS_BEARING_STATUS
DGN	1FFA0h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.35.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0 to 1	-	Adjusted compass bearing	uint16	Deg	Precision = 1/128 Deg Value range = 0 to 360 Deg 0 - North 90 - East 180 - South 270 - West
2 to 3	-	Compass offset	uint16	Deg	Precision = 1/128 Deg Value range = 0 to 360 Deg 0 - North 90 - East 180 - South 270 - West
4	0 to 1	Compass calibration status	bit	-	00b - Compass is calibrated 01b - Compass in calibration process 10b - Error

6.35.3 Compass Calibration

Table 6.35.3a defines the DG attributes and Table 6.35.3b defines the signal and parameter attributes. This DGN uses a similar command method as ALTIMETER_COMMAND. If the first field is 1, 2, or 3, the second field provides the value with which to adjust the compass offset.

Table 6.35.3a — DG definition

DG attribute	Value
Name	COMPASS_CALIBRATE_COMMAND
DGN	1FF9Fh
Default priority	6
Maximum broadcast rate	N/A

Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, COMPASS_BEARING_STATUS

Table 6.35.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0 to 1	-	Command	uint8	-	0 - Enter self-calibration mod 1 - Set compass offset 2 - Increment compass offset 3 - Decrement compass offset
2 to 3	-	Compass offset / increment	uint16	Deg	Precision = 1/128 Deg Value range = 0 to 360 Deg 0 - North 90 - East 180 - South 270 - West

6.35.4 Service Points

Table 6.35.4lists the Service Points.

Table 6.35.4 — Service Points

SPN	Description
0 to 255	Standard SPNs (see Table 7.3)
256	Compass - X Sensor
257	Compass - Y Sensor

6.36 Automatic Generator Start

6.36.1 Introduction

Automatic Generator Start products have two responsibilities in an RV-C network. Whereas it possible to start the generator by using the GENERATOR_COMMAND DGN, there are no provisions within that DGN for dealing with multiple devices that wish to control the generator. One device may shut down the generator even as another device needs it to be on. This is generally not acceptable.

Products that wish to control the generator should first check to see whether an Automatic Generator Start device is present. It should only use the GENERATOR_COMMAND if no device supporting AUTO_GENERATOR_COMMAND is available. The following formats apply (see Table 6.36.1).

Table 6.36.1 — Device definition

Device attribute	Value
Category	Power components
Default Source Address	65

Dynamic Address Range	128 to 143
Instance	Single

The AGS Controller (not to be confused with the Generator Controller, which controls the start and stop logic for the generator) can be considered in two parts. First, it is a device similar in structure to the Chassis Mobility Control that maintains a list of devices that desire the generator to be on. It turns the generator on and off according to demand. Secondly, it may have its own internal criteria for starting and stopping the generator for a variety of purposes.

6.36.2 Generator Demand Status

This DGN allows products to determine the status of generator demand. Note that this is not the same as generator run status - the generator may be running or not, regardless of demand. This DGN also indicates whether there is demand for generator power from this system. The flags in the first byte indicate whether demand exists, and whether external activity is overriding the demand. Generally an external stop should take precedence over the network or internal demand. Such a stop may be a manual stop, for example for service, or caused by a generator failure. This flag may be reset by the next DGN, or by some automatic means.

Table 6.36.2a defines the DG attributes and Table 6.36.2b defines the signal and parameter attributes.

Table 6.36.2a — DG definition

DG attribute	Value
Name	GENERATOR_DEMAND_STATUS
DGN	1FF80h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.36.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Generator demand	bit	-	00b - No demand for generator 01b - Generator is demanded
	2 to 3	Internal generator demand	bit	-	00b - No internal demand 01b - Internal AGS criterion is demanding generator
	4 to 5	Network generator demand	bit	-	00b - No demand from other network nodes 01b - Network device is demanding generator
	6 to 7	External activity detected	bit	-	00b - No external activity detected. 01b - Generator has turned on or off due to external process, or a generator fault prevents running.
1	0 to 1	Manual override detected	bit	-	00b - Normal Operation 01b - Manual Override

	2 to 3	Quiet time	bit	-	00b - Unit is not in Quiet Time 01b - Unit is in Quiet Time
	4 to 5	Quiet time override	bit	-	00b - Normal operation 01b - Quiet Time is being overridden
	6 to 7	Generator lock	bit	-	00b - Normal operation 01b - Genset is locked. Node will not start generator for any reason
2	-	Quiet time begin hour	uint8	h	Precision = 1 h Value range = 0 to 23 h 0 - 12:00AM 11 - 11:00AM 12 - 12:00 PM 23 - 11:00PM This should be Local Time.
3	-	Quiet time begin minute	uint8	min	Precision = 1 min Value range = 0 to 59 min
4	-	Quiet time end hour	uint8	h	Precision = 1 h Value range = 0 to 23 h 0 - 12:00AM 11 - 11:00AM 12 - 12:00 PM 23 - 11:00PM This should be Local Time.
5	-	Quiet time end minute	uint8	min	Precision = 1 min Value range = 0 to 59 min
6	-	Minimum cycle time	uint8	min	Precision = 1 min Value range = 0 to 250 min 0 - No minimum. Minimum time generator will be run.

6.36.3 Generator Demand Command

This DGN allows devices to indicate their need for generator power. Devices that use this DGN must also support the request for this DGN. Before stopping the generator, the controller may poll devices for this DGN, and if any device indicates it demands power it should not stop the generator.

Note that this DGN is not the same as GENERATOR_COMMAND. That DGN starts or stops the generator without regard to Quiet Time or other demands upon the generator. If this DGN is implemented in the network it should be used in preference to GENERATOR_COMMAND. That DGN should be used only for testing and by the AGS controller itself.

The AGS controller may also maintain a list of devices that have demanded power, and base its decision on that list rather than polling the network. Either scheme is acceptable in RV-C, so products may use either or both methods.

Table 6.36.3a defines the DG attributes and Table 6.36.3b defines the signal and parameter attributes. If the AGS is in Quiet Time, the ACK should return a value of 3 (“Conditions do not allow command to be implemented”) or 7 (“More time required to reply”), depending on whether the AGS is programmed to start the genset at the end of quiet time. If the AGS has detected external activity that takes precedence, then a value of 8 (“User override has priority”) should be returned. If the generator has a known fault, then it should return a 3.

Table 6.36.3a — DG definition

DG attribute	Value
Name	GENERATOR_DEMAND_COMMAND
DGN	1FEFFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DEMAND_STATUS

Table 6.36.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Generator demand	bit	-	00b - No demand for generator 01b - Generator power is demanded
	2 to 3	Quiet time override	bit	-	00b - Normal operation 01b - Override Quiet Time
	4 to 5	External activity reset	bit	-	00b - No action. 01b - Reset External Activity flag.
	6 to 7	Manual override	bit	-	00b - Normal operation 01b - Override other demand/criteria.
1	0 to 1	Generator lock	bit	-	00b - Normal operation 01b - Generator is locked.
2	-	Set quiet time begin hour	uint8	h	Precision = 1 h Value range = 0 to 23 h 0 - 12:00AM 11 - 11:00AM 12 - 12:00 PM 23 - 11:00PM This should be Local Time.
3	-	Set quiet time begin minute	uint8	min	Precision = 1 min Value range = 0 to 59 min
4	-	Set quiet time end hour	uint8	h	Precision = 1 h Value range = 0 to 23 h 0 - 12:00AM 11 - 11:00AM 12 - 12:00 PM 23 - 11:00PM This should be Local Time.
5	-	Set quiet time end minute	uint8	min	Precision = 1 min Value range = 0 to 59 min
6	-	Set minimum cycle time	uint8	min	Precision = 1 min Value range = 0 to 250 min

					Minimum time generator will be run.

If the Manual Override and Demand flags are set, the AGS shall run until another command is sent with the Manual Override, or until Quiet Time. If the Quiet Time override is set, then only another command will stop the generator.

6.36.4 AGS Criterion Status

This DGN shows the status of an internal AGS criterion and is multi-instance. The protocol assumes that only one AGS product is in the network and there are no provisions for multiple devices.

Table 6.36.4a defines the DG attributes and Table 6.36.4b defines the signal and parameter attributes. If requested, the device should report this DGN once for each internal criterion. This should not be done using the multi -packet DGN, but by repeated broadcasts of this DGN. (This will make it easier to ensure that future versions of this DGN are backwards-compatible.)

Unlike most DGNs, the format for this DGN is different for different types of criteria. Byte 3 must be examined to determine how to parse the rest of the packet.

It is likely that additional formats will be added to the RV-C protocol over time.

Table 6.36.4a — DG definition

DG attribute	Value
Name	AGS_CRITERION_STATUS
DGN	1FEFEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	100 ms
Number of frames	1 (repeated as necessary for each criterion)
ACK requirements	None

Table 6.36.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3
1	0 to 1	Current demand status	bit	-	00b - Not demanding generator now 01b - Currently demanding generator
	2 to 3	Active status	bit	-	00b - Currently inactive 01b - Active (Shall generate demand as appropriate.)
2	-	Criterion type	uint8	-	0 - DC voltage 1 - DC state of charge 2 - DC current 3 - Ambient temperature 4 - Transfer switch AC point voltage 5 - Quiet Time 6 - Timed Start

					128 to 250 - Proprietary

If Criterion Type = 0 (DC voltage)

Byte	Bit	Name	Data type	Unit	Value description
3	-	DC instance	uint8	-	Instance of DC source being monitored
4 to 5	-	DC voltage threshold	uint16	V	see Table 5.3
6	-	Time under threshold	uint8	min	Precision = 0.1 min Value range = 0.0 to 25.0 min 0 - No minimum Indicates amount of time below the threshold before triggering demand.

If Criterion Type = 1 (DC state of charge)

Byte	Bit	Name	Data type	Unit	Value description
3	-	DC instance	uint8	-	Instance of DC source being monitored
4	-	DC State of Charge Start Threshold	uint8	%	see Table 5.3
5	-	DC State of Charge Stop Threshold	uint8	%	see Table 5.3
6	-	Time under threshold	uint8	min	Precision = 0.1 min Value range = 0.0 to 25.0 min 0 — No minimum Indicates amount of time below the threshold before triggering demand.

If Criterion Type = 2 (DC current)

Byte	Bit	Name	Data type	Unit	Value description
3	-	DC Instance	uint8	-	Instance of DC Source being monitored
4 to 5	-	DC Current Threshold	uint16	A	see Table 5.3
6	-	Time over Threshold	uint8	min	Precision = 0.1 min Value range = 0.0 to 25.0 min 0 — No minimum Indicates amount of time below the threshold before triggering demand.

If Criterion Type = 3 (Ambient temperature)

Byte	Bit	Name	Data type	Unit	Value description
3	-	Thermostat ambient instance	uint8	-	Thermostat Instance being monitored.
4 to 5	-	Ambient temperature threshold	uint16	*C	see Table 5.3

6	-	Time under threshold	uint8	min	Precision = 0.1 min Value range = 0.0 to 25.0 min 0 — No minimum Indicates amount of time below the threshold before triggering demand.

If Criterion Type = 4 (Transfer switch AC point voltage)

Byte	Bit	Name	Data type	Unit	Value description
3	-	ATS instance	uint8	-	ATS AC Point being monitored. See ATS_AC_STATUS.
4 to 5	-	RMS voltage threshold	uint16	Vac	see Table 5.3
6	-	Time under threshold	uint8	min	Precision = 0.1 min Value range = 0.0 to 25.0 min 0 — No minimum Indicates amount of time below the threshold before triggering demand.

If Criterion Type = 5 (Quiet Time)

Byte	Bit	Name	Data type	Unit	Value description
3	-	Reserved	uint8	-	Reserved
4	-	Quiet Time Begin Hour	uint8	Hour	0 = 12:00 AM 12 = Noon 23 = 11:00 PM 24 to 255 = Undefined This should be Local Time
5		Quiet Time Begin Minute	uint8	Minute	Value Range = 0 - 59
6	-	Quiet Time End Hour	uint8	Hour	0 = 12:00 AM 12 = Noon 23 = 11:00 PM 24 to 255 = Undefined This should be Local Time
7		Quiet Time End Minute	uint8	Minute	Value Range = 0 - 59

If Criterion Type = 6 (Timed Start)

Byte	Bit	Name	Data type	Unit	Value description
3	-	Reserved	uint8	-	Reserved
4	-	Time Begin Hour	uint8	Hour	0 = 12:00 AM 12 = Noon 23 = 11:00 PM 24 to 255 = Undefined This should be Local Time
5	-	Time Begin Minute	uint8	Minute	Value Range = 0 - 59
6 to 7	-	Run Time	uint16	Minute	0 = Disable

					1-1439 = Minutes to run genset.

6.36.5 AGS Criterion Status 2

This DGN provides additional AGS status information in parallel with the AGS_CRITERION_STATUS DGN. Like that DGN, the format of this DGN varies with the type of AGS criterion.

Table 6.36.5a — DG definition

DG Attribute	Value
Name	AGS_CRITERION_STATUS_2
DGN	1FED2h
Default Priority	6
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	On Change or On Request
Minimum Broadcast Rate	1000 ms
Number of Frames	1
ACK Requirements	None

Table 6.36.5b — DG definition

Byte	Name	Data Type	Definition
0	Instance	UINT8	
1	Criterion Type	UINT8	See AGS_CRITERION_STATUS, Byte 2.

If Criterion Type = 0 (DC Voltage), 1 (DC State of Charge), 2 (DC Current), 3 (Ambient Temperature), 4 (Transfer Switch AC Point Voltage)

Byte	Name	Data Type	Unit	Definition
2 to 3	Time-Under Counter	UINT16	Sec	Counter indicating the amount of time the measured value has been below (above) the target value. When the time-under threshold is exceeded, the criterion will activate demand. 0 = Measured value is above (below)target value.

6.36.6 AGS Criterion Command

This allows the creation, deletion, or changing of AGS criteria. The format is generally the same as AGS_CRITERION_STATUS. This DGN also provides a method of querying the status of a specific instance without triggering a packet for each current

Instance.

Table 6.36.6a defines the DG attributes and Table 6.36.6b defines the signal and parameter attributes. To query the status of an Instance set all data bytes other than the Instance to 255 (0xFF). If the Instance does not exist in the AGS criteria list, it should respond with a NAK and a return value of 5 (“Request Out of Range”).

Note the difference in data byte 2. Data bytes 4 through 8 are determined by the Criterion Type, and are of the same formats listed above for AGS_CRITERION_STATUS.

Table 6.36.6a — DG definition

DG attribute	Value
Name	AGS_CRITERION_COMMAND
DGN	1FEFDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DEMAND_STATUS (only for indicated instances)

Table 6.36.6b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3
1	0 to 1	Command	bit	-	00b - Add or edit this criterion 01b - Delete this criterion
	2 to 3	Active status	bit	-	00b - Deactivate criterion 01b - Activate criterion
2	-	Criterion type	uint8	-	0 - DC voltage 1 - DC state of charge 2 - DC current 3 - Ambient temperature 4 - Transfer switch AC point voltage 5 – Quiet Time 6 – Timed Start 128 to 250 - Proprietary

6.36.7 AGS Demand Configuration Status

The disable flags in this PGN indicate whether the AGS is configured to automatically disable all demands in response to various inputs. Generally, if one of these flags is set and the indicated condition is ever satisfied the AGS will automatically disable all AGS Criteria. The AGS will not be re-enabled without user intervention. These flags do not indicate whether those inputs are currently active. These flags are intended primarily to allow OEMs and service technicians to view, test, and possibly modify the safety interlocks implemented in the AGS.

Table 6.36.7a — DG definition

DG attribute	Value
Name	GENERATOR_DEMAND_CONFIGURATION_STATUS
DGN	1FED5h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.36.7b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Disable on Park Brake Release	bit	-	00 = Inactive 01 = Active
0	2 to 3	Disable on Ignition	bit	-	00 = Inactive 01 = Active
0	4 to 5	Disable on Drive	bit	-	00 = Inactive 01 = Active
0	6 to 7	Disable on Motion	bit	-	00 = Inactive 01 = Active
1	0 to 1	Disable on OEM Switch	bit	-	00 = Inactive 01 = Active
1	2 to 3	Disable on Service Brake	bit	-	00 = Inactive 01 = Active
1	4 to 5	Disable on Monoxide Detect	bit	-	00 = Inactive 01 = Active
1	6 to 7	Disable on Opened Compartment	bit	-	00 = Inactive 01 = Active
2	0 to 1	Disable on Fire Alarm	bit	-	00 = Inactive 01 = Active
2	2 to 3	Disable on Manual Operation	bit	-	00 = Inactive 01 = Active
2	4 to 5	Disable on Genset Fault	bit	-	00 = Inactive 01 = Active
2	6 to 7	Disable on System Fault	bit	-	00 = Inactive 01 = Active
3	0 to 1	Disable on Shore Power	bit	-	00 = Inactive 01 = Active
3	2 to 3	Disable on 50 Amp Shore	bit	-	00 = Inactive 01 = Active

4		Disable AGS After Time Span	uint8	days	range = 0 to 250 days 0 = AGS is not automatically disabled
5		Days Remaining Before Automatic Disabling	uint8	days	range = 0 to 250 days 0 = AGS is not automatically disabled

6.36.8 AGS Demand Configuration Command

The command to configure the conditions for disabling the AGS system is provided in Table 6.36.8a and 6.36.8b.

Table 6.36.8a — DG definition

DG attribute	Value
Name	GENERATOR_DEMAND_CONFIGURATION_COMMAND
DGN	1FED4
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, GENERATOR_DEMAND_CONFIGURATION_STATUS

Table 6.36.8b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 1	Disable on Park Brake Release	bit	-	00 = Inactive 01 = Active
0	2 to 3	Disable on Ignition	bit	-	00 = Inactive 01 = Active
0	4 to 5	Disable on Drive	bit	-	00 = Inactive 01 = Active
0	6 to 7	Disable on Motion	bit	-	00 = Inactive 01 = Active
1	0 to 1	Disable on OEM Switch	bit	-	00 = Inactive 01 = Active
1	2 to 3	Disable on Service Brake	bit	-	00 = Inactive 01 = Active
1	4 to 5	Disable on Monoxide Detect	bit	-	00 = Inactive 01 = Active
1	6 to 7	Disable on Opened Compartment	bit	-	00 = Inactive 01 = Active
2	0 to 1	Disable on Fire Alarm	bit	-	00 = Inactive 01 = Active
2	2 to 3	Disable on Manual Operation	bit	-	00 = Inactive 01 = Active

2	4 to 5	Disable on Genset Fault	bit	-	00 = Inactive 01 = Active
2	6 to 7	Disable on System Fault	bit	-	00 = Inactive 01 = Active
3	0 to 1	Disable on Shore Power	bit	-	00 = Inactive 01 = Active
3	2 to 3	Disable on 50 Amp Shore	bit	-	00 = Inactive 01 = Active
4		Disable AGS After Time Span	uint8	days	range = 0 to 250 days 0 = AGS is not automatically disabled

6.36.9 Service Points

As with most multiple instance devices, if the Most Significant Byte (MSB) is non-zero the Intermediate Byte (ISB) provides the Instance associated with the failure. Table 6.36.9 lists the Service Points.

Table 6.36.9 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
0	32	0	Generator (This indicates the generator is not responding as desired. The Generator or Generator Start Controller should be queried for more details.)
1	Instance	0	Invalid Configuration
1	Instance	1	Data Not Available

6.37 Floor Heat

6.37.1 Introduction

Although Floor Heat is conceptually similar to an ordinary furnace, it differs in that the temperature sensor is almost always internal to the floor heat system. Each floor heat unit operates independently from the conventional thermostats and their zones. There may be multiple floor heat units.

These DGNs may also be used for other specialized heating products that operate in isolation from the conventional zones. The following formats apply (see Table 6.37.1).

Table 6.37.1 — Floor heat definition

Device attribute	Value
Category	Comfort systems
Default Source Address	97 to 99
Dynamic Address Range	192 to 207
Instance	Multiple

Multiple source addresses are available, but these products are identified by the Instance field in each DGN.

6.37.2 Floor Heat Status

This DGN allows products to determine the status of a floor heat unit. Table 6.37.2a defines the DG attributes and Table 6.37.2b defines the signal and parameter attributes.

Table 6.37.2a — DG definition

DG attribute	Value
Name	FLOOR_HEAT_STATUS
DGN	1FEFCh
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.37.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3 Does not correspond to Thermostat Instances (“Zones”)
1	0 to 1	Operating mode	bit	-	00b — Automatic 01b — Manual
	2 to 3	Operating status	bit	-	00b — Off 01b — On
	4 to 5	Heat element status	bit	-	00b — Off 01b — On
2 to 3	-	Measured temperature	uint16	°C	see Table 5.3
4 to 5	-	Set point	uint16	°C	see Table 5.3
6	-	Dead band	uint8	°C	Precision = 0.1 °C Value range = 0.0 to 25.0 °C

6.37.3 Floor Heat Command

This DGN allows products to control the status of a floor heat unit. Table 6.37.3a defines the DG attributes and Table 6.37.3b defines the signal and parameter attributes.

Table 6.37.3a — DG definition

DG attribute	Value
Name	FLOOR_HEAT_COMMAND
DGN	1FEFBh
Default priority	6
Maximum broadcast rate	N/A

Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, FLOOR_HEAT_STATUS

Table 6.37.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	see Table 5.3 Does not correspond to Thermostat Instances ("Zones")
1	0 to 1	Desired operating mode	bit	-	00b — Automatic 01b — Manual
	2 to 3	Desired operating status	bit	-	00b — Off 01b — On
2 to 3	-	Set point	uint16	°C	see Table 5.3
4	-	Dead band	uint8	°C	Precision = 0.1 °C Value range = 0.0 to 25.0 °C

6.37.4 Service Points

As with most multiple instance devices, if the Most Significant Byte is non-zero the Intermediate Byte provides the Instance associated with the failure. Table 6.37.4 lists the Service Points.

Table 6.37.4 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Temperature Sensor
1	Instance	1	Power Source
1	Instance	2	Heat Element

6.38 Tire Monitoring

6.38.1 Introduction

These DGNs replace the J1939 DGNs for Tire Pressure reporting (J1939 protocol does not fully support all the features of current TPM systems.) These DGNs assume a system in which some type of sensor is installed at each tire, including possibly in a trailer or towed vehicle. The sensor reports pressure and/or temperature information along with some sort of identifier.

The following formats apply (see Table 6.38.1).

Table 6.38.1 — Tire monitoring definition

Device attribute	Value
Category	Sensors

Default Source Address	133
Dynamic Address Range	160 to 175
Instance	Multi-instance

The receiver may simply report raw sensor data using the TIRE_RAW_STATUS DGN, or with the data indexed to the tire location using the TIRE_STATUS DGNs.

The RV-C protocol makes no statements about the appropriate frequency of transmissions from the sensors. The TIRE_STATUS and TIRE_RAW_STATUS DGNs are transmitted immediately whenever sensor data is received. This may mean gaps of several minutes, or even much longer if the vehicle is stationary.

6.38.2 Raw Tire Status

If tire data cannot be correlated with a specific location, then the data should be broadcast with this DGN. Table 6.38.2a defines the DG attributes and Table 6.38.2b defines the signal and parameter attributes. This DGN is broadcast only on the reception of sensor data. It is not available on request.

Table 6.38.2a — DG definition

DG attribute	Value
Name	TIRE_RAW_STATUS
DGN	1FEF1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on sensor transmission
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0 to 3	-	Sensor ID	uint32	-	Manufacturer-specific sensor identifier..
4 to 5	-	Tire pressure	uint16	kPa	Precision = 1 kPa Value range = 0 to 65 530 kPa Actual Gage pressure. This value should not be temperature corrected.
6 to 7	-	Tire temperature	uint16	°C	see Table 5.3

6.38.3 Tire Status

If sensor data can be identified with a specific tire location, then the data should be sent using this DGN. Table 6.38.3a defines the DG attributes and Table 6.38.3b defines the signal and parameter attributes.

If this DGN is requested, the most recent data for each identified tire should be sent. This should be sent through repeated transmissions of this DGN, not a Long Message. If no data has yet been received from a specific tire, the DGN should still be sent, but with FFb values in all data items except Tire Location.

Table 6.38.3a — DG definition

DG attribute	Value
Name	TIRE_STATUS
DGN	1FEF0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on transmission
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 3	Tire location – Position	uint4	-	0 - Outside left tire 1 - Inside left tire 2 - Inside right tire 3 - Outside right tire If only two tires are mounted on an axle, they should be numbered 0 and 3. If more than four tires are on an axle, they should be numbered sequentially from left to right.
	4 to 7	Tire location - Axle	uint4	-	0 - Steer axle 1 - Drive axle 2 - Tag axle 3 to 13 - Trailer / Tow axle If the sensors are mounted only on a trailer, then Zero indicates the most forward axle, and other axles are numbered sequentially from front to rear.
1 to 2	-	Tire pressure	uint16	kPa	Precision = 1 kPa Value range = 0 to 65530 kPa
3 to 4	-	Tire temperature	uint16	°C	see Table 5.3
5	-	Battery level	uint8	V	Precision = 0.02 V Value range = 0.00 to 5.00 V Note that this does not match Table 5.3
6	-	Signal level	uint8	Pct	see Table 5.3
7	0 to 2	Pressure status	bit3	-	000b – Ok 001b - Extremely low 010b - Low
	3 to 5	Temperature status	bit3	-	000b - Ok 001b - Extremely high 010b - High

	6 to 7	Battery status	bit	-	00b - Ok 01b - Low battery warning

6.38.4 Slow Leak Alarm

If a slow leak is detected, this alarm shall be sent for the appropriate sensor. This alarm can only be provided for sensors identified with a specific location. If the Slow Leak Threshold defined in TIRE_PRESSURE_CONFIGURATION_STATUS is set to zero, this alarm will not be sent.

Table 6.38.4a defines the DG attributes and Table 6.38.4b defines the signal and parameter attributes. If this DGN is requested, the unit should respond with values for every tire. When an alarm occurs, only the data for the leaking tire should be transmitted.

Table 6.38.4a — DG definition

DG attribute	Value
Name	TIRE_SLOW_LEAK_ALARM
DGN	1FEEFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	Upon detection of leak. Repeated every 5000 ms while leak active
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 3	Tire location - Position	uint4	-	0 - Outside left tire 1 - Inside left tire 2 - Inside right tire 3 - Outside right tire If only two tires are mounted on an axle, they should be numbered 0 and 3. If more than four tires are on an axle, they should be numbered sequentially from left to right.
	4 to 7	Tire location - Axle	uint4	-	0 - Steer axle 1 - Drive axle 2 - Tag axle 3 to 13 - Trailer / Tow axle If the sensors are mounted only on a trailer, then Zero indicates the most forward axle, and other axles are numbered sequentially from front to rear.
1	0 to 1	Alarm status	bit	-	00b - No alarm 01b - Slow leak detected
2 to 3	-	Leak rate	uint16	kPa/h	Precision = 1 kPa/h Value range = 0 to 65 530 kPa/h

					0 - No leak detected

6.38.5 Tire Alarm Configuration (Introduction)

The Pressure, Temperature, and Battery Status items in the TIRE_STATUS DGN are determined by configuration values set for each axle. The protocol assumes that all tires on a given axle are of the same type and have the same target levels.

6.38.6 Tire Temperature Configuration Status

Table 6.38.6a defines the DG attributes and Table 6.38.6b defines the signal and parameter attributes. If this DGN is requested, the device should respond with data for every axle.

Table 6.38.6a — DG definition

DG attribute	Value
Name	TIRE_TEMPERATURE_CONFIGURATION_STATUS
DGN	1FEEEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.6b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 3	Reserved	-	-	Tire parameters are assumed to be consistent across all tires on a specific axle.
0	4 to 7	Tire location - Axle	uint4	-	0 - Steer axle 1 - Drive axle 2 - Tag axle 3 to 13 - Trailer / Tow axle If the sensors are mounted only on a trailer, then Zero indicates the most forward axle, and other axles are numbered sequentially from front to rear.
1 to 2	-	Extremely high tire temperature	uint16	°C	see Table 5.3
3 to 4	-	High tire temperature	uint16	°C	see Table 5.3
5	-	Low battery level	uint8	V	Precision = 0.02 V Value range = 0.00 to 5.00 V Note that this does not match Table 5.3

6.38.7 Tire Pressure Configuration Status

Table 6.38.7a defines the DG attributes and Table 6.38.7b defines the signal and parameter attributes. If this DGN is requested,

the device should respond with data for every axle.

Table 6.38.7a — DG definition

DG attribute	Value
Name	TIRE_PRESSURE_CONFIGURATION_STATUS
DGN	1FEEDh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.7b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 3	Reserved	-	-	Tire parameters are assumed to be consistent across all tires on a specific axle.
0	4 to 7	Tire location - Axle	uint4	-	0 - Steer axle 1 - Drive axle 2 - Tag axle 3 to 13 - Trailer / Tow axle If the sensors are mounted only on a trailer, then Zero indicates the most forward axle, and other axles are numbered sequentially from front to rear.
1 to 2	-	Extremely low tire pressure	uint16	kPa	Precision = 1 kPa Value range = 0 to 65 530 kPa
3 to 4	-	Low tire pressure	uint16	kPa	Precision = 1 kPa/hr Value range = 0 to 65 530 kPa/hr
5 to 6	-	Slow leak threshold	uint16	kPa/hr	Precision = kPa/hr range = 0 to 65 530 kPa/hr 0 = No slow leak alarms

6.38.8 Tire Pressure/Temperature Configuration Command

Table 6.38.8a describes the DG definitions. The signal and parameter attributes have the same format as their corresponding STATUS DGNs. If this DGN is requested, the device should respond with data for every axle.

Table 6.38.8 — DG definition

DG attribute	Value
Name	TIRE_PRESSURE_CONFIGURATION_COMMAND TIRE_TEMPERATURE_CONFIGURATION_COMMAND
DGN	1FEECh

	1FEEBh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, TIRE_PRESSURE_CONFIGURATION_STATUS / TIRE_TEMPERATURE_CONFIGURATION_STATUS

6.38.9 Tire Sensor Configuration (Introduction)

These DGNs allow the assignment of sensor ID numbers to specific locations. When a sensor transmission is received, the device should check to see whether that sensor has been assigned a position, and if so, report the data using TIRE_STATUS. If the sensor has not been assigned a location, the data should be sent using TIRE_RAW_STATUS.

6.38.10 Tire ID Status

Table 6.38.10a defines the DG attributes and Table 6.38.10b defines the signal and parameter attributes. If this DGN is requested, the device should respond with data for every assigned tire location.

Table 6.38.10a — DG definition

DG attribute	Value
Name	TIRE_ID_STATUS
DGN	1FEEAh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on request
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.38.10b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	0 to 3	Tire location - Position	uint4	-	0 - Outside left tire 1 - Inside left tire 2 - Inside right tire 3 - Outside right tire If only two tires are mounted on an axle, they should be numbered 0 and 3. If more than four tires are on an axle, they should be numbered sequentially from left to right.

	4 to 7	Tire location - Axle	uint4	-	0 - Steer axle 1 - Drive axle 2 - Tag axle 3 to 13 - Trailer / Tow axle If the sensors are mounted only on a trailer, then Zero indicates the most forward axle, and other axles are numbered sequentially from front to rear.
1 to 4		Sensor identification number	uint32	-	see Table 5.3

6.38.11 Tire ID Command

Table 6.38.11 describes the DG definitions. The signal and parameter attributes format is identical to TIRE_ID_STATUS. If the Sensor Identification Number is FFFFFFFFh, the device should respond by removing the tire currently assigned to that location from the assignment table.

Table 6.38.11 — DG definition

DG attribute	Value
Name	TIRE_ID_COMMAND
DGN	1FEE9h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	As needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, TIRE_ID_STATUS

6.38.12 Service Points

As with other multi-instance items, SPNs that are particular to a tire instance are coded with a non-zero value in the MSB and the Instance in the ISB. The Instance is a combination of axle and wheel location, with the four MSBs being the Axle, and the four LSBs being the Tire Position.

If a sensor has not been assigned a location, the Instance should be set to 0xFF. There is no method provided for specific identification of a failure on an unassigned sensor.

Note that all diagnostic messages apply to the sensors and the receiver, not to the tires themselves. Tire failures shall be reported using the TIRE_STATUS DGN. Table 6.38.12 lists the Service Points.

Table 6.38.12 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Pressure Sensor
1	Instance	1	Temperature Sensor
1	Instance	2	Battery Level

1	Instance	3	Internal Failure

6.39 Awning

6.39.1 Introduction

This DGN contains control information for the awnings. The following formats apply (see Table 6.39.1).

Table 6.39.1 — Awning definition

Device attribute	Value
Category	Mechanical components
Default Source Address	130
Dynamic Address Range	176 to 191
Instance	Multiple

6.39.2 Awning Status

Table 6.39.2a defines the DG attributes and Table 6.39.2b defines the signal and parameter attributes.

Table 6.39.2a — DG definition

DG attribute	Value
Name	AWNING_STATUS
DGN	1FEF3h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change 100 ms when awning is in motion
Minimum broadcast rate	100 ms
Number of frames	1
ACK requirements	None

Table 6.39.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 - Awning 1 (main patio awning) 2 to 13 - Awning 2 to 13
1	-	Motion	uint8	-	0 - No motion 1 - Extending 2 - Retracting
2	-	Position	uint8	%	see Table 5.3 0 - Retracted 200 - 100% Extended Products that only know that the awning is either in or out should report 50%.

3	0 to 1	Lock status	bit	-	00b - Awning is secured 01b - Awning is not secured
	2 to 3	Unlock status	bit	-	00b - Awning is unlocked and ready to move 01b - Awning is not unlocked and should not be moved
	4 to 5	User lock status	bit	-	00b - User lock is not activated. Awning is OK to move 01b - User lock is activated. Awning will not move
	6 to 7	Brake status	bit	-	00b - All motor brakes are not locked 01b - One or more motor brake is locked.
4	0 to 1	Park brake	bit	-	00b - Awning may move 01b - Awning will not move because of Park Brake status
	2 to 3	Ignition key	bit	-	00b - Awning may move 01b - Awning will not move because of Ignition status
	4 to 5	Low voltage	bit	-	00b - Awning may move 01b - Awning will not move because of Low Voltage status
5	0 to 1	Awning light	bit	-	00b – Integrated awning light off, if present 01b – Integrated awning light on
	2 to 3	Secondary light	bit	-	00b – Secondary awning light off, if present 01b – Secondary awning light on

6.39.3 Awning Command

Table 6.39.3a defines the DG attributes and Table 6.39.3b defines the signal and parameter attributes. This DGN triggers awning actions. If the Direction of Motion is Extend or Retract, the command must be repeated every 100ms to keep the awning in motion. If a longer gap occurs, the awning should stop automatically for safety. The Direction of Motion command for Stop does not need to be repeated, but it should certainly be sent to stop the motion.

Table 6.39.3a — DG definition

DG attribute	Value
Name	AWNING_COMMAND
DGN	1FEF2h
Default priority	3
Maximum broadcast rate	N/A
Normal broadcast rate	on change 100 ms when awning is in motion
Minimum broadcast rate	N/A

Number of frames	1
ACK requirements	ACK, AWNING_STATUS

Table 6.39.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	1 - Awning 1 (main patio awning) 2 to 13 - Awning 2 to 13
1	0 to 1	User lock	bit	-	00b - Release user lock 01b - Set user lock
	2 to 3	Mechanical lock	bit	-	00b - Disengage lock 01b - Engage lock
	4 to 5	Awning light	bit	-	00b – Set integrated awning light off, if present 01b – Set integrated awning light on
	6 to 7	Secondary light	bit	-	00b – Set secondary awning light off, if present 01b – Set secondary awning light on
2	-	Direction of movement	uint8	-	0 - Stop 1 - Extend 2 - Retract
3	-	Move to Position	uint8	%	Desired Amount of Extension see Table 5.3 0 – Full Retraction 200 – Full Extention

6.40 Window Shade Control

6.40.1 Introduction

This group of DGN's applies to devices that drive and control DC powered motorized window shades. The following formats apply (see Table 6.40.1). Static addressing is discouraged in this product.

Table 6.40.1 – Window Shade Control Definition

Device attribute	Value
Category	Power components
Default Source Address	134
Dynamic Address Range	128-143
Instance	Multiple

6.40.2 Window Shade Control Status

The following table (Table 6.40.2a) defines the DG attributes and Table 6.40.2b defines the signal and parameter attributes.

Table 6.40.2a – DG Definition

DG attribute	Value

Name	WINDOW_SHADE_CONTROL_STATUS
DGN	1FEDEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.40.2b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250.
1	-	Group	uint8	bitmap	Indicates group membership. One bit is assigned to each of seven groups. Highest bit is not used to indicate a group. If 0, t he other bit s refer to the groups. 0 in any other position indicates the load is a member of the corresponding group. 01111110 – Group 1 01111101 – Group 2 00000000 - All groups 11111111 – No Data
2	-	Operating Status (Motor Duty)	uint8	Percent	See Table 5.3
3	0 to 1	Lock Status	Bit2	-	00b – Load is unlocked 01b – Load is locked 11b – Lock command is not supported When locked, the instance will ignore certain commands until an unlock command is received.
	2 to 3	Motor Status	Bit2	-	00b — Neither ‘Forward’ nor ‘Reverse’ output is on. 01b — either ‘Forward’ or ‘Reverse’ output is on (Motor active in either direction)
	4 to 5	Forward Status	Bit2	-	00b — ‘Forward’ output not on 01b — ‘Forward’ output is on
	6 to 7	Reverse Status	Bit2	-	00b — ‘Reverse’ output not on 01b — ‘Reverse’ output is on
4	-	Duration	uint8	Sec	Number of seconds remaining in Duration command. Max = 240 seconds 0 = delay/duration expired 1 – 239 = seconds remaining

					240 = 240 or more seconds remaining 255 = no delay/duration active
5	-	Last Command	uint8		Indicates last command (function) executed by this instance. This is the last command executed by the WINDOW_SHADE_CONTROL_COMMAND (DGN 1FEDF). See Table 6.40.2C below for a list of possible commands.
6	0 to 1	Overcurrent Status	Bit2	-	00b — load output not in overcurrent 01b — load output has drawn overcurrent 11b – Overcurrent status is unavailable or not supported
	2 to 3	Override Status	Bit2	-	00b – External override is inactive 01b – External override is active 11b – Override status is unavailable or not supported When the override is active, the output has been physically changed by a user outside of the device.
	4 to 5	Disable1 Status	Bit2	-	00b — Disable 1 is not active 01b — Disable 1 is active 11b – Disable 1 is not supported When disable 1 is active, it has been set through an external signal input.
	6 to 7	Disable2 Status	Bit2	-	00b — Disable 2 is not active 01b — Disable 2 is active 11b – Disable 2 is not supported When disable 2 is active, it has been set through an external signal input.
7	-	Reserved			

Table 6.40.2c – Commands Possible for "Last Command"

Command	Description
0x04 – Stop	If motor is active in either direction, immediately stop it.
0x81 – Forward	Turn motor on in the "Forward" (open shade) direction for specified duration (Controller may enforce a dead time for direction reversal)
0x41 – Reverse	Turn motor on in the "Reverse" (close shade) direction for specified duration (Controller may enforce a dead time for direction reversal)
0x85 - Toggle Forward	If motor is off, turn on in the forward direction for specified duration. If motor is on in forward direction, stop it. If motor is on in reverse direction, stop it and turn on in forward direction (Controller may enforce a dead time for direction reversal).
0x45 - Toggle Reverse	If motor is off, turn on in the reverse direction for specified duration. If motor is on in reverse direction, stop it. If motor is on in forward direction, stop it and turn on in reverse direction (Controller may enforce a dead time for direction reversal).
0x10 – Tilt	Tilts louvers type shades in the upward direction.
0x21 – Lock	Lock instance preventing certain commands from affecting it until an "Unlock" command is received.

0x22 – Unlock	Unlock an instance that is currently locked.

6.40.3 Window Shade Control Command

The following table (Table 6.40.3a) defines the DG attributes and Table 6.40.3b defines the signal and parameter attributes.

Table 6.40.3a – DG Definition

DG attribute	Value
Name	WINDOW_SHADE_CONTROL_COMMAND
DGN	1FEDFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, WINDOW_SHADE_CONTROL_STATUS

Table 6.40.3b – Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	Valid = 1 to 250. 0xFF for group commands.
1	-	Group	uint8	bitmap	see Table 6.40.2b If bit 7 = 1 and bit 6 = 0, it is a node group. Node groups support more then seven groups where multiple groups cannot be selected in one command. This is required to handle the physical grouping of multiple control instances within one node. 10000001 – Node Group 1 10011111 – Node Group 31 (max for this mode) 11111111 – For non-group commands
2	-	Motor Duty	uint8	%	0-200 = 0-100% in 0.5% increments
3	-	Command	uint8	Bitmap	0x04 – Stop 0x81 – Forward 0x41 – Reverse 0x85 – Toggle Forward 0x45 – Toggle Reverse 0x10 – Tilt 0x21 – Lock 0x22 – Unlock

					See table 6.40.2c above for an explanation of each command. If a node does not support some of the above commands, it must return a NAK – Command Not Supported.
4	-	Duration	uint8	Sec	Number of seconds to enable motor for before stopping. Range: 1 to 240 seconds Additional minute increment values: 241 = 5 min 242 = 6 min … 250 = 14 min 255 = Continuous command 0 = momentary command. This command will only turn on the channel for 2 seconds. However, if the message is repeated with a period less than 2 seconds, the channel will stay on indefinitely. Duration is ignored if not supported by specified command
5	-	Interlock	uint8	Bitmap	Bit 0 – Interlock A Bit 1 – Interlock B A command message with either interlock bit set to '1' will not be activated until an identical message is received from a different source with the opposing interlock bit set to '1'. Bit 2-7 – Reserved
6-7	-	Reserved			

6.41 Door and Window Controller

6.41.1 Introduction

A door controller commonly provides the ability to lock and unlock one or more doors, and/or operate power windows. Although typically these functions are found in cab doors, they may also refer to storage bay doors or any networked door lock or powered window. It is possible that a Door Controller is in fact only a window control or a lock, or a combination of door and window controls might be installed in an RV.

Door and window placement varies considerably with the make and model of RV. Therefore no instancing scheme can apply unambiguously to all situations. However, if appropriate the following guidelines shall be used to assign instances to physical locations in the RV.

In a motorized RV with a driver door:
- The driver door/window shall be assigned Instance 1.
- The passenger door/window shall be assigned Instance 2.
- Additional Instances shall be assigned in a clockwise order, starting at the passenger door/window, and incrementing by one.

Thus, in a four-door RV, the driver door is Instance 1, the front passenger door in Instance 2, the right rear door is Instance 3, and the left rear door is Instance 4.

In a non-motorized RV, or a motorized RV without a driver door:
- The main entry door/window shall be assigned Instance 1. If there are two entry doors, the door further forward shall be Instance 1.
- Additional Instances shall be assigned in clockwise order, as above.

Commands broadcast with Instance 0 shall be accepted and carried out by all instances. In this case, only locks and windows that fail to carry out the command are required to send a NAK DGN. All locks shall respond with their status after the command.

Note that sending a command with Instance zero but no data in the Lock field has the same result as requesting the LOCK_STATUS DGN.

Table 6.41.1 – Door Lock Control Definition

Device Attribute	Value
Category	Mechanical Components
Default Source Address	135
Dynamic Address Range	176-191
Instance	Multiple

The main DGNs associated with a Door Controller are sent only on request. Moreover, these devices are often powered from the chassis accessory or ignition circuits, and are therefore often off-line. Therefore it is particularly important that the controller send a regular status message when on-line to ensure that network devices are aware of its presence.

6.41.2 Lock Status

The following table (Table 6.41.2a) defines the DG attributes and Table 6.41.2b defines the signal and parameter attributes.

Table 6.41.2a – DG Definition

DG Attribute	Value
Name	LOCK_STATUS
DGN	1FEE5h
Default Priority	6
Maximum Broadcast Rate	50 ms
Normal Broadcast Rate	On Request or Change of Status
Minimum Broadcast Rate	5000 ms
Number of Frames	1
ACK Requirements	None

Table 6.41.2b – Signal and Parameter Definition

Byte	Bit	Name	Data Type	Definition
0		Instance	uint8	1 - 250. See above for preferred numbering scheme.
1	0 to 1	Lock Status	bit	0 = Unlocked 1 = Locked

6.41.3 Lock Command

The following table (Table 6.41.3a) defines the DG attributes.

Table 6.41.3a – DG Definition

DG Attribute	Value
Name	LOCK_COMMAND
DGN	1FEE4h
Default Priority	6
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	As Needed
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	ACK, LOCK_STATUS

The format of the LOCK_COMMAND is the same as LOCK_STATUS, except it allows the use of zero in the Instance field to indicate that the command is directed at all instances simultaneously. See 6.41.2b.

6.41.4 Window Status

The following table (Table 6.41.4a) defines the DG attributes and Table 6.41.4b defines the signal and parameter attributes.

Table 6.41.4a – DG Definition

DG Attribute	Value
Name	WINDOW_STATUS
DGN	1FEE3h
Default Priority	6
Maximum Broadcast Rate	50 ms
Normal Broadcast Rate	On Request 100 ms when window is in motion.
Minimum Broadcast Rate	5000 ms
Number of Frames	1
ACK Requirements	None

Table 6.41.4b – Signal and Parameter Definition

Byte	Bit	Name	Data Type	Unit	Definition
0		Instance	uint8		1 - 250. See above for preferred numbering scheme.
1		Motion	uint8		0 = No Motion 1 = Opening 2 = Closing
2		Position	uint8	%	See Table.

3	0 to 1	User Lock Status	bit		0 = Window is not locked and free to move. 1 = Window is locked to prevent movement.

This DGN should be sent whenever the window is in motion, or on any change in status. After motion has stopped, it should be sent again to indicate the change in motion status.

6.41.5 Window Command

The following table (Table 6.41.5a) defines the DG attributes and Table 6.41.5b defines the signal and parameter attributes.

Table 6.41.5a – DG Definition

DG Attribute	Value
Name	WINDOW_COMMAND
DGN	1FEE2h
Default Priority	6
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	As Needed. 100 ms during manual operation.
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

During manual operation, if this message is not repeated in the indicated time frame the target window should stop moving.

Table 6.41.5b – Signal and Parameter Definition

Byte	Bit	Name	Data Type	Unit	Definition
0		Instance	uint8		0 = All Instances 1 - 250 = Target Instance. See above for preferred numbering scheme.
1	0 to 1	Lock	bit		0 = Unlock Window 1 = Lock Window
2		Manual Operation	uint8		0 = Stop 1 = Open Window 2 = Close Window
3		Automatic Operation	uint8	%	See Table. Desired window position. 0 = Fully closed. 200 = 100% Open

The Lock parameter supports a common safety feature intended to prevent children from operating the windows in a distracting or hazardous manner.

6.42 GPS

6.42.1 Introduction

Table 6.42.1 describes the GPS device.

Table 6.42.1 - GPS Definition

Device Attribute	Value
Category	Sensors
Default Source Address	136
Dynamic Address Range	160-175
Instance	Single

6.42.2 GPS Position

The following table (Table 6.42.2a) defines the DG attributes and Table 6.42.2b defines the signal and parameter attributes.

Table 6.42.2a – DG Definition

DG Attribute	Value
Name	GPS_POSITION
DGN	0xFEF3 (65267)
Default Priority	6
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	On Request, or 5000 ms when in motion.
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

Table 6.42.2b – Signal and Parameter Definition

Byte	Bit	Name	Data Type	Definition
0 to 3		Latitude	UINT32	0 = -210 Degrees 1 bit = 0.0000001 Deg (10^-7) Positive values are Northern Hemisphere South Pole = 1,200,000,000 (-90 Deg) Equator = 2,100,000,000 (0 Deg) North Pole = 3,000,000,000 (90 Deg)
4 to 7		Longitude	UINT32	0 = -210 Degrees 1 bit = 0.0000001 Deg (10^-7) Prime Meridian = 2,100,000,000 (0 Deg) Negative Values are Western Hemisphere.

The resolution of this DGN is adequate to identify the position of the RV to within six feet.

6.42.3 GPS Status

The following table (Table 6.42.3a) defines the DG attributes and Table 6.42.3b defines the signal and parameter attributes.

Table 6.42.3a – DG Definition

DG Attribute	Value
Name	GPS_STATUS
DGN	1FED3h
Default Priority	6
Maximum Broadcast Rate	N/A
Normal Broadcast Rate	On Request, or 5000 ms when in motion.
Minimum Broadcast Rate	50 ms
Number of Frames	1
ACK Requirements	None

Table 6.42.3b – Signal and Parameter Definition

Byte	Bit	Name	Data Type	Unit	Definition
0 to 1		Heading	uint16	Deg	1 bit = 1/128 degrees Range = 0 to 360 degrees 0 = North, 90 = East, 180 = South, 270 = West
2 to 3		Speed	uint16	kph	1 bit = 1/128 kph Range = 0 to 255 kph
4 to 5		Altitude	uint16	m	0 = -500m 1 bit = 0.1 m Range = -500 to 6053.0m
6		Satellites in View	uint8		Number of Satellites used for calculations.

The resolution of this DGN is adequate to identify the position of the RV to within six feet.

6.43 DC System Disconnect and Bridge

6.43.1 Introduction

These DGNs are for a DC System Disconnect. This is typically a solenoid or similar cut-off switch that control the DC power to a substantial portion of the RV. It may also bridge two or more DC systems, such as the chassis and house batteries. The precise function of the device is not explicit in the DGN - there is generally no way to identify the purpose of a circuit in RV-C. The following formats apply (see Table 6.43).

Table 6.43 — DC Disconnect/Bridge

Device attribute	Value
Category	Power components
Default Source Address	139
Dynamic Address Range	128 to 143
Instance	Multiple

Each circuit is identified with an Instance from 1 to 250. In practice multiple instances are likely to be contained in a single controller.

6.43.2 DC Disconnect Status

This should not be used with the Multi-Packet protocol. If multiple devices are to be reported, each should be reported in its own packet. Table 6.43.2a defines the DG attributes and Table 6.43.2b defines the signal and parameter attributes.

Table 6.43.2a — DG definition

DG attribute	Value
Name	DC_DISCONNECT_STATUS
DGN	1FED0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.43.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 – Invalid 1 – Main House Battery Disconnect 2 – Chassis Battery Disconnect 3 – House/Chassis Bridge 4-250 - 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	-	00b – Circuit is under system control. 01b – Circuit has been bypassed.

The Bypass Detect flag is set when the physical status of the circuit does not match the expected status – typically due to the use of a physical override that is independent of the RV-C controller.

6.43.3 DC Disconnect Command

Table 6.43.3a defines the DG attributes and Table 6.43.3b defines the signal and parameter attributes.

Table 6.43.3a — DG definition

DG attribute	Value
Name	DC_DISCONNECT_COMMAND
DGN	1FECFh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	On change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.43.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	0 – Invalid 1 – Main House Battery Disconnect 2 – Chassis Battery Disconnect 3 – House/Chassis Bridge 4-250 - Other
1	0 to 1	Command	bit	-	00b – Disconnect circuit. 01b – Connect circuit.

6.43.4 Service Points

Table 6.43.4 lists the Service Points.

Table 6.43.4 — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	Solenoid

6.44 Network Bridge

This is typically a bridge to a high-speed network such as Ethernet, where raw RV-C data is translated across the bridge in its

entirety. The following formats apply (see Table 6.44).

Table 6.44 — Network Bridge

Device attribute	Value
Category	Appliances and Bridges
Default Source Address	253
Dynamic Address Range	208-223
Instance	Single

No DGNs or SPNs are defined for this device type.

6.45 External Interface

This is typically a connection to a non-RV-C device or devices that are low-speed or high-latency, such as Cellular SMS. Only a small amount of data is typically transmitted across the bridge, providing a limited interface to the external device or network. The following formats apply (see Table 6.45).

Table 6.45 — External Interface

Device attribute	Value
Category	Appliances and Bridges
Default Source Address	139
Dynamic Address Range	208-223
Instance	Single

No DGNs or SPNs are defined for this device type.

6.46 Solar Charge Controller

6.46.1 Introduction

Solar Charge Controller(s) are associated with Solar Panels to provide features such as multi-stage battery charging. There may be more than It one charge controller associated with a single DC source (battery) to increase capacity. The following formats apply (see Table 6.46.1).

Table 6.46.1 — Solar definition

Device attribute	Value
Category	Power components
Default Source Address	141
Dynamic Address Range	128 to 143
Instance	Multiple

6.46.2 Solar Controller Status

The controller status DGN describes the general operating status of the Solar Controller on a particular DC Source (Battery

Bank). Table 6.46.2a defines the DG attributes and Table 6.46.2b defines the signal and parameter attributes.

Table 6.46.2a — DG definition

DG attribute	Value
Name	SOLAR_CONTROLLER_STATUS
DGN	1FEB3h
Default priority	6
Maximum broadcast rate	5000 ms
Normal broadcast rate	5000 ms or on change
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.46.2b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	
1 to 2	-	Charge voltage	uint16	V	see Table 5.3 Control voltage: The voltage desired to be delivered to the battery.
3 to 4	-	Charge current	uint16	A	see Table 5.3 Control current: The current desired to be delivered to the battery.
5	-	Charge current percent of maximum	uint8	%	see Table 5.3 Control current as a percent of the maximum.
6	-	Operating state	uint8	-	Specifies the current operating state of the controller. see table 6.5.5b

6.46.3 Solar Controller Configuration Status

This DG provides configuration information for the Solar Controller(s). Table 6.46.3a defines the DG attributes and Table 6.46.3b defines the signal and parameter attributes.

Table 6.46.3a — DG definition

DG attribute	Value
Name	SOLAR_CONTROLLER_CONFIGURATION_STATUS
DGN	1FEB2h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A

Number of frames	1
ACK requirements	None

Table 6.46.3b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	
1	-	Charging algorithm	uint8	-	The algorithm being applied to the battery. see table 6.21.9b
2	-	Controller mode	uint8	-	see table 6.21.9b
3	0 to 1	Battery sensor present	bit	-	00b - No Battery Temperature sensor in use. 01b - Sensor is present and active.
3	2 to 3	Linkage mode	bit	-	00b – Independent 01b – Linked to DC Source Indicates that operation is linked to a DC source which reports through the DC_SOURCE_STATUS DGNs.
3	4 to 7	Battery type	uint4	-	see Table 6.5.5b
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
7	-	Maximum charging current	uint8	A	see Table 5.3

6.46.4 Solar Controller Command

This command starts or stops the charger. Note that Enabling the charger does not necessarily start the unit to converting power. Table 6.46.4a defines the DG attributes and Table 6.46.4b defines the signal and parameter attributes.

Table 6.46.4a — DG definition

DG attribute	Value
Name	SOLAR_CONTROLLER_COMMAND
DGN	1FEB1h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on charge
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, SOLAR_CONTROLLER_STATUS

Table 6.46.4b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description

0	-	Instance	uint8	-	
1	-	Status	uint8	-	0 — Disable 1 — Enable controller 2 — Start equalization
2	0 to 1	Default state on power- up	bit	-	00b — Controller disabled on power-up 01b — Controller enabled on power-up

6.46.5 Solar Controller Configuration Command

This DGN provides changes in the Solar Controller configuration. Table 6.46.5a defines the DG attributes and Table 6.46.5b defines the signal and parameter attributes.

Placing a No Data (255, 65 535) in a field will cause that setting to be ignored. Thus it is possible to adjust any single setting without changing any others.

Table 6.46.5a — DG definition

DG attribute	Value
Name	SOLAR_CONTROLLER_CONFIGURATION_COMMAND
DGN	1FEB0h
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, SOLAR_CONTROLLER_CONFIGURATION_STATUS

Table 6.46.5b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	
1	-	Charging algorithm	uint8	-	The algorithm to apply to the battery. see table 6.21.9b
2	-	Charger mode	uint8	-	see 6.21.9b
3	0 to 1	Battery sensor present	bit	-	00b — No battery temperature sensor in use 01b — Sensor is present and active
3	2 to 3	Linkage mode	bit	-	00b – Independent 01b – Linked to DC Source Indicates that operation is linked to a DC source which reports through the DC_SOURCE_STATUS DGNs.
3	4 to 7	Battery type	uint4	-	see table 6.5.5b
4 to 5	-	Battery bank size	uint16	A•h	Precision = 1 A•h Value range = 0 to 65 530 A•h
7	-	Maximum charging current	uint8	A	see Table 5.3

6.46.6 Solar Equalization Status

This describes the status of the Equalization process. Table 6.46.6a defines the DG attributes and Table 6.46.6b defines the signal and parameter attributes. This DGN is normally broadcast only during the equalization process.

Table 6.46.6a — DG definition

DG attribute	Value
Name	SOLAR_EQUALIZATION_STATUS
DGN	1FEAFh
Default priority	6
Maximum broadcast rate	5000 ms if active
Normal broadcast rate	1000 if active
Minimum broadcast rate	500 ms
Number of frames	1
ACK requirements	None

Table 6.46.6b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	
1 to 2	-	Time remaining	uint16	min	Precision = 1 min Value range = 0 to 65 530 min
3	0 to 1	Pre-charging status	Bit	-	00b — Pre-charging is not in process 01b — Charger is charging the batteries to prepare for equalization

6.46.7 Solar Equalization Configuration

This describes configuration information for the Equalization mode of the Charger. Table 6.46.7a defines the DG attributes and Table 6.46.7b defines the signal and parameter attributes.

Table 6.46.7a — DG definition

DG attribute	Value
Name	SOLAR_EQUALIZATION_CONFIGURATION_STATUS
DGN	1FEAEh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	on change
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	None

Table 6.46.7b — Signal and parameter definition

Byte	Bit	Name	Data type	Unit	Value description
0	-	Instance	uint8	-	
1 to 2	-	Equalization voltage	uint16	V	see Table 5.3
3 to 4	-	Equalization time	uint16	min	Precision = 1 min Value range = 0 to 65 530 min

6.46.8 Solar Equalization Configuration Command

This changes the configuration information for the Equalization mode of the Charger. Table 6.46.8 defines the DG attributes. The signal and parameter attributes have the same format as SOLAR_EQUALIZATION_CONFIGURATION_STATUS (see Table 6.46.7b).

Table 6.46.8 — DG definition

DG attribute	Value
Name	SOLAR_EQUALIZATION_CONFIGURATION_COMMAND
DGN	1FEADh
Default priority	6
Maximum broadcast rate	N/A
Normal broadcast rate	as needed
Minimum broadcast rate	N/A
Number of frames	1
ACK requirements	ACK, SOLAR_EQUALIZATION_CONFIGURATION_STATUS

6.46.9 Service Points

The SPNs defined in Table 6.46.9a shall apply to the Solar Charge Controller

Table 6.46.9a — Service Points

MSB	ISB	LSb	Description
0	0-FFh	0-7	Node-Global Service Points. Combine the ISB and LSb to calculate. Values from 0-FFh are Standard SPNs – see Table 7.3
1	Instance	0	DC Voltage
1	Instance	1	DC Current
1	Instance	2	Battery Temperature
1	Instance	3	DC Source State of Charge
1	Instance	4	DC Source State of Health
1	Instance	5	DC Source Capacity
1	Instance	6	DC Source AC Ripple
1	Instance	7	DC Source Reverse Polarity
2	Instance	0	Ambient Temperature
2	Instance	1	Battery Equalization

7 Informational Tables

7.1 Manufacturer codes

The manufacturer codes shown in Table 7.1 are defined and used by the corresponding companies before any agreement was made with SAE in regards of assigning manufacturer codes. Any manufacturer shall apply for a code from SAE and it is highly recommended to use SAE assigned manufacturer codes.

Table 7.1 — Manufacturer codes

Code	Manufacturer
101	Atwood Mobile Products
102	Carefree of Colorado
103	Dometic Corporation
104	Freightliner Custom Chassis Corp.
105	General Dynamics - Intellitec Products
106	Girard Systems
107	Hopkins Manufacturing Corp.
108	HWH Corporation
109	Integrated Power Systems
110	Onan / Cummins Power Generation
111	Progressive Dynamics, Inc.
112	SilverLeaf Electronics, Inc.
113	Spartan Motors Chassis, Inc.
114	Technology Research Corporation
115	Transportation Systems Design, Inc.
116	Vehicle Systems, Inc.
117	Wire Design, Inc.
118	Workhorse Custom Chassis
119	Xantrex Technology, Inc.
120	Power Gear
121	RV Products
122	Suburban
123	Borg-Warner
124	Garnet Instruments
125	American Technology
126	Automated Engineering Corp.

7.2 Default source addresses (DSA)

The following table provides a list of products, the static address it should be assigned, and the dynamic address where it should

start the claiming process. Nodes using dynamic source addresses should start with the highest address in the preferred range and work down.

Product	DSA	Preferred Dynamic Address Range	Notes Dynamic Address Group	Section
Generator	64	128-143	Power Components	6.19
Genstart Controller	65	128-143	Power Components	6.36
Inverter #1-2	66, 67	128-143	Power Components	6.20
Control Panel*	68	144-159	Controls and Displays	
Battery State of Charge #1 -2	69, 70	160-175	Sensors	6.5
Chassis Battery S.O.C.	71	160-175	Sensors	6.5
Water/Waste Tank System	72	160-175	Sensors	6.29
LPG Tank System	73	160-175	Sensors	6.29
Converter #1	74	128-143	Power Components	6.21
Converter #2	75	128-143	Power Components	6.21
Charge Controller	76	128-143	Power Components	6.21
AC Load Monitor / Controller	77	128-143	Power Components	6.23
AC Fault Protection System	78	128-143	Power Components	6.33
Transfer Switch	79	128-143	Power Components	6.33
Weather Station	80	160-175	Sensors	6.34
Hydraulic System Controller	81	176-191	Mechanical Components	6.14
Hydraulic Leveling System	82	176-191	Mechanical Components	6.14
Air Leveling System	83	176-191	Mechanical Components	6.14
Slide Room #1-4	84-87	176-191	Mechanical Components	6.15
Main Thermostat	88	192-207	Comfort Systems	6.17
Bedroom Thermostat	89	192-207	Comfort Systems	6.17
Thermostat #3-6	90-93	192-207	Comfort Systems	6.17
Main Furnace (Conventional)	94	192-207	Comfort Systems	6.16
Conventional Furnace #2-3	95, 96	192-207	Comfort Systems	6.16
Aux. Heat (e.g Tile Heat), #1-3	97-99	192-207	Comfort Systems	6.37
Furnace (Hydronic)	100	192-207	Comfort Systems	6.16
Water Heater #1-2	101, 102	208-223	Appliances and Bridges	6.9
Air Conditioners #1-4	103-106	192-207	Comfort Systems	6.18
Refrigerator	107	208-223	Appliances and Bridges	
Aux. Refer (Wine Cooler)	108	208-223	Appliances and Bridges	
Aux. Freezer	109	208-223	Appliances and Bridges	
Ice Maker	110	208-223	Appliances and Bridges	

Stove	111	208-223	Appliances and Bridges	
Audio Entertainment #1-3	112-114	224-239	Entertainment Systems	
Video Entertainment #1-3	115-117	224-239	Entertainment Systems	
TV Lift (Living, Bedroom)	118, 119	224-239	Entertainment Systems	
Gas Detectors	120-125	208-223	Appliances and Bridges	6.10
Active Air Suspension	126	144-159	Chassis	6.12
Water Pump	127	208-223	Appliances and Bridges	6.30
Tank Autofill	128	208-223	Appliances and Bridges	6.31
Waste Dump	129	208-223	Appliances and Bridges	6.32
Awning	130	176-191	Mechanical Components	6.39
DC Load, DC Dimmer	131	128-143	Power Components	6.24, 6.25
DC Input, Keypad	132	144-159	Controls and Displays	6.26
Tire Monitor	133	160-175	Sensors	6.38
Window Shade Control	134	128-143	Power Components	6.40
Door, Window Control	135	176-191	Mechanical Components	6.41
GPS	136	160-175	Sensors	6.35, 6.42
AC Load	137	128-143	Power Components	6.23
DC Motor Controller	138	128-143	Power Components	6.28
External Interface	139	144-159	Appliances and Bridges	6.45
Generic AC Source	140	128-143	Power Components	
Solar Charge Controller	141	128-143	Power Components	6.46
Service Tool	249	-		
System Clock	250	-		6.4
Data Logger	251	-		
Chassis Bridge	252	144-159	Chassis	6.11
Network Bridge	253	144-159	Appliances and Bridges	6.44

7.3 Standard SPNs

These SPNs apply to devices of all types. The range of 0 to 255 is reserved for this purpose. Node-specific SPNs shall be 256 or greater.

Table 7.3 — Standard SPNs

Value	Description
0	Specific Point Unknown
1	Node Microprocessor (or ECM)
2	Node Analog-Digital Converter
3	Node Settings or Configuration
4	Node RAM

5	Node Power Supply
6	Node Temperature
7	Node Clock / Timer
8	Node Date / Time. Usually indicates a product that requires a clock DGN from another source.
9	Node RV-C Connection. Usually indicates a product that requires a specific DGN from another source.
10	Node Serial/ID Number
11	Node Processor Supervisor (Watchdog)
12	Node Firmware
13	Node Internal Subnetwork Communications.

7.4 Standard acknowledgments

Table 7.4 — Standard acknowledgments

Value	Description
0	ACK. Command will be executed.
1	NAK. Command will not be executed.
2	Command is not acceptable from the source.
3	Conditions do not allow command to be executed.
4	Command is not formatted properly.
5	Command parameters are out of range.
6	Command requires a security password.
7	Command requires more time to execute. This should be followed by an ACK when complete.
8	Command overridden by user.
9 to 127	Reserved
128 to 254	Command-specific responses.

These are the valid values for the Acknowledgment field in the Acknowledgment DGN (59392).

NAK 7 is used for operations in which an immediate positive or negative response is not possible. For example, if the node must check the status of other devices before it knows whether the command is possible, and those devices do not respond within the 1250 ms time window allowed for commands, it should send an immediate NAK 7 then send a second message when the outcome is fully known.

7.5 DGN designations

The following table provides the values for the DGNs defined by RV-C. The scheme is intended to reduce the probability of intersecting NMEA 2000 DGNs. New DGNs should be added in sequence, counting down to 1FF80h, then resuming again at 1FEFFh. At 1FE80h the sequence should again be interrupted and resumed at 1FDFFh. NMEA numbers their DGNs in groups, with each group starting at 1F#00h. Thus unless any NMEA group exceeds 128 DGNs, there is no chance of collision.

Table 7.5 — DGN designations

DGN	Hex	Decimal	Section
DATE_TIME_STATUS	1FFFF	131071	6.4.2
SET_DATE_TIME_COMMAND	1FFFE	131070	6.4.3
DC_SOURCE_STATUS_1	1FFFD	131069	6.5.2
DC_SOURCE_STATUS_2	1FFFC	131068	6.5.3
DC_SOURCE_STATUS_3	1FFFB	131067	6.5.4
COMMUNICATION_STATUS_1	1FFFA	131066	6.6.2
COMMUNICATION_STATUS_2	1FFF9	131065	6.6.3
COMMUNICATION_STATUS_3	1FFF8	131064	6.6.4
WATERHEATER_STATUS	1FFF7	131063	6.9.2
WATERHEATER_COMMAND	1FFF6	131062	6.9.3
GAS_SENSOR_STATUS	1FFF5	131061	6.10.2
CHASSIS_MOBILITY_STATUS	1FFF4	131060	6.11.2
CHASSIS_MOBILITY_COMMAND	1FFF3	131059	6.11.3
AAS_CONFIG_STATUS	1FFF2	131058	6.12.2
AAS_COMMAND	1FFF1	131057	6.12.3
AAS_STATUS	1FFF0	131056	6.12.4
AAS_SENSOR_STATUS	1FFEF	131055	6.12.5
LEVELING_CONTROL_COMMAND	1FFEE	131054	6.13.2
LEVELING_CONTROL_STATUS	1FFED	131053	6.14.2
LEVELING_JACK_STATUS	1FFEC	131052	6.14.3
LEVELING_SENSOR_STATUS	1FFEB	131051	6.14.4
HYDRAULIC_PUMP_STATUS	1FFEA	131050	6.14.5
LEVELING_AIR_STATUS	1FFE9	131049	6.14.7
SLIDE_STATUS	1FFE8	131048	6.15.1
SLIDE_COMMAND	1FFE7	131047	6.15.2
SLIDE_SENSOR_STATUS	1FFE6	131046	6.15.3
SLIDE_MOTOR_STATUS	1FFE5	131045	6.15.4
FURNACE_STATUS	1FFE4	131044	6.16.2
FURNACE_COMMAND	1FFE3	131043	6.16.3
THERMOSTAT_STATUS_1	1FFE2	131042	6.17.2
AIR_CONDITIONER_STATUS	1FFE1	131041	6.18.5
AIR_CONDITIONER_COMMAND	1FFE0	131040	6.18.3
GENERATOR_AC_STATUS_1	1FFDF	131039	6.19.3
GENERATOR_AC_STATUS_2	1FFDE	131038	6.19.4
GENERATOR_AC_STATUS_3	1FFDD	131037	6.19.5

DGN	Hex	Decimal	Section
GENERATOR_STATUS_1	1FFDC	131036	6.19.16
GENERATOR_STATUS_2	1FFDB	131035	6.19.17
GENERATOR_COMMAND	1FFDA	131034	6.19.18
GENERATOR_START_CONFIG_STATUS	1 FFD9	131033	6.19.19
GENERATOR_START_CONFIG_COMMAND	1 FFD8	131032	6.19.20
INVERTER_AC_STATUS_1	1FFD7	131031	6.20.3
INVERTER_AC_STATUS_2	1FFD6	131030	6.20.4
INVERTER_AC_STATUS_3	1FFD5	131029	6.20.5
INVERTER_STATUS	1FFD4	131028	6.20.6
INVERTER_COMMAND	1FFD3	131027	6.20.9
INVERTER_CONFIGURATION_STATUS_1	1FFD2	131026	6.20.10
INVERTER_CONFIGURATION_STATUS_2	1FFD1	131025	6.20.11
INVERTER_CONFIGURATION_COMMAND_1	1FFD0	131024	6.20.13
INVERTER_CONFIGURATION_COMMAND_2	1FFCF	131023	6.20.14
INVERTER_STATISTICS_STATUS	1FFCE	131022	6.20.16
INVERTER_APS_STATUS	1FFCD	131021	6.20.17
INVERTER_DCBUS_STATUS	1FFCC	131020	6.20.18
INVERTER_OPS_STATUS	1FFCB	131019	6.20.19
CHARGER_AC_STATUS_1	1FFCA	131018	6.21.3
CHARGER_AC_STATUS_2	1FFC9	131017	6.21.4
CHARGER_AC_STATUS_3	1FFC8	131016	6.21.5
CHARGER_STATUS	1FFC7	131015	6.21.6
CHARGER_CONFIGURATION_STATUS	1FFC6	131014	6.21.9
CHARGER_COMMAND	1FFC5	131013	6.21.10
CHARGER_CONFIGURATION_COMMAND	1FFC4	131012	6.21.11
reserved	1FFC3	131011	
CHARGER_APS_STATUS	1FFC2	131010	6.21.21
CHARGER_DCBUS_STATUS	1FFC1	131009	6.21.22
CHARGER_OPS_STATUS	1FFC0	131008	6.21.23
AC_LOAD_STATUS	1FFBF	131007	6.23.2
AC_LOAD_COMMAND	1FFBE	131006	6.23.4
DC_LOAD_STATUS	1FFBD	131005	6.24.2
DC_LOAD_COMMAND	1FFBC	131004	6.24.4
DC_DIMMER_STATUS_1	1FFBB	131003	6.25.2
DC_DIMMER_STATUS_2	1FFBA	131002	6.25.3
DC_DIMMER_COMMAND	1FFB9	131001	6.25.5

DGN	Hex	Decimal	Section
DIGITAL_INPUT_STATUS	1FFB8	131000	6.26.2
TANK_STATUS	1FFB7	130999	6.29.2
TANK_CALIBRATION_COMMAND	1FFB6	130998	6.29.3
TANK_GEOMETRY_STATUS	1FFB5	130997	6.29.4
TANK_GEOMETRY_COMMAND	1FFB4	130996	6.29.5
WATER_PUMP_STATUS	1FFB3	130995	6.30.2
WATER_PUMP_COMMAND	1FFB2	130994	6.30.3
AUTOFILL_STATUS	1FFB1	130993	6.31.2
AUTOFILL_COMMAND	1FFB0	130992	6.31.3
WASTEDUMP_STATUS	1FFAF	130991	6.32.2
WASTEDUMP_COMMAND	1FFAE	130990	6.32.3
ATS_AC_STATUS_1	1FFAD	130989	6.33.2
ATS_AC_STATUS_2	1FFAC	130988	6.33.2
ATS_AC_STATUS_3	1FFAB	130987	6.33.2
ATS_STATUS	1FFAA	130986	6.33.4
ATS_COMMAND	1FFA9	130985	6.33.5
reserved	1FFA8	130984	
reserved	1FFA7	130983	
reserved	1FFA6	130982	
WEATHER_STATUS_1	1FFA5	130981	6.34.2
WEATHER_STATUS_2	1FFA4	130980	6.34.3
ALTIMETER_STATUS	1FFA3	130979	6.34.4
ALTIMETER_COMMAND	1FFA2	130978	6.34.5
WEATHER_CALIBRATE_COMMAND	1FFA1	130977	6.34.6
COMPASS_BEARING_STATUS	1FFA0	130976	6.35.2
COMPASS_CALIBRATE_COMMAND	1FF9F	130975	6.35.3
reserved (formerly BRIDGE_COMMAND)	1FF9E	130974	6.8
reserved (formerly BRIDGE_DGN_LIST)	1FF9D	130973	6.8
THERMOSTAT_AMBIENT_STATUS	1FF9C	130972	6.17.11
HEAT_PUMP_STATUS	1FF9B	130971	6.18.4
HEAT_PUMP_COMMAND	1FF9A	130970	6.18.5
CHARGER_EQUALIZATION_STATUS	1FF99	130969	6.21.18
CHARGER_EQUALIZATION_CONFIGURATION_STATUS	1FF98	130968	6.21.19
CHARGER_EQUALIZATION_CONFIGURATION_COMMAND	1FF97	130967	6.21.20
CHARGER_CONFIGURATION_STATUS_2	1FF96	130966	6.21.12
CHARGER_CONFIGURATION_COMMAND_2	1FF95	130965	6.21.13

DGN	Hex	Decimal	Section
GENERATOR_AC_STATUS_4	1FF94	130964	6.19.6
GENERATOR_ACFAULT_CONFIGURATION_STATUS_1	1FF93	130963	6.19.7
GENERATOR_ACFAULT_CONFIGURATION_STATUS_2	1FF92	130962	6.19.7
GENERATOR_ACFAULT_CONFIGURATION_COMMAND_1	1FF91	130961	6.19.7
GENERATOR_ACFAULT_CONFIGURATION_COMMAND_2	1FF90	130960	6.19.7
INVERTER_AC_STATUS_4	1FF8F	130959	6.20.6
INVERTER_ACFAULT_CONFIGURATION_STATUS_1	1FF8E	130958	6.20.7
INVERTER_ACFAULT_CONFIGURATION_STATUS_2	1FF8D	130957	6.20.7
INVERTER_ACFAULT_CONFIGURATION_COMMAND_1	1FF8C	130956	6.20.7
INVERTER_ACFAULT_CONFIGURATION_COMMAND_2	1FF8B	130955	6.20.7
CHARGER_AC_STATUS_4	1FF8A	130954	6.21.6
CHARGER_ACFAULT_CONFIGURATION_STATUS_1	1FF89	130953	6.21.7
CHARGER_ACFAULT_CONFIGURATION_STATUS_2	1FF88	130952	6.21.7
CHARGER_ACFAULT_CONFIGURATION_COMMAND_1	1FF87	130951	6.21.7
CHARGER_ACFAULT_CONFIGURATION_COMMAND_2	1FF86	130950	6.21.7
ATS_AC_STATUS_4	1FF85	130949	6.33.2
ATS_ACFAULT_CONFIGURATION_STATUS_1	1FF84	130948	6.33.3
ATS_ACFAULT_CONFIGURATION_STATUS_2	1FF83	130947	6.33.3
ATS_ACFAULT_CONFIGURATION_COMMAND_1	1FF82	130946	6.33.3
ATS_ACFAULT_CONFIGURATION_COMMAND_2	1FF81	130945	6.33.3
GENERATOR_DEMAND_STATUS	1FF80	130944	6.36.2
GENERATOR_DEMAND_COMMAND	1FEFF	130815	6.36.3
AGS_CRITERION_STATUS	1FEFE	130814	6.36.4
AGS_CRITERION_COMMAND	1FEFD	130813	6.36.6
FLOOR_HEAT_STATUS	1FEFC	130812	6.37.2
FLOOR_HEAT_COMMAND	1FEFB	130811	6.37.3
THERMOSTAT_STATUS_2	1FEFA	130810	6.17.3
THERMOSTAT_COMMAND_1	1FEF9	130809	6.17.4
THERMOSTAT_COMMAND_2	1FEF8	130808	6.17.5
THERMOSTAT_SCHEDULE_STATUS_1	1FEF7	130807	6.17.7
THERMOSTAT_SCHEDULE_STATUS_2	1FEF6	130806	6.17.8
THERMOSTAT_SCHEDULE_COMMAND_1	1FEF5	130805	6.17.9
THERMOSTAT_SCHEDULE_COMMAND_2	1FEF4	130804	6.17.10
INVERTER_DC_STATUS	1FEE8	130792	6.20.20
AWNING_STATUS	1FEF3	130803	6.39.2
AWNING_COMMAND	1FEF2	130802	6.39.3

DGN	Hex	Decimal	Section
TIRE_RAW_STATUS	1FEF1	130801	6.38.2
TIRE_STATUS	1FEF0	130800	6.38.3
TIRE_SLOW_LEAK_ALARM	1FEEF	130799	6.38.4
TIRE_TEMPERATURE_CONFIGURATION_STATUS	1FEEE	130798	6.38.6
TIRE_PRESSURE_CONFIGURATION_STATUS	1FEED	130797	6.38.7
TIRE_PRESSURE_CONFIGURATION_COMMAND	1FEEC	130796	6.38.8
TIRE_TEMPERATURE_CONFIGURATION_COMMAND	1FEEB	130795	6.38.8
TIRE_ID_STATUS	1FEEA	130794	6.38.10
TIRE_ID_COMMAND	1FEE9	130793	6.38.11
INVERTER_DC_STATUS	1FEE8	130792	6.20.20
GENERATOR_DEMAND_CONFIGURATION_STATUS	1FEE7	130791	6.36.7
GENERATOR_DEMAND_CONFIGURATION_COMMAND	1FEE6	130790	6.36.8
LOCK_STATUS	1FEE5	130789	6.41.2
LOCK_COMMAND	1FEE4	130788	6.41.3
WINDOW_STATUS	1FEE3	130787	6.41.4
WINDOW_COMMAND	1FEE2	130786	6.41.5
DC_MOTOR_CONTROL_COMMAND	1FEE1	130785	6.28.3
DC_MOTOR_CONTROL_STATUS	1FEE0	130784	6.28.2
WINDOW_SHADE_CONTROL_COMMAND	1FEDF	130783	6.40.3
WINDOW_SHADE_CONTROL_STATUS	1FEDE	130782	6.40.2
AC_LOAD_STATUS_2	1FEDD	130781	6.23.3
DC_LOAD_STATUS_2	1FEDC	130780	6.24.3
DC_DIMMER_COMMAND_2	1FEDB	130779	6.25.6
DC_DIMMER_STATUS_3	1FEDA	130778	6.25.4
GENERIC_INDICATOR_COMMAND	1FED9	130777	6.27.2
GENERIC_CONFIGURATION_STATUS	1FED8	130776	6.3.2
GENERIC_INDICATOR_STATUS	1FED7	130775	6.27.1.1
MFG_SPECIFIC_CLAIM_REQUEST	1FED6	130774	3.3.4
AGS_DEMAND_CONFIGURATION_STATUS	1FED5	130773	6.36.7
AGS_DEMAND_CONFIGURATION_COMMAND	1FED4	130772	6.36.8
GPS_STATUS	1FED3	130771	6.42.3
AGS_CRITERION_STATUS_2	1FED2	130770	6.36.5
SUSPENSION_AIR_PRESSURE_STATUS	1FED1	130769	6.12.6
PGN_DC_DISCONNECT_STATUS	1FED0	130768	6.43.2
PGN_DC_DISCONNECT_COMMAND	1FECF	130767	6.43.3
INVERTER_CONFIGURATION_STATUS_3	1FECE	130766	6.20.12

DGN	Hex	Decimal	Section
INVERTER_CONFIGURATION_COMMAND_3	1FECD	130765	6.20.15
CHARGER_CONFIGURATION_STATUS_3	1FECC	130764	6.21.14
CHARGER_CONFIGURATION_COMMAND_3	1FECB	130763	6.21.15
DM-RV	1FECA	130762	3.2.5
DC_SOURCE_STATUS_4	1FEC9	130761	6.5.5
DC_SOURCE_STATUS_5	1FEC8	130760	6.5.6
DC_SOURCE_STATUS_6	1FEC7	130759	6.5.7
GENERATOR_DC_STATUS_1	1FEC6	130758	6.19.9
GENERATOR_DC_CONFIGURATION_STATUS	1FEC5	130757	6.19.10
GENERATOR_DC_COMMAND	1FEC4	130756	6.19.11
GENERATOR_DC_CONFIGURATION_COMMAND	1FEC3	130755	6.19.12
GENERATOR_DC_EQUALIZATION_STATUS	1FEC2	130754	6.19.13
GENERATOR_DC_EQUALIZATION_CONFIGURATION_STATUS	1FEC1	130753	6.19.14
GENERATOR_DC_EQUALIZATION_CONFIGURATION_COMMAND	1FEC0	130752	6.19.15
CHARGER_CONFIGURATION_STATUS_4	1FEBF	130751	6.21.16
CHARGER_CONFIGURATION_COMMAND_4	1FEBE	130750	6.21.17
INVERTER_TEMPERATURE_STATUS	1FEBD	130749	6.20.21
HYDRAULIC_PUMP_COMMAND	1FEBC	130748	6.14.6
GENERIC_AC_STATUS_1	1FEBB	130747	6.22.2
GENERIC_AC_STATUS_2	1FEBA	130746	6.22.3
GENERIC_AC_STATUS_3	1FEB9	130745	6.22.4
GENERIC_AC_STATUS_4	1FEB8	130744	6.22.5
GENERIC_ACFAULT_CONFIGURATION_STATUS_1	1FEB7	130743	6.22.6
GENERIC_ACFAULT_CONFIGURATION_STATUS_2	1FEB6	130742	6.22.6
GENERIC_ACFAULT_CONFIGURATION_COMMAND_1	1FEB5	130741	6.22.6
GENERIC_ACFAULT_CONFIGURATION_COMMAND_2	1FEB4	130740	6.22.6
SOLAR_CONTROLLER_STATUS_1	1FEB3	130739	6.46.2
SOLAR_CONTROLLER_CONFIGURATION	1FEB2	130738	6.46.3
SOLAR_CONTROLLER_COMMAND	1FEB1	130737	6.46.4
SOLAR_CONTROLLER_CONFIGURATION_COMMAND	1FEB0	130736	6.46.5
SOLAR_EQUALIZATION_STATUS	1FEAF	130735	6.46.6
SOLAR_EQUALIZATION_CONFIGURATION_STATUS	1FEAE	130734	6.46.7
SOLAR_EQUALIZATION_CONFIGURATION_COMMAND	1FEAD	130733	6.46.8
GENERAL_RESET	17F##	98048 + address	6.2.3
TERMINAL	17E##	97792	6.2.2

DGN	Hex	Decimal	Section
		+ address	
DOWNLOAD	17D##	97536 + address	6.2.3
INSTANCE_ASSIGNMENT	17C##	97280 + address	6.2.4
INSTANCE_STATUS	17B##	97024 + address	6.2.4