SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

J1939-75

REV. JUN2007

Issued 2002-12
Revised 2007-06

Superseding J1939-75 JUL2006

Application Layer—Generator Sets and Industrial

RATIONALE

This document has been modified to record new parameters (SPNs) and parameter groups (PGNs) assignments made since November 2004 and predominantly associated with generator sets and industrial applications, as these will not be recorded in the Application Layer document J1939-71.

FOREWORD

This series of SAE Recommended Practices have been developed by the Truck and Bus Control and Communications Network Subcommittee of the Truck and Bus Electrical and Electronics Committee. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the requirements, design, and usage of devices that transmit electronic signals and control information among vehicle components. The usage of these Recommended Practices is not limited to truck and bus applications; other applications may be accommodated with immediate support being provided for construction and agricultural equipment, and stationary power systems. These SAE Recommended Practices are intended as a guide toward standard practice and are subject to change so as to keep pace with experience and technical advances.

This particular document, SAE J1939-75, describes the parameters and parameter groups that are predominantly associated with monitoring and control generators and driven equipment in electric power generation and industrial applications.

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1. SCOPE

The SAE J1939 documents are intended for light, medium, and heavy-duty vehicles used on or off road as well as appropriate stationary applications which use vehicle derived components (e.g., Generator sets). Vehicles of interest include, but are not limited to: on- and off-highway trucks and their trailers, construction equipment, and agricultural equipment and implements.

The purpose of these documents is to provide an open interconnect system for electronic systems. It is the intention of these documents to allow Electronic Control Units to communicate with each other by providing a standard architecture.

This particular document, SAE J1939-75, describes the parameters and parameter groups that are predominantly associated with monitoring and control generators and driven equipment in electric power generation and industrial applications. Parameters and parameter groups that may be associated with monitoring and control of the power units, such as engines, turbines, etc, that power the generators and driven industrial equipment and which may be applied in on- and off-highway applications, shall be documented in SAE J1939-71.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1939 Recommended Practice for a Serial Control and Communications Vehicle Network is the parent document and should be referenced in general.

SAE J1939-71 Vehicle Application Layer

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 ISO Publications

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 11898-1 Road vehicles—Controller area network (CAN)—Part 1: Data link layer and physical signaling

ISO 11898-2 Road vehicles—Controller area network (CAN)—Part 2: High-speed medium access unit

3. DEFINITIONS

3.1 AC Apparent Power

The range and resolution requirements for AC Apparent Power are the same as for AC Real Power. Apparent power is an unsigned quantity, but there is no benefit in having a larger range for apparent power than for real power.

3.2 AC Frequency

Measured AC frequency is an unsigned quantity. Common nominal frequencies in use worldwide for generator sets are 50 Hz, 60 Hz, and 400 Hz. The minimum resolution for display and control is 0.1 Hz.

When AC frequency is used to represent frequency difference, such as might be used by a synchronizer, then a signed quantity is required.

3.3 AC Kilowatt-Hour

AC Kilowatt-hour measures the total energy output of a generator set, or the total import/export energy of a utility incomer. AC Kilowatt-hour could be considered a signed quantity, since reverse power would subtract (or, for a utility incomer, import and export power would cancel each other). In practice, if there is a significant amount of power flowing in either direction at different times, the "positive" and "negative" flow should be accumulated separately. A utility might charge a different rate for "imported" power than it pays for "exported" power. Therefore it is desirable to treat this as an unsigned quantity, and to accumulate positive and negative kW separately.

For a generator set, the range should be sufficient to accumulate the output of a 10 MW generator set operating continuously at 80% capacity for 100 000 hours: 800 000 MWH. (For a utility incomer, the range must be somewhat higher.)

3.4 AC Phase Difference

AC Phase Difference represents the phase difference between the Bus #1 and Utility or Generator voltages. The voltages tested may be line-line or line-neutral, and may be based on a single phase or a combination of two or more phases. This is up to the control generating the data. The phase difference is a signed angle ranging from -180 degrees to +180 degrees. A resolution of 0.1 degree is adequate.

3.5 AC Power Factor

AC Power Factor measures the ratio of real power to apparent power, sometimes approximated as the cosine of the angle between voltage and current for a single phase. The range is -1.0 to +1.0. Negative values indicate reverse power flow. A value of 1.0 indicates that all of the power flow is real power delivered to the load (i.e. a purely resistive load). A value of 0.0 indicates that no real power is delivered to the load (i.e. a purely reactive load).

Power factor can be leading (a capacitive load) or lagging (an inductive load). This is not indicated by the sign of the power factor, but by a separate flag.

3.6 AC Reactive Power

In a normally operating system, the reactive power will be less than half the real power. In order to allow for fault conditions, it is desirable to have the same range for reactive power as for real power. Reactive power is a signed quantity, like real power.

3.7 AC Real Power

AC Real Power must be signed since power may flow in both directions. The range for reverse power does not need to be as large as the range for positive power for a generator set, but this quantity might also be used to measure power imported from a utility. In this case, a negative value for real power indicates power delivered (sold) to the utility, and might equal the total capacity of the generator sets.

A "large" diesel or gas generator set might have a capacity of around 10 MW (about 13 000 HP). Assuming it is desired to measure the power output of up to 20 generator sets paralleled together, the total capacity will be around 200 MW. The required resolution for a small (20 kW) generator set is approximately 0.1 kW = 100 W.

3.8 AC RMS Current

The maximum size breaker commonly available for generator sets is 6500 A. It is desirable to provide a 10X allowance for fault current measurement, which results in a desired range of 0 to 65 000 A.

3.9 AC RMS Voltage

The maximum voltage likely to be measured by a generator set monitoring device is 33 kV (the UK heavy distribution voltage). Utility voltage may be much higher, but will be stepped down for paralleling with generator sets.

3.10 Dead Bus

Dead Bus flag indicates whether the synchronizer or sync check relay has determined that the bus is dead for the purpose of connecting the utility to the bus. When standby generator sets are brought online in response to a utility failure, the first generator set to connect to the bus must connect to a dead bus without synchronizing. Subsequent generator sets may synchronize to the first online generator set. A dead bus is typically indicated by a bus voltage less than a programmed threshold, but a more sophisticated method may be used. (The dead bus threshold used for Bus #1 / Utility synchronization may be different than that used for Bus #1 / Generator synchronization.) The voltages tested may be line-line or line-neutral, and may be based on a single phase or a combination of two or more phases. This is up to the control generating the flag.

3.11 Total AC Energy

Total AC Energy is the total energy exported or imported by the generator set or utility.

For generator sets, exported energy is energy delivered to the load (the normal situation). Imported energy is energy taken from the load or bus (reverse power, an abnormal and potentially damaging situation).

For utilities, exported energy is energy delivered by the generator set to the utility. Imported energy is energy delivered by the utility to the load. Unlike the case with generator sets, both exported and imported energy are normal for a utility.

3.12 Utility Incomer

Any source of power that is present for which the user is not responsible for the generation of that power. This is typically the local utility or power company, but could be other power sources, such as the power coming from a system at a separate building.

4. ABBREVIATIONS

A	Ampere
AC	Alternating Current
Hz	Hertz
kWh	Kilowatt hour
RMS	Root Mean Square
V	Voltage
VA	Volt-Ampere
VAr	Volt-Ampere reactive
W	Watts

5. TECHNICAL REQUIREMENTS

The application Layer provides a means for application processes to access the OSI environment. This layer contains management functions and generally useful mechanisms to support applications.

5.1 Parameters and Parameter Group Introduction

5.1.1 General Parameter Grouping

The Parameter Groups are organized according to Generator, Utility, and Bus related parameter quantities. The Generator PGNs describe the generator output: voltage, current, frequency, and power. The Utility PGNs describe the input from a utility: also voltage, current, frequency, and power. The Bus PGNs describe the voltage and some other parameters on the bus, which is a point where multiple generator sets and utilities can be paralleled together to drive a load.

5.1.2 Generator and Utility Parameters and Parameter Groups

The Generator and Utility related PGNs are further organized according to Total and Per-Phase related parameter quantities. In a three-phase power system, the voltage, current, and power can be measured independently for each phase (labeled phase A, phase B, and phase C). These per-phase values can then be combined to form total (or average, or overall) quantities. For some generator configurations, the per-phase values are not meaningful, and the total quantities are the only values available. Frequency parameter information is in the per-phase PGNs in order to keep symmetry with the total PGNs, and to support independent frequency measurements on the individual phases. The SPNs and PGNs for the Generator and Utility parameters are summarized in Table 1 through Table 4.

TABLE 1 - SPN SUMMARY FOR GENERATOR PARAMETERS

Generator AC Quantities	Reference Type	Phase A	Phase B	Phase C	Total	Average
Real Power	SPN	2453	2454	2455	2452	-
Apparent Power	SPN	2461	2462	2463	2460	-
Reactive Power	SPN	2457	2458	2459	2456	-
Power Factor	SPN	2465	2466	2467	2464	-
Power Factor Lagging	SPN	2519	2520	2521	2518	-
Line-to-Line AC RMS Voltage	SPN	2441	2442	2443	-	2440
Line-to-Neutral AC RMS Voltage	SPN	2445	2446	2447	-	2444
AC RMS Current	SPN	2449	2450	2451	-	2448
AC Frequency	SPN	2437	2438	2439	-	2436
KWh Import	SPN	-	-	-	2469	-
KWh Export	SPN	-	-	-	2468	-

TABLE 2 - PGN SUMMARY FOR GENERATOR PARAMETERS

Generator AC Quantities	Reference Type	Phase A	Phase B	Phase C	Total	Average
Real Power	PGN	65026	65023	65020	65029	-
Apparent Power	PGN	65026	65023	65020	65029	-
Reactive Power	PGN	65025	65022	65019	65028	-
Power Factor	PGN	65025	65022	65019	65028	-
Power Factor Lagging	PGN	65025	65022	65019	65028	-
Line-to-Line AC RMS Voltage	PGN	65027	65024	65021	-	65030
Line-to-Neutral AC RMS Voltage	PGN	65027	65024	65021	-	65030
AC RMS Current	PGN	65027	65024	65021	-	65030
AC Frequency	PGN	65027	65024	65021	-	65030
KWh Import	PGN	-	-	-	65018	-
KWh Export	PGN	-	-	-	65018	-

TABLE 3 - SPN SUMMARY FOR UTILITY PARAMETERS

Utility AC Quantities	Reference Type	Phase A	Phase B	Phase C	Total	Average
Real Power	SPN	2487	2488	2489	2486	-
Apparent Power	SPN	2495	2496	2497	2494	-
Reactive Power	SPN	2491	2492	2493	2490	-
Power Factor	SPN	2499	2500	2501	2498	-
Power Factor Lagging	SPN	2553	2554	2555	2552	-
Line-to-Line AC RMS Voltage	SPN	2475	2476	2477	-	2474
Line-to-Neutral AC RMS Voltage	SPN	2479	2480	2481	-	2478
AC RMS Current	SPN	2483	2484	2485	-	2482
AC Frequency	SPN	2471	2472	2473	-	2470
KWh Import	SPN	-	-	-	2503	-
KWh Export	SPN	-	-	-	2502	-

TABLE 4 - PGN SUMMARY FOR UTILITY PARAMETERS

Utility AC Quantities	Reference Type	Phase A	Phase B	Phase C	Total	Average
Real Power	PGN	65013	65010	65007	65016	-
Apparent Power	PGN	65013	65010	65007	65016	-
Reactive Power	PGN	65012	65009	65006	65015	-
Power Factor	PGN	65012	65009	65006	65015	-
Power Factor Lagging	PGN	65012	65009	65006	65015	-
Line-to-Line AC RMS Voltage	PGN	65014	65011	65008	-	65017
Line-to-Neutral AC RMS Voltage	PGN	65014	65011	65008	-	65017
AC RMS Current	PGN	65014	65011	65008	-	65017
AC Frequency	PGN	65014	65011	65008	-	65017
KWh Import	PGN	-	-	-	65005	-
KWh Export	PGN	-	-	-	65005	-

5.1.3 Bus Parameter Groups

All bus PGNs are called “Bus #1...” to allow for multiple busses in a system. It is expected that future PGNs for other busses would be identical to the Bus #1 PGNs. The SPNs and PGNs for the Bus parameters are summarized in Table 5 and Table 6.

TABLE 5 - SPN SUMMARY FOR BUS #1 PARAMETERS

Bus #1 AC Quantities	Reference Type	Phase A	Phase B	Phase C	Average
Line-to-Line AC RMS Voltage	SPN	2509	2510	2511	2508
Line-to-Neutral AC RMS Voltage	SPN	2513	2514	2515	2512
AC Frequency	SPN	2505	2506	2507	2504

TABLE 6 - PGN SUMMARY FOR BUS #1 PARAMETERS

Bus #1 AC Quantities	Reference Type	Phase A	Phase B	Phase C	Average
Line-to-Line AC RMS Voltage	PGN	65003	65002	65001	65004
Line-to-Neutral AC RMS Voltage	PGN	65003	65002	65001	65004
AC Frequency	PGN	65003	65002	65001	65004

Multiple gensets, loads, and possibly a utility may be connected to a bus at any time. Ignoring resistive losses, the voltage and frequency will be constant at all points on the bus. The current and power, on the other hand, will vary depending on where the sensing is done. Consider the example of two gensets G1 and G2, and one load L. Suppose they are connected on the bus in the configuration G1 ---- L ---- G2, so L is between the gensets. If the bus current is sensed between G1 and L, it will show the current and power delivered by G1. If the bus current is sensed between G2 and L, it will show the current and power delivered by G2. These two quantities may be completely different. For this reason, Bus #1 current is not included in the Bus #1 Basic AC Quantities, and no Bus #1 power PGNs are currently defined.

5.1.4 Synchronization Parameter Groups

The synchronization PGNs are organized according to synchronization of Bus #1 to a generator set or utility. These PGNs contain parameters that would be generated by, or perhaps used by, a synchronizer or sync check relay to connect the generator set or utility to Bus #1. These parameters include AC Phase Difference, Voltage Match, Frequency Match, Phase Match, In Sync, and Dead Bus flag. The SPNs and PGNs for the Synchronization parameters for Bus #1 to the Utility and the Generator are summarized in Table 7 and Table 8.

TABLE 7 - SPN SUMMARY FOR SYNCHRONIZATION PARAMETERS

Synchronization Quantities	Reference Type	Bus #1 to Utility	Bus #1 to Generator
Frequency Match	SPN	2533	2528
Voltage Match	SPN	2532	2527
Phase Match	SPN	2531	2526
Phase Difference	SPN	2517	2516
Utility in Sync	SPN	2534	2529
Dead Bus	SPN	2535	2530

TABLE 8 - PGN SUMMARY FOR SYNCHRONIZATION PARAMETERS

Synchronization Quantities	Reference Type	Bus #1 to Utility	Bus #1 to Generator
Frequency Match	PGN	64999	65000
Voltage Match	PGN	64999	65000
Phase Match	PGN	64999	65000
Phase Difference	PGN	64999	65000
Utility in Sync	PGN	64999	65000
Dead Bus	PGN	64999	65000

5.2 Parameter (SPN) Definitions

The parameter definitions presented in this section of this document are listed in numerical order by SPN.

SPN 2436 Generator Average AC Frequency

Average AC frequency measured at the generator output.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65030

SPN 2437 Generator Phase A AC Frequency

AC frequency measured at the generator phase A output.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65027

SPN 2438 Generator Phase B AC Frequency

AC frequency measured at the generator phase B output.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65024

SPN 2439 Generator Phase C AC Frequency

AC frequency measured at the generator phase C output.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65021

SPN 2440 Generator Average Line-Line AC RMS Voltage

Average Line to Line RMS voltage measured at the generator output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65030

SPN 2441 Generator Phase AB Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the generator phase AB output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65027

SPN 2442 Generator Phase BC Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the generator phase BC output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65024

SPN 2443 Generator Phase CA Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the generator phase CA output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65021

SPN 2444 Generator Average Line-Neutral AC RMS Voltage

The average Line to Neutral AC RMS voltage measured at the Generator output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65030

SPN 2445 Generator Phase A Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the generator phase A output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65027

SPN 2446 Generator Phase B Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the generator phase B output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65024

SPN 2447 Generator Phase C Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the generator phase C output.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65021

SPN 2448 Generator Average AC RMS Current

Average RMS current measured at the generator output.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65030

SPN 2449 Generator Phase A AC RMS Current

RMS current measured at the generator phase A output.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65027

SPN 2450 Generator Phase B AC RMS Current

RMS current measured at the generator phase B output.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65024

SPN 2451 Generator Phase C AC RMS Current

RMS current measured at the generator phase C output.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65021

SPN 2452 Generator Total Real Power

Total real power delivered by the generator.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65029

SPN 2453 Generator Phase A Real Power

The real power delivered by phase A of the generator.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65026

SPN 2454 Generator Phase B Real Power

The real power delivered by phase B of the generator.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65023

SPN 2455 Generator Phase C Real Power

The real power delivered by phase C of the generator.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65020

SPN 2456 Generator Total Reactive Power

The total reactive power delivered by the generator

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65028

SPN 2457 Generator Phase A Reactive Power

The reactive power delivered by phase A of the generator

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65025

SPN 2458 Generator Phase B Reactive Power

The reactive power delivered by phase B of the generator

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65022

SPN 2459 Generator Phase C Reactive Power

The reactive power delivered by phase C of the generator

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65019

SPN 2460 Generator Total Apparent Power

The total apparent power delivered by the generator.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65029

SPN 2461 Generator Phase A Apparent Power

The apparent power delivered by phase A of the generator.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65026

SPN 2462 Generator Phase B Apparent Power

The apparent power delivered by phase B of the generator.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65023

SPN 2463 Generator Phase C Apparent Power

The apparent power delivered by phase C of the generator.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65020

SPN 2464 Generator Overall Power Factor

The average power factor of the generator.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:-1 to +1
Type: Measured
Supporting information:
PGN Reference: 65028

SPN 2465 Generator Phase A Power Factor

The power factor of phase A of the generator.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:-1 to +1
Type: Measured
Supporting information:
PGN Reference: 65025

SPN 2466 Generator Phase B Power Factor

The power factor of phases B of the generator.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:-1 to +1
Type: Measured
Supporting information:
PGN Reference: 65022

SPN 2467 Generator Phase C Power Factor

The power factor of phases C of the generator.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:-1 to +1
Type: Measured
Supporting information:
PGN Reference: 65019

SPN 2468 Generator Total kW Hours Export

The total kilowatt-hours that have been exported by the generator.

Data Length: 4 bytes
Resolution: 1 kWh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kWh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65018

SPN 2469 Generator Total kW Hours Import

The total kilowatt-hours that have been imported by the generator.

Data Length: 4 bytes
Resolution: 1 kWh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kWh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65018

SPN 2470 Utility Average AC Frequency

Average AC frequency measured at the utility incomer.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65017

SPN 2471 Utility Phase A AC Frequency

AC frequency measured at the utility incomer phase A.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65014

SPN 2472 Utility Phase B AC Frequency

AC frequency measured at the utility incomer phase B.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65011

SPN 2473 Utility Phase C AC Frequency

AC frequency measured at the utility incomer phase C.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65008

SPN 2474 Utility Average Line-Line AC RMS Voltage

Average Line to Line RMS voltage measured at the utility incomer.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65017

SPN 2475 Utility Phase AB Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the utility incomer phase AB.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65014

SPN 2476 Utility Phase BC Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the utility incomer phase BC.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65011

SPN 2477 Utility Phase CA Line-Line AC RMS Voltage

Line to Line RMS voltage measured at the utility incomer phase CA.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65008

SPN 2478 Utility Average Line-Neutral AC RMS Voltage

The average Line to Neutral AC RMS voltage measured at the utility incomer.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65017

SPN 2479 Utility Phase A Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the utility incomer phase A.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65014

SPN 2480 Utility Phase B Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the utility incomer phase B.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65011

SPN 2481 Utility Phase C Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at the utility incomer phase C.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65008

SPN 2482 Utility Average AC RMS Current

Average RMS current measured at the utility incomer.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65017

SPN 2483 Utility Phase A AC RMS Current

RMS current measured at the utility incomer phase A.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65014

SPN 2484 Utility Phase B AC RMS Current

RMS current measured at the utility incomer phase B.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65011

SPN 2485 Utility Phase C AC RMS Current

RMS current measured at the utility incomer phase C.

Data Length: 2 bytes
Resolution: 1 A/bit, 0 offset
Data Range: 0 to 64 255 Amps Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65008

SPN 2486 Utility Total Real Power

Total real power delivered by the utility incomer.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65016

SPN 2487 Utility Phase A Real Power

The real power delivered by phase A of the utility incomer.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65013

SPN 2488 Utility Phase B Real Power

The real power delivered by phase B of the utility incomer.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65010

SPN 2489 Utility Phase C Real Power

The real power delivered by phase C of the utility incomer.

Data Length: 4 bytes
Resolution: 1 W/bit, -2 000 000 000 Watts offset
Data Range: -2 000 000 000 to +2 211 081 215 W Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65007

SPN 2490 Utility Total Reactive Power

The total reactive power delivered by the utility incomer

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65015

SPN 2491 Utility Phase A Reactive Power

The reactive power delivered by phase A of the utility incomer

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65012

SPN 2492 Utility Phase B Reactive Power

The reactive power delivered by phase B of the utility incomer

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65009

SPN 2493 Utility Phase C Reactive Power

The reactive power delivered by phase C of the utility incomer

Data Length: 4 bytes
Resolution: 1 VAr/bit, -2 000 000 000 VAr offset
Data Range: -2 000 000 000 to +2 211 081 215 VAr Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65006

SPN 2494 Utility Total Apparent Power

The total apparent power delivered by the utility incomer.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65016

SPN 2495 Utility Phase A Apparent Power

The apparent power delivered by phase A of the utility incomer.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65013

SPN 2496 Utility Phase B Apparent Power

The apparent power delivered by phase B of the utility incomer.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65010

SPN 2497 Utility Phase C Apparent Power

The apparent power delivered by phase C of the utility incomer.

Data Length: 4 bytes
Resolution: 1 VA/bit, -2 000 000 000 VA offset
Data Range: -2 000 000 000 to +2 211 081 215 VA Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65007

SPN 2498 Utility Overall Power Factor

The average power factor of the utility incomer.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65015

SPN 2499 Utility Phase A Power Factor

The power factor of phase A of the utility incomer.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65012

SPN 2500 Utility Phase B Power Factor

The power factor of phases B of the utility incomer.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65009

SPN 2501 Utility Phase C Power Factor

The power factor of phases C of the utility incomer.

Data Length: 2 bytes
Resolution: 1/16384 per bit, -1 offset
Data Range: -1.00000 to +2.921 814 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65006

SPN 2502 Utility Total kW Hours Export

The total kilowatt-hours that have been exported by the utility incomer.

Data Length: 4 bytes
Resolution: 1 kWh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kWh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65005

SPN 2503 Utility Total kW Hours Import

The total kilowatt-hours that have been imported by the utility incomer.

Data Length: 4 bytes
Resolution: 1 kWh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kWh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65005

SPN 2504 Bus #1 Average AC Frequency

Average AC frequency measured at bus #1.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65004

SPN 2505 Bus #1 Phase A AC Frequency

AC frequency measured at bus #1 phase A.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65003

SPN 2506 Bus #1 Phase B AC Frequency

AC frequency measured at bus #1 phase B.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65002

SPN 2507 Bus #1 Phase C AC Frequency

AC frequency measured at bus #1 phase C.

Data Length: 2 bytes
Resolution: 1/128 Hz/bit, 0 offset
Data Range: 0 to 501.992 1875 Hz Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65001

SPN 2508 Bus #1 Average Line-Line AC RMS Voltage

Average Line to Line RMS voltage measured at bus #1.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65004

SPN 2509 Bus #1 Phase AB Line-Line AC RMS Voltage

Line to Line RMS voltage measured at bus #1 phase AB.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65003

SPN 2510 Bus #1 Phase BC Line-Line AC RMS Voltage

Line to Line RMS voltage measured at bus #1 phase BC.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65002

SPN 2511 Bus #1 Phase CA Line-Line AC RMS Voltage

Line to Line RMS voltage measured at bus #1 phase CA.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65001

SPN 2512 Bus #1 Average Line-Neutral AC RMS Voltage

The average Line to Neutral AC RMS voltage measured at bus #1.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65004

SPN 2513 Bus #1 Phase A Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at bus #1 phase A.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65003

SPN 2514 Bus #1 Phase B Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at bus #1 phase B.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65002

SPN 2515 Bus #1 Phase C Line-Neutral AC RMS Voltage

Line to Neutral RMS voltage measured at bus #1 phase C.

Data Length: 2 bytes
Resolution: 1 V/bit, 0 offset
Data Range: 0 to 64 255 Volts Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65001

SPN 2516 Bus #1/Generator AC Phase Difference

The phase difference between the Bus #1 voltage and Generator voltage.

Data Length: 2 bytes
Resolution: 1/128 deg/bit, -200 deg offset
Data Range: -200 to 301.99 deg Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 65000

SPN 2517 Bus #1/Utility AC Phase Difference

The phase difference between the Bus #1 voltage and Utility voltage.

Data Length: 2 bytes
Resolution: 1/128 deg/bit, -200 deg offset
Data Range: -200 to 301.99 deg Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64999

SPN 2518 Generator Overall Power Factor Lagging

Lead/lag status for generator average power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65028

SPN 2519 Generator Phase A Power Factor Lagging

Lead/lag status for generator phase A power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65025

SPN 2520 Generator Phase B Power Factor Lagging

Lead/lag status for generator phase B power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65022

SPN 2521 Generator Phase C Power Factor Lagging

Lead/lag status for generator phase C power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65019

SPN 2522 Utility Overall Power Factor Lagging

Lead/lag status for utility incomer average power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65015

SPN 2523 Utility Phase A Power Factor Lagging

Lead/lag status for utility incomer phase A power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65012

SPN 2524 Utility Phase B Power Factor Lagging

Lead/lag status for utility incomer phase B power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65009

SPN 2525 Utility Phase C Power Factor Lagging

Lead/lag status for utility incomer phase C power factor.

00 Leading
01 Lagging
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65006

SPN 2526 Bus #1/Generator Phase Match

Indicator of whether phase difference between Bus #1 and Generator is adequate for paralleling. This indicator will be based on the measured AC phase difference qualified using parameters such as Phase Tolerance and Dwell Time.

00 Phases do not match
01 Phases match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65000

SPN 2527 Bus #1/Generator Voltage Match

Indicator of whether voltage difference between Bus #1 and Generator is adequate for paralleling. This indicator will be based on the measured AC voltages qualified using parameters such as Voltage Tolerance.

00 Voltages do not match
01 Voltages match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65000

SPN 2528 Bus #1/Generator Frequency Match

Indicator of whether frequency difference between Bus #1 and Generator is adequate for paralleling. This indicator will be based on the measured AC frequencies qualified using parameters such as Frequency Tolerance, Phase Tolerance, and Dwell Time.

00 Frequencies do not match
01 Frequencies match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65000

SPN 2529 Bus #1/Generator In Sync

Indicator of whether Bus #1 and Generator are properly synchronized for paralleling. This indicator will be based on parameters such as Voltage Match, Frequency Match, and Phase Match.

00 Not synchronized
01 Synchronized
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65000

SPN 2530 Bus #1/Generator Dead Bus

Indicator of whether Bus #1 is considered dead for closing to the generator. This indicator will be based on parameters such as Bus #1 Voltage and dead bus threshold values.

00 Bus is not dead
01 Bus is dead
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 65000

SPN 2531 Bus #1/Utility Phase Match

Indicator of whether phase difference between Bus #1 and Utility is adequate for paralleling. This indicator will be based on the measured AC phase difference qualified using parameters such as Phase Tolerance and Dwell Time.

00 Phases do not match
01 Phases match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64999

SPN 2532 Bus #1/Utility Voltage Match

Indicator of whether voltage difference between Bus #1 and Utility is adequate for paralleling. This indicator will be based on the measured AC voltages qualified using parameters such as Voltage Tolerance.

00 Voltages do not match
01 Voltages match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64999

SPN 2533 Bus #1/Utility Frequency Match

Indicator of whether frequency difference between Bus #1 and Utility is adequate for paralleling. This indicator will be based on the measured AC frequencies qualified using parameters such as Frequency Tolerance, Phase Tolerance, and Dwell Time.

00 Frequencies do not match
01 Frequencies match
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64999

SPN 2534 Bus #1/Utility In Sync

Indicator of whether Bus #1 and Utility are properly synchronized for paralleling. This indicator will be based on parameters such as Voltage Match, Frequency Match, and Phase Match.

00 Not synchronized
01 Synchronized
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64999

SPN 2535 Bus #1/Utility Dead Bus

Indicator of whether Bus #1 is considered dead for closing to the utility. This indicator will be based on parameters such as Bus #1 Voltage and dead bus threshold values.

00 Bus is not dead
01 Bus is dead
10 Error
11 Not Available or Not Installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64999

SPN 3375 Voltage Regulator Load Compensation Mode

State signal indicating the voltage regulator load compensation mode. Load compensation is when the voltage is adjusted based on the magnitude of load current

000 - load compensation disabled
001 - Voltage droop compensation enabled
010 - IR line drop compensation enabled
011 - Reserved
100 - Reserved
101 - Reserved
110 - Reserved
111 - Not available

Notes:
Voltage droop compensation is used to minimize the amount of reactive current that flows between generators when they are parallelled together. Excessive reactive current will result in the eventual failure of the generator exciter.

IR line compensation increases the generator output voltage as the load increases so the voltage measured at the load will remain constant. Without IR compensation, the voltage measured at the load drops due the IR losses in the power line.

Data Length: 3 bits
Resolution: 8 states/3 bit, 0 offset
Data Range: 0 to 7 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64935

SPN 3376 Voltage Regulator VAr/Power Factor Operating Mode

State signal indicating the operating mode for the Voltage regulator VAr/Power Factor

000 - VAr/Power Factor regulation disabled
001 - Power factor regulation enabled
010 - VAr regulation enabled
011 - Reserved
100 - Reserved
101 - Reserved
110 - Reserved
111 - Not available

Note:
This parameter sets the mode of regulation for the voltage regulator. The voltage regulator can regulate the generator AC output voltage by using the generator AC output voltage, the generator power factor, or the generator reactive power (VAr). The generator AC output voltage, the generator power factor, and the generator reactive power (VAr) are defined in SAE J1939-75

Data Length:	3 bits	
Resolution:	8 states/3 bit, 0 offset	
Data Range:	0 to 7	Operational Range:same as data range
Type:	Status	
Supporting information:		
PGN Reference:	64935	

SPN 3377 Voltage Regulator Underfrequency Compensation Enabled

State signal indicating the operating mode for underfrequency compensation.

00 - Underfrequency compensation disabled
01 - Underfrequency compensation enabled
10 - Reserved
11 - Not available

Note:
Underfrequency compensation is when the generator voltage is adjusted based on the generator frequency. Typically generator voltage decreases as frequency decreases. A frequency decrease occurs when load is increased on the genset. Underfrequency compensation decreases the load by reducing the voltage as frequency decreases until a point is reached where the engine can accept more load. Load is applied to the engine when the voltage increases with frequency.

Data Length:	2 bits	
Resolution:	4 states/2 bit, 0 offset	
Data Range:	0 to 3	Operational Range:same as data range
Type:	Status	
Supporting information:		
PGN Reference:	64935	

SPN 3378 Voltage Regulator Soft Start State

State signal indicating the mode of the Voltage regulator soft start function. Soft start controls the generator voltage overshoot by controlling the rate of rise of the generator output voltage at generator start up.

00 - Soft start is inactive
01 - Soft start is active
10 - Reserved
11 - Not available

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64935

SPN 3379 Voltage Regulator Enabled

State signal indicating the Voltage Regulator is enabled. This parameter indicates whether the regulator is regulating or not regulating generator output voltage.

00 - Not regulating voltage - unit disabled
01 - Regulating voltage
10 - Reserved
11 - Not available

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64935

SPN 3380 Generator Excitation Field Voltage

Measured signal that represents the generator excitation field voltage. Generator excitation field voltage is indicative of the amount of excitation current being supplied by the voltage regulator to the generator field.

Data Length: 2 bytes
Resolution: 0.05 V/bit, -1606.00 V offset
Data Range: -1606.00 to 1606.75 V Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64934

SPN 3381 Generator Excitation Field Current

Measured signal that represents the generator excitation field current.

Data Length:	2 bytes	
Resolution:	0.05 A/bit, 0 offset	
Data Range:	0 to 3212.75 A	Operational Range:same as data range
Type:	Measured	
Supporting information:		
PGN Reference:	64934	

SPN 3382 Generator Output Voltage Bias Percentage

Measured signal that represents the voltage bias percentage of the generator output voltage being requested by external to the voltage regulator. Generator output voltage bias percentage is the amount of voltage in percent the generator output voltage will vary from the generator nominal setpoint.

Data Length:	16 bits	
Resolution:	0.1 %/bit, -100 offset	
Data Range:	-100 to 100 %	Operational Range:-100 to 100%
Type:	Measured	
Supporting information:		
PGN Reference:	64934	

SPN 3383 Requested Generator Total AC Reactive Power

The total reactive power requested to be delivered by the generator

Data Length:	4 bytes	
Resolution:	1 VA/bit, -2 000 000 000 VA offset	
Data Range:	-2 000 000 000 to +2 211 081 215 VA	Operational Range:same as data range
Type:	Status	
Supporting information:		
PGN Reference:	61461	

SPN 3384 Requested Generator Overall Power Factor

The requested average power factor of the generator.

Data Length:	2 bytes	
Resolution:	1/16384 per bit, -1 offset	
Data Range:	-1.00000 to +2.921 814	Operational Range:-1 to 1
Type:	Status	
Supporting information:		
PGN Reference:	61461	

SPN 3385 Requested Generator Overall Power Factor Lagging

The requested lead/lag status for the generator average AC power factor

00 - Leading
01 - Lagging
10 - Reserved
11 - Not available or Not installed

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 61461

SPN 3386 Requested Generator Average Line-Line AC RMS Voltage

The requested average AC RMS voltage to be delivered by the generator.

Data Length: 4 bytes
Resolution: 1/128 V/bit, 0 offset
Data Range: 0 to 32 899 071 V Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 61468

SPN 3542 Requested Engine Control Mode

This parameter is used to request a change to the engine control mode. This is a status parameter.

Bit state 0000 = Normal Engine Shutdown
Bit state 0001 = Rapid Engine Shutdown
Bit state 0010 = Emergency Engine Shutdown
Bit state 0011 = Normal Engine Start
Bit state 0100 = Rapid Engine Start
Bit states 0101-1101 = available for SAE assignment
Bit state 1110 = Reserved
Bit state 1111 = Don't Care / Take No Action

Normal Engine Shutdown – Used to request that the engine control system shut down the engine, using the normal shutdown sequence for the engine. The shutdown sequence might include cool down or other intermediate states that delay stopping the engine.

Rapid Engine Shutdown – Used to request that the engine control system shut down the engine, using an abbreviated shutdown sequence for the engine. The intent is that the rapid engine shutdown take less time than a normal engine shutdown, but the specific shutdown sequence will depend on the configuration of the engine control system.

Emergency Engine Shutdown – Used to request that the engine control system shut down the engine, using the emergency shutdown sequence for the engine. The intent is to shut down the engine in the fastest possible manner, using all mechanisms available. All intermediate states that delay stopping the engine must be skipped for an emergency engine shutdown. In addition, any installed emergency stop aids (such as air shutoff, Jake Brakes, etc.) must be activated for an emergency shutdown.

Normal Engine Start – Used to request that the engine control system start the engine, using the normal starting sequence for the engine. All starting aids and pre-start states will be employed as appropriate for the engine and the current operating conditions.

Rapid Engine Start – Used to request that the engine control system start the engine, using an abbreviated starting sequence for the engine. The intent is that the rapid engine start take less time than a normal engine start, but the specific starting sequence will depend on the configuration of the engine control system.

Data Length: 4 bits
Resolution: 16 states/4 bit, 0 offset
Data Range: 0 to 15 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64915

SPN 3545 Generator Circuit Breaker Status

This parameter indicates the measured state of the generator circuit breaker.

Bit state 000 = Open
Bit state 001 = Closed
Bit state 010 = Locked Out
Bit states 011-101 = available for SAE assignment
Bit state 110 = error
Bit state 111 = not available

Data Length: 3 bits
Resolution: 8 states/3 bit, 0 offset
Data Range: 0 to 7 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64913

SPN 3546 Utility Circuit Breaker Status

This parameter indicates the measured state of the utility circuit breaker.

Bit state 000 = Open
Bit state 001 = Closed
Bit state 010 = Locked Out
Bit states 011-101 = available for SAE assignment
Bit state 110 = error
Bit state 111 = not available

Data Length: 3 bits
Resolution: 8 states/3 bit, 0 offset
Data Range: 0 to 7 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64913

SPN 3547 Automatic Transfer Switch Status

This parameter indicates the measured state of the automatic transfer switch.

Bit state 000 = Normal position
Bit state 001 = Emergency position
Bit states 010-101 = available for SAE assignment
Bit state 110 = error
Bit state 111 = not available

Data Length: 3 bits
Resolution: 8 states/3 bit, 0 offset
Data Range: 0 to 7 Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64913

SPN 3567 Generator Control Not In Automatic Start State

This parameter indicates whether or not the generator set is in a condition to automatically start up and provide power. If not, this status parameter is in the ACTIVE state.

00 = inactive (ready to start automatically)
01 = active (not ready to start automatically)
10 = error
11 = not available

NOTE: Legislative requirements for generator sets require that this condition be visually indicated (alarmed) on the local generator set control and remotely indicated on ancillary monitoring devices. The state has been defined in this manner ('Not in automatic start") to allow the use of FMI 31 to indicate NOT ready to automatically start up and provide power, which is an undesired condition.

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64915

SPN 3568 Generator Not Ready to Automatically Parallel State

This parameter indicates whether or not all systems required to start the engine and close to the bus are prepared to operate automatically. If not, the generator is not ready to automatically parallel, and the status parameter is in the ACTIVE state.

00 = inactive (ready to parallel)
01 = active (not ready to parallel)
10 = error
11 = not available

NOTE: Legislative requirements for generator sets require that this condition be visually indicated (alarmed) on the local generator set control and remotely indicated on ancillary monitoring devices. The state has been defined in this manner ("Not ready") to allow the use of FMI 31 to indicate NOT ready to automatically parallel, which is an undesired condition.

Data Length: 2 bits
Resolution: 4 states/2 bit, 0 offset
Data Range: 0 to 3 Operational Range:same as data range
Type: Status
Supporting information:
PGN Reference: 64915

SPN 3590 Generator Total Percent kW

This parameter reports the generator total AC power, as a percentage of rated power.

Data Length: 16 bits
Resolution: 0.0078125 %/bit, -251 offset
Data Range: -251 to 250.99 % Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64911

SPN 3591 Generator Total Percent kVA

This parameter reports the generator total AC apparent power, as a percentage of rated power.

Data Length: 16 bits
Resolution: 0.0078125 %/bit, -251 offset
Data Range: -251 to 250.99 % Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64911

SPN 3592 Generator Total Percent kVAr

This parameter reports the generator total AC reactive power, as a percentage of rated power.

Data Length: 16 bits
Resolution: 0.0078125 %/bit, -251 offset
Data Range: -251 to 250.99 % Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64911

SPN 3593 Generator Total kVAr Hours Export

This parameter reports the cumulative total AC reactive energy exported from the generator.

Data Length: 4 bytes
Resolution: 1 kVArh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kVArh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64910

SPN 3594 Generator Total kVAr Hours Import

This parameter reports the cumulative total AC reactive energy imported to the generator.

Data Length: 4 bytes
Resolution: 1 kVArh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kVArh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64910

SPN 3595 Utility Total kVAr Hours Export

This parameter reports the cumulative total AC reactive energy exported from the utility.

Data Length: 4 bytes
Resolution: 1 kVArh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kVArh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64909

SPN 3596 Utility Total kVAr Hours Import

This parameter reports the cumulative total AC reactive energy imported to the utility.

Data Length: 4 bytes
Resolution: 1 kVArh/bit, 0 offset
Data Range: 0 to 4 211 081 215 kVArh Operational Range:same as data range
Type: Measured
Supporting information:
PGN Reference: 64909

SPN 3938 Generator Governing Bias

Control signal used to govern the genset's speed or load (depending on isochronous or utility parallel operation, respectively)

NOTE: If this method of engine control is used, the PGN 0 (TSC1) is not expected to be received by the engine controller

Data Length: 16 bits
Resolution: 0.004%/bit, -125 offset
Data Range: -125 to 132.02% Operational Range:-125 to 125%
Type: Status
Supporting information:
PGN Reference: 61470

SPN 4078 Generator Alternator Efficiency

Measured, calculated, and/or estimated operating efficiency of the generator alternator. Percentage reflects ratio of power output divided by power input, multiplied by 100.

Data Length: 2 bytes
Resolution: 0.0025 %/bit, 0 offset
Data Range: 0 to 160.6375 % Operational Range:0 to 100%
Type: Measured
Supporting information:
PGN Reference: 64915

SPN 4079 Generator Governing Speed Command

Command from user and/or generator control system for the genset (engine) to govern to low idle or rated base speed setpoints. If this method of engine control is used, then the PGN 0 (TSC1) is not expected to be received by the engine controller and it will not be processed.

00 = Rated Speed
01 = Low Idle Speed
10 = Reserved
11 = Don't care / take no action

Data Length:	2 bits	
Resolution:	4 states/2 bit, 0 offset	
Data Range:	0 to 3	Operational Range:same as data range
Type:	Status	
Supporting information:		
PGN Reference:	64915	

SPN 4080 Generator Frequency Selection

Command from user and/or generator control system for the genset (engine) to target operations for 50 Hz, 60 Hz, or 400 Hz.

0000 = 50 Hz
0001 = 60 Hz
0010 = 400 Hz
0011 - 1101 = SAE Reserved
1110 = Unknown

Data Length:	4 bits	
Resolution:	16 states/4 bit, 0 offset	
Data Range:	0 to 15	Operational Range:same as data range
Type:	Status	
Supporting information:		
PGN Reference:	64915	

5.3 Parameter Group (PGN) Definitions

The message definitions presented in this section of this document are listed in numerical order by PGN. Reference the 'Conventions for SPN Start Position and Unused Bits in Message Definitions' section in SAE J1939-71 for details on interpreting data position and identifying unused bits in these PGN definitions.

PGN 61461 Requested Generator Total AC Reactive Power - RGTACRP

Contains requested reactive and power factor control values

Transmission Repetition Rate: 100 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 240
PDU Specific: 21 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 61461 (0x00F015)

Start Position	*Length*	*Parameter Name*	*SPN*
1-4	4 bytes	Requested Generator Total AC Reactive Power	3383
5-6	2 bytes	Requested Generator Overall Power Factor	3384
7.1	2 bits	Requested Generator Overall Power Factor Lagging	3385

PGN 61468 Requested Generator Average Basic AC Quantities - RGAAC

Contains Requested Generator Average Basic AC Quantities

Transmission Repetition Rate: 100 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 240
PDU Specific: 28 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 61468 (0x00F01C)

Start Position	*Length*	*Parameter Name*	*SPN*
1-4	4 bytes	Requested Generator Average Line-Line AC RMS Voltage	3386

PGN 61470 Generator Control 2 - GC2

Contains parameters that allow the generator control system to control the engine and to provide information about the generator control system

Transmission Repetition Rate: 20 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 240
PDU Specific: 30 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 61470 (0x00F01E)

Start Position	*Length*	*Parameter Name*	*SPN*
1-2	16 bits	Generator Governing Bias	3938

PGN 64909 Utility Total AC Reactive Energy - UTACER

This PGN contains quantities for the cumulative AC reactive energy from the utility.

Transmission Repetition Rate: 250 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 141 PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 64909 (0x00FD8D)

Start Position	*Length*	*Parameter Name*	*SPN*
1-4	4 bytes	Utility Total kVAr Hours Export	3595
5-8	4 bytes	Utility Total kVAr Hours Import	3596

PGN 64910 Generator Total AC Reactive Energy - GTACER

This PGN contains quantities for the cumulative AC reactive energy from the generator.

Transmission Repetition Rate: 250 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 142 PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 64910 (0x00FD8E)

Start Position	*Length*	*Parameter Name*	*SPN*
1-4	4 bytes	Generator Total kVAr Hours Export	3593
5-8	4 bytes	Generator Total kVAr Hours Import	3594

PGN 64911 Generator Total AC Percent Power - GTACPP

This PGN contains quantities for the instantaneous AC power from the generator, as percentages of rated power

Transmission Repetition Rate: 250 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 143 PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 64911 (0x00FD8F)

Start Position	*Length*	*Parameter Name*	*SPN*
1-2	16 bits	Generator Total Percent kW	3590
3-4	16 bits	Generator Total Percent kVA	3591
5-6	16 bits	Generator Total Percent kVAr	3592

PGN 64913 AC Switching Device Status - ACS

This contains parameters indicating the status of various breakers throughout a power generation system. These include: Generator Circuit Breaker Status, Utility Circuit Breaker Status, and Automatic Transfer Switch

Transmission Repetition Rate: 250 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 145 PGN Supporting Information:
Default Priority: 6
Parameter Group Number: 64913 (0x00FD91)

Start Position	*Length*	*Parameter Name*	*SPN*
1.1	3 bits	Generator Circuit Breaker Status	3545
1.4	3 bits	Utility Circuit Breaker Status	3546
2.1	3 bits	Automatic Transfer Switch Status	3547

PGN 64915 Generator Control 1 - GC1

Message for the generator set control to change or report the status of the generator system.

Transmission Repetition Rate: 100 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 147 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 64915 (0x00FD93)

Start Position	*Length*	*Parameter Name*	*SPN*
1.1	4 bits	Requested Engine Control Mode	3542
1.5	2 bits	Generator Control Not In Automatic Start State	3567
1.7	2 bits	Generator Not Ready to Automatically Parallel State	3568
2-3	2 bytes	Generator Alternator Efficiency	4078
4.1	2 bits	Generator Governing Speed Command	4079
4.3	4 bits	Generator Frequency Selection	4080

PGN 64934 Voltage Regulator Excitation Status - VREP

Contains voltage regulator parameters that pertain to the generation excitation

Transmission Repetition Rate: 100 ms
Data Length: 8
Extended Data Page: 0
Data Page: 0
PDU Format: 253
PDU Specific: 166 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 64934 (0x00FDA6)

Start Position	*Length*	*Parameter Name*	*SPN*
1-2	2 bytes	Generator Excitation Field Voltage	3380
3-4	2 bytes	Generator Excitation Field Current	3381
5-6	16 bits	Generator Output Voltage Bias Percentage	3382