LONMARK®
Functional Profile:
Generator Set
Overview

This document describes the functional profile of a Generator Set (genset) object. The genset object does not require other nodes for operation. The object is self-contained but may be monitored and controlled by other nodes. The Genset Functional Profile is shown below:

![Diagram of Genset Functional Profile]

Figure 1 Generator Set

Example Usage

The Generator Set object may interact with one or more of the following LONMARK devices:

- Transfer Switch node
- Annunciation Panel node
- Supervisory node (Master Controller)
- Circuit Breaker node

![Diagram of Example Usage of Generator Set Object]

Figure 1.2 Example Usage of Generator Set Object
Figure 1.3 Generator Set Object Details
<table>
<thead>
<tr>
<th>NV # (M/O)*</th>
<th>Name</th>
<th>In/Out</th>
<th>SNVT Type (SNVT Index)</th>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (M)</td>
<td>nviStartCmd</td>
<td>In</td>
<td>SNVT_switch (95)</td>
<td>I/O</td>
<td>start and stop the generator set</td>
</tr>
<tr>
<td>2 (M)</td>
<td>nviFaultResetCmd</td>
<td>In</td>
<td>SNVT_switch (95)</td>
<td>I/O</td>
<td>reset or clear a generator set fault</td>
</tr>
<tr>
<td>3 (M)</td>
<td>nvoRunStatus</td>
<td>Out</td>
<td>SNVT_switch (95)</td>
<td>I/O</td>
<td>running at rated speed and voltage and is ready to accept load</td>
</tr>
<tr>
<td>4 (M)</td>
<td>nvoFaultStatus</td>
<td>Out</td>
<td>SNVT_switch (95)</td>
<td>I/O</td>
<td>report the presence of a generator set fault</td>
</tr>
<tr>
<td>5 (O)</td>
<td>nviShutdownCmd</td>
<td>In</td>
<td>SNVT_switch (95)</td>
<td>I/O</td>
<td>emergency, unconditional shutdown/disable of run</td>
</tr>
<tr>
<td>6 (O)</td>
<td>nvoNFPA110Annun</td>
<td>Out</td>
<td>SNVT_state (83)</td>
<td>I/O</td>
<td>report state of National Fire Protection Agency (USA) genset faults (NFPA §110)</td>
</tr>
<tr>
<td>7 (O)</td>
<td>nvoFrequency</td>
<td>Out</td>
<td>SNVT_freq_hz (76)</td>
<td>I/O</td>
<td>output frequency of the generator set</td>
</tr>
<tr>
<td>8 (O)</td>
<td>nvoVoltageLL</td>
<td>Out</td>
<td>SNVT_volt_ac (138)</td>
<td>I/O</td>
<td>line-to-line output voltage(s) of the generator set</td>
</tr>
<tr>
<td>9 (O)</td>
<td>nvoVoltageLN</td>
<td>Out</td>
<td>SNVT_volt_ac (138)</td>
<td>I/O</td>
<td>line-to-neutral output voltage(s) of the generator set</td>
</tr>
<tr>
<td>10 (O)</td>
<td>nvoCurrent</td>
<td>Out</td>
<td>SNVT_amp_ac (139)</td>
<td>I/O</td>
<td>output line current(s) of the generator set</td>
</tr>
<tr>
<td>11 (O)</td>
<td>nvoPowerFactor</td>
<td>Out</td>
<td>SNVT_pwr_fact (98)</td>
<td>I/O</td>
<td>power factor of the generator set</td>
</tr>
<tr>
<td>12 (O)</td>
<td>nvoRealPower</td>
<td>Out</td>
<td>SNVT_power_f (57)</td>
<td>I/O</td>
<td>real power output as a floating type (in Watts)</td>
</tr>
<tr>
<td>13 (O)</td>
<td>nvoGenEnergy</td>
<td>Out</td>
<td>SNVT_elec_whr_f (68)</td>
<td>I/O</td>
<td>total (cumulative) electrical energy (WHR) generated by genset</td>
</tr>
<tr>
<td>14 (O)</td>
<td>nvoEngineSpeed</td>
<td>Out</td>
<td>SNVT_rpm (102)</td>
<td>I/O</td>
<td>engine speed of the generator set</td>
</tr>
<tr>
<td>15 (O)</td>
<td>nvoEngineTemp</td>
<td>Out</td>
<td>SNVT_temp (39)</td>
<td>I/O</td>
<td>engine temperature of the generator set</td>
</tr>
<tr>
<td>16 (O)</td>
<td>nvoOilPressure</td>
<td>Out</td>
<td>SNVT_press (30)</td>
<td>I/O</td>
<td>engine oil pressure of the generator set</td>
</tr>
<tr>
<td>17 (O)</td>
<td>nvoBattery</td>
<td>Out</td>
<td>SNVT_volt (44)</td>
<td>I/O</td>
<td>starting battery voltage of the engine</td>
</tr>
<tr>
<td>18 (O)</td>
<td>nvoEngineStarts</td>
<td>Out</td>
<td>SNVT_count (8)</td>
<td>I/O</td>
<td>total number of successful engine starts</td>
</tr>
<tr>
<td>SCPT Index (M/O)*</td>
<td>Name Association **</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nci49 (M)</td>
<td>SCPTmaxSendTime</td>
<td>maximum period of time that expires before the generator set object will automatically update NVs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>nciMaxSendTime</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SNVT_time_sec (107)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>nvo EngineRun Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SNVT_time_f (64)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I/O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>total (cumulative) run time of the engine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>nci17 (O)</td>
<td>Location Label</td>
<td>used to provide physical location of the node</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>config SNVT_str_asc (36)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* M = mandatory, O = optional

** List of NVs to which this configuration property applies. NV index = 0 means configuration property applies to the object as a whole (nv0).
Mandatory Network Variables

**Start Command Input**

```c
network input SNVT_switch   nviStartCmd;
```

This input network variable is used to allow an external node to start and stop the generator set. This input is mandatory but does not have to be bound to an external node. When state = TRUE, the generator set will start and begin running. When state = FALSE, the generator set will stop running (if other non-network start commands are not present).

The ‘value’ field may be used to specify the percent of rated electrical load the generator set will provide when base loading. A value of 0 (zero) implies the generator will provide the required electrical load (no base loading). The ‘value’ field is only applicable when state = TRUE.

**Valid Range**

<table>
<thead>
<tr>
<th>state</th>
<th>value</th>
<th>command</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (FALSE)</td>
<td>NA</td>
<td>Stop</td>
</tr>
<tr>
<td>1 (TRUE)</td>
<td>0</td>
<td>Start (no base loading)</td>
</tr>
<tr>
<td>1 (TRUE)</td>
<td>1..125%</td>
<td>Start (value = base load)</td>
</tr>
</tbody>
</table>

**Default Value**

state: 0  (STOP)
value: 0

**Fault Reset Command Input**

```c
network input SNVT_switch   nviFaultResetCmd;
```

This input network variable is used to allow an external node to reset or clear a generator set fault. This input is mandatory but does not have to be bound to an external node. When state = TRUE, the generator set will clear all active faults. When state = FALSE, generator set will do nothing. The ‘value’ field is not used.

**Valid Range**

state: 0 (FALSE) or 1 (TRUE)
value: NA
**Default Value**

state: 0 (FALSE)  
value: 0

---

**Run Status Output**

```
network output SNVT_switch  nvoRunStatus;
```

This output network variable will report if the generator set is running at rated speed and voltage and is ready to accept load. This output is mandatory but does not have to be bound to an external node. When state = TRUE, the genset is running at rated speed and voltage (ready to load). When state = FALSE, the genset is not running at rated speed and/or voltage (not ready to load).

The ‘value’ field will indicate the percent of rated electrical power the generator set is providing.

---

**Valid Range**

<table>
<thead>
<tr>
<th>state</th>
<th>value</th>
<th>run status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (FALSE)</td>
<td>NA</td>
<td>Not Running</td>
</tr>
<tr>
<td>1 (TRUE)</td>
<td>0 .. 125%</td>
<td>Running* (value = percent of rated load)</td>
</tr>
<tr>
<td>1 (TRUE)</td>
<td>0xFF</td>
<td>Running (percent of rated load unknown)</td>
</tr>
</tbody>
</table>

* ‘Running’ is defined as the ability to accept load.

---

**Default Value**

state: 0xFF (INVALID), indicating the Run Status is unknown.  
value: 0

---

**When Transmitted**

The output variable is transmitted:

- Upon node reset, after obtaining valid data.
- When the 'state' has changed.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.
**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.

---

**Fault Status Output**

`network output SNVT_switch nvoFaultStatus;`

This output network variable will report the presence of a generator set fault. This output is mandatory but does not have to be bound to an external node. When state = TRUE, the generator set has detected a fault condition. When state = FALSE, no faults are present at the generator set or all faults have been cleared. The ‘value’ field is not used.

**Valid Range**

- state: 0 (FALSE) or 1 (TRUE)
- value: NA

**Default Value**

- state: 0xFF (INVALID), indicating the Fault Status is unknown.
- value: 0

**When Transmitted**
The output variable is transmitted:

- Upon node reset, after obtaining valid data.
- When the fault status has changed.

**Update Rate**
There is no maximum update rate.

**Default Service Type**
The default service type is acknowledged.
**Optional Network Variables**

---

**Shutdown Command Input**

```c
network input SNVT_switch nviShutdownCmd;
```

In the event of an emergency, this input network variable is used to allow an external node to unconditionally shutdown the generator set (stop it from running). If the generator set is not running, this input is used to inhibit it from running. When state = TRUE, the generator set will be shutdown or inhibited from running (regardless of any run commands). When state = FALSE, the generator set returns to normal operation. The shutdown command must be cleared before the generator can return to normal operation. The 'value' field is not used.

The 'shutdown' command differs from the 'stop' command (setting nviRunCmd = FALSE), in that the stop command will not override other local or remote run commands. While the shutdown command will override all local or remote run commands.

**Valid Range**

<table>
<thead>
<tr>
<th>state</th>
<th>0 (FALSE) or 1 (TRUE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>NA</td>
</tr>
</tbody>
</table>

**Default Value**

<table>
<thead>
<tr>
<th>state</th>
<th>0 (FALSE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>0</td>
</tr>
</tbody>
</table>

---

**NFPA 110 Annunciation Output**

```c
network output SNVT_state nvoNFPA110Annun;
```

This output network variable will report the state of all the applicable National Fire Protection Agency, section 110, generator set faults (NFPA 110). This output is intended for providing the required NFPA 110 generator set status. Normal Battery Voltage, Generator Set Running and Normal Supplying Load states are not required by NFPA 110 but have been added to complete the bit-field. Any states, which are unknown to the generator set, will be set FALSE.
The states included in this variable are:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>High Battery Voltage</td>
</tr>
<tr>
<td>1</td>
<td>Low Battery Voltage</td>
</tr>
<tr>
<td>2</td>
<td>Normal Battery Voltage*</td>
</tr>
<tr>
<td>3</td>
<td>Generator Set Running*</td>
</tr>
<tr>
<td>4</td>
<td>Normal Supplying Load*</td>
</tr>
<tr>
<td>5</td>
<td>Emergency Supplying Load</td>
</tr>
<tr>
<td>6</td>
<td>Pre-Low Oil Pressure</td>
</tr>
<tr>
<td>7</td>
<td>Low Oil Pressure</td>
</tr>
<tr>
<td>8</td>
<td>Pre-High Engine Temperature</td>
</tr>
<tr>
<td>9</td>
<td>High Engine Temperature</td>
</tr>
<tr>
<td>10</td>
<td>Low Engine Temperature</td>
</tr>
<tr>
<td>11</td>
<td>Overspeed</td>
</tr>
<tr>
<td>12</td>
<td>Fail To Start (Overcrank)</td>
</tr>
<tr>
<td>13</td>
<td>Not in Automatic</td>
</tr>
<tr>
<td>14</td>
<td>Battery Charger Malfunction</td>
</tr>
<tr>
<td>15</td>
<td>Low Fuel Main Tank</td>
</tr>
</tbody>
</table>

* These states are not required by NFPA 110.

Valid Range
All bits: 0 (FALSE) .. 1 (TRUE)

Default Value
The network variable will default to 0 (all bit-states FALSE).

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· When any bit/state has changed.

Update Rate
There is no maximum update rate.

Default Service Type
The default service type is acknowledged.
**Frequency Output**

network output SNVT_freq_hz nvoFrequency;

This output network variable will report the output frequency of the generator set. This output is intended for monitoring the generator output.

**Valid Range**
The valid range is 0 to 6553.4 Hz.

**Default Value**
The default value is 0xFFFF (6,553.5 Hz), indicating the generator frequency is unknown.

**When Transmitted**
The variable is transmitted:
- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.
**Line-to-Line Voltage Output**

network output SNVT_volt_ac   nvoVoltageLL;

This output network variable will report the line-to-line output voltage(s) of the generator set. For multi-phase generator sets, this output may have several instances in order to display the output voltage between phases A–B, B–C, C–A or the average line-to-line voltage of all phases. This output is intended for monitoring the generator output.

**Valid Range**
The valid range is 0 to 65534 VAC.

**Default Value**
The default value is 0xFFFF (65,535 VAC), indicating the generator output voltage is unknown.

**When Transmitted**
The variable is transmitted:
- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.
**Line-to-Neutral Voltage Output**

network output SNVT_volt_ac  nvoVoltageLN;

This output network variable will report the line-to-neutral output voltage(s) of the generator set. For multi-phase generator sets, this output may have several instances in order to display the output voltage of phase A–N, B–N, C–N or the average line-to-neutral voltage of all phases. This output is intended for monitoring the generator output.

**Valid Range**
The valid range is 0 to 65534 VAC.

**Default Value**
The default value is 0xFFFF (65,535 VAC), indicating the generator output voltage is unknown.

**When Transmitted**
The variable is transmitted:

- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.
**Line Current Output**

network output SNVT_amp_ac nvoCurrent;

This output network variable will report the output line current(s) of the generator set. For multi-phase generator sets, this output may have several instances in order to display the line current of phases A, B, C or the average line current of all phases. Another instance of this output may also be used to display the neutral phase current of the generator set. This output is intended for monitoring the generator load.

**Valid Range**

The valid range is 0 to 65534 A.

**Default Value**

The default value is 0xFFFF (65,535 A), indicating the line current is unknown.

**When Transmitted**

The variable is transmitted:

- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**

The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**

The default service type is acknowledged.
Power Factor Output

network output SNVT_pwr_fact  nvoPowerFactor;

This output network variable will report the power factor of the generator set. This output is intended for monitoring the generator load characteristic.

Valid Range
The valid range is –1.00000 to +1.00000. Values less than zero indicate a 'leading' power factor.

Default Value
The default value is 0x7FFF (+1.63835), indicating the power factor is unknown.

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
**Real Power Output**

network output SNVT_power_f  nvoRealPower;

This output network variable will report the real power output of the generator set. This output is intended for monitoring the generator load.

**Valid Range**
The valid range is $-1\times10^{38}$ to $+1\times10^{37}$ W. Values less than zero indicate a reverse power condition.

**Default Value**
The default value is $+1\times10^{38}$ W, indicating the real power output is unknown.

**When Transmitted**
The variable is transmitted:
- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.
Generated Energy Output

network output SNVT_elec_whr_f nvoGenEnergy;

This output network variable will report the total (cumulative) electrical energy generated by the generator set. This output is intended to provide engine usage information.

Valid Range
The valid range is 0 to +1E37 WHr. Values less than 0 (zero) are invalid.

Default Value
The default value is +1E38 WHr, indicating the total generated energy is unknown.

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
Engine Speed Output

network output SNVT_rpm   nvoEngineSpeed;

This output network variable will report the engine speed of the generator set. This output is intended for monitoring the engine governing.

Valid Range
The valid range is 0 to 65,534 RPM.

Default Value
The default value is 0xFFFF (65,535 RPM), indicating the engine speed is unknown.

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
Engine Temperature Output

network output SNVT_temp nvoEngineTemp;

This output network variable will report the engine temperature of the generator set. This output is intended for engine monitoring purposes.

Valid Range
The valid range is -274.0 to +6279.4 °C.

Default Value
The default value is 0xFFFF (6279.5 °C), indicating the engine temperature is unknown.

When Transmitted
The variable is transmitted:
- Upon node reset, after obtaining valid data.
- Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
**Engine Oil Pressure Output**

network output SNVT_press nvoOilPressure;

This output network variable will report the engine oil pressure of the generator set. This output is intended for engine monitoring purposes.

**Valid Range**
The valid range is 0.0 to +3276.7 kPa.

**Default Value**
The default value is 0xFFFF (–0.1 kPa), indicating the oil pressure is unknown.

**When Transmitted**
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

**Update Rate**
The update rate is determined by the configuration variable nciMaxSendTime.

**Default Service Type**
The default service type is acknowledged.
Battery Voltage Output

network output SNVT_volt nvoBattery;

This output network variable will report the engine’s starting battery voltage. This output is intended for engine monitoring purposes.

Valid Range
The valid range is 0.0 to +3276.7 VDC.

Default Value
The default value is 0xFFFF (-0.1 VDC), indicating the battery voltage is unknown.

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
**Engine Starts Output**

`network output SNVT_count nvoEngineStarts;`

This output network variable will report the total number of successful engine starts. This output is intended to provide engine usage information.

**Valid Range**

The valid range is 0 to 65534 Starts.

**Default Value**

The default value is 0xFFFF (65,535 Starts), indicating the number of engine starts is unknown.

**When Transmitted**

The variable is transmitted:

- Upon node reset, after obtaining valid data.
- When the number of engine starts has changed.

**Update Rate**

There is no maximum update rate.

**Default Service Type**

The default service type is acknowledged.
Engine Run Time Output

network output SNVT_time_f nvoEngineRunTime;

This output network variable will report the total (cumulative) run time of the engine. This output is intended to provide engine usage information.

Valid Range
The valid range is 0 to +1E37 Seconds. Values less than 0 (zero) are invalid.

Default Value
The default value is +1E38 Seconds, indicating the engine run time is unknown.

When Transmitted
The variable is transmitted:
· Upon node reset, after obtaining valid data.
· Regularly at the interval defined by the configuration variable nciMaxSendTime.

Update Rate
The update rate is determined by the configuration variable nciMaxSendTime.

Default Service Type
The default service type is acknowledged.
Configuration Properties

**Maximum Send Time (Mandatory)**

```
network input config SNVT_time_sec nciMaxSendTime;
```

This input configuration variable sets the maximum period of time that expires before the generator set object will automatically update the following network variables:

- nvoRunStatus (mandatory).
- nvoEngineSpeed, nvoEngineTemp, nvoOilPressure, nvoBattery, nvoEngineRunTime, nvoGenEnergy (optional).

**Valid Range**

The valid range is 1.0 to 3600.0 sec. Values outside this range are invalid and will disable the automatic update mechanism.

**Default Value**

The default value is 0.0 sec (no automatic update).

**SCPT Reference**

SCPTmaxSendTime (49)

**Location Label (Optional)**

```
network input config SNVT_str_asc nciLocation;
```

This configuration property can be used to provide physical location of the node. Write access can be disable by the manufacturer.

**Valid Range**

Any NULL-terminated ASCII string up to 31 bytes of total length (including NULL).

**Default Value**

The default value is an ASCII string containing all NULLs (0x00).

**SCPT Reference**

SCPT_location (17)
Data Transfer

None specified.

Power-up State

There is no immediate network action on Power-up State.

Boundary and Error Conditions

None specified.

Additional Considerations

None.