LONMARK®
Functional Profile:
Variable Speed Motor Drive

Overview

This functional profile describes a variable speed motor drive (VSD).
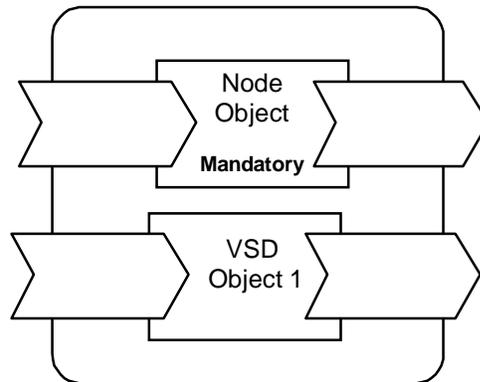

Figure 1 Variable Speed Motor Drive (VSD)

Example Usage

Utilization of the LONMARK Variable Speed Motor Drive (VSD) Object Functional Profile permits easy connection to control systems and operator interface devices from multiple vendors. The VSD will reside on a LONWORKS network and its SNVTs can be bound to controllers, operating interfaces, energy management systems, etc.

For example, an air handling unit controller will send messages to control the start/stop and speed reference of the VSD. The VSD will output messages such as the actual drive speed and output current to the controller, operating interfaces and energy management systems. A network management tool will be used to install the VSD on the network and bind the SNVTs to other devices on the network.
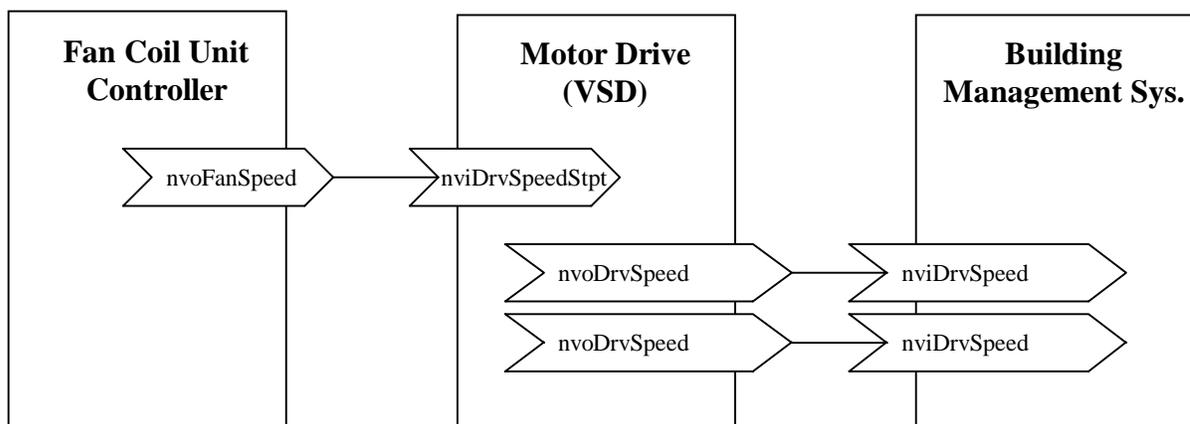

Figure 1.2 Example Usage of VSD

Object Details

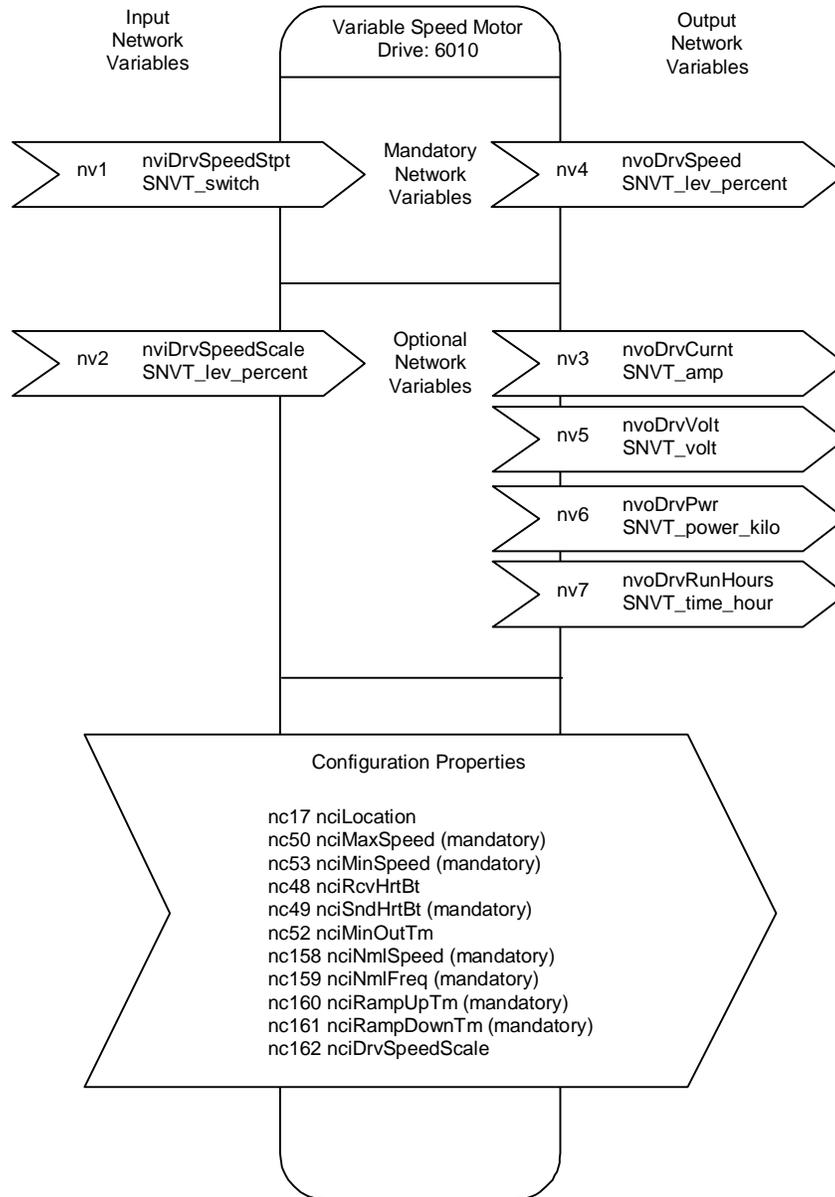The variable speed motor drive object is shown in the figure below:

Figure 1.3 VSD Object Details

Table 1 SNVT Details

NV # (M/O)*	Name	In/Out	SNVT Type (SNVT Index)	Class	Description
1 (M)	nvi DrvSpeedStpt	In	SNVT_switch (95)	I/O	Drive Speed Setpoint
2 (O)	nvi DrvSpeedScale	In	SNVT_lev _percent (81)	I/O	Drive Speed Setpoint Scaling
3 (O)	nvoDrvCurnt	Out	SNVT_amp (1)	I/O	Drive Output Current
4 (M)	nvoDrvSpeed	Out	SNVT_lev _percent (81)	I/O	Drive Speed Feedback
5 (O)	nvoDrvVolt	Out	SNVT_volt (44)	I/O	Drive Output Voltage
6 (O)	nvoDrvPwr	Out	SNVT_power _kilo (28)	I/O	Drive Output Power
7 (O)	nvo DrvRunHours	Out	SNVT_time _hour (124)	I/O	Drive Total Running Hours

* M = mandatory, O = optional

Table 2 SCPT Details

SCPT Index (M/O)*	Name	Association **	Description
17 (O)	SCPTlocation nciLocation SNVT_str_asc (36)	nv0 (O)	Location Label: used to provide physical location of the node
50 (M)	SCPTmaxSetpoint nciMaxSpeed SNVT_lev _percent (81)	nv0 (O)	Maximum Motor Speed
53 (M)	SCPTminSetpoint nciMinSpeed SNVT_lev _percent (81)	nv0 (O)	Minimum Motor Speed
48 (O)	SCPTmaxRcvTime nciRcvHrtBt SNVT_str_asc (36)	nv1 (M), nv2 (O)	Receive Heartbeat Time
49 (M)	SCPTmaxSendTime nciSndHrtBt SNVT_time _sec (107)	nv3 (O), nv4 (M), nv5 (O), nv6 (O)	Send Heartbeat Time

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52 (O)	SCPTminSendTime nciMinOutTm SNVT_time _sec (107)	nv3 (O), nv4 (M), nv5 (O), nv6 (O), nv7 (O)	Minimum Send Time
158 (M)	SCPTnomRPM nciNmlSpeed SNVT_rpm (102)	nv0 (O)	Nominal Motor Speed in RPM
159 (M)	SCPTnomFreq nciNmlFreq SNVT_freq_hz (76)	nv0 (O)	Nominal Motor Frequency
160 (M)	SCPTrampUpTm nciRampUpTm SNVT_time _sec (107)	nv0 (O)	Minimum Ramp Up Time
161 (M)	SCPTrampDownTm nciRampDownTm SNVT_time _sec (107)	nv0 (O)	Minimum Ramp Down Time
162 (O)	SCPTdefScale nciDrvSpeedScale SNVT_lev _percent (81)	nv2 (O)	Default Value for nviDrvSpeedScale

* M = mandatory, O = optional

** These are the NVs to which this configuration property applies. NV index = 0
means configuration property applies to the object as a whole.

Mandatory Network Variables

Drive Speed Setpoint (Mandatory)

```
network input SNVT_switch nviDrvSpeedStpt;
```

This input network variable provides start/stop control and a low resolution speed setpoint.

Valid Range

state	value	command
0 (FALSE)	NA	Stop
1 (TRUE)	0	0%
1 (TRUE)	1 to 200	0.5 to 100.0%
1 (TRUE)	201 to 255	100.0%
0xFF	NA	AUTO (Invalid)

Default Value
Default value is AUTO (state = 0xFF). This value will be adopted at power-up and in case of not receiving an update within the specified Receive Heartbeat time.

Drive Speed Feedback (Mandatory)

```
network output SNVT_lev_percent nvoDrvSpeed;
```

This output network variable provides the speed of the drive as a percentage of the nominal speed.

Valid Range

The valid range is -163.840% to 163.830% (0.005%). The value 0x7FFF = +163.835% will be handled as an invalid value.

When Transmitted
This value is transmitted immediately when its value has changed significantly. Additionally, this network variable will also be transmitted as a heartbeat output on a regular basis as specified by the Maximum Send Time (nciSndHrtBt) configuration value.

Update Rate

This value will be updated no faster than the Minimum Send Time (nciMinOutTm) configuration value, if used (manufacturer-defined).

Default Service Type
The default service type is acknowledged.

Optional Network Variables

Drive Speed Setpoint Scaling

```
network input SNVT_lev_percent nviDrvSpeedScale;
```

This input network variable provides scaling for nviDrvSpeedStpt. Negative values indicate a motor direction in reverse. For example, if the nviDrvSpeedStpt value is 50% and nviDrvSpeedScale is –150%, then the actual speed setpoint is –75%, or 0.75 times the nominal speed in the reverse direction.

Valid Range
The valid range is –163.840% to 163.830% (0.005%). The value 0x7FFF = +163.835% will be handled as an invalid value.

Default Value
Default value is determined by nciDrvSpeedScale, which must be implemented if nviDrvSpeedScale is implemented. This value will be adopted at power-up and in case of not receiving an update within the specified Receive Heartbeat time.

Drive Output Current

```
network output SNVT_amp nvoDrvCurnt;
```

This output network variable provides the drive output current in amperes.

Valid Range
The valid range is 0 to 3,276.6 amps (0.1A). The value 0x7FFF = +3,276.7 amps will be handled as an invalid value.

When Transmitted

This value is transmitted immediately when its value has changed significantly. Additionally, this network variable will also be transmitted as a heartbeat output on a regular basis as specified by the Maximum Send Time (nciSndHrtBt) configuration value.

Update Rate

This value will be updated no faster than the Minimum Send Time (nciMinOutTm) configuration value, if used (manufacturer-defined).

Default Service Type

The default service type is acknowledged.

Drive Output Voltage

```
network output SNVT_volt nvoDrvVolt;
```

This output network variable provides the drive output voltage in volts.

Typical Range

The typical range is 0 to 700 volts. The value 0x7FFF = +3,276.7 volts will be handled as an invalid value.

When Transmitted

This value is transmitted immediately when its value has changed significantly. Additionally, this network variable will also be transmitted as a heartbeat output on a regular basis as specified by the Maximum Send Time (nciSndHrtBt) configuration value.

Update Rate

This value will be updated no faster than the Minimum Send Time (nciMinOutTm) configuration value, if used (manufacturer-defined).

Default Service Type

The default service type is acknowledged.

Drive Output Power

```
network output SNVT_power_kilo nvoDrvPwr;
```

This output network variable provides the drive power in kilowatts.

Valid Range

The valid range is 0 to 6,553.4 kW (0.1 kW). The value 0xFFFF=
6,553.5 kW will be handled as an invalid value.

When Transmitted

This value is transmitted immediately when its value has changed significantly.
Additionally, this network variable may also be transmitted as a heartbeat output on a
regular basis (as defined by the manufacturer) as specified by the Maximum Send
Time (nciSndHrtBt) configuration value.

Update Rate

This value will be updated no faster than the Minimum Send Time (nciMinOutTm)
configuration value, if used (manufacturer-defined).

Default Service Type

The default service type is acknowledged.

Drive Total Running Hours

```
network output SNVT_time_hour nvoDrvRunHours;
```

This output network variable provides the total operation time for the motor in
running hours.

Valid Range

The valid range is 0 to 65,534 hours (1 hour). The value 0xFFFF=
65,535 hours will be handled as an invalid value.

When Transmitted

This value is transmitted immediately when its value has changed significantly (as
defined by the manufacturer).

Update Rate
This value will be updated no faster than the Minimum Send Time (nciMinOutTm) configuration value, if used (manufacturer-defined).

Default Service Type
The default service type is acknowledged.

Configuration Properties

Maximum Motor Speed (Mandatory)

```
network input config SNVT_lev_percent  nciMaxSpeed;
```

This configuration property is used to define the maximum speed of a motor. The value is entered as a percent of nominal speed in RPM, as defined by the Nominal Speed (nciNmlSpeed) configuration value. The value of the maximum speed must be validated against the value of the minimum speed as follows:

$-163.840 \leq$ minimum speed $\leq$ maximum speed ≤ 163.830

Typical Range

100.000 to 150.000 %

Default Value

100.000 %

SCPT Reference
SCPTmaxSetpoint (50)

Minimum Motor Speed (Mandatory)

```
network input config SNVT_lev_percent  nciMinSpeed;
```

This configuration property is used to define the minimum speed of a motor. The value is entered as a percent of nominal speed in RPM, as defined by the Nominal Speed (nciNmlSpeed) configuration value. The value of the minimum speed must be validated against the value of the maximum speed as follows:

$-163.840 \leq$ minimum speed $\leq$ maximum speed ≤ 163.830

Typical Range

0 to 40.000 %

Typical Default Value

0 (%)

SCPT Reference
SCPTminSetpoint (53)

Send Heartbeat Time (Mandatory)

```
network input config SNVT_time_sec nciSndHrtBt;
```

This configuration property defines the maximum period of time that expires before the network variables specified for heartbeat in Table 2.2 will automatically be updated.

Valid Range

The valid range is 0.0 to 6,553.4 sec (0.1 sec)

Typical Default Value

0 (no automatic update)

SCPT Reference
SCPTmaxSendTime(49)

Nominal Motor Speed in RPM (Mandatory)

```
network input config SNVT_rpm nciNmlSpeed;
```

This configuration property is used to provide the nominal speed of the motor in RPM. This value is necessary to determine the minimum and maximum speed for the motor, based on the configuration properties nciMinSpeed, nciMaxSpeed (entered as percent of nominal speed).

Valid Range

The valid range is 0 to 65,534 rpm (1 rpm)

Typical Default Value

1800 rpm

SCPT Reference

SCPTnomRPM (158)

Nominal Motor Frequency (Mandatory)

```
network input config SNVT_freq_hz nciNmlFreq;
```

This configuration property is used to provide the nominal frequency of the motor.

Valid Range

0 to 100 Hz (1 Hz)

Typical Default Value

50 or 60 Hz

SCPT Reference

SCPTnomFreq (159)

Minimum Ramp Up Time (Mandatory)

```
network input config SNVT_time_sec  nciRampUpTm;
```

This configuration property determines the ramp up time of the motor.

Valid Range

0.0 to 6,553.4 sec (0.1 sec)

Typical Default Value

10.0 sec

SCPT Reference
SCPTrampUpTm (160)

Minimum Ramp Down Time (Mandatory)

```
network input config SNVT_time_sec  nciRampDownTm;
```

This configuration property determines the ramp down time of the motor.

Valid Range

0.0 to 6,553.4 sec (0.1 sec)

Typical Default Value

10.0 sec

SCPT Reference
SCPTrampDownTm (161)

Receive Heartbeat Time

```
network input config SNVT_time_sec nciRcvHrtBt;
```

This configuration property is used to control the maximum time that elapses after the last update of the network variables specified to in Table 2.1 before the VSD object starts to use its default values.

Valid Range

The valid range is 0.0 to 6,553.4 sec (0.1 sec). A value of 0 (zero) disables the Receive Heartbeat mechanism.

Typical Default Value

0 (no failure detect)

SCPT Reference
SCPTmaxRcvTime (48)

Minimum Send Time

```
network input config SNVT_time_sec nciMinOutTm;
```

This configuration property defines the minimum period of time between automatic network variable transmissions. Although this configuration property is optional, it must be provided if the minimum send time function is used.

Valid Range

0.0 to 6,553.4 sec (0.1 sec). Setting nciMinOutTm to 0.0 disables transmission limiting.

Typical Default Value

0.5 sec

SCPT Reference
SCPTminSendTime (52)

Location Label

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

This configuration property can optionally be used to provide more descriptive physical location information than can be provided by the Neuron Chip's 6 byte location string. The location relates to the object and not to the node.

Valid Range

Any NULL terminated ASCII string of 31 bytes total length.

Typical Default Value

The default value is an ASCII string containing all zeros ("\0").

SCPT Reference

SCPT_location (17)

Default Value for nviDrvSpeedScale

```
network input config SNVT_lev_percent  nciDrvSpeedScale;
```

This configuration property is used as the default value for nviDrvSpeedScale and must be implemented together with nviDrvSpeedScale if it exists in the variable speed motor drive object.

Valid Range

The valid range is −163.840% to 163.830 (0.005%).
The value 0x7FFF = +163.835% will be handled as an invalid value.

Typical Default Value

0 (%)

SCPT Reference

SCPTdefScale (162)

Data Transfer

None specified.

Power-up State

The object will assume the default values and be ready to receive commands on its input network variables.

Boundary and Error Conditions

On a hardware failure, the motor drive device shall default to a pre-determined state (manufacturer defined). If possible, the device will continue to log errors.

Additional Considerations

The node object is to be used together with the variable speed motor drive object and the following requests should be supported:

1. Start/Stop (RQ_ENABLE = NO ACTION (AUTO); Enable the system, without starting any action in the system (no spinning of motor, etc.). RQ_DISABLE = STOP); RQ_DISABLE shall always bring the motor to a controlled stop.

2. Status (SNVT_obj_status)

3. Reset fault (RQ_CLEAR_ALARM)
    If the object request field of SNVT_obj_request does not change reset will only be performed once. This means that if a new fault occurs while RQ_CLEAR_ALARM is already active, it will not be cleared. This is important to avoid potential hazards caused by an unintended reset.