LONMARK®
Functional Profile:
Pump Controller

SFPTpumpController

Overview

This document describes the Functional Profile of a Pump Controller functional block for a variable-speed pump.
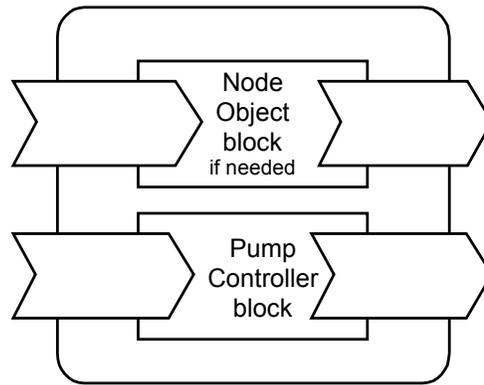

Figure 1 Device Concept

Example Usage

Utilization of the LONMARK Pump Controller profile facilitates interoperability between the pump controller and other control devices from multiple vendors. The Pump Controller functional block will reside in a device on a LONWORKS network and its network variables can be bound to other controllers, operator-interface devices, energy-management systems, etc.

For example, an air-handling unit controller may send messages over the network to start and stop or control the speed, pressure, or flow of the pump. The pump controller functional block may output messages such as the actual pump speed, pump pressure, and status information to the controller, operator-interface devices, and energy-management systems. A network-management tool will be used to install the pump controller device on the network and bind the network variables to other devices on the network.
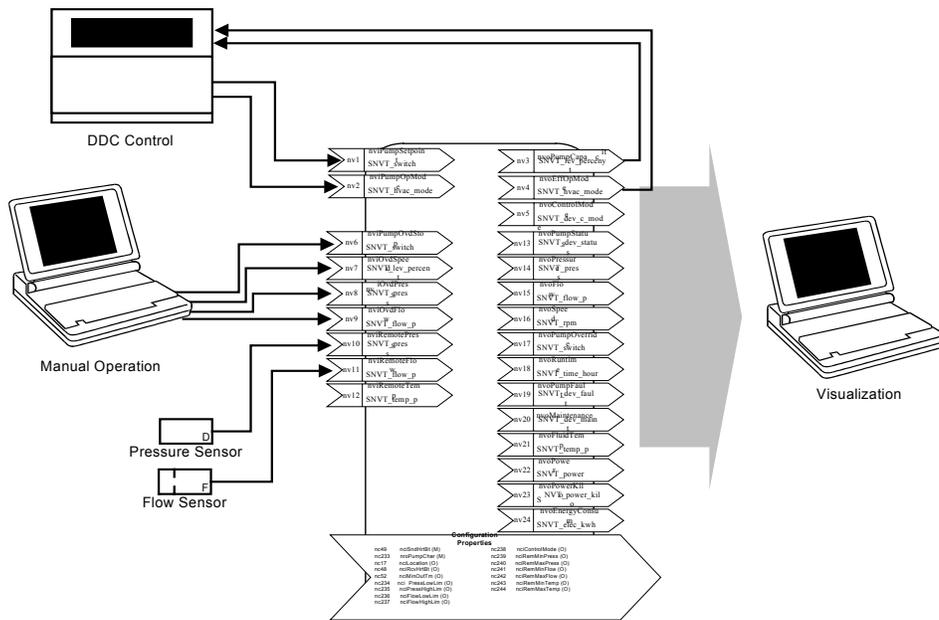
Figure 2 Example Usage of the Functional Block

A pump provides the primary force to distribute and circulate heated and chilled water in a variety of space-temperature and air-conditioning systems. Simple pumps operate at only one speed (which may or may not be manually chosen) and can only be switched "on" or "off." A pump with an intelligent controller can operate at a variable speed. The capacity of the pump can be controlled in several different ways:

The simplest way is to control the *speed* of the pump: In this case, the pump works in the "Constant-Speed Mode" and the setpoint of the pump is interpreted as the required speed:
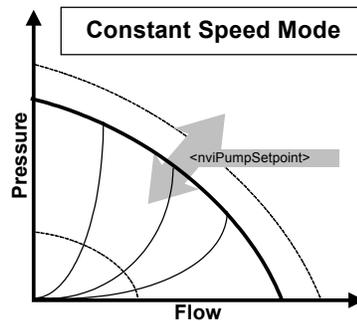

Figure 3 Constant-Speed Mode for Pump-Capacity Control

Another way to control the capacity of the pump is to vary the speed to maintain a certain *pressure*. The pressure can be calculated or measured internally in the pump and controller assembly, or remotely measured by a differential-pressure sensor in the piping system.

There are three pressure-control modes:

1. "Constant-Pressure Mode," where the setpoint of the pump is interpreted as the required pressure and is independent of the flow;

2. "Compensated-Pressure Mode," where the setpoint of the pump is interpreted as the required pressure <u>at maximum speed</u>. The pressure setpoint is reduced by the controller in a proportional manner between maximum and minimum pump capacity. The actual method of compensating the pressure setpoint by pump speed or flow is determined by the manufacturer;

3. "Automatic-Pressure Mode," where the setpoint is *chosen by the pump* itself to fit the installation in the most effective way. The actual method of choosing the setpoint is defined by the manufacturer. The setpoint <u>cannot</u> be set manually in this mode.
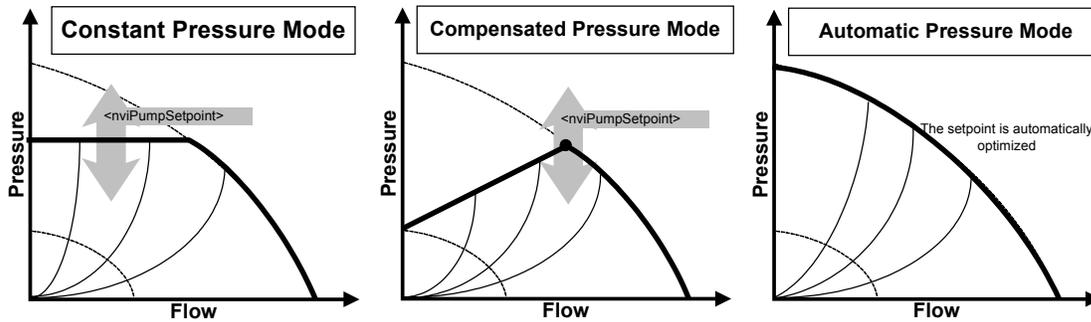
Constant Pressure Mode	Compensated Pressure Mode	Automatic Pressure Mode

Figure 4 Pressure-Control Modes for Pump-Capacity Control

Yet, another way to control the capacity of the pump is to vary the speed to maintain a certain *flow*. In "Constant-Flow Mode," the setpoint of the pump is interpreted as the required flow and is independent of the pressure. The flow can be calculated or measured internally in the pump and controller assembly, or remotely measured by a flow sensor in the piping system:
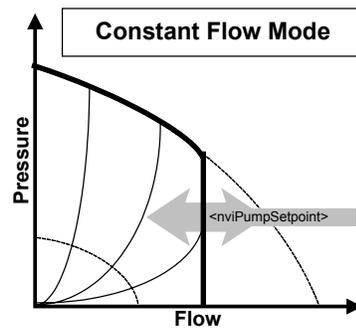
Figure 5 Constant-Flow Mode for Pump-Capacity Control

The capacity of the pump can also be controlled by varying the speed to maintain a certain *temperature* (not shown). This temperature can be the return-water temperature by a hot-water heating system. The setpoint of the pump is interpreted as the required temperature.

The pump can also be set into special operating modes. These modes are designed to save energy by reducing the pump capacity to the minimum (HVAC_ECONOMY) or to bring the controlled space more quickly into the comfort condition by increasing the pump capacity to the maximum value (HVAC_MRNG_WRMUP).

The Pump Controller profile includes input network variables to manually override the operation of the pump. A valid value on any one of these input variables sets the pump into the override mode. The pump will not return to normal setpoint control until all manual override inputs are invalid. The priority of the various override inputs can be seen in figure 6:
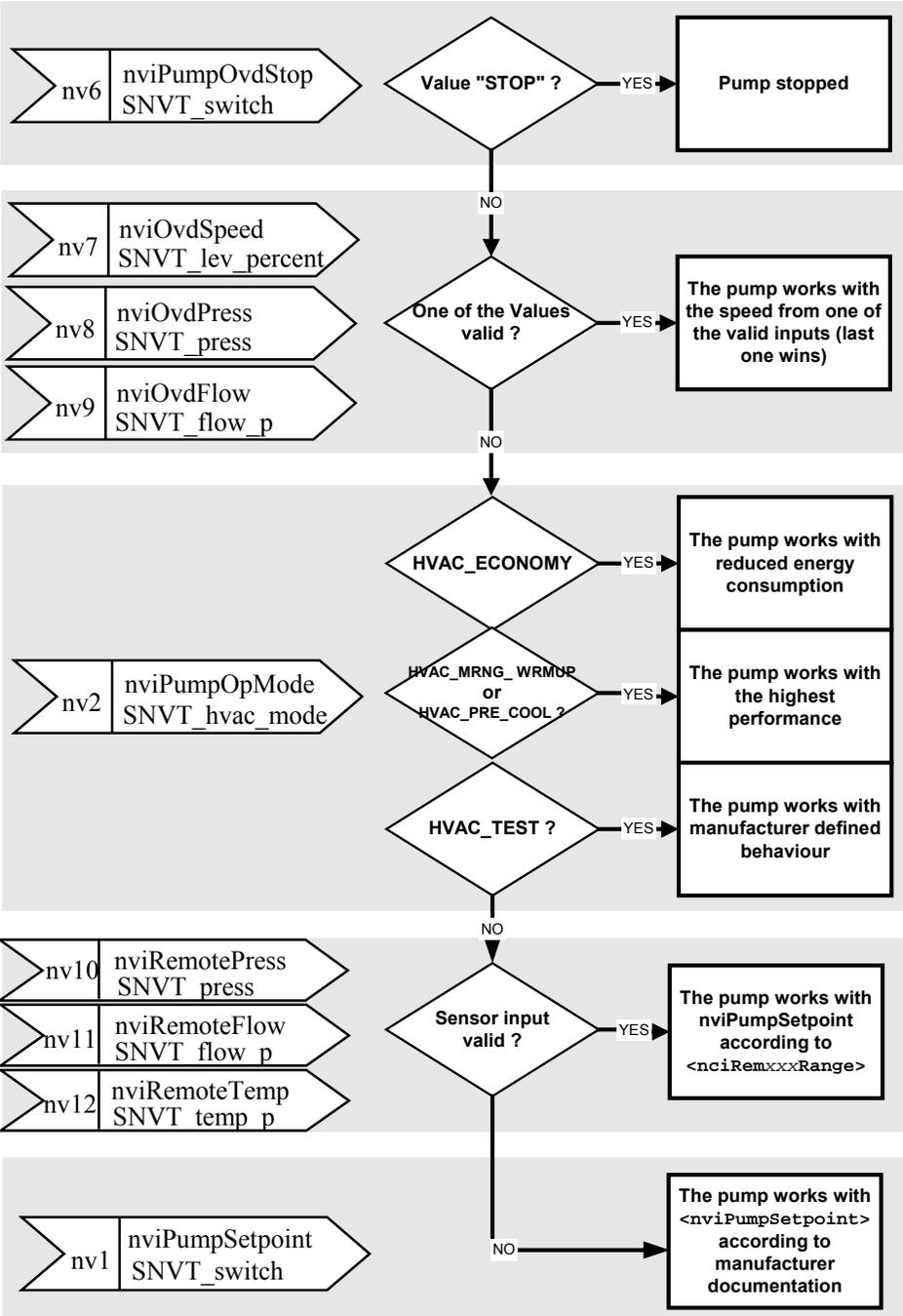

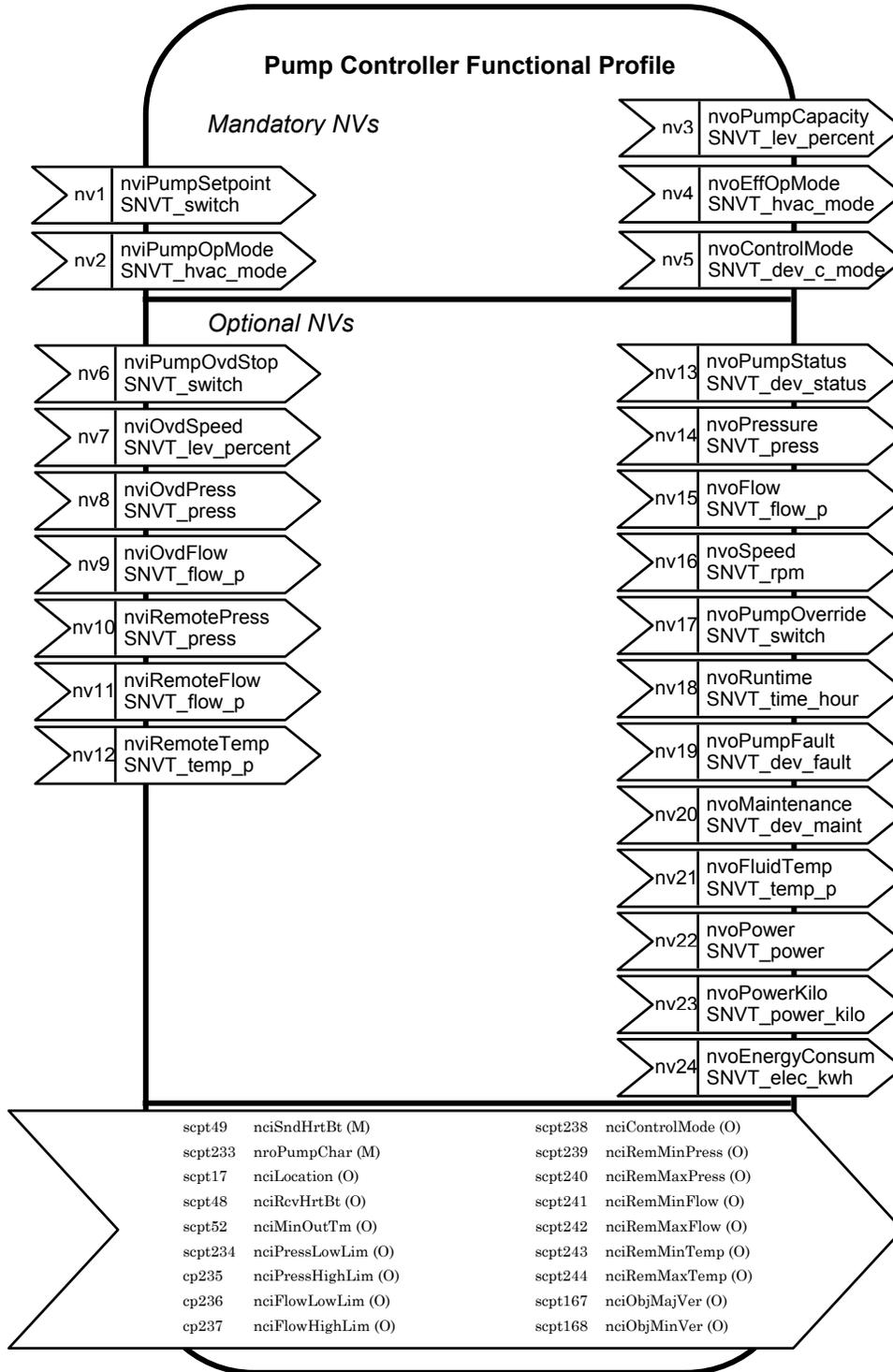**Figure 6** Manual Pump-Override Diagram

Functional-Block Details

Pump Controller Functional Profile

Mandatory NVs

| nv1 | nviPumpSetpoint SNVT_switch |
| nv2 | nviPumpOpMode SNVT_hvac_mode |

nv3	nvoPumpCapacity SNVT_lev_percent
nv4	nvoEffOpMode SNVT_hvac_mode
nv5	nvoControlMode SNVT_dev_c_mode

Optional NVs

nv6	nviPumpOvdStop SNVT_switch
nv7	nviOvdSpeed SNVT_lev_percent
nv8	nviOvdPress SNVT_press
nv9	nviOvdFlow SNVT_flow_p
nv10	nviRemotePress SNVT_press
nv11	nviRemoteFlow SNVT_flow_p
nv12	nviRemoteTemp SNVT_temp_p

nv13	nvoPumpStatus SNVT_dev_status
nv14	nvoPressure SNVT_press
nv15	nvoFlow SNVT_flow_p
nv16	nvoSpeed SNVT_rpm
nv17	nvoPumpOverride SNVT_switch
nv18	nvoRuntime SNVT_time_hour
nv19	nvoPumpFault SNVT_dev_fault
nv20	nvoMaintenance SNVT_dev_maint
nv21	nvoFluidTemp SNVT_temp_p
nv22	nvoPower SNVT_power
nv23	nvoPowerKilo SNVT_power_kilo
nv24	nvoEnergyConsum SNVT_elec_kwh

scpt49	nciSndHrtBt (M)	scpt238	nciControlMode (O)
scpt233	nroPumpChar (M)	scpt239	nciRemMinPress (O)
scpt17	nciLocation (O)	scpt240	nciRemMaxPress (O)
scpt48	nciRcvHrtBt (O)	scpt241	nciRemMinFlow (O)
scpt52	nciMinOutTm (O)	scpt242	nciRemMaxFlow (O)
scpt234	nciPressLowLim (O)	scpt243	nciRemMinTemp (O)
cp235	nciPressHighLim (O)	scpt244	nciRemMaxTemp (O)
cp236	nciFlowLowLim (O)	scpt167	nciObjMajVer (O)
cp237	nciFlowHighLim (O)	scpt168	nciObjMinVer (O)

Figure 7 Functional-Profile Details

Table 1 SNVT Details

NV # (M/O)*	Variable Name	SNVT Name	SNVT Index	Description
1 (M)	nviPumpSetpoint	SNVT_switch	95	Pump setpoint for normal operation
2 (M)	nviPumpOpMode	SNVT_hvac_mode	108	Requested pump operating mode
6 (O)	nviPumpOvdStop	SNVT_switch	95	Pump override stop command
7 (O)	nviOvdSpeed	SNVT_lev_percent	81	Override setpoint for speed
8 (O)	nviOvdPress	SNVT_press	30	Override setpoint for pressure
9 (O)	nviOvdFlow	SNVT_flow_p	161	Override setpoint for flow
10 (O)	nviRemotePress	SNVT_press	30	Remote differential pressure sensor
11 (O)	nviRemoteFlow	SNVT_flow_p	161	Remote flow sensor
12 (O)	nviRemoteTemp	SNVT_temp_p	105	Remote temperature sensor

NV # (M/O)*	Variable Name	SNVT Name	SNVT Index	Description
3 (M)	nvoPumpCapacity	SNVT_lev_percent	81	Pump capacity as percent of maximum
4 (M)	nvoEffOpMode	SNVT_hvac_mode	108	Effective operating mode
5 (M)	nvoControlMode	SNVT_dev_c_mode	162	Effective device control mode
13 (O)	nvoPumpStatus	SNVT_dev_status	173	Pump status diagnostic information
14 (O)	nvoPressure	SNVT_press	30	Pump pressure
15 (O)	nvoFlow	SNVT_flow_p	161	Pump flow
16 (O)	nvoSpeed	SNVT_rpm	102	Pump speed
17 (O)	nvoPumpOverride	SNVT_switch	95	Pump override active
18 (O)	nvoRuntime	SNVT_time_hour	124	Runtime in hours
19 (O)	nvoPumpFault	SNVT_dev_fault	174	Fault states of the pump
20 (O)	nvoMaintenance	SNVT_dev_maint	175	Maintenance states of the pump
21 (O)	nvoFluidTemp	SNVT_temp_p	105	Fluid temperature
22 (O)	nvoPower	SNVT_power	27	Electrical power consumption in Watts
23 (O)	nvoPowerkilo	SNVT_power_kilo	28	Electrical power consumption in kilowatts
24 (O)	nvoEnergyConsum	SNVT_elec_kwh	13	Total energy consumption of the pump

*   M = mandatory, O = optional

Table 2 SCPT Details

Man. Opt. *	SCPT Name NV Name Type or SNVT	SCPT Index	Associated NVs **	Description
Man	SCPTmaxSendTime nciSndHrtBt SNVT_time_sec (107)	49	nv3(M), nv4(M), nv5(M), nv13(M)	Maximum period of time that expires before the functional block will automatically update NVs
Man	SCPTpumpCharacteristic nroPumpChar (structure)	233	Entire Functional Block	Maximum period of time that expires before the functional block will automatically update NVs
Opt	SCPTlocation nciLocation SNVT_str_asc (36)	17	Entire Functional Block	Used to provide physical location of the device
Man	SCPTmaxRcvTime nciRcvHrtBt SNVT_time_sec (107)	48	nv10(M), nv11(M), nv12(M)	Maximum period of time that expires before the functional block will automatically update NVs
Opt	SCPTminSendTime nciMinOutTm SNVT_time_sec (107)	52	nv3(M), nv4(M), nv5(M), nv13(M)	Minimum period of time that expires before the functional block will automatically update NVs
Opt	SCPTminPressureSetpoint nciPressLowLim SNVT_press (30)	234	Entire Functional Block	User-defined operational-pressure low limit
Opt	SCPTmaxPressureSetpoint nciPressHighLim SNVT_press (30)	235	Entire Functional Block	User-defined operational-pressure high limit
Opt	SCPTminFlowSetpoint nciFlowLowLim SNVT_flow_p (161)	236	Entire Functional Block	User-defined operational-flow low limit
Opt	SCPTmaxFlowSetpoint nciFlowHighLim SNVT_flow_p (161)	237	Entire Functional Block	User-defined operational-flow high limit
Opt	SCPTdeviceControlMode nciControlMode SNVT_dev_c_mode (162)	238	Entire Functional Block	Control mode for normal operation
Opt	SCPTminRemotePressureSetpoint nciRemMinPress SNVT_press (30)	239	Entire Functional Block	Remote pressure-sensor minimum value
Opt	SCPTmaxRemotePressureSetpoint nciRemMaxPress SNVT_press (30)	240	Entire Functional Block	Remote pressure-sensor maximum value
Opt	SCPTminRemoteFlowSetpoint nciRemMinFlow SNVT_flow_p (161)	241	Entire Functional Block	Remote flow-sensor minimum value
Opt	SCPTmaxRemoteFlowSetpoint nciRemMaxFlow SNVT_flow_p (161)	242	Entire Functional Block	Remote flow-sensor maximum value
Opt	SCPTminRemoteTempSetpoint nciRemMinTemp SNVT_temp_p (105)	243	Entire Functional Block	Remote temperature-sensor minimum value

Man. Opt. *	SCPT Name NV Name Type or SNVT	SCPT Index	Associated NVs **	Description
Opt	SCPTmaxRemoteTempSetpoint nciRemMaxTemp SNVT_temp_p (105)	244	Entire Functional Block	Remote temperature-sensor maximum value
Opt	SCPTobjMajVer nciObjMajVer unsigned short	167	Entire Functional Block	Defines the major version number of the functional block
Opt	SCPTobjMinVer nciObjMinVer unsigned short	168	Entire Functional Block	Defines the minor version number of the functional block

* "Man" = mandatory, "Opt" = optional.
It should be Mandatory for CPs that are Mandatory for an NV that is also Mandatory. This is also valuable for CPs that apply to the Entire Functional Block.

** List of NVs to which this configuration property applies.
An "(M)" means that the CP is Mandatory if the NV (to which it applies) is implemented. An "(O)" means that the CP is Optional if the NV (to which it applies) is implemented.

Mandatory Network Variables

Pump Setpoint

```
network input sd_string("@p|1") SNVT_switch
nviPumpSetpoint;
```

This input network variable provides start/stop control and a setpoint. The setpoint is given as a percentage of the effective maximum value (max = 100%). The setpoint value can represent the pump speed, the pump pressure, or the pump flow, depending on the Effective Operating Mode of the pump (nvoControlMode).
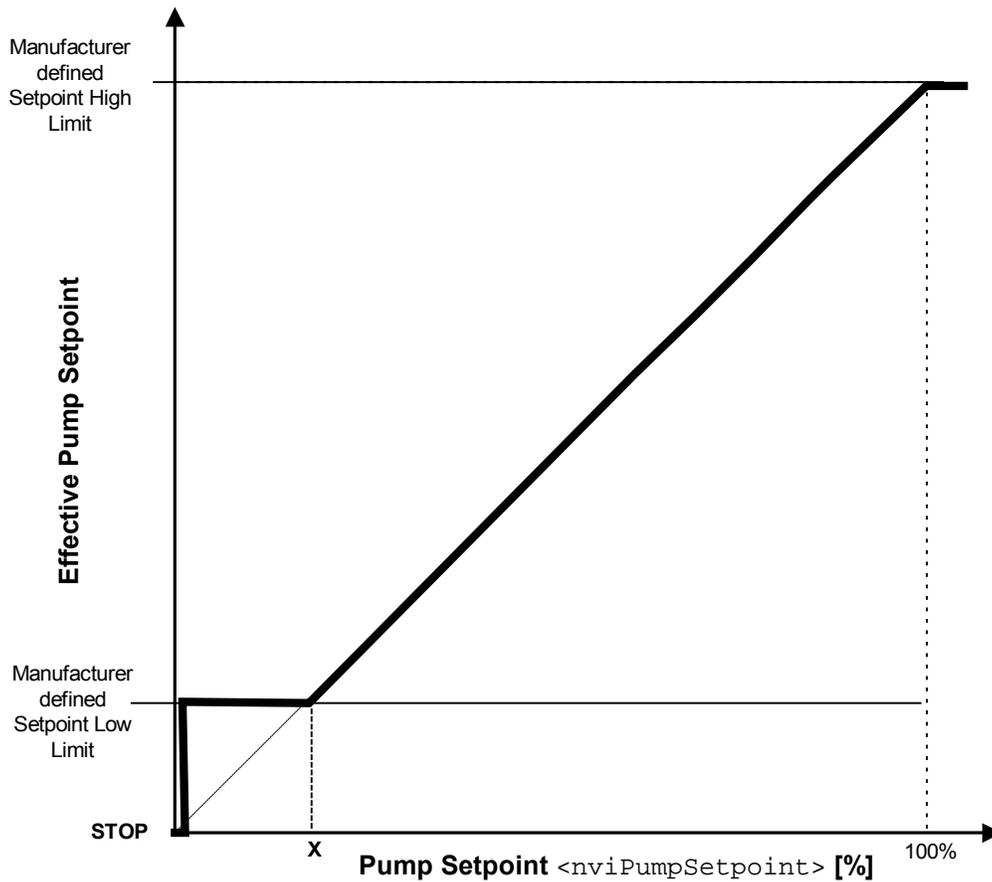

Figure 8 Effective Setpoint vs. Actual Setpoint

$$X = \left(\frac{\text{Manufacturer-defined Setpoint Low Limit}}{\text{Manufacturer-defined Setpoint High Limit}} \right) * 100\%$$

Or

$$X = \left(\frac{\text{Remote-Sensor Low Value}}{\text{Remote-Sensor High Value}} \right) * 100\%$$

The manufacturer-defined setpoint limits (lowest and highest possible setpoint settings) can be found in the documentation provided by the pump manufacturer.

For example, if the control mode is constant pressure (nvoControlMode = DCM_PRESS_CONST), and the setpoint limits for this control mode (found in the pump manufacturer's manual) are 10 kPa and 100 kPa, "X" can be calculated to be 10%. This means that a setpoint value from 1% to 10% provides a setpoint of 10 kPa (0% stops the pump). 11% up to 100% provides a setpoint of 11 kPa up to 100 kPa.

Please note that the actual pump performance may be affected by the settings in the user-defined low and high operational limits' configuration properties.

Valid Range

Please refer to the description of nvoControlMode for a detailed explanation of the different control modes that can be specified by the configuration property, nciControlMode.

For *n*-state Pumps:

State	Value	Equivalent Percent	Requested Speed
0	n/a	n/a	STOP
1	0	0%	STOP
1	1 to (1/n)200	0.5% to (1/n)100.0%	Pump speed #1
1	1 + (1/n)200 … (2/n)200	0.5% + (1/n)100.0% … (2/n)100%	Pump speed #2
1	1 + ((m-1)/n)200 … (m/n)200	0.5% + ((m-1)/n)100.0% … (m/n)100%	Pump speed #m
1	1 + ((n-1)/n)200 … 200	0.5% + ((n-1)/n)100.0% … 100%	Pump speed #n

For variable-speed Pumps:

State	Value	Equivalent Percent	Requested Speed
0	n/a	n/a	STOP
1	0	0%	STOP
1	1 to 200	0.5 to 100.0%	0.5 to 100.0%
1	201 to 255	100.0%	100.0%

Default Value

Default value is manufacturer defined. This value will be adopted at power-up.

Configuration Considerations

None specified.

Requested Pump-Operating Mode

```
network input sd_string("@p|2") SNVT_hvac_mode
nviPumpOpMode;
```

This input network variable is typically used by a supervisory controller to override the pump-controller operating mode. If a mode is requested that is not supported by the unit, the unit will treat it as an invalid value (treated as HVAC_NUL).

When the mode is HVAC_AUTO, the network-variable input, nviPumpSetpoint, defines the working setpoint of the pump. When the mode is HVAC_MRNG_WRMUP or HVAC_PRE_COOL, the pump typically operates at maximum capacity. The actual behavior is manufacturer defined.

For energy saving at night, in the summer, or under low-load conditions, the mode HVAC_ECONOMY may be used. The pump typically operates in this mode at minimum capacity or with reduced energy consumption. The actual behavior is manufacturer defined.

For test purposes, the mode HVAC_TEST may be used. The actual behavior in this mode is manufacturer defined.

For calibration purposes, the mode HVAC_CALIBRATE may be used. The actual behavior in this mode is manufacturer defined.

Value	Identifier	Notes
0	HVAC_AUTO	Normal operation: nviPumpSetpoint defines the effective setpoint
2	HVAC_MRNG_WRMUP	Morning warm-up: maximum-capacity mode
5	HVAC_PRE_COOL	Morning cool-down: maximum-capacity mode
7	HVAC_TEST	Equipment being tested
13	HVAC_ECONOMY	Energy saving: minimum-capacity mode
15	HVAC_CALIBRATE	Equipment being calibrated
-1 (0xFF)	HVAC_NUL	Invalid value

Default Value

Default value is HVAC_AUTO. This value will be adopted at power-up.

Configuration Considerations

None specified.

Pump Capacity

```
network output sd_string("@p|3") SNVT_lev_percent
nvoPumpCapacity;
```

This output network variable provides the actual pump capacity as a percentage of the effective maximum-setpoint value. A value of more than 100% means that the pump is providing a value that is higher than the highest possible setpoint.

Valid Range

-163.840% .. 163.830% (0.005% or 50 ppm). The value 0x7FFF represents invalid data.

Default Value

The actual pump capacity as a percentage of the effective maximum-setpoint value. The value should not exceed normal operating ranges unless representing an invalid value.

Configuration Considerations

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

When Transmitted

This value is transmitted immediately…

- ❑ when its value has significantly changed (manufacturer defined),
- ❑ as a heartbeat output on a regular basis, as specified by the Maximum Send Time, nciSndHrtBt, configuration property.
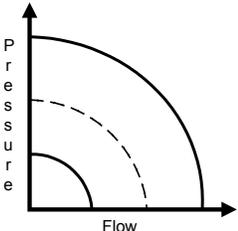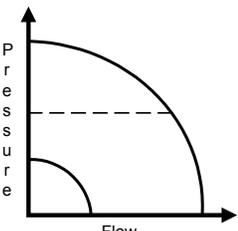
Default Service Type

The default service type is acknowledged.

Effective Operating Mode

```
network output sd_string("@p|4") SNVT_hvac_mode
nvoEffOpMode;
```

This output network variable provides the actual pump operating mode. The value of this network variable is the same as the value of the Requested Operating Mode (nviPumpOpMode) except when a different mode is selected by a local input on the pump; in which case, the value will reflect this, and nvoPumpStatus.pump_ctrl.local_control ("Locally controlled pump") will be set ("1").

Valid Range

Value	Identifier	Notes
0	HVAC_AUTO	Normal operation: nviPumpSetpoint defines the effective setpoint
2	HVAC_MRNG_WRMUP	Morning warm-up: maximum-capacity mode
5	HVAC_PRE_COOL	Morning cool-down: maximum-capacity mode
6	HVAC_OFF	Offline mode: manufacturer defined
7	HVAC_TEST	Equipment being tested
13	HVAC_ECONOMY	Energy saving: minimum-capacity mode
15	HVAC_CALIBRATE	Equipment being calibrated
-1 (0xFF)	HVAC_NUL	Invalid value

Default Value

None specified.

Configuration Considerations

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

When Transmitted

This value is transmitted immediately…

- ❑ when its value has significantly changed (manufacturer defined),
- ❑ as a heartbeat output on a regular basis, as specified by the Maximum Send Time, nciSndHrtBt, configuration property.
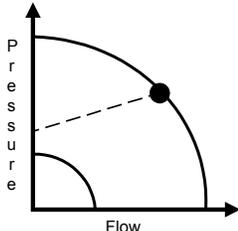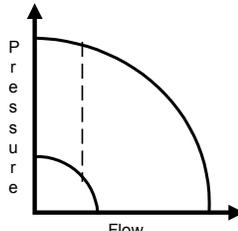
Default Service Type

The default service type is acknowledged.

Effective Device-Control Mode

```
network output sd_string("@p|5") SNVT_dev_c_mode
nvoControlMode;
```

This output network variable provides the actual control mode of the pump.

Valid Range

Control mode	*Description*
DCM_SPEED_CONST (0) Pump is running in the constant-speed mode	The setpoint of the pump will be interpreted as setpoint for the pump speed. The setpoint value is a percentage of the maximum speed of the pump.
DCM_PRESS_CONST (1) Pump is running in the constant-pressure mode	The setpoint of the pump will be interpreted as setpoint for the pressure. The controller inside the pump will change the pump speed so that the pressure is constant. The controlled pressure can be the pump pressure or it can come from an external pressure sensor. The setpoint value is a percentage of the maximum possible constant-pressure setpoint of the pump, or it is a percentage of the maximum remote pressure-sensor value.
DCM_PRESS_COMP (2) Pump is running in the compensated-pressure mode	The setpoint of the pump will be interpreted as basic setpoint for the compensated-pressure mode (the black dot in the drawing). The controller inside the pump will automatically lower the actual pressure setpoint dependent on the flow (flow compensation—the dotted line in the drawing). The controller will change the pump speed so that the actual pressure is equal to the actual-pressure setpoint. The controlled pressure can be the pump pressure or it can come from an external pressure sensor. The setpoint value is a percentage of the maximum possible compensated-pressure setpoint of the pump.
DCM_FLOW_CONST (3) Pump is running in the constant-flow mode	The setpoint of the pump will be interpreted as setpoint for the flow. The controller inside the pump will change the pump speed so that the flow will be constant. The controlled flow can be the flow through the pump or the flow signal can come from an external sensor. The setpoint value is a percentage of the maximum possible constant-flow setpoint of the pump, or it is a percentage of the maximum remote flow-sensor value.
DCM_TEMP_CONST (5) Pump is running in the constant-temperature mode	The setpoint of the pump will be interpreted as setpoint for the media temperature. The controller inside the pump will change the pump speed so that the temperature will be constant. The controlled temperature can be the temperature measured by the pump or the temperature signal can come from an external sensor. The setpoint is a percentage of the maximum possible constant-temperature setpoint of the pump, or it is a percentage of the maximum remote temperature-sensor value.

Control mode	*Description*
DCM_PRESS_AUTO (7) Pump is running in the automatic pressure-control mode	In this mode, the setpoint setting has no effect; except for starting and stopping the pump. The actual pressure setpoint of the pump is chosen and optimized automatically by the pump to suit the needs of the installation in the most effective way. The only effect of the setpoint input is to start and stop the pump. The actual setpoint-optimizing behavior is defined by the manufacturer.
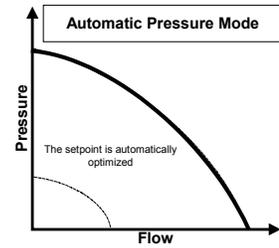
Default Value

None specified.

Configuration Considerations

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

When Transmitted

This value is transmitted immediately…

- ❑ when its value has significantly changed (manufacturer defined),
- ❑ as a heartbeat output on a regular basis, as specified by the Maximum Send Time, nciSndHrtBt, configuration property.

Default Service Type

The default service type is acknowledged.

Optional Network Variables

Pump Override Stop Command

```
network input sd_string("@p|6") SNVT_switch
nviPumpOvdStop;
```

This input network variable provides a manual override function to stop the pump, typically from a supervisory device. The value "OVDSTOP" (see Valid Range) stops the pump and has priority over the value of the Pump Setpoint, nviPumpSetpoint, and the three override setpoints: nviOvdSpeed, nviOvdPress, and nviOvdFlow.

The manual-override status of the pump controller is indicated in the nvoPumpOverride network variable.

Valid Range

State	Value	Equivalent Percent	Requested Operation
0	n/a	n/a	NORMAL
1	0	n/a	NORMAL
1	1 to 255	n/a	OVDSTOP
0xFF	n/a	n/a	Invalid (NORMAL)

Default Value

Default value is 0xFF (invalid value) in the *state* field. The value will be adopted at power-up.

Configuration Considerations

None specified.

Override Setpoint for Speed

```
network input sd_string("@p|7") SNVT_lev_percent
nviOvdSpeed;
```

This input network variable provides an override request and a speed setpoint, typically from a supervisory device. This speed setpoint is given as a percentage of the maximum speed of the pump. When a valid value is received, and the Pump Override Stop Command is not active, the present pump setpoint (nviPumpSetpoint, nviOvdPress, or nviOvdFlow) will be overridden and the pump will be controlled to the given speed setpoint. The pump then works in the DCM_SPEED_CONST mode.

Invalid values of all three override-setpoint inputs (nviOvdSpeed, nviOvdPress, and nviOvdFlow), and a NORMAL status of the Pump Override Stop Command (nviPumpOvdStop), will set the pump back into the NORMAL mode. The manual-override status of the pump controller is indicated in the nvoPumpOverride network variable.

Valid Range

-163.840% .. 163.830% (0.005% or 50 ppm). The value 0x7FFF represents invalid data that must be interpreted as "no override requested."

A negative value will be interpreted as 0%, and the
nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out of range") will be
set ("1").

A value of more than 100% will be interpreted as 100%, and the
nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out of range") will be
set ("1").

The override setpoint may be affected by the user-defined operational limits if
implemented (see Configuration Properties).

Default Value

Default value is 0x7FFF (invalid value). The value will be adopted at power-up.

Configuration Considerations

None specified.

Override Setpoint for Pressure

```
network input sd_string("@p|8") SNVT_press
nviOvdPress;
```

This input network variable provides an override request and a pressure setpoint,
typically from a supervisory device. When a valid value is received, and the
Pump Override Stop Command is not active, the present pump setpoint
(nviPumpSetpoint, nviOvdSpeed, or nviOvdFlow), will be overridden and the
pump will be controlled to the given pressure setpoint. The pump then works in
the DCM_PRESS_CONST mode.

Invalid values of all three override setpoint inputs (nviOvdSpeed, nviOvdPress,
and nviOvdFlow), and a NORMAL status of the Pump Override Stop Command
(nviPumpOvdStop) will set the pump back into the NORMAL mode. The
manual-override status of the pump controller is indicated in the
nvoPumpOverride network variable.

Valid Range

-3,276.8 .. 3,276.7 kiloPascals (0.1 kPa). The value 0x7FFF represents invalid
data that must be interpreted as "no override requested."

A value below the Manufacturer-defined Setpoint Low-Limit will be saturated to
this value, and the nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out
of range") will be set ("1").

A value above the Manufacturer-defined Setpoint High-Limit will be saturated to
this value, and the nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out
of range") will be set ("1").

The override setpoint may be affected by the user-defined operational limits if implemented (see Configuration Properties).

Default value

Default value is 0x7FFF (invalid value). The value will be adopted at power-up.

Configuration Considerations

None specified.

Override Setpoint for Flow

```
network input sd_string("@p|9") SNVT_flow_p
nviOvdFlow;
```

This input network variable provides an override request and a flow setpoint, typically from a supervisory device. When a valid value is received, and the Pump Override Stop Command is not active, the present pump setpoint (nviPumpSetpoint, nviOvdSpeed, or nviOvdPress), will be overridden and the pump will be controlled to the given flow setpoint. The pump then works in the DCM_FLOW_CONST mode.

Invalid values of all three override setpoint inputs (nviOvdSpeed, nviOvdPress, and nviOvdFlow), and a NORMAL status of the Pump Override Stop Command (nviPumpOvdStop), will set the pump back into the NORMAL mode. The manual-override status of the pump controller is indicated in the nvoPumpOverride network variable.

Valid Range

0 .. 655.34 m³/h (0.01). The value 0xFFFF represents invalid data that must be interpreted as "no override requested."

A value below the Manufacturer-defined Setpoint Low-Limit will be saturated to this value, and the nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out of range") will be set ("1").

A value above the Manufacturer-defined Setpoint High-Limit will be saturated to this value, and the nvoPumpStatus.pump_ctrl.setpt_out_of_range ("Setpoint out of range") will be set ("1").

The override setpoint may be affected by the user-defined operational limits if implemented (see Configuration Properties).

Default value

Default value is 0xFFFF (invalid value). The value will be adopted at power-up.

Configuration Considerations

None specified.

Remote Pressure-Sensor Input

```
network input sd_string("@p|10") SNVT_press
nviRemotePress;
```

The nviRemotePress network variable allows the use of a remote differential-pressure sensor on the network as the feedback signal to the pump controller.

A valid value on the nviRemotePress network variable will disable the internal feedback signal of the pump controller and activate the remote-sensor operating mode—forcing the pump to run in the constant-pressure control mode. This is indicated by the nvoPumpStatus.pump_ctrl.remote_press ("Remote pressure sensor") being set ("1").

The nvoPumpCapacity output variable will indicate the value of the pressure signal from the sensor as a percentage of its maximum value. This makes it possible to compare the sensor value with the nviPumpSetpoint value.

The nvoPressure output variable always indicates the differential pressure across the pump flanges measured, or estimated, by the pump controller. This may help in analyzing the behavior of the system.

When using nviRemotePress, the pressure setpoint is given by nviPumpSetpoint. The ranging of both the setpoint and the feedback are given by the configuration properties: Remote Minimum and Maximum Pressure Sensor Value (nciRemMinPress and nciRemMaxPress). These values are used in place of the manufacturer-defined setpoint limits found in the pump-manufacturer documentation.

If the nviRemotePress variable receives an invalid value, or if the heartbeat (specified by nciRcvHrtBt) is missing, remote control is deactivated and the pump controller will return to the control mode defined by nciControlMode.

Any valid value in the manual-override inputs will take priority over the remote-sensor control, and the pump controller will use the internal feedback signals.
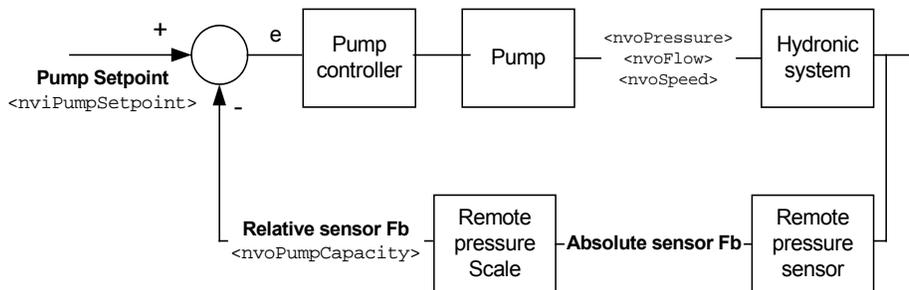
Figure 9 Remote Pressure-Sensor Use

Valid Range

-3,276.8 .. 3,276.7 kiloPascal (0.1 kPa). The value 0x7FFF represents invalid data and can be interpreted as "not connected."

Default value

Default value is 0x7FFF (invalid value). The value will be adopted at power-up and in the case of not receiving an update within the specified receive-heartbeat time.

Configuration Considerations

None specified.

Remote Flow-Sensor Input

```
network input sd_string("@p|11") SNVT_flow_p
nviRemoteFlow;
```

The nviRemoteFlow network variable allows the use of a remote flow sensor on the network as the feedback signal to the pump controller.

A valid value on the nviRemoteFlow network variable will disable the internal feedback signal of the pump controller and activate the remote-sensor operating mode—forcing the pump to run in the constant-flow control mode. This is indicated by the nvoPumpStatus.pump_ctrl.remote_pressflow ("Remote flow sensor") being set ("1").

The nvoPumpCapacity output variable will indicate the value of the flow signal from the sensor as a percentage of its maximum value. This makes it possible to compare the sensor value with the nviPumpSetpoint value.

The nvoFlow output variable always indicates the flow through the pump measured, or estimated, by the pump controller. This may help in analyzing the behavior of the system.

When using nviRemoteFlow, the flow setpoint is given by nviPumpSetpoint. The ranging of both the setpoint and the feedback are given by the configuration properties: Remote Minimum and Maximum Flow Sensor Value (nciRemMinFlow and nciRemMinFlow). These values are used in place of the manufacturer-defined setpoint limits found in the pump-manufacturer documentation.

If the nviRemoteFlow variable receives an invalid value, or if the heartbeat (specified by nciRcvHrtBt) is missing, remote control is deactivated and the pump controller will return to the control mode defined by nciControlMode.

Any valid value in the manual-override inputs will take priority over the remote-sensor control, and the pump controller will use the internal feedback signals.
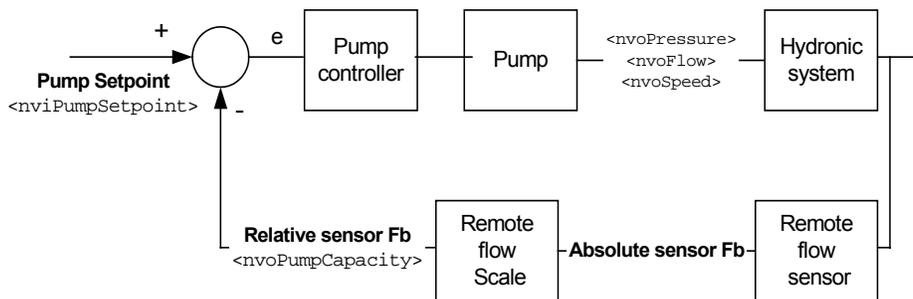
Figure 10 Remote Flow-Sensor Use

Valid Range

0 .. 655.34 m³/h (0.01 m³/h). The value 0xFFFF represents invalid data and can be interpreted as "not connected."

Default value

Default value is 0xFFFF (invalid value). The value will be adopted at power-up and in the case of not receiving an update within the specified receive-heartbeat time.

Configuration Considerations

None specified.

Remote Temperature-Sensor Input

```
network input sd_string("@p|12") SNVT_temp_p
nviRemoteTemp;
```

The nviRemoteTemp network variable allows the use of a remote temperature sensor on the network as the feedback signal to the pump controller.

A valid value on the nviRemoteTemp network variable will disable the internal feedback signal of the pump controller and activate the remote sensor operating mode—forcing the pump to run in the constant-temperature control mode. This is indicated by the nvoPumpStatus.pump_ctrl.remote_temp ("Remote temperature sensor") being set ("1").

The nvoPumpCapacity output variable will indicate the value of the temperature signal from the sensor as a percentage of its maximum value. This makes it possible to compare the sensor value with the nviPumpSetpoint value.

The nvoFluidTemp output variable always indicates the temperature of the medium flowing through the pump measured, or estimated, by the pump controller. This may help in analyzing the behavior of the system.

When using nviRemoteTemp, the temperature setpoint is given by nviPumpSetpoint. The ranging of both the setpoint and the feedback are given by the configuration properties: Remote Minimum and Maximum Temperature Sensor Value (nciRemMinTemp and nciRemMinTemp). These values are used in place of the Manufacturer defined Setpoint Limits found in the pump manufacturer documentation.

If the nviRemoteTemp variable receives an invalid value, or if the heartbeat (specified by nciRcvHrtBt) is missing, remote control is deactivated and the pump controller will return to the control mode defined by nciControlMode.

Any valid value in the manual-override inputs will take priority over the remote-sensor control, and the pump controller will use the internal feedback signals.
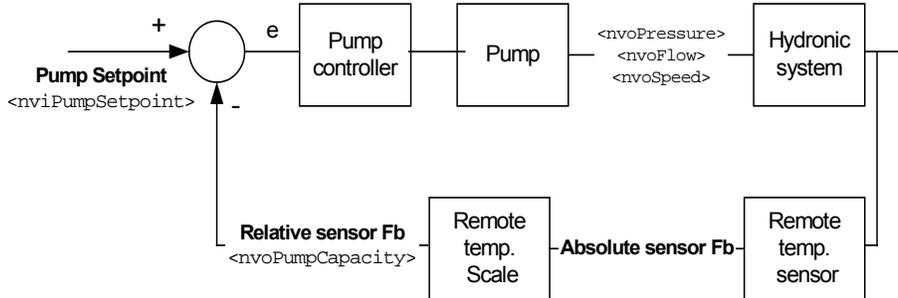

Figure 11 Remote Temperature-Sensor Use

Valid Range

-273.17 .. +327.66 degrees C (0.01 degrees C). The value 0xFFFF represents invalid data and can be interpreted as "not connected."

Default value

Default value is 0xFFFF (invalid value). The value will be adopted at power-up and in the case of not receiving an update within the specified receive-heartbeat time.

Pump-Status Diagnostic Information

```
network output sd_string("@p|13") SNVT_dev_status
nvoPumpStatus;
```

This output network variable provides detailed diagnostic information on the status of the pump controller.

Valid Range

The valid range of SNVT_dev_status.pump_ctrl, excluding "reserved" fields.

Configuration Considerations

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

When Transmitted

This value is transmitted immediately…

- ❑ when its value has significantly changed (manufacturer defined),
- ❑ as a heartbeat output on a regular basis, as specified by the Maximum Send Time, nciSndHrtBt, configuration property.

Default Service Type

The default service type is acknowledged.

Pump Pressure

```
network output sd_string("@p|14") SNVT_press
nvoPressure;
```

This optional output network variable provides the pressure between the pump flanges as estimated, or measured, by the pump controller.

Valid Range

-3,276.8 .. 3,276.7 kiloPascal (0.1 kPa). The value 0x7FFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Pump Flow

```
network output sd_string("@p|15") SNVT_flow_p nvoFlow;
```

This optional output network variable provides the flow through the pump as estimated, or measured, by the pump controller.

Valid Range

0 .. 655,34 m³/h (0.01 m³/h). The value 0xFFFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Pump Speed

```
network output sd_string("@p|16") SNVT_rpm nvoSpeed;
```

This optional output network variable provides the speed of the pump.

Valid Range

0 .. 65,534 revolutions/minute (1 RPM). The value 0xFFFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Pump Override Active

```
network output sd_string("@p|17") SNVT_switch
nvoPumpOverride;
```

This optional output network variable provides the manual-override status of the pump. The variable has the value "OVERRIDE," if the pump setpoint has been overridden via one of the variables: nviOvdStop, nviOvdSpeed, nviOvdPress, or nviOvdFlow.

Valid Range

State	Value	Equivalent Percent	Override Status
0	0	n/a	NORMAL
1	200	n/a	OVERRIDE
0xFF	n/a	n/a	Invalid Value

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Runtime

```
network output sd_string("@p|18") SNVT_time_hour
nvoRuntime;
```

This output network variable provides the total running time for the pump, in hours. After 65535 hours, the counter starts again from zero (0).

Valid Range

The valid range is 0 .. 65535 hours (1 hour); (equivalent to 2730 days, or 7.67 years).

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Fault States of the Pump

```
network output sd_string("@p|19") SNVT_dev_fault
nvoPumpFault;
```

This output network variable provides fault information of the pump. The priority of the faults is manufacturer defined.

Valid Range

The valid range of SNVT_dev_fault.pump_ctrl, excluding "reserved" fields.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Maintenance States

```
network output sd_string("@p|20") SNVT_dev_maint
nvoMaintenance;
```

This output network variable provides the maintenance information of the pump. The priority of the maintenance actions is manufacturer defined.

Valid Range

The valid range of SNVT_dev_maint.pump_ctrl, excluding "reserved" fields.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Fluid Temperature

```
network output sd_string("@p|21") SNVT_temp_p
nvoFluidTemp;
```

This optional output network variable provides the temperature of the fluid in the pump as estimated, or measured, by the pump controller.

Valid Range

-273.17 .. +327.66 degrees C (0.01 degrees C). The value 0x7FFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Power Consumption in Watts

```
network output sd_string("@p|22") SNVT_power nvoPower;
```

This optional output network variable provides the actual power being consumed by the pump. This output is suitable for pumps up to approximately 6 kW.

Valid Range

0 .. 6,553.5 Watts (0.1 W). The value 0xFFFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Power Consumption in Kilowatts

```
network output sd_string("@p|23") SNVT_power_kilo
nvoPowerkilo;
```

This optional output network variable provides the actual power being consumed by the pump. This output is suitable for pumps <u>larger than</u> approximately 6 kW.

Valid Range

0 .. 6,553.5 kW (0.1 kW). The value 0xFFFF represents invalid data.

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Energy Consumption

```
network output sd_string("@p|24") SNVT_elec_kwh
nvoEnergyConsum;
```

This optional output network variable provides the total Energy Consumption of the pump from the beginning of its life. After 65,535 kWh the counter resets to 0 kWh.

Valid Range

0 .. 65,535 kiloWatt-hour (1 kWh).

Configuration Considerations

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

When Transmitted

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

Default Service Type

The default service type is unacknowledged.

Mandatory Configuration Properties

Send Heartbeat

```
network input config sd_string("&2,i.j.k,0\x80,49")
SNVT_time_sec nciSndHrtBt;
```

This input configuration property sets the maximum period of time that can expire before the functional block will automatically update the following network variables (plus any other network variables specified by the pump-controller manufacturer):

nv3(Mandatory), nvoPumpCapacity
nv4(Mandatory), nvoEffOpMode
nv5(Mandatory), nvoControlMode
nv13(Mandatory), nvoPumpStatus

Notice that this CP is Mandatory for nvoPumpStatus, which is an Optional NV. If nvoPumpStatus is implemented, then the CP must apply to nvoPumpStatus.

A Mandatory CP associated with a Mandatory NV means that the CP is Mandatory for implementing this functional block (as in Table 2).

i.j.k are example indices of the NVs in relation to their declaration order within the device, when implemented. Actual implementation of the CP (whether by array, single instance, or multiple instances) is manufacturer specific.

Valid Range

The valid range is 0 .. 6,553.4 seconds (0.1 seconds).

A value of 6,553.5 is invalid and will disable the automatic update mechanism. A value of zero (0) will be used for the internal timer in the case where the configured value is 6,553.5 seconds (0xFFFF). The value of zero (0) disables the Send Heartbeat mechanism.

Default Value

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

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTmaxSendTime (49)

Pump Characteristic

```
network input config sd_string("&1,p,0\x90,233")
SCPTpumpChar nroPumpChar;
```

This read-only configuration property provides the basic characteristic data for the pump. For further technical information, refer to the manufacturer's documentation.

Valid Range

The valid range of the supported pump characteristics is given in the following structure:

```
typedef struct {
  SNVT_rpm      speedMax;
  SNVT_press    pressMax;
  SNVT_flow_p   flowMax;
} SCPTpumpCharacteristic;
```
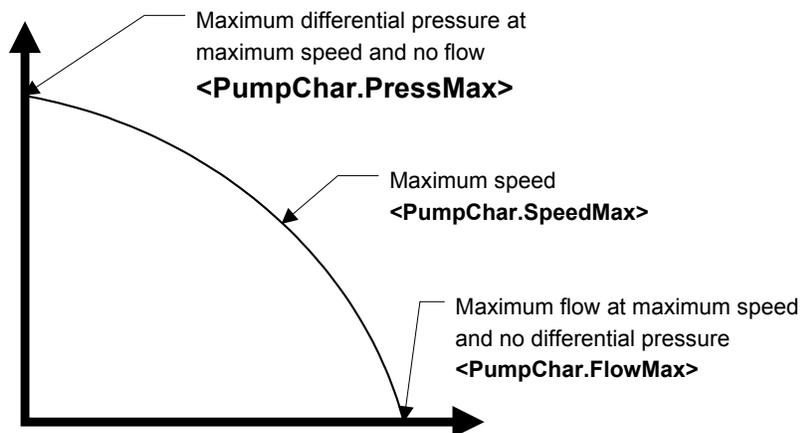

Figure 12 Pump Characteristic

Typical Default Value

The Pump Characteristic default is manufacturer specific.

Configuration Requirements/Restrictions

The read-only nroPumpChar configuration property is "modified only during manufacture" (mfg_flg).

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SCPT Reference

SCPTpumpCharacteristic (233)

Optional Configuration Properties

Location Label

```
network input config sd_string("&1,p,0\x80,17")
SNVT_str_asc nciLocation;
```

This configuration property can be used to provide the location of the functional block (or device), where *p* is the functional-block index. The above code declaration is for providing the location of the functional block. This is separate from the location of the device itself.

Since the Node Object functional block is to be used (See Additional Considerations), the following declaration should be used to represent the location of the device (in addition to, or in lieu of, the functional-block location declaration):

```
network input config sd_string("&1,0,0\x80,17")
SNVT_str_asc nciDevLocation;
```

Valid Range

Any NULL-terminated ASCII string up to 31 bytes of total length (including NULL). The string must be truncated if the length does not allow the 31st character to be the NULL (0x00).

Default Value

The typical default value is an ASCII string containing 31 NULLs (0x00).

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTlocation (17)

Receive Heartbeat

```
network input config sd_string("&2,i.j.k,0\x80,48")
SNVT_time_sec nciRcvHrtBt;
```

This input configuration property sets the maximum period of time that can elapse before the functional block will automatically use the default values for the following network variables (plus any other network variables specified by the pump-controller manufacturer):

nv10(M), nviRemotePress
nv11(M), nviRemoteFlow
nv12(M), nviRemoteTemp

Notice that this CP is Mandatory for these NVs, which are Optional NVs. If the NVs are implemented, then the CP must be implemented and applied to the NVs.

i.j.k are example indices of the NVs in relation to their declaration order within the device, when implemented. Actual implementation of the CP (whether by array, single instance, or multiple instances) is manufacturer specific.

Valid Range

The valid range is 0 .. 6,553.4 seconds (0.1 seconds).

A value of 6,553.5 is invalid and will disable the automatic update mechanism. A value of zero (0) will be used for the internal timer in the case where the configured value is 6,553.5 seconds (0xFFFF). The value of zero (0) disables the Receive Heartbeat mechanism.

Default Value

The typical default value is 0.0 (no receive-heartbeat functionality).

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTmaxRcvTime (48)

Minimum Send Time

```
network input config sd_string("&2,i.j.k,0\x80,49")
SNVT_time_sec nciMinOutTm;
```

This input configuration property sets the minimum period of time that must expire before the functional block will allow an update to the following network variables to propagate over the network (plus any other network variables specified by the pump-controller manufacturer):

nv3(Mandatory), nvoPumpCapacity
nv4(Mandatory), nvoEffOpMode
nv5(Mandatory), nvoControlMode
nv13(Mandatory), nvoPumpStatus

Notice that this CP is Mandatory for nvoPumpStatus, which is an Optional NV. If nvoPumpStatus is implemented, then the CP must apply to nvoPumpStatus.

A Mandatory CP associated with a Mandatory NV means that the CP is Mandatory for implementing this functional block (as in Table 2).

Although this configuration property is optional, it must be provided if the minimum-send-time function is used.

i.j.k are example indices of the NVs in relation to their declaration order within the device, when implemented. Actual implementation of the CP (whether by array, single instance, or multiple instances) is manufacturer specific.

Valid Range

The valid range is 0 .. 6,553.4 seconds (0.1 seconds).

A value of 6,553.5 is invalid and will disable transmission-limiting (throttling) mechanism. A value of zero (0) will be used for the internal timer in the case where the configured value is 6,553.5 seconds (0xFFFF). The value of zero (0) disables the Minimum Send Time mechanism.

Default Value

The typical default value is 0.0 (no transmission-limiting/throttling).

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTminSendTime (52)

User-Defined Operational-Pressure Limits

```
network input config sd_string("&1,p,0\x80,235")
SNVT_press nciPressHighLim;

network input config sd_string("&1,p,0\x80,234")
SNVT_press nciPressLowLim;
```

These configuration properties are used to define pressure limits for the working area of the pump. See Figure 13:
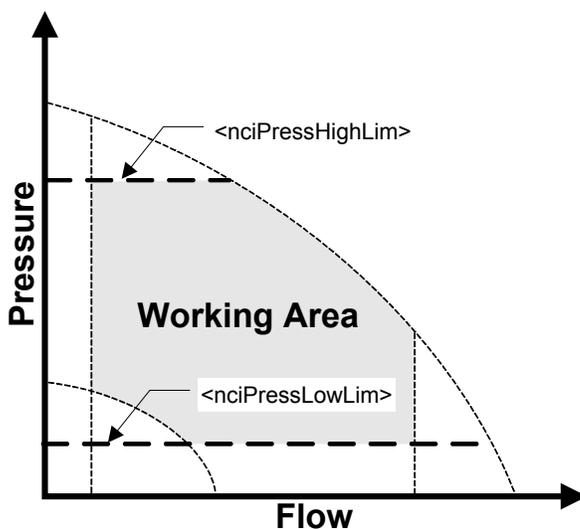

Figure 13 User-Defined Operational-Pressure Limits

Valid Range

The valid range of the high-pressure limit is:

Manufacturer-Defined High-Setpoint Limit $\geq$
    nciPressHighLim $\geq$
        Manufacturer-Defined Low-Setpoint Limit

or, if the remote pressure-sensor input is used:

Sensor High Limit $\geq$ nciPressHighLim $\geq$ Sensor Low Limit

The valid range of the low-pressure limit is:

Manufacturer-Defined High-Setpoint Limit $\geq$
    nciPressLowLim $\geq$
        Manufacturer-Defined Low-Setpoint Limit

or, if the remote pressure-sensor input is used:

Sensor High Limit $\geq$ nciPressLowLim $\geq$ Sensor Low Limit

And…

nciPressHighLim > nciPressLowLim

Default Value

Typical Default Values are:

nciPressHighLim = Manufacturer-Defined High-Setpoint Limit

nciPressLowLim = Manufacturer-Defined Low-Setpoint Limit

SCPT Reference

SCPTmaxPressureSetpoint (235)

SCPTminPressureSetpoint (234)

User-Defined Operational-Flow Limits

```
network input config sd_string("&1,p,0\x80,237")
SNVT_flow_p nciFlowHighLim;

network input config sd_string("&1,p,0\x80,236")
SNVT_flow_p nciFlowLowLim;
```

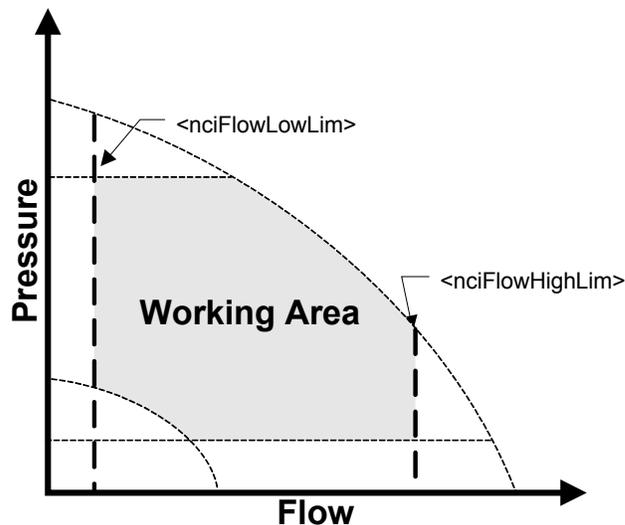These configuration properties are used to define limits for the working area of the pump. See Figure 14:

Figure 14 User-Defined Operational-Flow Limits

Valid Range

The valid range of the high-flow limit is:

Manufacturer-Defined High-Setpoint Limit ≥
        nciFlowHighLim ≥
                Manufacturer-Defined Low-Setpoint Limit

or, if the remote flow-sensor input is used:

Sensor High Limit $\geq$ nciFlowHighLim $\geq$ Sensor Low Limit

The valid range of the low-flow limit is:

Manufacturer-Defined High-Setpoint Limit $\geq$
    nciFlowLowLim $\geq$
        Manufacturer-Defined Low-Setpoint Limit

or, if the remote flow-sensor input is used:

Sensor High Limit $\geq$ nciFlowLowLim $\geq$ Sensor Low Limit

And…

nciFlowHighLim > nciFlowLowLim

Default Value

Typical Default Values are:

nciFlowHighLim = Manufacturer-Defined High-Setpoint Limit

nciFlowLowLim = Manufacturer-Defined Low-Setpoint Limit

SCPT Reference

SCPTmaxFlowSetpoint (237)

SCPTminFlowSetpoint (236)

Control Mode for Normal Operation

```
network input config sd_string("&1,p,0\x80,238")
SNVT_dev_c_mode nciControlMode;
```

This configuration property defines the device control mode to be used for the normal operating mode when a remote network-pressure, -flow, or -temperature sensor is not bound to the controller and the internal speed, pressure, or flow feedback signal is used by the controller.

Refer to Effective Device Control Mode (nvoEffControlMode) for details of the control modes.

Valid Range

The valid range is the same as that of nvoEffControlMode.

Default Value

The default control mode for a pump is manufacturer defined.

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTdeviceControlMode (238)

Remote Pressure-Sensor Minimum Value

```
network input config sd_string("&2,i,0\x80,239")
SNVT_press nciRemMinPress;
```

This input configuration property provides the minimum value for ranging the remote pressure sensor. Together with nciRemMaxPress, these range values replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Pressure-Sensor Input (nviRemotePress).

Valid Range

-3,276.8 .. 3,276.7 kiloPascal (0.1 kPa). The value 0x7FFF represents invalid data.

Default Value

nciRemMinPress = 0x7FFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTminRemotePressureSetpoint (239)

Remote Pressure-Sensor Maximum Value

```
network input config sd_string("&2,i,0\x80,240")
SNVT_press nciRemMaxPress;
```

This input configuration property provides the maximum value for ranging the remote pressure sensor. Together with nciRemMinPress, these range values

replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Pressure-Sensor Input (nviRemotePress).

Valid Range

-3,276.8 .. 3,276.7 kiloPascal (0.1 kPa). The value 0x7FFF represents invalid data.

Default Value

nciRemMaxPress = 0x7FFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTmaxRemotePressureSetpoint (240)

Remote Flow-Sensor Minimum Value

```
network input config sd_string("&2,i,0\x80,241")
SNVT_flow_p nciRemMinFlow;
```

This input configuration property provides the minimum value for ranging the remote flow sensor. Together with nciRemMaxFlow, these range values replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Flow-Sensor Input (nviRemoteFlow).

Valid Range

0 .. 655,34 m³/h (0,01 m³/h). The value 0xFFFF represents invalid data.

Default Value

nciRemMinFlow = 0xFFFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTminRemoteFlowSetpoint (241)

Remote Flow-Sensor Maximum Value

```
network input config sd_string("&2,i,0\x80,242")
SNVT_flow_p nciRemMaxFlow;
```

This input configuration property provides the maximum value for ranging the remote flow sensor. Together with nciRemMinFlow, these range values replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Flow-Sensor Input (nviRemoteFlow).

Valid Range

0 .. 655,34 m³/h (0,01 m³/h). The value 0xFFFF represents invalid data.

Default Value

nciRemMaxFlow = 0xFFFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTmaxRemoteFlowSetpoint (242)

Remote Temperature-Sensor Minimum Value

```
network input config sd_string("&2,i,0\x80,243")
SNVT_temp_p nciRemMinTemp;
```

This input configuration property provides the minimum value for ranging the remote temperature sensor. Together with nciRemMaxTemp, these range values replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Temperature-Sensor Input (nviRemoteTemp).

Valid Range

-273.17 .. +327.66 degrees C (0.01 degrees C). The value 0x7FFF represents invalid data.

Default Value

nciRemMinTemp = 0x7FFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTminRemoteTempSetpoint (243)

Remote Temperature-Sensor Maximum Value

```
network input config sd_string("&2,i,0\x80,244")
SNVT_temp_p nciRemMaxTemp;
```

This input configuration property provides the maximum value for ranging the remote temperature sensor. Together with nciRemMinTemp, these range values replace the manufacturer-defined setpoint limits when the remote sensor is used. See Remote Temperature-Sensor Input (nviRemoteTemp).

Valid Range

-273.17 .. +327.66 degrees C (0.01 degrees C). The value 0x7FFF represents invalid data.

Default Value

nciRemMaxTemp = 0x7FFF (invalid)

Configuration Requirements/Restrictions

This CP has no modification restrictions (no_restrictions). It can be modified at any time.

SCPT Reference

SCPTmaxRemoteTempSetpoint (244)

Object Major Version

```
network input config sd_string("&1,p,0\x84,167")
unsigned short nciObjMajVer;
```

This configuration property can be used to provide the major version number of the functional block when implemented on a device.

Valid Range

Any integer number from 1 to 256. Only 1-byte of information is accepted.

Default Value

The default value is one (1).

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is not to be modified except that it is allowable to modify the value in a download of new code to the device.

SCPT Reference

SCPTobjMajVer (167)

Object Minor Version

```
network input config sd_string("&1,p,0\xA4,168")
unsigned short nciObjMinVer;
```

This configuration property can be used to provide the minor version number of the functional block when implemented on a device.

Valid Range

Any integer number from 0 to 256. Only 1-byte of information is accepted.

Default Value

The default value is zero (0).

Configuration Requirements/Restrictions

This CP device specific (device_specific_flg). It is not to be modified except that it is allowable to modify the value in a download of new code to the device. The value is always obtained from the device (not from a Device Interface File, for example).

SCPT Reference

SCPTobjMinVer (168)

Key for Unresolved References

i.j.k are the indices of the CP-associated NVs in relation to their declaration order within the device, when implemented.

p is this functional block's index relative to the Device Self-Documentation String (DSDS) declaration, when implemented.

Data Transfer

None specified.

Power-up State

The functional block 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 pump device shall default to a pre-determined state (manufacturer defined). If possible, the device will continue to record errors.

Additional Considerations

The node object is to be used together with the Pump Controller Object and the following requests should be supported:

1. RQ_ENABLE = NO ACTION (AUTO);

2. RQ_DISABLE = STOP,
   RQ_DISABLE shall always bring the pump to a controlled stop;

3. Reset fault (RQ_CLEAR_ALARM);

4. Status (SNVT_obj_status).