

Grundfos MAGNA Series 2000 LON Module

Ⓞ GB Installation and operating instructions



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1. General description of MAGNA-LON

The LON-interface add on module for GRUNDFOS MAGNA™ (MAGNA-LON) will connect a GRUNDFOS MAGNA™ pump to a LON network. Via MAGNA-LON it is possible to control the pump and get pump status.

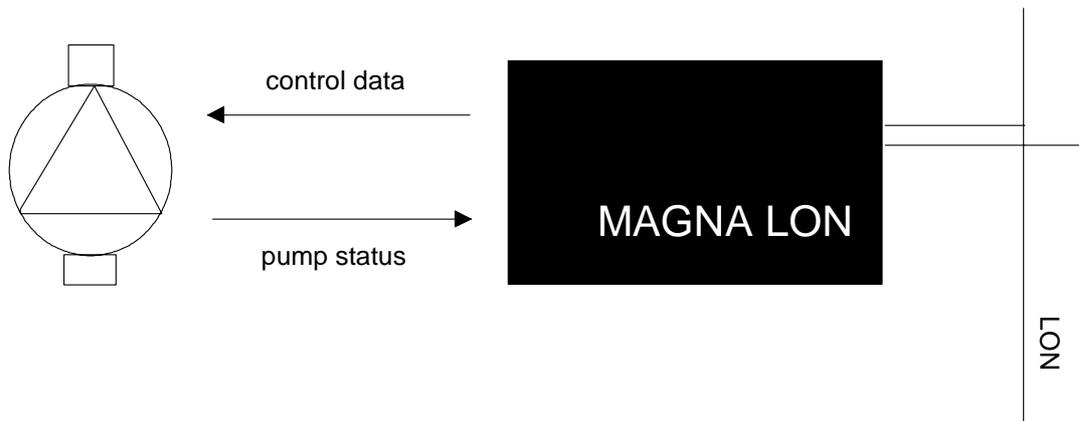


Figure 1

MAGNA-LON is designed using a 3150 neuron chip, an FTT10 transceiver and a 32 Kbyte Flash memory, which makes updating of software possible.

The pump profile in this document is compliant with version 1.0 of “Pump Controller Object”, from LonMark organization.

The MAGNA-LON module has been developed according to LonMark Application Layer Interoperability Guidelines 3.3.

MAGNA-LON uses self documentation strings, which means an installation-tool can access the relevant information over the network, otherwise `MAGNALON.XIF` can be found on the same disk as this document.

2. Installation

When MAGNA-LON is delivered it is already configured. This means that when it is powered up the application program will start. The Flash memory will contain Firmware version 7.0, and application code. Furthermore the communication parameters will be present in the EEPROM memory of the neuron-chips. The customer will need to install the network and make the required bindings.

MAGNA-LON can be installed on a network in two different ways.

1. MAGNA-LON can be installed by pushing the SERVICE pin, which will cause the neuron-chip to transmit a unique 48 bit ID code to the network.
2. The unique ID code can also be found on the label situated on the side of the MAGNA-LON interface. The bar code is in Code 39 format. An additional label with the same unique code is supplied with the MAGNA-LON interface. This label can be attached to the building installation plan.

MAGNA has a yellow service LED that indicates various states of the interface. When is delivered it should only flash for a moment and then remain off. For further information see Echelon documentation.

3. SNVT Details

NV #	Name	Recv HrtBt	SNVT Type	SNVT Index	Class	Description
1	nviPumpSetpoint	No	SNVT_switch	95	RAM	Pump setpoint for normal operation
2	nviPumpOpMode	No	SNVT_hvac_mode	108	RAM	Requested pump operating mode
6	nviPumpOvdStop	No	SNVT_switch	95	RAM	Pump override stop command
7	nviOvdSpeed	No	SNVT_lev_percent	81	RAM	Override setpoint for speed
8	nviOvdPress	No	SNVT_press	30	RAM	Override setpoint for pressure
10	nviRemotePress	Yes	SNVT_press	30	RAM	Remote differential pressure sensor input
11	nviRemoteFlow	Yes	SNVT_flow_p	161	RAM	Remote flow sensor input

3	nvoPumpCapacity	Yes	SNVT_lev_percent	81	RAM	Pump capacity as percent of maximum
4	nvoEffOpMode	Yes	SNVT_hvac_mode	108	RAM	Effective operating mode
5	nvoControlMode	Yes	SNVT_dev_c_mode	162	RAM	Effective device control mode
13	nvoPumpStatus	Yes	SNVT_dev_status	173	RAM	Pump status diagnostic information
14	nvoPressure	No	SNVT_press	30	RAM	Pump pressure
15	nvoFlow	No	SNVT_flow_p	161	RAM	Pump flow
16	nvoSpeed	No	SNVT_rpm	102	RAM	Pump speed
17	nvoPumpOverride	No	SNVT_switch	95	RAM	Pump override active
18	nvoRuntime	No	SNVT_time_hour	124	RAM	Runtime in hours
19	nvoPumpFault	No	SNVT_dev_fault	174	RAM	Fault states of the pump
21	nvoFluidTemp	No	SNVT_temp_p	105	RAM	Fluid temperature
22	nvoPower	No	SNVT_power	27	RAM	Electrical power consumption in watts
24	nvoEnergyConsum	No	SNVT_elec_kwh	13	RAM	Total energy consumption of the pump

SNVT number is according to SFPTpumpController

4. SCPT / UCPT Details

SCPT Name NV Name Type or SNVT	SCPT Index	Associated NVs	Description
SCPTmaxSendTime nciSndHrtBt SNVT_time_sec(107)	49	nv3, nv4, nv5, nv13	Maximum period of time that expires before the functional block will automatically update NVs
SCPTpumpCharacteristic nroPumpChar (structure)	233	Entire Functional Block	Maximum flow, maximum pressure and maximum speed for the pump, defines the pump characteristics.
SCPTlocation nciLocation SNVT_str_asc(36)	17	Entire Functional Block	Used to provide physical location of the device
SCPTmaxRcvTime nciRcvHrtBt SNVT_time_sec(107)	48	nv10, nv11	Maximum period of time that will expires before the functional block resets to default values, and start using internal flow, pressure or speed feedback.
SCPTdeviceControlMode nciControlMode SNVT_dec_c_mode(162)	238	Entire Functional Block	Control Mode for normal operation
SCPTminRemotePressureSetpoint nciRemMinPress SNVT_press(30)	239	nv10	Remote pressure-sensor minimum value
SCPTmaxRemotePressureSetpoint nciRemMaxPress SNVT_press(30)	240	nv10	Remote pressure-sensor maximum value
SCPTminRemoteFlowSetpoint nciRemMinFlow SNVT_flow_p (161)	241	nv11	Remote flow-sensor minimum value
SCPTmaxRemoteFlowSetpoint nciRemMaxFlow SNVT_flow_p (161)	242	nv11	Remote flow-sensor maximum value
UCPT_Ti nciT SNVT_time_sec(107)		nv10, nv11	Integral time for PI regulator
UCPT_Ts nciT SNVT_time_sec(107)		nv10, nv11	sample time for PI regulator
UCPT_Kp nciKp SNVT_multiplier (82)		nv10, nv11	Gain for PI regulator

5. Application example

Any HVAC unit can use the pump object, either as an actuator, where the pump speed is used to control the flow or pressure in the HVAC application, or the pump can be used as an intelligent device, which can maintain a constant pressure in the system. In both cases the pump can be monitored and manually controlled via the system.

In the following example the pump is used as an intelligent device which is running in `PRESS_COMP` control mode. This means the pump will automatically lower the pressure setpoint in proportion to the system flow. The unit turns the pump into minimum mode during nighttime via `nviPumpOpMode` and gets status for pump operation mode from `nvoEffOpMode`. The HVAC control unit uses `nvoPumpStatus` to retrieve status information from the pump. The controller can use this information to see pump faults and hardware overrides, and whether the pump is running or not.

The pump is attached to a manual stop button, which can be used to stop the pump. When the pump is stopped via `nviPumpOvdStop` the HVAC control unit is no longer able to control the pump via normal setpoint.

The example also shows a local control and monitor panel. Via this panel the pump fault status can be seen, as well as the pump flow and pressure. From this local panel it is possible to give the pump a pressure setpoint. This means the pump will keep a constant pressure, which will override the HVAC control unit.

The whole system is monitored via a main system.

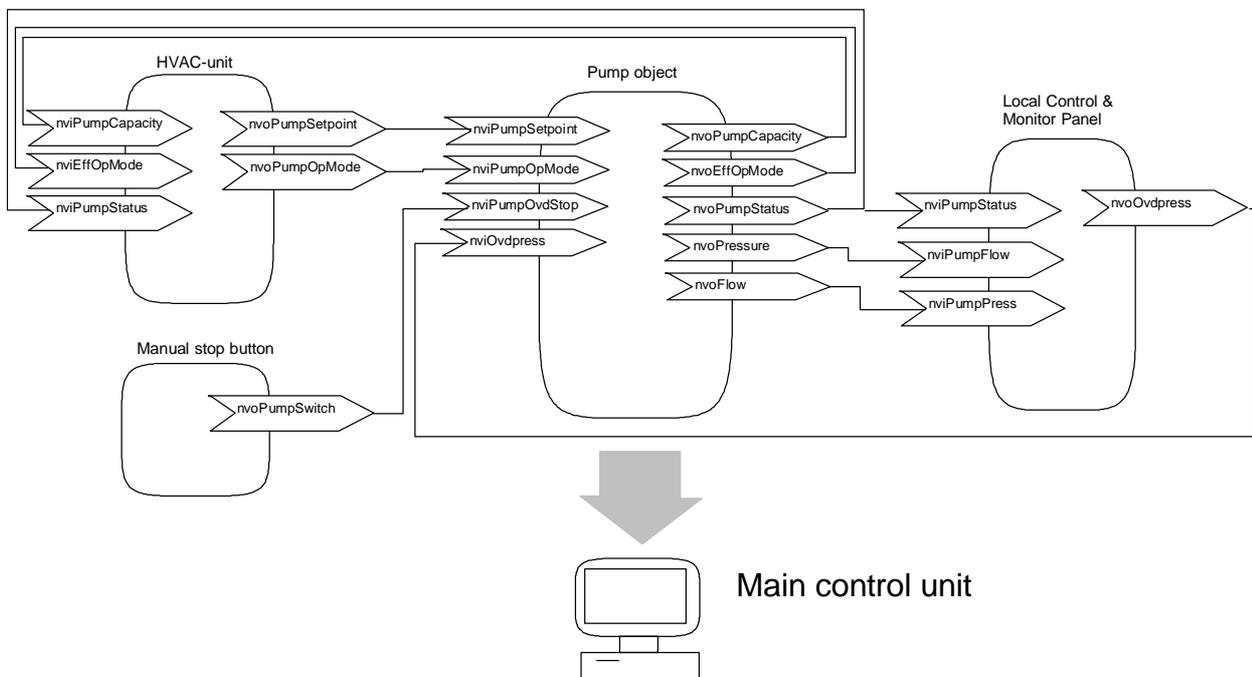


Figure 2

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 3

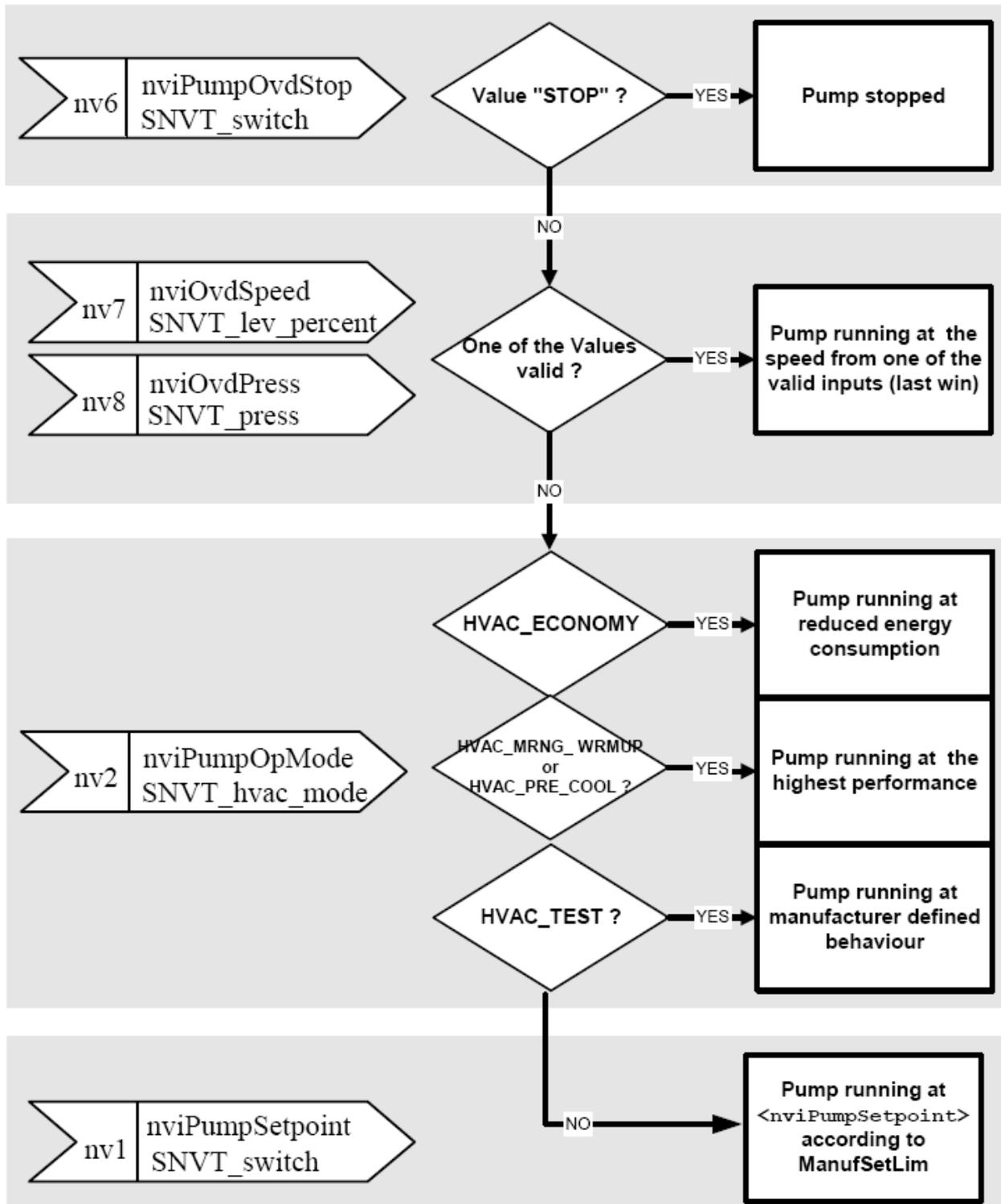


Figure 3

6. PumpController Functional-Block Details

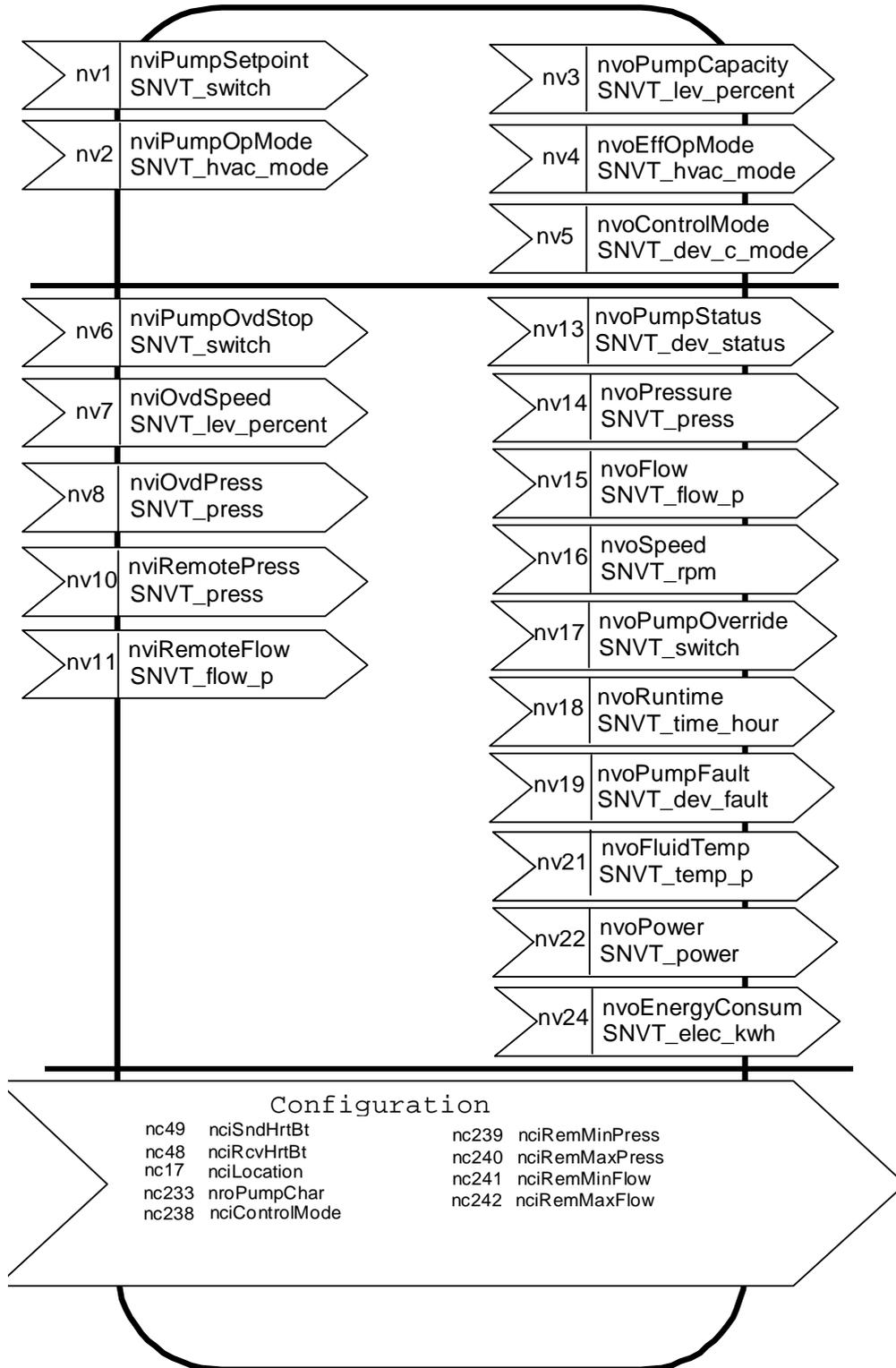


Figure 4

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 pressure or the flow, depending on the Effective Operating Mode of the pump (nvoControlMode).

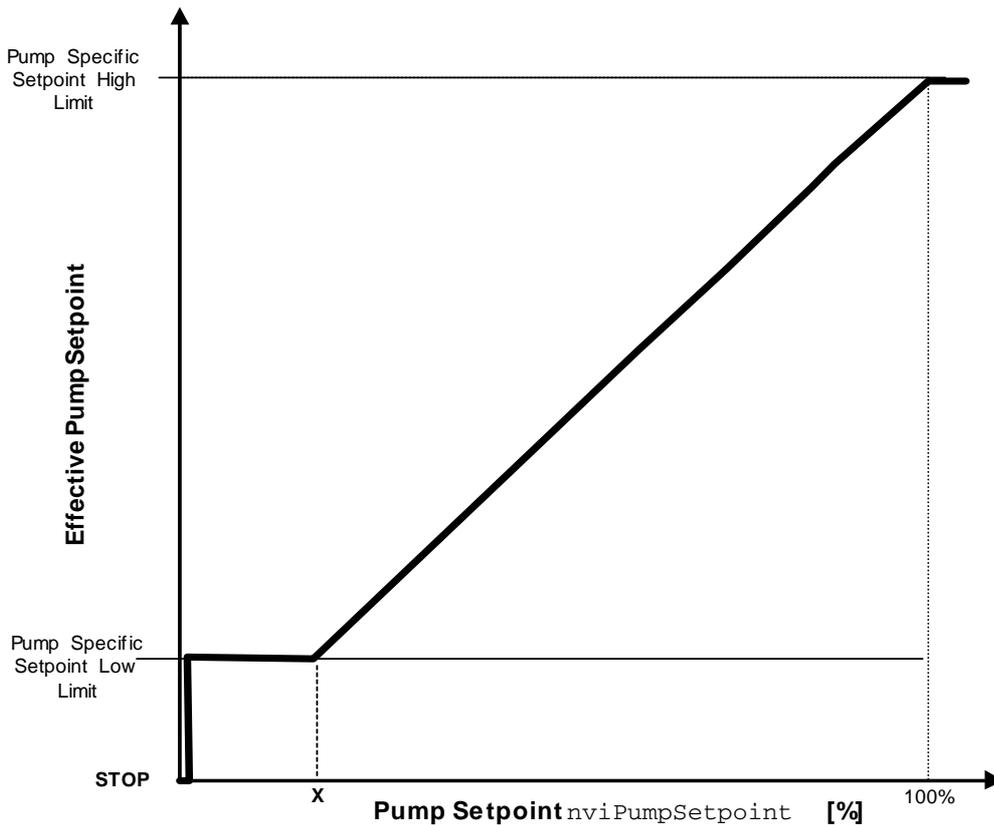


Figure 5

Effective Setpoint vs Actual Setpoint

$$X = \left(\frac{\text{Pump Specific Setpoint Low Limit}}{\text{Pump Specific Setpoint High Limit}} \right) * 100\%$$

Or

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

When using an external sensor, X can be calculated from the sensor range values.

The pump specific setpoint limits and the calculation of X for the different MAGNA pump types when not using an external sensor can be seen in the table below:

Pump type	Setpoint Low Limit	Setpoint High Limit	Calculated “X” in regulated mode (DCM_PRESS_CONST T or DCM_PRESS_COMP)	Calculated “X” in unregulated mode (DCM_SPEED_CONST)
MAGNA 32-120	1 m ≈ 10 kPa	10 m ≈ 100 kPa	10 %	30 %
MAGNA 40-120	1 m ≈ 10 kPa	10 m ≈ 100 kPa	10 %	30 %
MAGNA 50-60	1 m ≈ 10 kPa	5 m ≈ 50 kPa	20 %	45 %
MAGNA 65-60	1 m ≈ 10 kPa	5 m ≈ 50 kPa	20 %	45 %
MAGNA 50-120	1 m ≈ 10 kPa	10 m ≈ 100 kPa	10 %	30 %
MAGNA 65-120	1 m ≈ 10 kPa	10 m ≈ 100 kPa	10 %	30 %

For example, if the setpoint limits (control mode DCM_PRESS_CONST or DCM_PRESS_COMP) 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.

The values of X for the unregulated mode are approximated values. A value of e.g. 30 % means that the lower speed limit of the pump is approx. 30 % of the value of the maximum speed.

The setpoint cannot be set in the control mode DCM_PRESS_AUTO.
Control mode DCM_FLOW_CONST requires an external flow sensor.

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.

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 50%, and pump is running, however the pump will poll this network variable at startup (if bound), to ensure correct startup value.

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 HVACPRE_COOL, the pump operates at maximum capacity.

For energy saving at night, in the summer, or under low-load conditions, the mode HVAC_ECONOMY or HVAC_NIGHT_PURGE may be used. The pump operates in this mode at minimum capacity.

Valid range

<i>Value</i>	<i>Identifier</i>	<i>Notes</i>
0	HVAC_AUTO	Normal operation: nviPumpSetpoint defines the effective setpoint
2	HVAC_MRNG_WRMUP	Morning warm-up: maximum-capacity mode
4	HVAC_NIGHT_PURGE	Night purge: minimum-capacity mode
5	HVAC_PRE_COOL	Morning cool-down: maximum-capacity mode
6	HVAC_OFF	The pump cannot be controlled from the network, but will continue to monitor its outputs.
13	HVAC_ECONOMY	Energy saving: minimum-capacity mode
-1 (0xFF)	HVAC_NUL	Invalid value

Default Value

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

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 (pump specific setpoint high limit). 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.

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 property.

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, this could be STOP / MAX from push buttons or external STOP, in this case, the value will reflect this by setting the output to HVAC_OFF, and nvoPumpStatus.pump_ctrl.local_control ("Locally controlled pump") will be set ("1").

Valid range

<i>Value</i>	<i>Identifier</i>	<i>Notes</i>
0	HVAC_AUTO	Normal operation: nviPumpSetpoint defines the effective setpoint
2	HVAC_MRNG_WRMUP	Morning warm-up: maximum-capacity mode
4	HVAC_NIGHT_PURGE	Night purge: minimum-capacity mode
5	HVAC_PRE_COOL	Morning cool-down: maximum-capacity mode
6	HVAC_OFF	The pump cannot be controlled from the network, but will continue to monitor its outputs.
13	HVAC_ECONOMY	Energy saving: minimum-capacity mode
-1 (0xFF)	HVAC_NUL	Invalid value

When transmitted

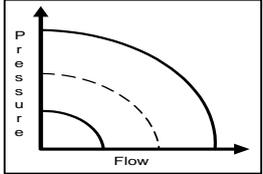
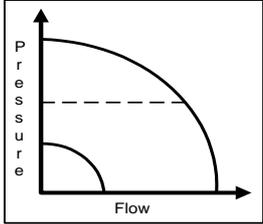
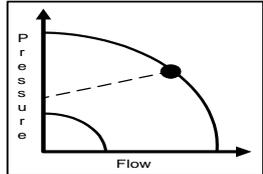
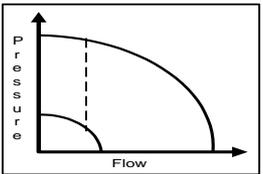
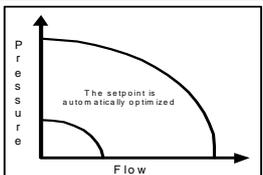
This value is transmitted immediately when its value has changed. Additionally, this network variable will also be transmitted as a heartbeat output on a regular basis as specified by the Maximum Send Time `nciSndHrtBt` configuration property.

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. The actual control mode is determined by `nciControlMode`, `nviOvdSpeed`, `nviOvdPress`, `nviRemotePress` or `nviRemoteFlow`.

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 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 dashed line in the drawing). 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 pump 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_PRESS_AUTO (7) pump is running in the automatic pressure-control mode	In this mode, the setpoint 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.	

*)only valid with flow sensor input

When transmitted

This value is transmitted immediately when its value has changed. 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 property.

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" stops the pump and has priority over the value of the Pump Setpoint `nviPumpSetpoint` and the two override setpoints `nviOvdSpeed` and `nviOvdPress`.

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

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

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` or `nviOvdPress`) 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 override setpoint inputs (`nviOvdSpeed` and `nviOvdPress`) 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. The control flow can be seen from Figure 3.

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").

Default value

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

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 current pump setpoint (`nviPumpSetpoint` or `nviOvdSpeed`) 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 override setpoint inputs (`nviOvdSpeed` or `nviOvdPress`) 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. The control flow can be seen from Figure 3.

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”).

Default value

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

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").

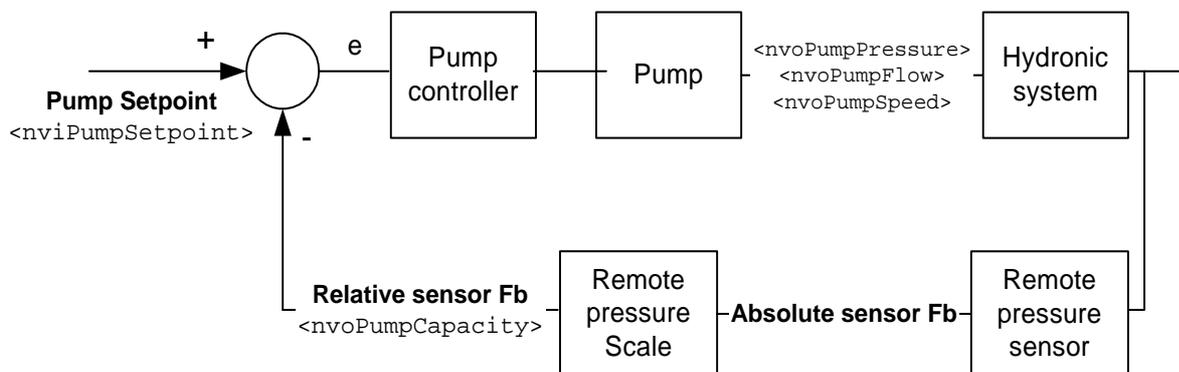
The nvoPumpCapacity output variable will indicate the value of the pressure signal from the sensor as a percentage of its maximum value. This makes it possible to compare the sensor value with the nviPumpSetpoint value.

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 is 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.

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.



Valid Range

-3,276.8 .. 3,276.7 kilo Pascal (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 case of not receiving an update within the specified receive heartbeat time.

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_flow` (“remote flow sensor”) being set (“1”).

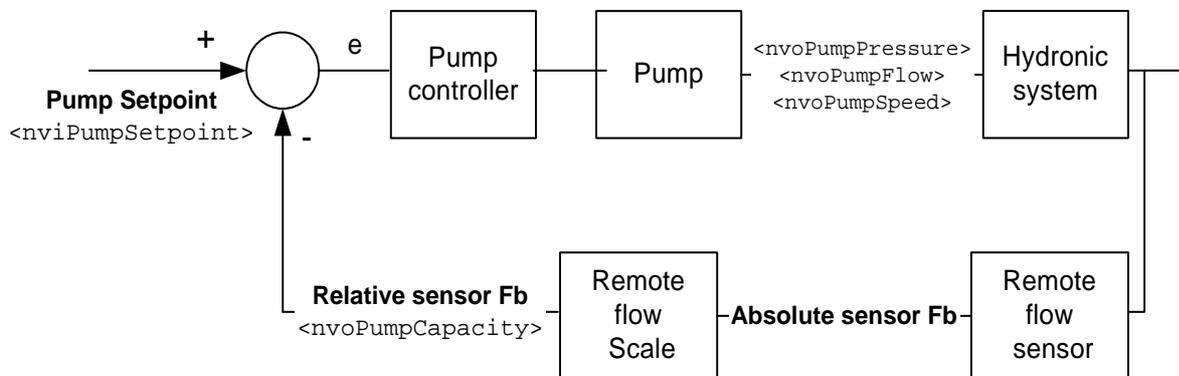
The `nvoPumpCapacity` output variable will indicate the value of the flow signal from the sensor as a percentage of its maximum value. This makes it possible to compare the sensor value with the `nviPumpSetpoint` value.

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 value (`nciRemMinFlow` and `nciRemMaxFlow`). These values are used in place of the manufacturer-defined setpoint limits.

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.



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 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:

<i>Bit name</i>	<i>Description</i>
dev_type.pump_ctrl.device_fault	(see nvoPumpFault for detailed information).
dev_type.pump_ctrl.supply_fault	No electrical power, no fluid in pump, etc. – see nvoPumpFault for detailed information.
dev_type.pump_ctrl.speed_low	The pump is running at the lowest possible speed, therefore the requested performance is not possible.
dev_type.pump_ctrl.speed_high	The pump is running at the highest possible speed, therefore the requested performance is not possible.
dev_type.pump_ctrl.setpt_out_of_range	This bit is set if any of the manual override variables are out of range.
dev_type.pump_ctrl.local_control	Hardware override (push buttons, external STOP or R100).
dev_type.pump_ctrl.running	The pump is running.
dev_type.pump_ctrl.remote_press	The pump is using network pressure sensor.
dev_type.pump_ctrl.remote_flow	The pump is using network flow sensor.
dev_type.pump_ctrl.remote_temp	Not supported for MAGNA-LON.

When transmitted

This value is transmitted immediately when its state has changed. 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 property.

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 kilo Pascal (0.1 kPa). The value 0x7FFF represents invalid data.

When transmitted

This value is transmitted immediately when its value has changed more than 2 KPa.

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).

When transmitted

This value is transmitted immediately when its value has changed more than 0.3 m³/h.

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.

When transmitted

This value is transmitted immediately when its value has changed more than 107 rpm .

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: nviOvdSpeed or nviOvdPress.

Valid range

State	Value	Equivalent percent	Override status
0	0	0	Normal
1	200	100	OVERRIDE
0xFF	n/a	n/a	invalid value

When transmitted

This value is transmitted immediately when its value has changed.

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), (2730 days or 7.67 years).

When transmitted

This value is transmitted immediately when its value has changed.

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 fault can be device fault or can be supply fault.

Valid range

The valid range of SNVT_dev_fault.pump_ctrl, excluding “reserved” fields.

<i>Bit name</i>	<i>Description</i>
dev_type.pump_ctrl.sf_voltage_low	Supply voltage is too low
dev_type.pump_ctrl.sf_voltage_high	Supply voltage is too high
dev_type.pump_ctrl.sf_phase	Power missing phase
dev_type.pump_ctrl.sf_no_fluid	No fluid in pump
dev_type.pump_ctrl.sf_press_low	System pressure is too low
dev_type.pump_ctrl.sf_press_high	System pressure is too high
dev_type.pump_ctrl.df_motor_temp	Motor temperature is too high
dev_type.pump_ctrl.df_motor_failure	Motor has fatal failure
dev_type.pump_ctrl.df_pump_blocked	Pump is blocked
dev_type.pump_ctrl.df_elect_failure_nf	Electronic non fatal failure
dev_type.pump_ctrl.df_elect_failure	Electronic fatal failure
dev_type.pump_ctrl.df_sensor_failure	Sensor failure

The shaded cells are supported by MAGNA-LON.

Additional fault info can be retrieved by using Grundfos remote control R100.

When transmitted

This value is transmitted immediately when one of the states has changed.

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.

Valid range

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

When transmitted

This value is transmitted immediately when its value has changed more than 1 °C.

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.

Valid range

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

When transmitted

This value is transmitted immediately when its value has changed more than 2 W.

Energy consumption

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

This optional output network variable provides the 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 kilo watt hour (1 kWh).

When transmitted

This value is transmitted immediately when its value has changed.

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 expires before the functional block will automatically update the following network variables:

nv3, nvoPumpCapacity

nv4, nvoEffOpMode

nv5, nvoControlMode

nv13, nvoPumpStatus

Valid range

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

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.

Typical default value

The typical default value is 0.0 (no automatic update)

SCPT reference

SCPTmaxSendTime (49)

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).

Valid range

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

Typical default value

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

SCPT reference

SCPT_location (17)

Receive Heartbeat

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

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:

nv10, nviRemotePress

nv11, nviRemoteFlow

Valid range

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

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.

Typical default value

The typical default value is 0.0 (no automatic update)

SCPT reference

SCPTmaxRcvTime (48)

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 or flow 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.

Typical default value

The default control mode for a pump is DCM_PRESS_COMP (value=2).

SCPT reference

SCPTdeviceControlMode (238)

Pump characteristic

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

This read-only configuration property provides the basic characteristic data for the pump. For further technical information refer to the operating instructions of the pump.

Valid range

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

```
typedef struct {
    SNVT_rpm                               SpeedMax
    SNVT_press                             PressMax
    SNVT_flow_p                            FlowMax
}SCPTpumpCharacteristic
```

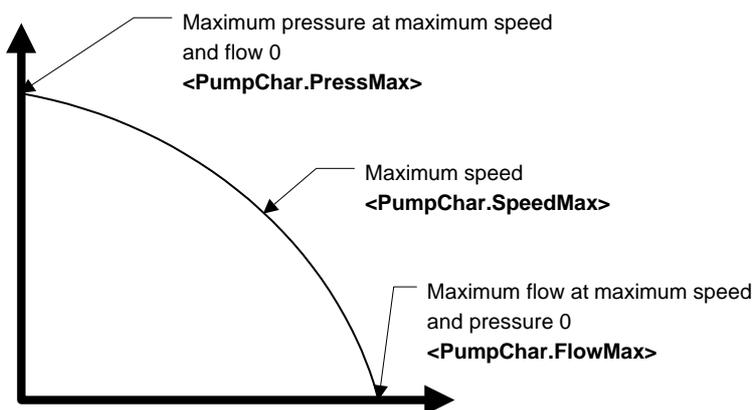


Figure 6

Default value

The configuration property `nroPumpChar` is read only. The Pump Characteristic will be set according to the attached pump.

SCPT reference

SCPTpumpCharacteristic (233)

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 normal 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)

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 minimum value for ranging the remote pressure sensor. Together with nciRemMinPress, these range values replace the normal 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)

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 normal 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)

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 normal 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)

SCPT reference

SCPTmaxRemoteFlowSetpoint (242)

Kp

```
network input config sd_string("&2,i.j.k,0\x80,6") SNVT_multiplier nciKp
```

This input configuration property defines the value of Kp in the PI regulator, used when an external flow or pressure sensor is connected.

Valid range

0 .. 25,4 (0.1). The value 0xFFFF represents invalid data.

Typical default value

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

UCPT reference

UCPT_Kp (6)

Ti

```
network input config sd_string("&2,i.j.k,0\x80,4") SNVT_time_sec nciTi
```

This input configuration property defines the value of Ti in the PI regulator, used when an external flow or pressure sensor is connected.

Valid range

The valid range is 0.0 to 6,553.4 sec (0.1 sec). The value 0xFFFF represents invalid data

Typical default value

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

UCPT reference

UCPT_Ti (4)

Ts

```
network input config sd_string("&2,i.j.k,0\x80,5") SNVT_time_sec nciTs
```

This input configuration property defines the value of Ts in the PI regulator, used when an external flow or pressure sensor is connected.

Valid range

The valid range is 0.0 to 6,553.4 sec (0.1 sec). The value 0xFFFF represents invalid data

Typical default value

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

UCPT reference

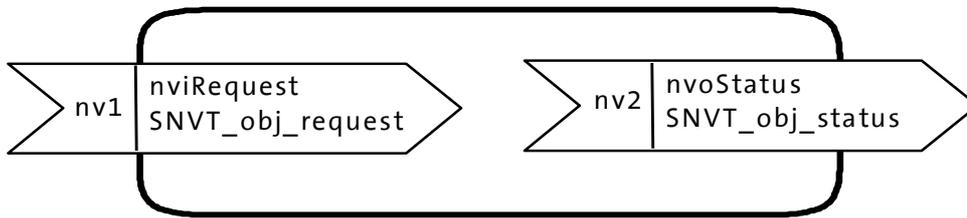


Figure 7

UCPT_Ts (5)

7. Node object

Object request

```
network input sd_string("@0|1") SNVT_obj_request nviRequest
```

This input network variable provides the mechanism to request a particular mode for a particular object within a node.

Valid range

The shaded cells are supported by MAGNA-LON.

0	RQ_NORMAL
1	RQ_DISABLED
2	RQ_UPDATE_STATUS
3	RQ_SELF_TEST
4	RQ_UPDATE_ALARM
5	RQ_REPORT_MASK
6	RQ_OVERRIDE
7	RQ_ENABLE
8	RQ_RMV_OVERRIDE
9	RQ_CLEAR_STATUS
10	RQ_CLEAR_ALARM *)
11	RQ_ALARM_NOTIFY_ENABLED
12	RQ_ALARM_NOTIFY_DISABLED
13	RQ_MANUAL_CTRL
14	RQ_REMOTE_CTRL
15	RQ_PROGRAM
0xFF	RQ_NUL

*) this will reset pump alarms.

Object status

network output sd_string("@0|2") SNVT_obj_status nvoStatus

This output network variable reports the status for any object within a node.

The shaded cells are supported by MAGNA-LON

Status bit	Explanation
invalid_id	Requested ID is not implemented in this node
invalid_request	Request for unimplemented function
disabled	
out_of_limits	
open_circuit	
out_of_service	
mechanical_fault	
feedback_failure	
over_range	
under_range	
electrical_fault	Electrical fault detected in pump
unable_to_measure	The MAGNA-LON add on module is not properly connected, more information might be retrieved using GRUNDFOS R100.
comm_failure	
failure	
fail_self_test	
self_test_in_progress	
locked_out	
manual_control	MAGNA-LON add on module is not able to control the pump (Pump is in Hardware override) equal to nvoPumpStatus bit8 and nvoEffOpmode = HVAC_OFF, may be caused by pump STOP on push buttons, or from R100
in_alarm	Pump has an alarm
in_override	MAGNA-LON is in manual override equal to nvoPumpOverride
report_mask	Node is reporting mask
programming_mode	
programming_fail	
alarm_notify_disabled	

8. Manufacture specific variables

Grundfos command

```
network input UNVT_GF_cmd nviGrundfosCmd
```

This manufacturer specific input network variable provides the mechanism to request a particular information string from Grundfos products. This string contains information about node software version and date, which can be used when downloading new software to the node. The result from this command can be seen in nvoGrundfosInfo.

Valid range

0	GF_NO_CMD	no command
1	GF_PRODUCT_VER	product version
2	GF_PRODUCT_INFO	product_info
3	GF_SOFTWARE_VERSION	the current software version
4	GF_SOFTWARE_DATE	software date
5	GF_SOFTWARE_DEVELOPERS	Initials for software developers

Grundfos info

```
network output SNVT_str_asc nvoGrundfosInfo
```

This manufacturer specific output network variable provides the mechanism to get a information string from Grundfos products. This string contains information about node software version and date, which can be used when downloading new software to the node. This string is the result from nviGrundfosCmd.

Valid range

Any NULL terminated ASCII string of 31 bytes total length.

9. Device resource files

MAGNA-LON contains UNVTs and UCPT's (User Network Variable Types), therefore Grundfos is supplying DRF (Device Resource Files). If the DRFs are used, the right formatting and type-definition will be achieved.

The DRFs can be found on the same disk as this document. The files can be installed by copying the files to e.g. C:\LONWORKS\TYPES\USER\GRUNDFOS\ then use the program ldrfcac.exe to add the files. For further information about how to install DRFs please look in Echelon documentation.

The following UNVTs and UCPTs are supported in the DRfiles:

```
UNVT_dev_c_mode  
UNVT_flow_p  
UNVT_ManufSetLim  
UNVT_PumpChar  
UNVT_GF_cmd  
UCPT_Kp  
UCPT_Ts  
UCPT_Ti
```

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