

# LONworks for Grundfos pumps

CIM/CIU 100

Functional profile and user manual



## English (GB) Functional profile and user manual

## Original functional profile and user manual.

## CONTENTS

	Page		
<b>1. Symbols used in this document</b>	<b>2</b>	<b>11.38 Control mode for normal operation</b>	<b>31</b>
<b>2. Introduction</b>	<b>3</b>	<b>11.39 Maximum flow limit</b>	<b>31</b>
2.1 About this functional profile	3	<b>11.40 Pump characteristic</b>	<b>32</b>
2.2 Assumptions	3	<b>11.41 Remote pressure-sensor minimum value</b>	<b>32</b>
2.3 Definitions and abbreviations	3	<b>11.42 Remote pressure-sensor maximum value</b>	<b>32</b>
2.4 System diagram	3	<b>11.43 Remote flow-sensor minimum value</b>	<b>33</b>
<b>3. Installation</b>	<b>4</b>	<b>11.44 Remote flow-sensor maximum value</b>	<b>33</b>
<b>4. CIM 100 LON module</b>	<b>5</b>	<b>11.45 Kp</b>	<b>33</b>
4.1 Connecting the LON module	5	<b>11.46 Ti</b>	<b>33</b>
4.2 Registration in a LON network	6	<b>11.47 Ts</b>	<b>33</b>
4.3 LEDs	6	<b>12. Node object functional block details</b>	<b>34</b>
<b>5. Considerations when installing the E-pump or Hydro Multi-E</b>	<b>7</b>	12.1 Object request	34
<b>6. Power-on behaviour</b>	<b>8</b>	12.2 Object status	34
<b>7. SNVT/UNVT details</b>	<b>9</b>	12.3 Location label	34
7.1 Network variable inputs	9	<b>13. Manufacturer-specific variables</b>	<b>35</b>
7.2 Network variable outputs	9	13.1 Grundfos command	35
7.3 Manufacturer-defined network variables	9	13.2 Grundfos info	35
<b>8. SCPT/UCPT details</b>	<b>10</b>	<b>14. Product-specific network variables</b>	<b>36</b>
8.1 Configuration properties	10	<b>15. Fitting a sensor</b>	<b>38</b>
<b>9. Application examples</b>	<b>11</b>	<b>16. Device resource files</b>	<b>39</b>
9.1 Complete LON-based system	11	<b>17. Fault finding</b>	<b>40</b>
9.2 Control with combined LON/AO/DO	12		
9.3 Twin-head pump functionality with LON module and two single pumps	13		
9.4 Twin-head pump functionality with two LON modules and one twin-head pump	13		
<b>10. Override functionality</b>	<b>14</b>		
<b>11. Pump controller functional block details</b>	<b>15</b>		
11.1 Pump setpoint	17		
11.2 Requested pump operating mode	18		
11.3 Pump capacity	18		
11.4 Actual setpoint	19		
11.5 Effective operating mode	19		
11.6 Effective device control mode	20		
11.7 Pump override stop command	22		
11.8 Override speed setpoint	22		
11.9 Override pressure setpoint	22		
11.10 Remote pressure sensor input	23		
11.11 Remote flow sensor input	24		
11.12 Pump status, diagnostic information	25		
11.13 Pump pressure	25		
11.14 Pump inlet pressure	25		
11.15 Remote pressure	25		
11.16 Pump flow (standard range)	26		
11.17 Pump flow (extended range)	26		
11.18 Remote flow	26		
11.19 Pump speed	26		
11.20 Pump override active	26		
11.21 Runtime	27		
11.22 Total ontime	27		
11.23 Pump fault status	27		
11.24 Heat energy metering	27		
11.25 Alarm code	29		
11.26 Warning code	29		
11.27 Liquid temperature	29		
11.28 Remote temperature 1	29		
11.29 Remote temperature 2	30		
11.30 Tank level	30		
11.31 Auxiliary sensor input	30		
11.32 Power consumption in watts	30		
11.33 Power consumption in kilowatts	30		
11.34 Energy consumption (standard range)	30		
11.35 Energy consumption (extended range)	30		
11.36 Send heartbeat	31		
11.37 Receive heartbeat	31		

## 1. Symbols used in this document

**Caution** *If these safety instructions are not observed, it may result in malfunction or damage to the equipment.*

**Note** *Notes or instructions that make the job easier and ensure safe operation.*

## 2. Introduction

### 2.1 About this functional profile

This functional profile describes the CIM 100 (LON Communication Interface Module 100) and the CIU 100 (LON Communication Interface Unit 100) for the following Grundfos E-pumps and Hydro Multi-E:

- UPE Series 2000
- GRUNDFOS MAGNA/MAGNA3
- TPE Series 1000/2000
- CRE/CRNE/CRIE
- NBE
- NKE
- CHIE
- MTRE
- CUE
- Hydro Multi-E.

References in the following:

- The CIM 100 is referred to as "LON module".
- The CIU unit is referred to as "LON unit".
- The E-pumps, CUE, Hydro Multi-E, GRUNDFOS MAGNA and MAGNA3 are referred to as "E-Pump".

#### Note

**TPED twin-head pump based on MGE motor, model H/I, in multipump mode requires a CIM 110 mounted in the master head.**

The data in this document are subject to change without prior notice. Grundfos cannot be held responsible for any problems caused directly or indirectly by using information in this functional profile.

### 2.2 Assumptions

This functional profile assumes that the reader is familiar with commissioning and programming LON devices. The reader should also have some basic knowledge of the anatomy of LON data communication.

### 2.3 Definitions and abbreviations

CIM 100	Communication Interface Module 100
CIU 100	Communication Interface Unit 100
CP	Configuration Properties
DRF	Device Resource Files
GENIbus	Proprietary Grundfos fieldbus standard
H	Head (pressure)
LED	Light-Emitting Diode
LON	Local Operating Network
nci	Network configuration property input
nro	Read-only configuration property
nv	Network variable
nvi	Network variable input
nvo	Network variable output
Q	Flow rate
R100	Grundfos remote control
SCPT	Standard Configuration Property Type
SNVT	Standard Network Variable Type
UCPT	User-defined Configuration Property Type
UFPT	User-defined Functional Profile Type
UNVT	User-defined Network Variable Type

### 2.4 System diagram

The system diagram gives an overview of how to connect the CIM 100/CIU 100 to the E-pump that is to be connected to a LON network.

#### CIM 100

The CIM 100 solution is an add-on communication module that is to be fitted in a Grundfos pump, using a 10-pin connection. In this setup, the pump will supply power to the CIM 100. See fig. 1.

#### CIU 100

The CIU 100 solution is a box with a power supply module and a CIM 100 LON module. It can either be mounted on a DIN rail or on a wall. See fig. 2.

This solution is used for Grundfos Hydro Multi-E and E-pumps that do not support an internal, add-on communication module (CIM 100). The enclosure class is IP54.

**Pump with built-in CIM 100**



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**Fig. 1** Example of CIM 100 solution

**Pump object**



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**Fig. 2** Example of CIU 100 solution

### 3. Installation

The LON module is programmed on delivery. This means that the application program will start when the power supply is switched on.

The customer has to install the network, including assignment of module addresses, and make the required bindings.

## 4. CIM 100 LON module

The LON module is designed using an FT 3150 neuron transceiver, an FT-X1 transformer and a 64 Kbyte flash memory which enables updating of software.

This functional profile is compliant with version 1.0 of "Pump Controller Object" from LonMark International.

The LON module has been certified to adhere to LonMark Application Layer interoperability guidelines 3.4.

Self-documentation strings are used. This means that an installation tool can access the relevant information via the network.

The XIF file can be found on the CD-ROM with this functional profile.

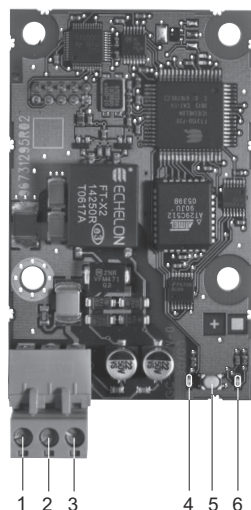


Fig. 3 CIM 100 LON module

Pos.	Designation	Description
1	A	LON terminal A
2	B	LON terminal B
3	Screen	LON terminal for cable screen
4	LED1	Yellow service LED
5	Pin	Service pin (push-button)
6	LED2	Red/green status LED for internal communication between the CIM 100 and the E-pump

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## 4.1 Connecting the LON module

We recommend using a screened cable.

A LON network must be terminated. The termination depends on the network topology chosen.

### Fitting the cable

Procedure:

See fig. 4.

1. Connect the conductors to terminal A (pos. 1).
2. Connect the conductors to terminal B (pos. 2).
3. Connect the twisted screen ends to terminal "Screen" (pos. 3).

**The screen must only be connected to the screen terminal of the CIM 100 LON module. See fig. 4, pos. 3.**

**The cable screen must never be connected to earth via the earth clamp. See fig. 4, pos. 4.**

**The stripped part of the cable screen must be as short as possible to reduce the impedance at high frequencies.**

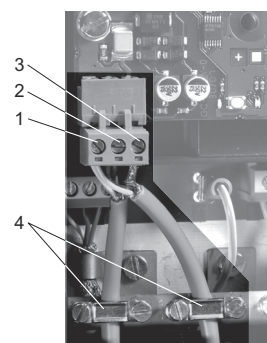


Fig. 4 Connecting the LON module

Pos.	Description
1	LON terminal A
2	LON terminal B
3	LON terminal for cable screen
4	Earth clamp

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## 4.2 Registration in a LON network

E-pumps with a CIM 100 LON module are registered by a LON network in one of these ways:

- Service pin
- Bar code label.

### Service pin

When the service pin push-button of the module is activated, the module will send a unique 48 bit ID code (Neuron ID) which is registered in the LON network. See fig. 5.



Fig. 5 Service pin

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### Bar code label

The Neuron ID on the module or on the enclosed bar code label is scanned and registered in the LON network. The bar code of the Neuron ID is in Code 128 format. The additional bar code label can be attached to the building installation plan.

## 4.3 LEDs

The CIM 100 LON module has two LEDs. See fig. 3.

- Yellow service LED (LED1)
- Red/green status LED (LED2) for internal communication between the CIM 100 and the E-pump.

### 4.3.1 LED1

The yellow LED on the CIM 100 functions as a service LED. When the E-pump is connected to the power supply, the service LED will flash once and then remain off if the installation has been made correctly. In case of deviations, see section 17. *Fault finding* and Echelon documentation.

The WINK command is supported by the LON module.

When the LON module receives a WINK command, the service LED (LED1) will flash five times with 2-second intervals and a duty cycle of 50 %. After five flashes, the service LED (LED1) goes out. See fig. 6.

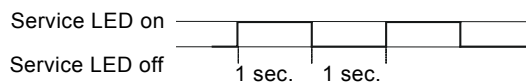


Fig. 6 Flashing pattern

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This flashing pattern must not be confused with the flashing pattern of an unconfigured device which will flash with 1-second intervals and a duty cycle of 50 %.

In a standard installation, the service LED (LED1) is permanently off.

The use of a WINK command does not affect the operation of the LON module in any way.

### 4.3.2 LED2

Status	Description
Off.	The CIM 100 has been switched off.
Flashing red.	No internal communication between the CIM 100 and the E-pump.
Permanently red.	The CIM 100 does not support the connected E-pump.
Permanently green.	Internal communication between the CIM 100, and the E-pump is OK.

## 5. Considerations when installing the E-pump or Hydro Multi-E

Flow has duplicate readouts (nvoFlow, nvoFlowF). Both NVOs are active at all times.

For an E-pump with a maximum flow higher than 650 m<sup>3</sup>/h, the nvoFlow will display the invalid value (655.35 m<sup>3</sup>/h, 0xFFFF) for pump flows above this limit.

At the time of installation, it should be determined which of the flow NVOs to monitor.

For an E-pump with a maximum flow higher than 650 m<sup>3</sup>/h, nvoFlowF should be used.

For an E-pump with a maximum flow lower than 650 m<sup>3</sup>/h, nvoFlow should be used as it offers a higher resolution.

See description of the NVOs in section [11. Pump controller functional block details](#).

For further details about the configuration, see the documentation for the relevant E-pump.



## 6. Power-on behaviour

A Grundfos LON module is designed to run with the following LON configuration:

- Node ID: 1
- Subnet ID: 1
- Domain ID: 00:00:00:00:00:00 (6 bytes).

The LON module will immediately start operating with these settings on the LON network when the power supply is first switched on. These settings can be changed with an installation tool (not supplied by Grundfos).

If the LON module is switched off and on (power cycle), the actual NV values in the LON module will be lost and reset to their default values. The NV default values can be found in section [11. Pump controller functional block details](#).

CP values are preserved in the LON module over power cycles.

When switched on, the LON module will apply control mode as per the value of the CP nciControlMode. No other operation of the E-pump is applied until an update of any of the following NVs is received via the LON network:

- nviPumpSetpoint
- nviPumpOpMode
- nviOvdStop
- nviOvdPress
- nviOvdSpeed.

When an update is received, the LON module will start operating the E-pump.

The LON module will poll the following NVs immediately after power-on (if they are bound):

- nviPumpSetpoint
- nviPumpOpMode.

The LON module will continue to poll these NVs with 10-second intervals (if they are bound) until an update of any of the following NVs is received via the LON network:

- nviPumpSetpoint
- nviPumpOpMode
- nviOvdStop
- nviOvdPress
- nviOvdSpeed.



## 7. SNVT/UNVT details

Network variables of the node object are described in section [12. Node object functional block details](#).

### 7.1 Network variable inputs

NV #	Name	SNVT type	SNVT index	Description
1	nviPumpSetpoint	SNVT_switch	95	Setpoint for normal operation
2	nviPumpOpMode	SNVT_hvac_mode	108	Requested operating mode
6	nviPumpOvdStop	SNVT_switch	95	Pump override stop command
7	nviOvdSpeed	SNVT_lev_percent	81	Override speed setpoint
8	nviOvdPress	SNVT_press	30	Override pressure setpoint
10	nviRemotePress	SNVT_press	30	Sensor input, remote differential-pressure sensor
11	nviRemoteFlow	SNVT_flow_p	161	Sensor input, remote flow sensor

### 7.2 Network variable outputs

NV #	Name	Send heartbeat	SNVT type	SNVT index	Description
3	nvoPumpCapacity	Yes	SNVT_lev_percent	81	Pump capacity as percent of maximum
4	nvoEffOpMode	Yes	SNVT_hvac_mode	108	Effective operating mode
5	nvoControlMode	Yes	SNVT_dev_c_mode	162	Effective device control mode
13	nvoPumpStatus	Yes	SNVT_dev_status	173	Pump status, diagnostic information
14	nvoPressure	No	SNVT_press	30	Pump pressure
15	nvoFlow	No	SNVT_flow_p	161	Pump flow
16	nvoSpeed	No	SNVT_rpm	102	Pump speed
17	nvoPumpOverride	No	SNVT_switch	95	Pump override active
18	nvoRuntime	No	SNVT_time_hour	124	Operating hours
19	nvoPumpFault	No	SNVT_dev_fault	174	Fault status
21	nvoFluidTemp	No	SNVT_temp_p	105	Liquid temperature
22	nvoPower	No	SNVT_power	27	Electrical power consumption in watt
23	nvoPowerK	No	SNVT_power_kilo	28	Electrical power consumption in kilowatt
24	nvoEnergyConsum	No	SNVT_elec_kwh	13	Total pump energy consumption

Note

**NV # number is according to *SFPTpumpController*.**

### 7.3 Manufacturer-defined network variables

Name	SNVT type	SNVT index	Description
nvoFlowF	SNVT_flow_f	53	Flow (floating point)
nvoRemoteFlow	SNVT_flow_f	53	Remote flow (floating point)
nvoRemotePress	SNVT_press	30	Remote pressure
nvoRemoteTemp	SNVT_temp	105	Remote temperature 1
nvoRemoteTemp2	SNVT_temp	105	Remote temperature 2
nvoEnergyConsumL	SNVT_elec_kwh_l	146	Energy consumption
nvoInletPressure	SNVT_press	30	Inlet pressure
nvoLevel	SNVT_length_f	54	Tank level
nvoAuxSensor	SNVT_lev_percent	81	Actual setpoint in %
nvoTotalOnTime	SNVT_time_hour	124	Total power-on time
nvoAlarmCode	SNVT_cont	8	Current system alarm code
nvoWarningCode	SNVT_cont	8	Current system warning code
nviGrundfosCmd	UNVT_GF_cmd		Request for sw/hw version
nvoGrundfosInfo	SNVT_str_asc	36	Sw/hw version according to nviGrundfosCmd
nvoPumpStatusOld	SNVT_state	83	Duplicate of nvoPumpStatus
nvoPumpFaultOld	SNVT_state	83	Duplicate of nvoPumpFault
nvoHeatEnergyCnt	SNVT_elec_kwh	146	Accumulated heat energy in total pump life time
nvoHeatPower	SNVT_power_kilo	28	Current heat power
nvoHeatTempDiff	SNVT_temp_p	105	Diff. temperature between forward and return pipes

## 8. SCPT/UCPT details

### 8.1 Configuration properties

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 will elapse before the functional block automatically updates the associated network variables.
SCPTpumpCharacteristic nroPumpChar (structure)	233	Entire functional block	Maximum flow, maximum pressure and maximum speed of the pump define the pump characteristics.
SCPTlocation nciLocation SNVT_str_asc (36)	17	Entire functional block	Used to provide physical location of the device.
SCPTmaxFlowSetpoint nciFlowHighLim SNVT_flow_p (161)	237	Entire functional block	Used to limit the flow.
SCPTdeviceControlMode nciControlMode SNVT_dec_c_mode (162)	238	Entire functional block	Control mode for normal operation.
UCPT_Kp nciKp SNVT_multiplier (82)		Entire functional block	Gain for PI controller.
UCPT_Ti nciT SNVT_time_sec (107)		Entire functional block	Integral time for PI controller.
UCPT_Ts nciT SNVT_time_sec (107)		Entire functional block	Sample time for PI controller.

## 9. Application examples

### 9.1 Complete LON-based system

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 operating in PRESS\_COMP control mode. The pump will automatically lower the pressure setpoint in proportion to the system flow. The unit changes the pump to minimum mode during the night via `nviPumpOpMode` and receives status of the pump operating mode from `nvoEffOpMode`. The HVAC unit uses `nvoPumpStatus` to retrieve status information from the pump. The controller can use this information to check pump faults and hardware overrides and whether the pump is running or not.

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

The example also shows a local control and monitoring panel. Via this panel, the pump fault status as well as the pump flow and pressure can be viewed. Via this local control panel, it is possible to allocate a pressure setpoint to the pump. The pump will maintain a constant pressure which will override the HVAC unit.

The whole system is monitored via a main system.

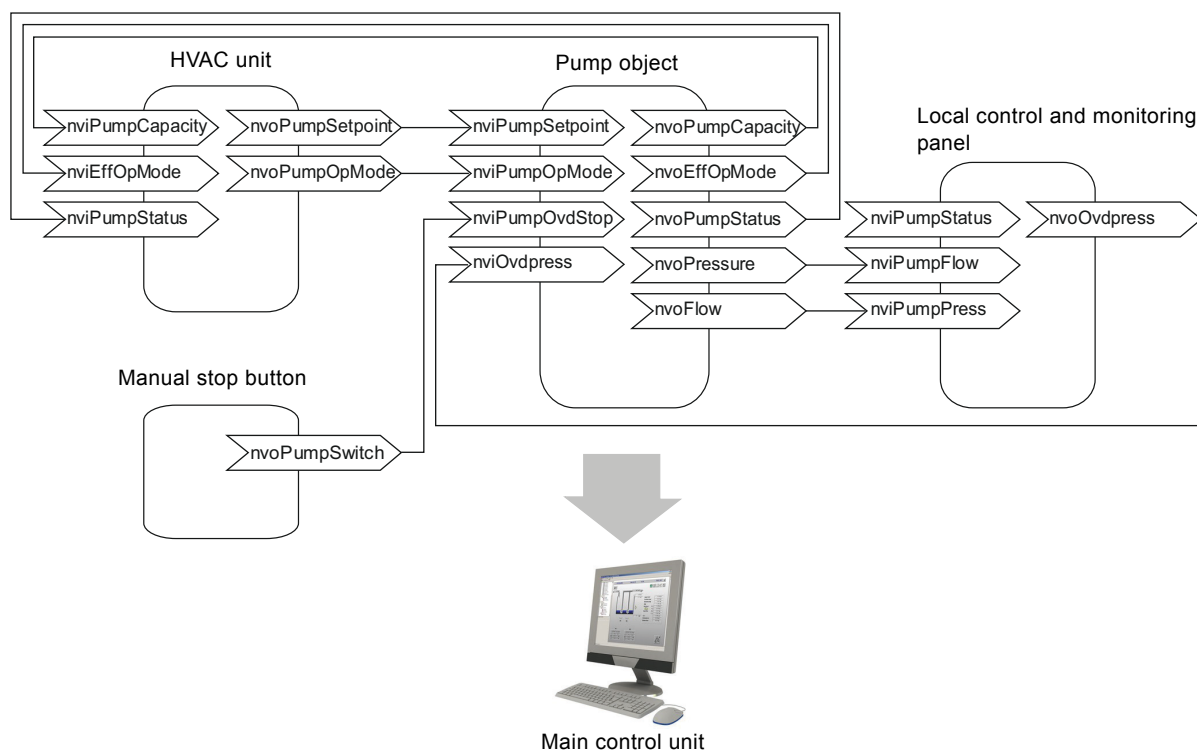
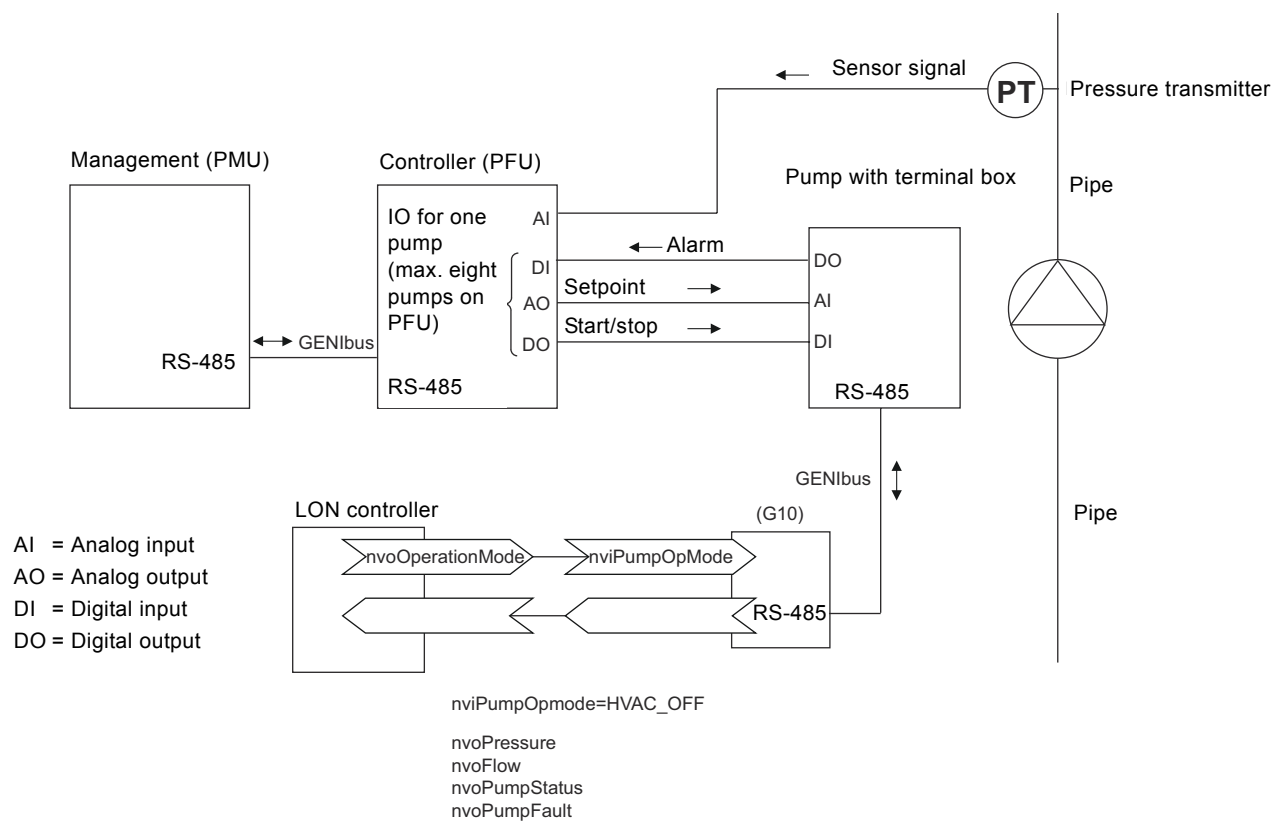


Fig. 7 LON-based control system

## 9.2 Control with combined LON/AO/DO

It is possible to control the pump via analog and digital outputs (AO/DO), e.g. when using the Grundfos PMU 2000 / PFU 2000, and to combine this with the monitoring features of a LON system.



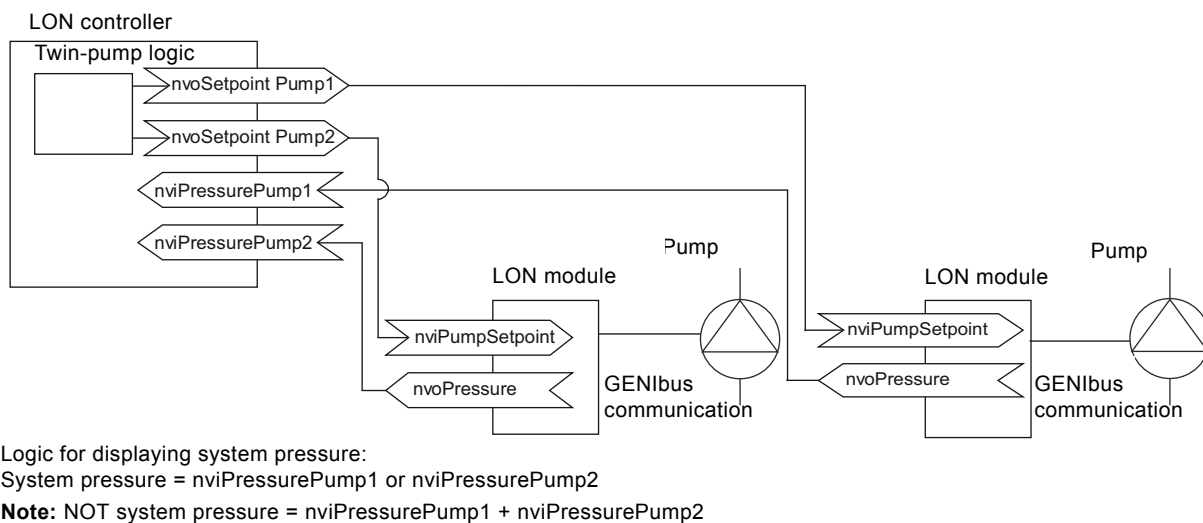
**Fig. 8** Control with combined LON/AO/DO

The LON controller forces the pump to "local control" by setting `nviPumpOpMode` to `HVAC_OFF`. In this way, the pump can be controlled via the analog and digital inputs (AI/DI) on the pump if it has been set up to do so with the Grundfos R100 remote control.

Pump status as well as pressure and flow readings can still be obtained via LON.

### 9.3 Twin-head pump functionality with LON module and two single pumps

With the LON module, it is possible to use a twin-head pump setup for two single pumps as shown in fig. 9.

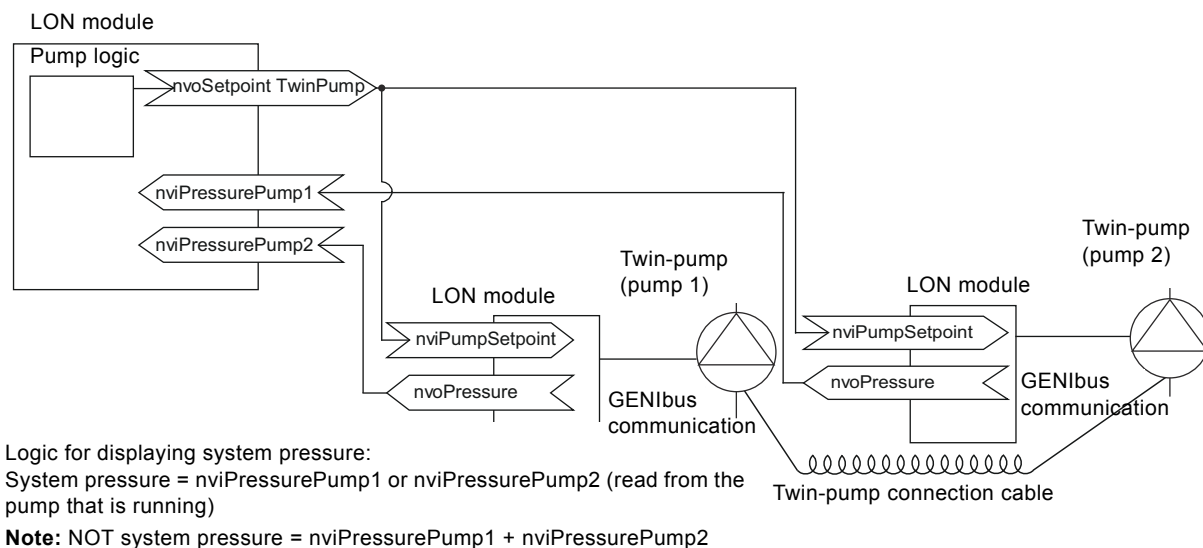


**Fig. 9** Twin-head pump setup with LON module

The LON controller must handle all twin-head pump functionality (alternating or standby duty) and control the pumps as required.

### 9.4 Twin-head pump functionality with two LON modules and one twin-head pump

With two LON modules, it is possible to use a "real" twin-head pump as shown in fig. 10.



**Fig. 10** Twin-head pump setup with LON control

The LON controller must handle the twin-head pump as a normal pump. The setpoint output of the LON controller shall be bound to both LON modules controlling the two pump heads of the twin-head pump.

The twin-head pump will handle all twin-head pump functionality itself. Both heads of the twin-head pump will receive the setpoint via LON. The active pump head will react to the received setpoint.

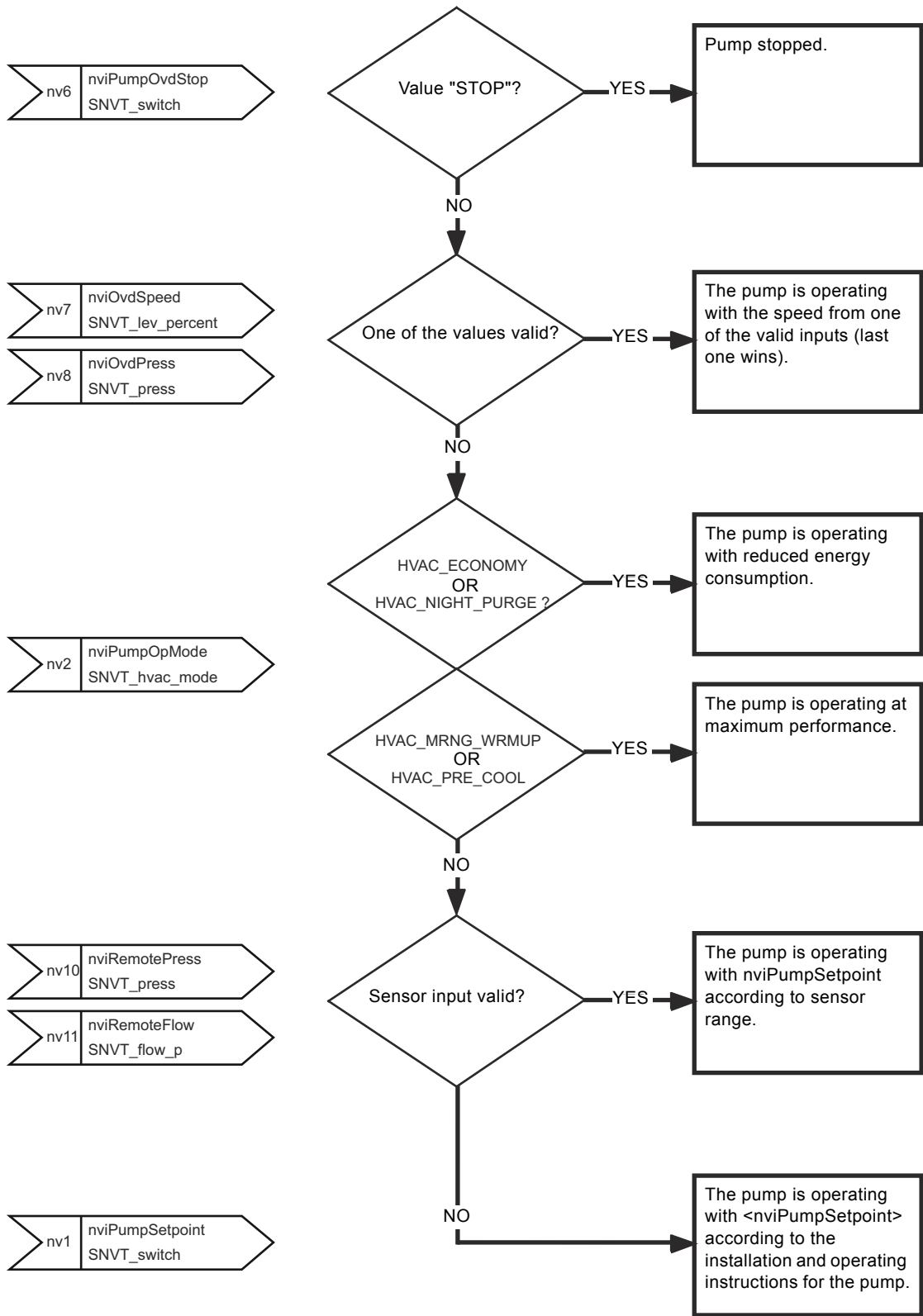
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10. Override functionality

The pump controller profile includes network variable inputs to manually override the operation of the pump. A valid value on any of these variable inputs changes the pump to override mode.

The pump will not return to normal setpoint control until all manual override inputs are invalid. The override priority can be seen in fig. 11.



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Fig. 11 Override functionality

## 11. Pump controller functional block details

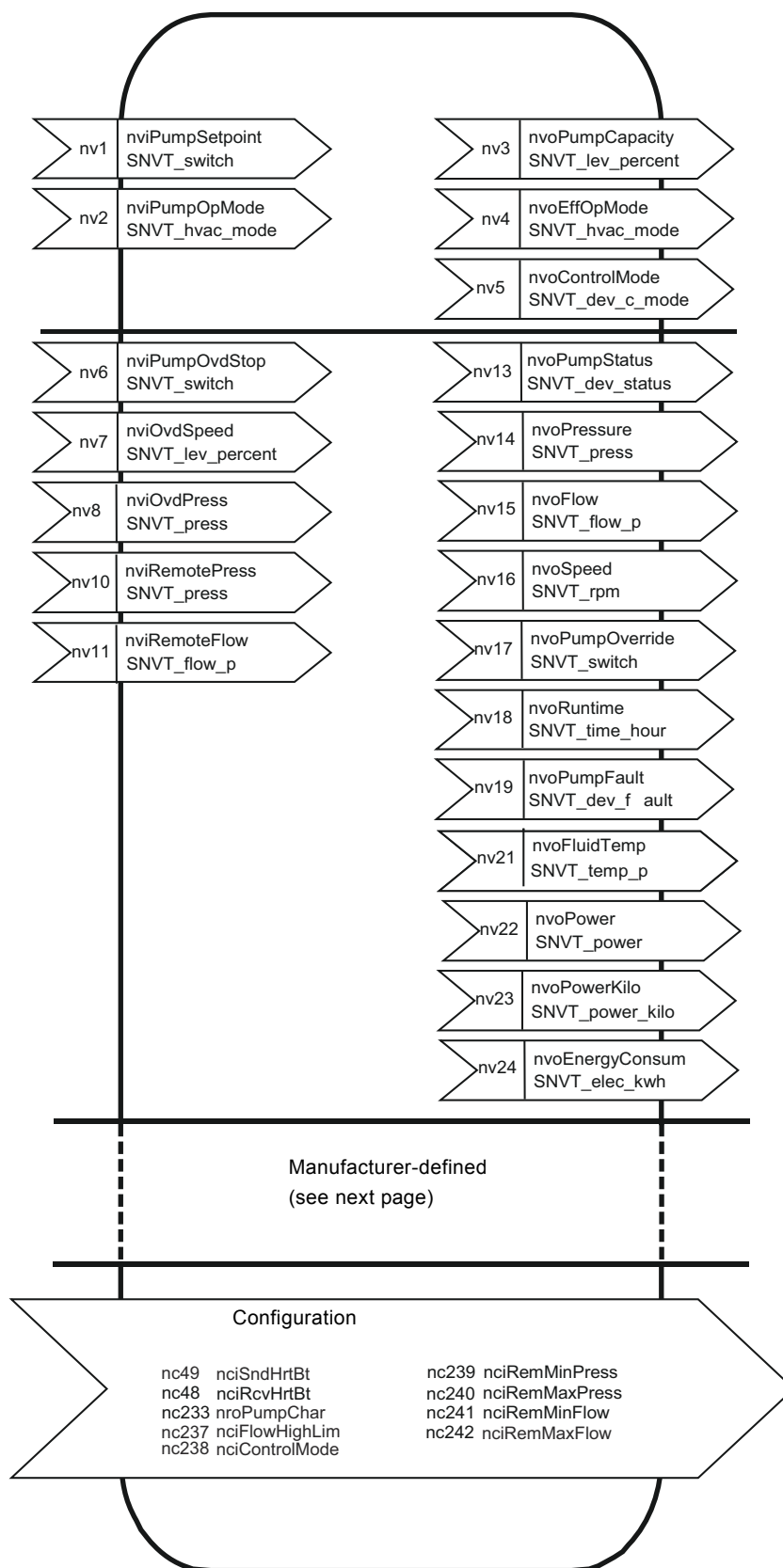
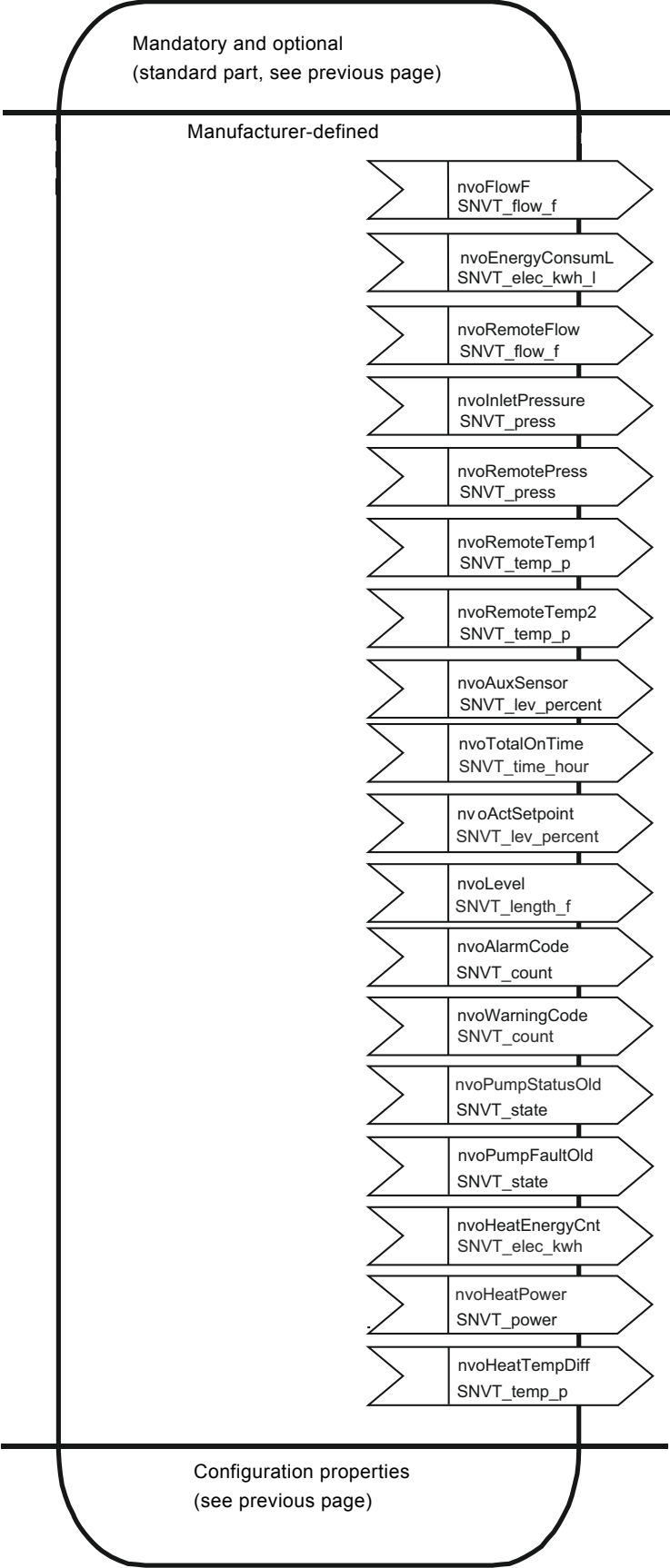


Fig. 12 Pump controller (standard part)





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Fig. 13 Pump controller (manufacturer-defined part)

## 11.1 Pump setpoint

network input SNVT\_switch nviPumpSetpoint;

This network variable input 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, pump pressure or pump flow, depending on the effective operating mode of the pump (nvoControlMode).

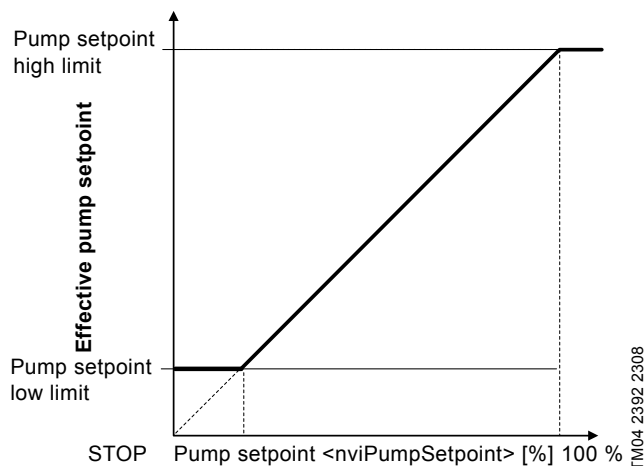


Fig. 14 Effective setpoint for closed-loop operation

$$X @ \frac{\text{Pump setpoint low limit}}{\text{Pump setpoint high limit}} \times 100 \%$$

or

$$X @ \frac{\text{Remote sensor low value}}{\text{Remote sensor high value}} \times 100 \%$$

### Example

If the control mode is constant pressure (nvoControlMode = DCM\_PRESS\_CONST), and the setpoint limits for this control mode are 10 kPa and 100 kPa, "X" can be calculated to 10 %. This means that a setpoint value of 1 to 10 % provides a setpoint of 10 kPa (0 % stops the pump). A setpoint value of 11 to 100 % provides a setpoint of 11 to 100 kPa.

### Valid range

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 %	Pump speed #1
1	1 + (1/n) 200 to (2/n) 200	0.5 % + (1/n) 100 % to (2/n) 100 %	Pump speed #2
1	1 + ((m-1)/n) 200 to (m/n) 200	0.5 % + ((m-1)/n) 100 % to (m/n) 100 %	Pump speed #m
1	1 + ((n-1)/n) 200 to 200	0.5 % + ((n-1)/n) 100 % to 100 %	Pump speed #n

### For variable-speed pumps

State	Value	Equivalent percent	Requested speed
0		n/a	STOP
1	0	0 %	STOP
1	1 to 200	0.5 to 100 %	0.5 to 100 %
1	201 to 255	100 %	100 %

### Default value

The pump will poll this network variable after power-up (if bound) to ensure a correct startup value. It will keep polling the bound remote device with 10-second intervals until a valid value is received in any of the following network variables: nviPumpSetpoint, nviPumpOpMode, nviOvdPress, nviOvdSpeed, nviPumpOvdStop.

After power-up, a TPE Series 1000/2000 or CRE pump will operate with the setpoint (and operating mode) of the local settings of the pump until a valid input is given to any of the following network variables: nviPumpSetpoint, nviPumpOpMode, nviOvdPress, nviOvdSpeed, nviPumpOvdStop.

After power-up, a GRUNDFOS MAGNA or UPE Series 2000 pump will operate with the setpoint (and operating mode) of the remote settings of the pump until a valid input is given to any of the following network variables: nviPumpSetpoint, nviPumpOpMode, nviOvdPress, nviOvdSpeed, nviPumpOvdStop. The default value for nviPumpSetpoint is State = 0, Value = 0.0.

### Product availability

For product availability, see overview on page 36.

## 11.2 Requested pump operating mode

network input SNVT\_hvac\_mode nviPumpOpMode;

This network variable input is typically used by a supervisory controller to override the pump controller operating mode. If the requested mode 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 nviPumpSetpoint defines the setpoint of the pump.

When the mode is HVAC\_MRNG\_WRMUP or HVAC\_PRE\_COOL, the pump operates at maximum capacity.

To save energy during the night, in the summer or under low-load conditions, the mode HVAC\_ECONOMY or HVAC\_NIGHT\_PURGE can be used. In this mode, the pump operates at minimum capacity.

### Valid range

Value	Identifier	Description
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 has been set to local mode via the network. In this mode, it cannot be controlled via the network, but it will continue to monitor its outputs.
13	HVAC_ECONOMY	Energy saving: minimum-capacity mode.
-1 (0xFF)	HVAC_NUL	Invalid value.

The LON module will poll this network variable after power-up (if bound) to ensure a correct startup value. It will keep polling the bound remote device with 10-second intervals until a valid value is received in any of the following network variables: nviPumpSetpoint, nviPumpOpMode, nviOvdPress, nviOvdSpeed, nviPumpOvdStop.

After power-up, the pump will operate with the operating mode (and setpoint) of the local settings of the pump until a valid input is given to any of the following network variables: nviPumpSetpoint, nviPumpOpMode, nviOvdPress, nviOvdSpeed, nviPumpOvdStop.

### Default value

The default value for nviPumpOpMode is HVAC\_AUTO.

### Product availability

For product availability, see overview on page 36.

## 11.3 Pump capacity

network output SNVT\_lev\_percent nvoPumpCapacity;

This network variable output 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 to 163.830 % (0.005 % or 50 ppm).

The value of 0x7FFF (163.835 %) represents invalid data and indicates that the capacity cannot be estimated.

### When transmitted

This value is transmitted immediately when it has changed more than 0.5 % for nvoControlMode = DCM\_SPEED\_CONST or more than 2 % for other values of nvoControlMode.

Additionally, this network variable will be transmitted as a heartbeat output on a regular basis as specified by the maximum send time nciSndHrtBt configuration property.

### Product availability

For product availability, see overview on page 36.

## 11.4 Actual setpoint

network output SNVT\_lev\_percent nvoActSetpoint;

This network variable output provides the actual pump setpoint as a percentage of the effective maximum-setpoint value (pump-specific setpoint high limit). This value makes it possible to monitor the influence that the control algorithm of e.g. proportional-pressure control has on the setpoint.

### Valid range

-163.840 to 163.830 % (0.005 % or 50 ppm).

The value of 0x7FFF (163.835 %) represents invalid data and indicates that the actual setpoint cannot be estimated.

### When transmitted

This value is transmitted immediately when it has changed more than 0.5 %.

### Product availability

For product availability, see overview on page [36](#).

## 11.5 Effective operating mode

network output SNVT\_hvac\_mode nvoEffOpMode;

This network variable output provides the actual pump operating mode.

### Valid range

Value	Identifier	Description
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 has been set to local mode via the network. In this mode, it cannot be controlled via the network, but it 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 it has changed.

Additionally, this network variable will be transmitted as a heartbeat output on a regular basis as specified by the maximum send time nciSndHrtBt configuration property.

### Product availability

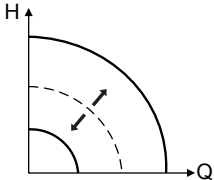
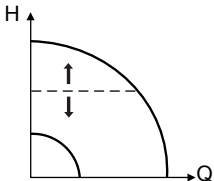
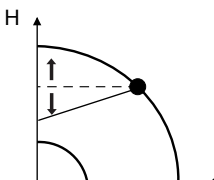
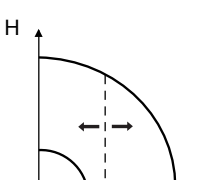
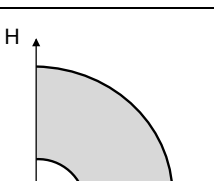
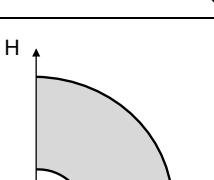
For product availability, see overview on page [36](#).

## 11.6 Effective device control mode

network output SNVT\_dev\_c\_mode nvoControlMode;

This network variable output provides the actual control mode of the pump. The actual control mode is determined by nciControlMode, nviOvdSpeed, nviOvdPress, nviRemotePress or nviRemoteFlow. See fig. 11 in section 10. *Override functionality*.

### Valid range

Control mode	Description		
DCM_SPEED_CONST (0) The pump is operating in open-loop mode.	The E-pump setpoint will be interpreted as percentage of the maximum open-loop performance of the E-pump.		TM04 2289 2308
DCM_PRESS_CONST (1) The pump is operating in constant-pressure mode.	The E-pump setpoint will be interpreted as pressure setpoint. The E-pump will maintain a constant pressure. If the pump is in local operation with a control mode which is not available via the LON, for instance "Constant level", the control mode will be mapped to DCM_PRESS_CONST on the LON. It will only be possible to select these special control modes from the pump display or via remote control when the LON module is in HVAC_OFF mode.		TM04 2290 2308
DCM_PRESS_COMP (2) The pump is operating in compensated-pressure mode.	The E-pump setpoint will be interpreted as basic setpoint for the compensated-pressure mode (the black dot in the drawing). The E-pump will maintain a constant pressure, but automatically lower the actual pressure setpoint dependent on the flow (flow compensation, the straight line in the drawing).		TM04 2291 2308
DCM_FLOW_CONST (3) The pump is operating in constant-flow mode.	The E-pump setpoint will be interpreted as flow setpoint. The E-pump will maintain a constant flow.		TM04 2288 2308
DCM_TEMP_CONST (5) The pump is operating in constant-temperature mode.	The E-pump setpoint will be interpreted as temperature setpoint. The E-pump will maintain a constant temperature.		TM04 2287 2508
DCM_PRESS_AUTO (7) The pump is operating in constant-pressure mode.	In this mode, the setpoint has no effect except for starting and stopping the E-pump. The actual pressure setpoint of the E-pump is chosen and optimised automatically by the E-pump to suit the needs of the installation in the most effective way.		TM04 2287 2508

DCM\_FLOW\_CONST is only available for GRUNDFOS MAGNA pumps with a remote flow sensor connected via the LON network or TPE Series 1000 or CRE pumps with a flow sensor.

DCM\_TEMP\_CONST is only available for TPE Series 1000 or CRE pumps with a temperature sensor and for the MAGNA3 pump.

DCM\_PRESS\_AUTO is not available for all pumps.

For some TPE Series 1000 or CRE pumps, all control modes are not available at the same time. The control mode is determined by the sensor connected to the pump.

Maximum flow limit (nciFlowHighLim) can be enabled for MAGNA3 and TPE 2000 (versions H/I) pumps to limit the flow of the pump.

## Control modes for TPE Series 1000, CRE, CRNE, CRIE, NBE, NKE, CHIE, MTRE, CUE

Sensor type	SPEED_CONST	PRESS_CONST	PRESS_COMP	FLOW_CONST	TEMP_CONST	PRESS_AUTO
Pressure	•	•	-	-	-	-
Flow	•	-	-	•	-	-
Temperature	•	-	-	-	•	-

## Control modes for TPE Series 2000, UPE Series 2000, GRUNDFOS MAGNA

Pump type	SPEED_CONST	PRESS_CONST	PRESS_COMP	FLOW_CONST	TEMP_CONST	PRESS_AUTO
TPE Series 2000	•	•	•	H	H	H
UPE Series 2000	•	•	•	-	-	-
MAGNA	•	•	•	-	3	•
MAGNA with LON pressure sensor	-	•	-	-	-	-
MAGNA with LON flow sensor	-	-	-	•	-	-

3: Only available on MAGNA3.

H: Only available on version H/I and later.

**When transmitted**

This value is transmitted immediately when it has changed.

Additionally, this network variable will be transmitted as a heartbeat output on a regular basis as specified by the maximum send time nciSndHrtBt configuration property.

**Product availability**

For product availability, see overview on page [36](#).

## 11.7 Pump override stop command

```
network input SNVT_switch nviPumpOvdStop;
```

This network variable input provides a manual override function to stop the pump, typically from a supervisory controller. The value of "OVDSTOP" in the table below stops the pump and has a higher priority than the value of the pump setpoint nviPumpSetpoint, the two remote sensor inputs nviRemotePress and nviRemoteFlow, a value on nviPumpOpMode other than HVAC\_AUTO and the two override setpoints nviOvdSpeed and nviOvdPress.

The manual override status of the pump controller is indicated in 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

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

### Product availability

For product availability, see overview on page 36.

## 11.8 Override speed setpoint

```
network input SNVT_lev_percent nviOvdSpeed;
```

This network variable input provides an override request and a speed setpoint, typically from a supervisory controller. 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 current pump setpoint (nviPumpSetpoint or nviOvdPress) will be overridden, and the pump will be controlled according to the given speed setpoint. The pump then operates 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 change the pump back to NORMAL mode. The manual override status of the pump controller is indicated in the nvoPumpOverride network variable. The control flow can be seen from fig. 11.

### Valid range

-163.840 to 163.830 % (0.005 % or 50 ppm).

The value of 0x7FFF (163.835 %) 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

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

### Product availability

For product availability, see overview on page 36.

## 11.9 Override pressure setpoint

```
network input SNVT_press nviOvdPress;
```

This network variable input provides an override request and a pressure setpoint, typically from a supervisory controller. 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 according to the given pressure setpoint. The pump then operates 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 change the pump back to NORMAL mode. The manual override status of the pump controller is indicated in the nvoPumpOverride network variable. The control flow can be seen from fig. 11.

### Valid range

-3,276.8 to 3,276.7 kPa (0.1 kPa).

The value of 0x7FFF (3,276.7 kPa) 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

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

### Product availability

For product availability, see overview on page 36.



## 11.10 Remote pressure sensor input

```
network input SNVT_press nviRemotePress;
```

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

This input will only have effect when the LON module is used with a GRUNDFOS MAGNA pump. For other pump types, this input will be ignored.

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

The `nvoPumpCapacity` 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` variable always indicates the differential pressure across the pump flanges measured or estimated by the pump controller. This may help analysing the behaviour 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: `nciRemMinPress` and `nciRemMaxPress`. These values are used instead of the pump setpoint high- and low-limits.

When using `nviRemotePress`, the internal PI controller of the pump can be adjusted by means of the configuration properties `nciKp`, `nciTl` and `nciTs`. These configuration properties, including `nciRemMinPress` and `nciRemMaxPress`, are associated with the `nviRemotePress` network variable and can be identified by their type in the installation tool. For a description of the individual configuration properties, see section [8.1 Configuration properties](#).

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 has higher priority than the remote-sensor control, and the pump controller will use the internal feedback signals.

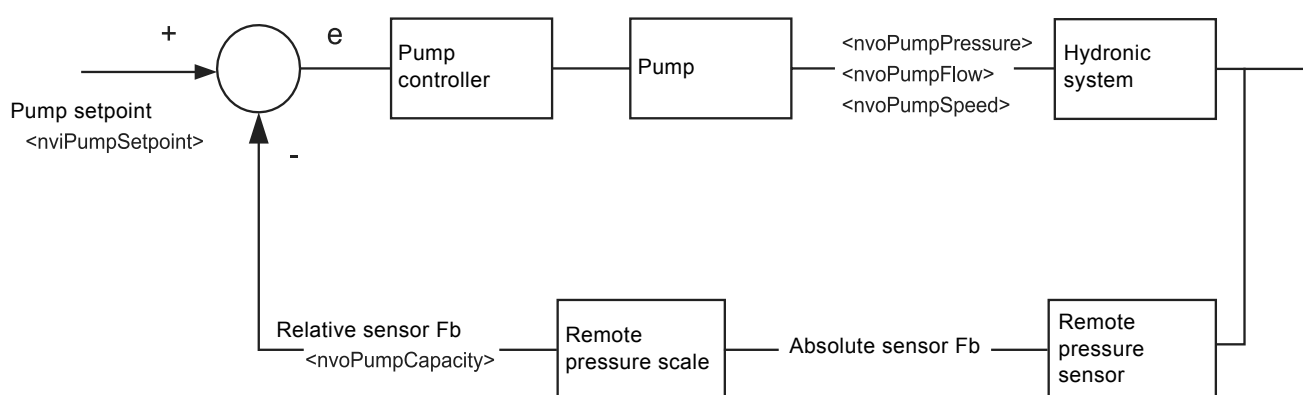


Fig. 15 Block diagram for remote pressure sensor

### Valid range

-3,276.8 to 3,276.7 kPa (0.1 kPa).

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

### Default value

The default value is 0x7FFF (invalid value). The value will be adopted at power-up and if no update is received within the specified "receive heartbeat" time.

### Product availability

For product availability, see overview on page [36](#).

TM04 2320 2508

### 11.11 Remote flow sensor input

```
network input SNVT_flow_p nviRemoteFlow;
```

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

This input will only have effect when the LON module is used with a GRUNDFOS MAGNA pump. For other pump types, this input will be ignored.

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

The `nvoPumpCapacity` 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 analysing the behaviour of the system.

When using `nviRemoteFlow`, the flow setpoint is given by `nviPumpSetpoint`. The ranging of both the setpoint and the feedback is given by the configuration properties: `nciRemMinFlow` and `nciRemMaxFlow`. These values are used instead of the pump setpoint high- and low-limits.

When using `nviRemoteFlow`, the internal PI controller of the pump can be adjusted by means of the configuration properties `nciKp`, `nciTl` and `nciTs`. These configuration properties, including `nciRemMinFlow` and `nciRemMaxFlow`, are associated with the `nviRemoteFlow` network variable and can be identified by their type in the installation tool. For a description of the individual configuration properties, see section [8.1 Configuration properties](#).

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 has higher priority than the remote-sensor control, and the pump controller will use the internal feedback signals.

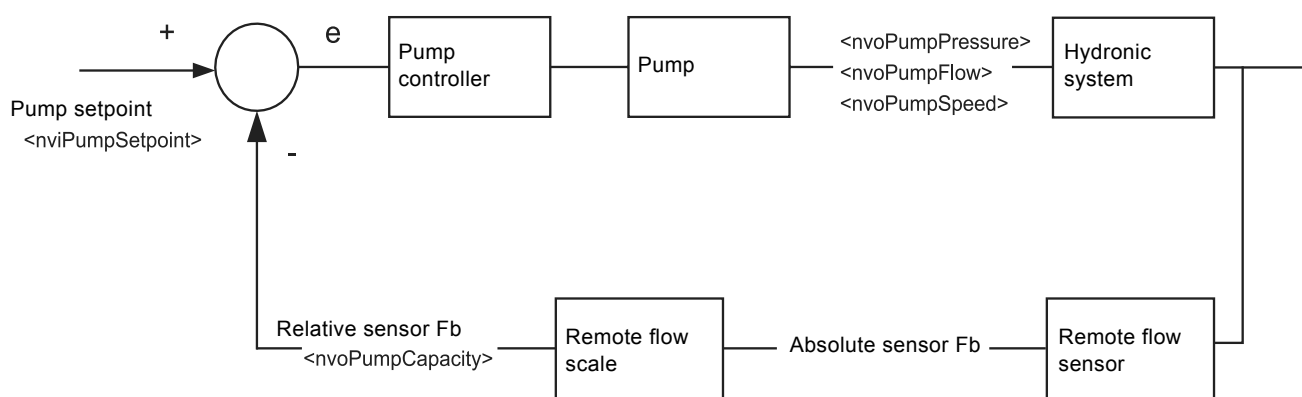


Fig. 16 Block diagram for remote flow sensor

#### Valid range

0 to 655.34 m<sup>3</sup>/h (0.01 m<sup>3</sup>/h).

The value of 0xFFFF (655.35 m<sup>3</sup>/h) represents invalid data and can be interpreted as "not connected".

#### Default value

The default value is 0xFFFF (invalid value). The value will be adopted at power-up and if no update is received within the specified "receive heartbeat" time.

#### Product availability

For product availability, see overview on page [36](#).

## 11.12 Pump status, diagnostic information

```
network output SNVT_dev_status nvoPumpStatus;
```

```
network output SNVT_state nvoPumpStatusOld;
```

This network variable output provides detailed diagnostic information on the status of the pump controller. nvoPumpStatusOld holds information identical to nvoPumpStatus. It is added for backwards compatibility, and we do not recommend it for new designs.

### Valid range

The bits below are supported.

Bit No	Bit name		Description
	nvoPumpStatus	nvoPumpStatusOld	
0	device_fault	Bit 0	A pump-related fault or warning has been detected. See section <a href="#">11.23 Pump fault status</a> for detailed information. Some faults on UPE Series 2000 will be seen in this bit, but will not appear in nvoPumpFault due to their general nature.
1	supply_fault	Bit 1	A system-related fault or warning has been detected. See section <a href="#">11.23 Pump fault status</a> for detailed information.
3	speed_low	Bit 3	The pump is operating at the lowest possible speed. Therefore, the requested performance is not possible.
4	speed_high	Bit 4	The pump is operating at the highest possible speed. Therefore, the requested performance is not possible.
6	setpt_out_of_range	Bit 6	This bit is set if any of the override variables are out of range.
8	local_control	Bit 8	The pump has been set to local mode by hardware override (push-buttons on pump, external STOP or with the R100).
10	running	Bit 10	The pump is running.
12	remote_press	Bit 12	The pump is using network pressure sensor.
13	remote_flow	Bit 13	The pump is using network flow sensor.

### When transmitted

This value is transmitted immediately when it has changed.

Additionally, this network variable will be transmitted as a heartbeat output on a regular basis as specified by the maximum send time nciSndHrtBt configuration property.

### Product availability

For product availability, see overview on page [36](#).

## 11.13 Pump pressure

```
network output SNVT_press nvoPressure;
```

This network variable output provides the pressure across the pump flanges as measured or estimated by the pump.

### Valid range

-3,276.8 to 3,276.7 kPa (0.1 kPa).

The value of 0x7FFF (3,276.7 kPa) represents invalid data and indicates that the pressure cannot be measured/estimated.

### When transmitted

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

### Product availability

For product availability, see overview on page [36](#).

## 11.14 Pump inlet pressure

```
network output SNVT_press nvoInletPressure;
```

This network variable output provides the system inlet pressure as measured by the pump.

If no inlet pressure sensor is available in the system, nvoInletPressure will display the invalid value.

### Valid range

-3,276.8 to 3,276.6 kPa (0.1 kPa).

The value of 0x7FFF (3,276.7 kPa) represents invalid data and indicates that the pressure cannot be measured or that no inlet pressure sensor is connected.

### When transmitted

This value is transmitted immediately when it has changed more than 2 kPa.

### Product availability

For product availability, see overview on page [36](#).

## 11.15 Remote pressure

```
network output SNVT_press nvoRemotePress;
```

This network variable output provides the pressure measured somewhere in the system with a pressure sensor connected to the pump.

### Valid range

-3,276.8 to 3,276.7 kPa (0.1 kPa).

The value of 0x7FFF (3,276.7 kPa) represents invalid data and indicates that the pressure cannot be measured or that no remote pressure sensor is connected.

### When transmitted

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

### Product availability

For product availability, see overview on page [36](#).

### 11.16 Pump flow (standard range)

network output SNVT\_flow\_p nvoFlow;

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

If the maximum pump flow is higher than 650 m<sup>3</sup>/h, nvoFlowF should be used as it offers an extended range.

Section 5. *Considerations when installing the E-pump or Hydro Multi-E* provides more information on the coherence of nvoFlow and nvoFlowF.

#### Valid range

0 to 655.34 m<sup>3</sup>/h (0.01 m<sup>3</sup>/h).

The value of 0xFFFF (655.35 m<sup>3</sup>/h) represents invalid data and indicates that the flow cannot be measured/estimated or that the flow is higher than 650 m<sup>3</sup>/h.

#### When transmitted

This value is transmitted immediately when it has changed significantly. The significance depends on the pump type.

- For UPE Series 2000, the value must change more than 0.2 m<sup>3</sup>/h.
- For GRUNDFOS MAGNA, the value must change more than 0.3 m<sup>3</sup>/h.
- For TPE Series 1000/2000, the value must change more than 0.5 m<sup>3</sup>/h.

#### Product availability

For product availability, see overview on page 36.

### 11.17 Pump flow (extended range)

network output SNVT\_flow\_f nvoFlowF;

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

If the maximum pump flow is lower than 650 m<sup>3</sup>/h, nvoFlow should be used as it offers a higher resolution.

Section 5. *Considerations when installing the E-pump or Hydro Multi-E* provides more information on the coherence of nvoFlow and nvoFlowF.

#### Valid range

-3.40282E38 to 3.40282E38 l/s.

If no flow sensor is available in the system, nvoFlowF will display a value of NaN (Not a Number).

#### When transmitted

This value is transmitted immediately when it has changed more than 1 l/s.

#### Product availability

For product availability, see overview on page 36.

### 11.18 Remote flow

network output SNVT\_flow\_f nvoRemoteFlowF;

This network variable output provides the flow measured somewhere in the system with a flow sensor connected to the pump.

#### Valid range

-3.40282E38 to 3.40282E38 l/s.

The value of 3.40282E38 l/s is not used as a physical representation of the flow, but represents invalid data and indicates that the flow cannot be measured or that no remote-flow sensor is connected.

If no remote-flow sensor is available in the system, nvoFlowF will display a value of NaN (Not a Number).

#### When transmitted

This value is transmitted immediately when it has changed more than 0.2 m<sup>3</sup>/h.

#### Product availability

For product availability, see overview on page 36.

### 11.19 Pump speed

network output SNVT\_rpm nvoSpeed;

This optional network variable output provides the pump speed.

#### Valid range

0 to 65,534 rpm (1 rpm).

The value of 0xFFFF (65,535 rpm) represents invalid data and indicates that the speed cannot be measured/estimated.

#### When transmitted

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

#### Product availability

For product availability, see overview on page 36.

### 11.20 Pump override active

network output SNVT\_switch nvoPumpOverride;

This optional network variable output provides the manual override status of the pump. This variable has the value "OVERRIDE" in the table below if the pump setpoint has been overridden by one of the variables: nviOvdSpeed, nviOvdPress or nviOvdStop.

#### Valid range

State	Value	Equivalent percent	Requested operation
0	0	0	NORMAL
1	200	100	OVERRIDE
0xFF	n/a	n/a	Invalid value

#### When transmitted

This value is transmitted immediately when it has changed.

#### Product availability

For product availability, see overview on page 36.

### 11.21 Runtime

```
network output SNVT_time_hour nvoRuntime;
```

This network variable output provides the total number of operating hours of the pump. After 65,535 hours, the counter is reset and will restart from zero (0).

#### Valid range

0 to 65,535 hours (1 hour), (2,730 days or 7.67 years).

#### When transmitted

This value is transmitted immediately when it has changed.

#### Product availability

For product availability, see overview on page 36.

### 11.22 Total ontime

```
network output SNVT_time_hour nvoTotalOnTime;
```

This network variable output provides the total number of hours the pump has been powered on. After 65,535 hours, the counter is reset and will restart from zero (0).

#### Valid range

0 to 65,535 hours (1 hour), (2,730 days or 7.67 years).

If this variable is not supported by the pump, a value of 0 is displayed.

#### When transmitted

This value is transmitted immediately when it has changed.

#### Product availability

For product availability, see overview on page 36.

### 11.23 Pump fault status

```
network output SNVT_dev_fault nvoPumpFault;
```

```
network output SNVT_state nvoPumpFaultOld;
```

This network variable output provides fault information about the pump, based on warnings and alarms from the pump. nvoPumpFaultOld holds information identical to nvoPumpFault. It is added for backwards compatibility and we do not recommend it for new designs.

**General faults and some overtemperature faults on UPE Series 2000 will not appear on nvoPumpFault, but only on the nvoPumpStatus.device\_fault bit. Therefore, a fault monitoring strategy should always include monitoring of nvoPumpStatus.**

Note

For a description of nvoPumpStatus, see section [11.12 Pump status, diagnostic information](#).

Both warnings and alarms will appear as faults in nvoPumpFault, except for warning and alarm codes corresponding to df\_elect\_failure and df\_elect\_failure\_nf. For these, warnings will appear as df\_elect\_failure\_nf, and alarms will appear as df\_elect\_failure.

#### Valid range

The valid range of SNVT\_dev\_fault. The following two tables show pump faults and their corresponding appearance on the R100 remote control.

If the LON module is unable to communicate with the pump for 30 seconds, the df\_elect\_failure bit is set. The fault is visible on the node object as well. See section [11. Pump controller functional block details](#). This fault will not be visible when using the R100.

### 11.24 Heat energy metering

```
network output SNVT_elec_kwh nvoHeatEnergyCnt;
```

```
network output SNVT_power_kilo nvoHeatPower;
```

```
network output SNVT_temp_p nvoHeatTempDiff;
```

These data points are used for heat energy metering by the MAGNA3 and MGE model H pumps. In order to use the heat energy meter function at the pump, an external sensor has to be connected. Please note that this feature is not to be used for billing purposes.

```
network output SNVT_elec_kwh nvoHeatEnergyCnt;
```

#### Valid range

0 to 65,535 kWh (1 kWh).

The value of 0xFFFF (65,535 kWh) represents invalid data and indicates that the power consumption cannot be measured/estimated.

#### When transmitted

This value is transmitted immediately when it has changed.

#### Product availability

For product availability, see overview on page 36.

```
network output SNVT_power_kilo nvoHeatPower;
```

#### Valid range

0 to 6,553.4 kW (0.1 kW).

The value of 0xFFFF (6,553.5 kW) represents invalid data and indicates that the power cannot be measured/estimated or that the power is higher than 6,500 kW.

#### When transmitted

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

#### Product availability

For product availability, see overview on page 36.

```
network output SNVT_temp_p nvoHeatTempDiff;
```

#### Valid range

-273.17 to +327.66 °C (0.01 °C).

The value of 0x7FFF (327.67 °C) represents invalid data and indicates that the temperature cannot be measured or that no remote temperature-sensor is connected.

#### When transmitted

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

#### Product availability

For product availability, see overview on page 36.

## Pump faults, TPE Series 1000 and 2000, CRE, CRNE , CRIE, NBE, NKE, CHIE, MTRE, CUE, GRUNDFOS MAGNA

Bit No	Bit name		Description	Corresponding warning/alarm on the R100
	nvoPumpFault	nvoPumpFaultOld		
0	sf_voltage_low	Bit 0	Supply voltage is too low.	Undervoltage (40) Undervoltage transient (41) Cut-in fault (dV/dt) (42) Inrush fault (155)
1	sf_voltage_high	Bit 1	Supply voltage is too high.	Overvoltage (32)
2	sf_phase	Bit 2	Power missing phase.	Electronic DC-link protection activated (ERP) (14)
3	sf_no_fluid	Bit 3	No liquid in pump.	Dry running (57)
4	sf_press_low	Bit 4	System pressure is too low.	-
5	sf_press_high	Bit 5	System pressure is too high.	Turbine operation (29)
8	df_motor_temp	Bit 8	Motor temperature is too high.	Overtemperature (64) Motor temperature 1 (65) Temperature too high, internal frequency converter module (t_m) (67)
9	df_motor_failure	Bit 9	Motor has fatal failure.	External fault signal (3) Too many restarts (from standby mode per 24 hours) (4) Too many hardware shutdowns (short standbys per minute) (7) Overload (48) Overcurrent (i_line, i_dc, i_mo) (49) Motor protection function, general shutdown (mpf) (50) Motor protection function 3 sec. limit (54) Motor current protection activated (MCP) (55) Underload (56)
10	df_pump_blocked	Bit 10	Pump is blocked.	Blocked motor/pump (51)
11	df_elect_temp	Bit 11	Electronic temperature is too high.	
12	df_elect_failure_nf	Bit 12	Electronic non-fatal failure.	<b>Warning codes:</b> Hardware fault, type 1 (72) Hardware shutdown (HSD) (73) Internal communication fault (76) Communication fault, twin-head pump (77) Hardware fault, type 2 (80) Verification error, BE parameter area (EEPROM) (85) Electronic rectifier protection activated (ERP) (105) Electronic inverter protection activated (EIP) (106) Communication fault, internal frequency converter module (156) <b>Alarm and warning codes:</b> Verification error, FE parameter area (EEPROM) (83)
13	df_elect_failure	Bit 13	Electronic fatal failure.	CIM fault (Communication Interface Module) (not visible on the R100) (159) <b>Alarm codes:</b> Leakage current (1) Hardware fault, type 1 (72) Hardware shutdown (HSD) (73) Internal communication fault (76) Communication fault, twin-head pump (77) Hardware fault, type 2 (80) Verification error, BE parameter area (EEPROM) (85) Electronic rectifier protection activated (ERP) (105) Electronic inverter protection activated (EIP) (106) Communication fault, internal frequency converter module (156)
14	df_sensor_failure	Bit 14	Sensor failure.	Sensor fault (88) Signal fault, (feedback) sensor 1 (89) Signal fault, speed sensor (90) Setpoint signal outside range (96)

## Pump faults, UPE Series 2000

Bit No	Bit name		Description	Corresponding warning/alarm on the R100
	nvoPumpFault	nvoPumpFaultOld		
0	sf_voltage_low	Bit 0	Supply voltage is too low.	Undervoltage
1	sf_voltage_high	Bit 1	Supply voltage is too high.	Overvoltage
2	sf_phase	Bit 2	Power missing phase.	-
3	sf_no_fluid	Bit 3	No liquid in pump.	-
4	sf_press_low	Bit 4	System pressure is too low.	-
5	sf_press_high	Bit 5	System pressure is too high.	-
8	df_motor_temp	Bit 8	Motor temperature is too high.	Overtemperature
9	df_motor_failure	Bit 9	Motor has fatal failure.	-
10	df_pump_blocked	Bit 10	Pump is blocked.	Pump blocked
11	df_elect_temp	Bit 11	Electronic temperature is too high.	Overtemperature
12	df_elect_failure_nf	Bit 12	Electronic non-fatal failure.	-
13	df_elect_failure	Bit 13	Electronic fatal failure.	Communication fault between LON module and pump (not visible on the R100)
14	df_sensor_failure	Bit 14	Sensor failure.	Differential-pressure sensor defective

Additional fault information can be retrieved with the Grundfos R100 remote control.

**When transmitted**

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

**Product availability**

For product availability, see overview on page 36.

**11.25 Alarm code**

```
network output SNVT_count nvoAlarmCode;
```

This network variable output provides the currently active alarm code from the pump.

In case of a common communication interface module fault (code 159), which is generated in the LON module solely, this will be displayed in nvoAlarmCode and override any alarm pending in the connected E-pump.

**Valid range**

See section .

**When transmitted**

This value is transmitted immediately when it has changed.

**Product availability**

For product availability, see overview on page 36.

**11.26 Warning code**

```
network output SNVT_count nvoWarningCode;
```

This network variable output provides the currently active warning code from the pump.

**Valid range**

See section .

**When transmitted**

This value is transmitted immediately when it has changed.

**Product availability**

For product availability, see overview on page 36.

**11.27 Liquid temperature**

```
network output SNVT_temp_p nvoFluidTemp;
```

This network variable output provides the pumped-liquid temperature.

**Valid range**

-273.17 to +327.66 °C (0.01 °C).

The value of 0x7FFF (327.67 °C) represents invalid data and indicates that the temperature cannot be measured.

**When transmitted**

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

**Product availability**

For product availability, see overview on page 36.

**11.28 Remote temperature 1**

```
network output SNVT_temp_p nvoRemoteTemp;
```

This network variable output provides the temperature measured somewhere in the system with a temperature sensor connected to the pump.

**Valid range**

-273.17 to +327.66 °C (0.01 °C).

The value of 0x7FFF (327.67 °C) represents invalid data and indicates that the temperature cannot be measured or that no remote temperature-sensor is connected.

**When transmitted**

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

**Product availability**

For product availability, see overview on page 36.



## 11.29 Remote temperature 2

```
network output SNVT_temp_p nvoRemoteTemp2;
```

This network variable output provides the temperature measured somewhere in the system with a temperature sensor connected to the pump.

### Valid range

-273.17 to +327.66 °C (0.01 °C).

The value of 0x7FFF (327.67 °C) represents invalid data and indicates that the temperature cannot be measured or that no remote temperature-sensor is connected.

### When transmitted

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

### Product availability

For product availability, see overview on page 36.

## 11.30 Tank level

```
network output SNVT_length_f nvoLevel;
```

This network variable output provides the liquid level in the tank of the hydraulic system as measured by the pump.

### Valid range

0 to 3.40282E38 m.

A value of NaN (Not a Number) represents invalid data and indicates that the level cannot be measured or that no level sensor is connected.

If no level sensor is available in the system, nvoLevel will display a value of NaN (Not a Number).

### When transmitted

This value is transmitted immediately when it has changed more than 0.01 m.

### Product availability

For product availability, see overview on page 36.

## 11.31 Auxiliary sensor input

```
network output SNVT_lev_percent nvoAuxSensor;
```

This network variable output enables the user to connect any kind of sensor to the product (e.g. a pH sensor), but the interpretation of 0 % and 100 % has to be managed somewhere else in the system.

### Valid range

-163.840 to 163.830 % (0.005 % or 50 ppm).

The value of 0x7FFF (163.835 %) represents invalid data and indicates that no auxiliary sensor input is connected.

### When transmitted

This value is transmitted immediately when it has changed more than 0.1 %.

### Product availability

For product availability, see overview on page 36.

## 11.32 Power consumption in watts

```
network output SNVT_power nvoPower;
```

This optional network variable output provides the actual power being consumed by the pump.

### Valid range

0 to 6,553.4 W (0.1 W).

The value of 0xFFFF (6,553.5 W) represents invalid data and indicates that the power cannot be measured/estimated or that the power is higher than 6,500 W.

### When transmitted

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

### Product availability

For product availability, see overview on page 36.

## 11.33 Power consumption in kilowatts

```
network output SNVT_power_kilo nvoPowerKilo;
```

This optional network variable output provides the actual power being consumed by the pump.

### Valid range

0 to 6,553.4 kW (0.1 kW).

The value of 0xFFFF (6,553.5 kW) represents invalid data and indicates that the power consumption cannot be measured/estimated.

### When transmitted

This value is transmitted immediately when it has changed more than 0.2 kW.

### Product availability

For product availability, see overview on page 36.

## 11.34 Energy consumption (standard range)

```
network output SNVT_elec_kwh nvoEnergyConsum;
```

This optional network variable output provides the accumulated energy consumption of the pump. After 65,535 kWh, the counter is reset and will restart from 0 kWh.

### Valid range

0 to 65,535 kWh (1 kWh).

The value of 0xFFFF (65,535 kWh) represents invalid data and indicates that the power consumption cannot be measured/estimated.

### When transmitted

This value is transmitted immediately when it has changed.

### Product availability

For product availability, see overview on page 36.

## 11.35 Energy consumption (extended range)

```
network output SNVT_elec_kwh_l nvoEnergyConsumL;
```

This optional network variable output provides the accumulated electrical energy consumption of the pump.

After 214,748,364.6 kWh, the counter is reset and will restart from 0 kWh.

### Valid range

-214,748,364.8 to 214,748,364.6 kWh (0.1 kWh).

The value of 0xFFFFFFFF (214,748,364.7 kWh) represents invalid data and indicates that the electrical energy consumption cannot be measured/estimated.

### When transmitted

This value is transmitted immediately when it has changed.

### Product availability

For product availability, see overview on page 36.

### 11.36 Send heartbeat

```
network input SNVT_time_sec nciSndHrtBt;
```

This network configuration property input sets the maximum period of time that will elapse before the functional block automatically updates the following network variables:

nv3, nvoPumpCapacity  
nv4, nvoEffOpMode  
nv5, nvoControlMode  
nv13, nvoPumpStatus.

#### Valid range

0.0 to 6,553.4 sec. (0.1 sec.).

A value of 0xFFFF (6,553.5 sec.) represents invalid data and will disable the automatic update function.

A value of zero (0) will be used for the internal timer if the configured value is invalid. The value of zero (0) disables the "send heartbeat" function.

#### Default value

The default value is 0.0 (no automatic update).

#### Product availability

For product availability, see overview on page 36.

### 11.37 Receive heartbeat

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

This network configuration property input sets the maximum period of time that will elapse before the functional block automatically uses the default values for the following network variables:

nv10, nviRemotePress  
nv11, nviRemoteFlow.

#### Valid range

0.0 to 6,553.4 sec. (0.1 sec.).

A value of 0xFFFF (6,553.5 sec.) represents invalid data and will disable the automatic update function.

A value of zero (0) will be used for the internal timer if the configured value is invalid. The value of zero (0) disables the "receive heartbeat" function.

#### Default value

The default value is 0.0 (no automatic update).

#### Product availability

For product availability, see overview on page 36.

### 11.38 Control mode for normal operation

```
network input config SNVT_dev_c_mode  
nciControlMode;
```

This network configuration property input defines the device control mode to be used for the normal operating mode. For more details about the control modes, see section [11.6 Effective device control mode](#).

#### Valid range

The valid range is the same as that of nvoControlMode.

#### Default value

The default control mode for a pump is DCM\_PRESS\_COMP (value = 2).

#### Product availability

For product availability, see overview on page 36.

### 11.39 Maximum flow limit

```
Network input config SNVT_flow_p nciFlowHighLim;
```

This configuration property defines the maximum limit of the flow of the pump. Applies to MAGNA3 and TPE 2000 version H and later only. It can be enabled in all control modes.

#### Valid range

The valid range is 0.0 to 655.34 m<sup>3</sup>/h.

A value of 0xFFFF (655.35 m<sup>3</sup>/h) represents invalid data and will disable the flow limit function.

#### Default value

The default value is 0xFFFF, i.e. disabled.

#### Product availability

Only available on MAGNA3.

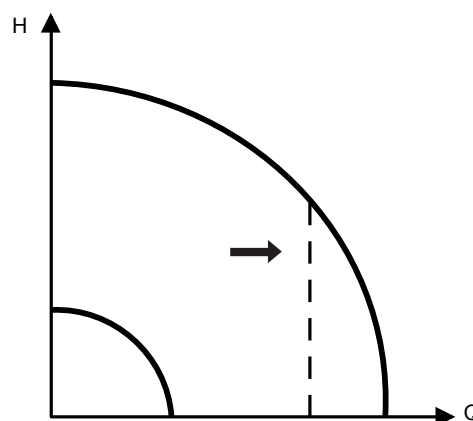


Fig. 17 Maximum flow limit

TM05 2950 0712

11.40 Pump characteristic

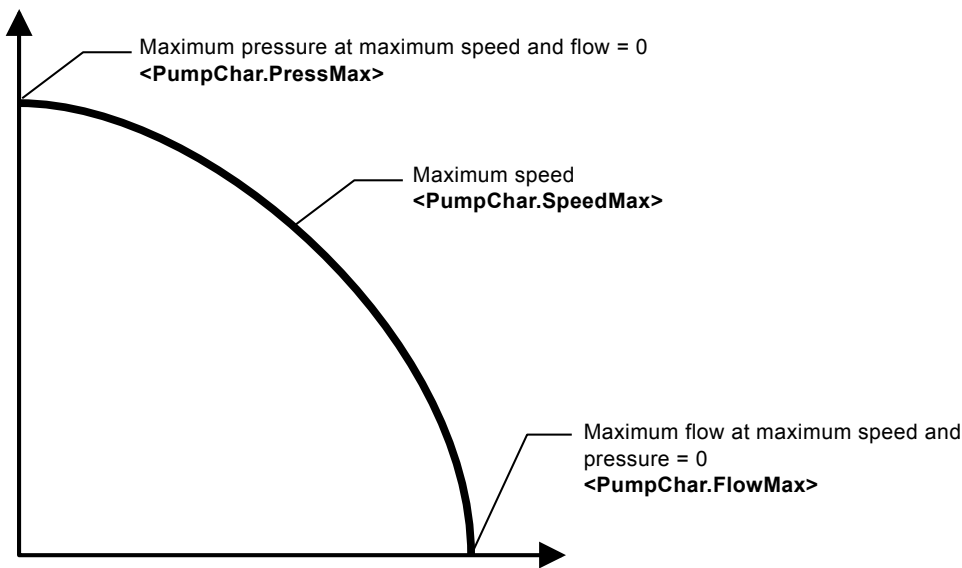
```
network input config SCPTpumpCharateristic
nroPumpChar;
```

This read-only configuration property input provides the basic characteristic data for the pump.  
For further technical details, see installation and operating instructions for the relevant pump or Hydro Multi-E.  
The configuration parameter consists of three variables.

Valid range

The valid ranges of the supported pump characteristics are shown below.

Variable	Description	Valid range	Invalid value
SNVT_rpm	Maximum pump speed	0 to 65,535 rpm	0xFFFF (65,535 rpm)
SNVT_press	Maximum pump pressure	-3,276.8 to 3,276.6 kPa	0x7FFF (3,276.7 kPa)
SNVT_flow_p	Maximum pump flow	0 to 655.35 m³/h	0xFFFF (655.35 m³/h)



TM04 2393 2508

Fig. 18 Pump characteristics

Default value

nroPumpChar is a read-only property. The pump characteristic will be set according to the connected pump.

Product availability

For product availability, see overview on page 36.

11.41 Remote pressure-sensor minimum value

```
SCPTminRemotePressureSetpoint cp_family
nciRemMinPress;
```

Basic network variable type for SCPTminRemotePressureSetpoint: SNVT\_press.  
This network configuration property input 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 section 11.10 Remote pressure sensor input.

Valid range

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

Default value

The default value is 0x7FFF (invalid value).

SCPT reference

SCPTminRemotePressureSetpoint (239).

Product availability

For product availability, see overview on page 36.

11.42 Remote pressure-sensor maximum value

```
SCPTmaxRemotePressureSetpoint cp_family
nciRemMaxPress;
```

Basic network variable type for SCPTmaxRemotePressureSetpoint: SNVT\_press.  
This network configuration property input provides the maximum 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 section 11.10 Remote pressure sensor input.

Valid range

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

Default value

The default value is 0x7FFF (invalid value).

SCPT reference

SCPTmaxRemotePressureSetpoint (240).

Product availability

For product availability, see overview on page 36.

### 11.43 Remote flow-sensor minimum value

```
SCPTminRemoteFlowSetpoint cp_family
nciRemMinFlow;
```

Basic network variable type for SCPTminRemoteFlowSetpoint: SNVT\_flow\_p.

This network configuration property input 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 section [11.11 Remote flow sensor input](#).

#### Valid range

0 to 655.34 m<sup>3</sup>/h (0.01 m<sup>3</sup>/h).

The value of 0xFFFF (655.35 m<sup>3</sup>/h) represents invalid data.

#### Default value

The default value is 0xFFFF (invalid value).

#### SCPT reference

SCPTminRemoteFlowSetpoint (241).

#### Product availability

For product availability, see overview on page [36](#).

### 11.44 Remote flow-sensor maximum value

```
SCPTmaxRemoteFlowSetpoint cp_family
nciRemMaxFlow;
```

Basic network variable type for SCPTmaxRemoteFlowSetpoint: SNVT\_flow\_p.

This network configuration property input 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 section [11.11 Remote flow sensor input](#).

#### Valid range

0 to 655.34 m<sup>3</sup>/h (0.01 m<sup>3</sup>/h).

The value of 0xFFFF (655.35 m<sup>3</sup>/h) represents invalid data.

#### Default value

The default value is 0xFFFF (invalid value).

#### SCPT reference

SCPTmaxRemoteFlowSetpoint (242).

#### Product availability

For product availability, see overview on page [36](#).

### 11.45 Kp

```
UCPT_Kp cp_family nciKp;
```

Basic network variable type for SCPTminRemotePressureSetpoint: SNVT\_multiplier.

This network configuration property input defines the value of Kp in the PI controller. The value is used when an external pressure or flow sensor is connected. See section [11.10 Remote pressure sensor input](#) or [11.11 Remote flow sensor input](#).

#### Valid range

0 to 25.4 (0.1).

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

#### Default value

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

#### UCPT reference

UCPT\_Kp (6).

#### Product availability

For product availability, see overview on page [36](#).

### 11.46 Ti

```
UCPT_Ti cp_family nciTi;
```

Basic network variable type for SCPTminRemotePressureSetpoint: SNVT\_time\_sec.

This network configuration property input defines the value of Ti in the PI controller. The value is used when an external pressure or flow sensor is connected. See section [11.10 Remote pressure sensor input](#) or [11.11 Remote flow sensor input](#).

#### Valid range

0.0 to 6,553.4 sec. (0.1 sec.).

The value of 0xFFFF (6,553.5 sec.) represents invalid data.

#### Default value

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

#### UCPT reference

UCPT\_Ti (4).

#### Product availability

For product availability, see overview on page [36](#).

### 11.47 Ts

```
UCPT_Ts cp_family nciTs;
```

Basic network variable type for SCPTminRemotePressureSetpoint: SNVT\_time\_sec.

This network configuration property input defines the value of Ts in the PI controller. The value is used when an external pressure or flow sensor is connected. See section [11.10 Remote pressure sensor input](#) or [11.11 Remote flow sensor input](#).

#### Valid range

0.0 to 6,553.4 sec. (0.1 sec.).

The value of 0xFFFF (6,553.5 sec.) represents invalid data.

#### Default value

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

#### UCPT reference

UCPT\_Ts (5).

#### Product availability

For product availability, see overview on page [36](#).

12. Node object functional block details

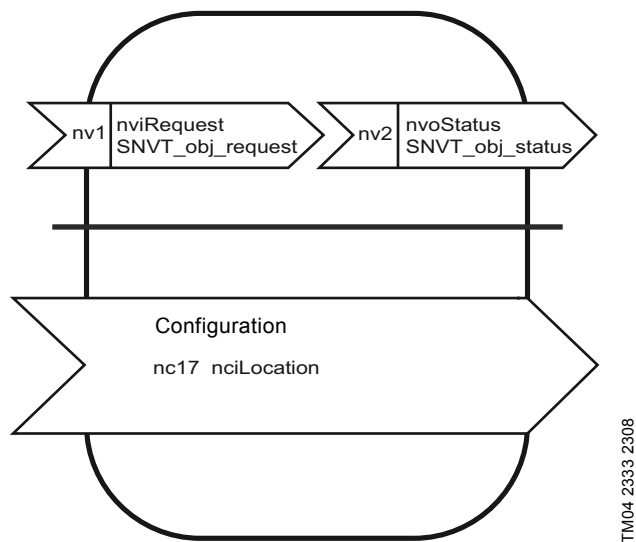


Fig. 19 Node object functional block

12.1 Object request

```
network input SNVT_obj_request nviRequest;
```

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

Valid range

The following values are supported.

No	Request	Description
0	RQ_NORMAL	Enters the normal state. Cancels disabled state.
1	RQ_DISABLED	Disables functional block.
2	RQ_UPDATE_STATUS	Reports status of functional block (refer to nvoStatus).
5	RQ_REPORT_MASK	Reports status mask.
7	RQ_ENABLE	Enables functional block.
9	RQ_CLEAR_STATUS	Clears bits of nvoStatus after RQ_REPORT_MASK request.
10	RQ_CLEAR_ALARM	Resets alarms in the pump.

12.2 Object status

```
network output SNVT_obj_status nvoStatus;
```

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

Bit No	Status bit	Description
1	invalid_id	The requested ID is not implemented in this node.
2	invalid_request	Request for unimplemented function.
4	disabled	The function block is currently disabled.
12	electrical_fault	Electrical fault detected in pump.
13	unable_to_measure	The LON module is unable to communicate with the pump.
18	manual_control	The pump has been set to local control (push-buttons on pump, external STOP or with the R100) and is not controlled by the LON module.
19	in_alarm	The pump has an alarm.
21	report_mask	The node is reporting mask.

12.3 Location label

```
network input SNVT_str_asc nciLocation;
```

This configuration property input 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).

Default value

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

## 13. Manufacturer-specific variables

### 13.1 Grundfos command

```
network input UNVT_GF_cmd nviGrundfosCmd;
```

This manufacturer-specific network variable input provides the function to request a particular information string from the E-pump. 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

No	Command	Description
0	GF_NO_CMD	No command
1	GF_PRODUCT_VER	Product version (not used)
2	GF_PRODUCT_INFO	Product info
3	GF_SOFTWARE_VERSION	Software version
4	GF_SOFTWARE_DATE	Release date of software
5	GF_SOFTWARE_DEVELOPERS	Initials for software developers

### 13.2 Grundfos info

```
network output SNVT_str_asc nvoGrundfosInfo;
```

This manufacturer-specific network variable output provides the function to get an information string from the E-pump. 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.

## 14. Product-specific network variables

Not all network variables are used with all pump types. The validity of a network variable depends on the pump connected to the LON module.

The following table gives an overview of network variables and their availability for the specific pumps.

Product availability

For product availability, see overview on page [36](#).

Product availability	UPE Series 2000	GRUNDFOS MAGNA	TPE Series 1000 and 2000, CRE, CRNE, CRIE, NBE, NKE, CHIE, MTRE			CUE
			1-phase	3-phase 0.55 - 7.5 kW	3-phase 11-22 kW	
nviPumpSetpoint	•	•	•	•	•	•
nviPumpOpMode	•	•	•	•	•	•
nviPumpOvdStop	•	•	•	•	•	•
nviOvdSpeed	•	•	•	•	•	•
nviOvdPress	•	•	•	•	•	•
nviRemotePress	-	•	-	-	-	-
nviRemoteFlow	-	•	-	-	-	-
nvoPumpCapacity	•	•	•	•	•	•
nvoEffOpMode	•	•	•	•	•	•
nvoControlMode	•	•	•	•	•	•
nvoPumpStatus	•	•	•	•	•	•
nvoPumpStatusOld	•	•	•	•	•	•
nvoPressure	•	•	•	•	•	•
nvoFlow	•	•	•	•	•	•
nvoFlowF	•	•	•	•	•	•
nvoSpeed	•	•	•	•	•	•
nvoPumpOverride	•	•	•	•	•	•
nvoRuntime	•	•	•	•	•	•
nvoPumpFault	•	•	•	•	•	•
nvoPumpFaultOld	•	•	•	•	•	•
nvoFluidTemp	•	•	•	•	•	•
nvoPower	•	•	•	•	•	•
nvoPowerK	•	•	•	•	•	•
nvoEnergyConsum	•	•	•	•	•	-
nvoEnergyConsumL	•	•	•	•	•	•
nvoRemoteFlow	-	-	H	G	•	•
nvoRemotePress	-	3	H	G	•	•
nvoRemoteTemp1	-	-	H	G	•	•
nvoRemoteTemp2	-	3	H	I	•	•
nvoAuxSensor	-	-	H	G	•	•
nvoInletPress	-	-	H	G	•	•
nvoTotalOnTime	-	3	H	G	•	•
nvoLevel	-	-	H	G	•	•
nvoActSetpoint	-	•	•	•	•	•
nvoAlarmCode	-	•	•	•	•	•
nvoWarningCode	-	3	•	•	•	•
nvoHeatEnergyCnt	-	3	H	-	-	-
nvoHeatPower	-	3	H	-	-	-
nvoHeatTempDiff	-	3	H	-	-	-
nviGrundfosCmd	•	•	•	•	•	•
nciSndHrtBt	•	•	•	•	•	•
nroPumpChar	•	•	•	•	•	•
nciLocation	•	•	•	•	•	•
nciRcvHrtBt	-	•	-	-	-	-
nciControlMode	•	•	•	•	•	•
nciRemMinPress	-	•	-	-	-	-
nciRemMaxPress	-	•	-	-	-	-



Product availability	UPE Series 2000	GRUNDFOS MAGNA	TPE Series 1000 and 2000, CRE, CRNE, CRIE, NBE, NKE, CHIE, MTRE			CUE
			1-phase	3-phase 0.55 - 7.5 kW	3-phase 11-22 kW	
nciRemMinFlow	-	●	-	-	-	-
nciRemMaxFlow	-	●	-	-	-	-
nciFlowHighLim	-	3	-	-	-	-
nciKp	-	●	-	-	-	-
nciTi	-	●	-	-	-	-
nciTs	-	●	-	-	-	-

3: Only available on MAGNA3.

G: Only available on model G and later versions.

H: Only available on model H and later versions.

I: Only available on model I and later versions.

## 15. Fitting a sensor

Applies to TPE Series 1000, CRE, CRNE, CRIE, NBE, NKE, CHIE, MTRE and CUE pumps.

When fitting a sensor to the pump, it is necessary to know the range limits for the SNVTs in this profile and the range for sensors connected to the pump.

The table below shows the maximum range for different types of sensors.

Sensor type	Unit	Range
Pressure	bar	0-32
	mbar	0-990
	mVs	0-330
	KPa	0-990
	psi	0-470
	ft	0-990
Flow	m <sup>3</sup> /h	0-650
	m <sup>3</sup> /s	0-0.1
	l/s	0-180
	gpm (US)	0-990
Temperature	C	-50-320
	F	-50-600
Other	%	0-100

If other sensor types than pressure sensors are fitted, it will not be possible to use the manual override variable `nviOvdPress`, but it will still be possible to use `nviPumpOvdStop` and `nviOvdSpeed`.

When using the LON module with a TPE Series 1000, CRE, NKE or NBE pump, only one of the network variable outputs `nvoPressure`, `nvoFlow`, `nvoFluidTemp` will be valid.

The table below shows the relationship between sensor type and validity of network variable.

Sensor type	nvoPressure	nvoFlow	nvoFluidTemp
Pressure	●	-	-
Flow	-	●	-
Temperature	-	-	●
Other	-	-	-

## 16. Device resource files

The LON module contains UNVTs and UCPTs. Therefore, Grundfos is supplying DRFs. If the DRFs are used, the right formatting and type definition will be achieved.

The DRFs can be found on the CD-ROM with this functional profile.

The files can be installed by copying them to for example

**C:\LONWORKS\TYPES\USER\GRUNDFOS\**

Then use the ldrfcac.exe program to add the files.

**Note**

*For further information about how to install DRFs, see Echelon documentation.*

The following UNVTs and UCPTs are supported by the DRFs:

UNVT\_GF\_cmd

UCPT\_Kp

UCPT\_Ti.

## 17. Fault finding

Faults in a LON module can be detected by observing the status of the service LED (LED1) and the LED for internal communication (LED2). See the tables below.

When the LON module is working properly on the LON network, the yellow service LED (LED1) is permanently off.

When an E-pump is connected to the LON module, the LED for internal communication (LED2) is permanently green.

**Note**

**When the CIM/CIU 110 is connected to the power supply, the yellow service LED (LED1) will flash once.**

### CIM 100 fitted in an E-pump

Fault (LED status)	Possible cause	Remedy
1. The service LED (LED1) remains off when the power supply is connected.	a) The CIM 100 has not been fitted correctly in the E-pump.	Fit the CIM 100 correctly in the E-pump.
	b) No power supply to the CIM 100.	Check the power supply to the E-pump.
	c) The CIM 100 is defective.	Replace the CIM 100.
2. The service LED (LED1) is permanently on.	a) The CIM 100 is defective.	Replace the CIM 100.
3. The service LED (LED1) flashes when the power supply is connected to the CIM 100, turns off, turns on again and remains permanently on.	a) The CIM 100 has no application software (application-less).	Try to download application software via a LON installation tool such as LonMaker.
	b) The CIM 100 is defective.	Replace the CIM 100.
4. The service LED (LED1) flashes every second.	c) The CIM 100 has not been installed.	Install the CIM 100 by means of a LON installation tool such as LonMaker.
5. The E-pump does not react to changes of settings, and the readout from the LON network is incorrect. The LED for internal communication (LED2) is permanently red.	a) The CIM 100 does not support the E-pump connected.	Contact the nearest Grundfos company. NOTE: Twin-head pump based on MGE motor, model H/I, in multipump mode requires a CIM 110 mounted in the master head.
	b) The LON application may be wrong, for instance CIM 110 software where CIM 100 software is required.	Download correct software via a LON installation tool such as LonMaker.
6. The E-pump does not react to changes of settings, and the readout from the LON network is incorrect. The LED for internal communication (LED2) is flashing red.	a) The cable between the CIM 100 and the E-pump is connected incorrectly or damaged.	Connect the cable correctly, or replace the cable.

### CIM 100 fitted in the CIU 100

Fault (LED status)	Possible cause	Remedy
1. The service LED (LED1) remains off when the power supply is connected.	a) No power supply to the CIU 100.	Check the power supply to the CIU 100.
	b) The CIM 100 is defective.	Replace the CIM 100.
2. The service LED (LED1) is permanently on.	a) The CIM 100 is defective.	Replace the CIM 100.
3. The service LED (LED1) flashes when the power supply is connected to the CIM 100, turns off, turns on again and remains permanently on.	a) The CIM 100 has no application software (application-less).	Try to download application software via a LON installation tool such as LonMaker.
	b) The CIM 100 is defective.	Replace the CIM 100.
4. The service LED (LED1) flashes every second.	a) The CIM 100 has not been installed.	Install the CIM 100 by means of a LON installation tool such as LonMaker.
5. The E-pump does not react to changes of settings, and the readout from the LON network is incorrect. The LED for internal communication (LED2) is permanently red.	a) The CIM 100 does not support the E-pump connected.	Contact the nearest Grundfos company.
	b) The LON application may be wrong, for instance CIM 110 software where CIM 100 software is required.	Download correct software via a LON installation tool such as LonMaker.
6. The E-pump does not react to changes of settings, and the readout from the LON network is incorrect. The LED for internal communication (LED2) is flashing red.	a) The cable between the CIM 100 and the E-pump is connected incorrectly or damaged.	Connect the cable correctly, or replace the cable.

**Note**

**Fault finding in a LON network requires a special tool such as Honeywell Excelon (not supplied by Grundfos).**

Subject to alterations.

## 18. Grundfos alarm and warning codes

This is a complete list of alarm and warning codes for Grundfos products. For the codes supported by booster systems, see the Alarms and warnings section.

Code	Description	Code	Description	Code	Description
1	Leakage current	84	Memory access error	181	Signal fault, PTC sensor (short-circuited)
2	Missing phase	85	Verification error, BE parameter area (EEPROM)	182	Signal fault, bearing temperature sensor (Pt100), bottom bearing
3	External fault signal	86	Fault (add-on) I/O module	183	Signal fault, extra temperature sensor
4	Too many restarts	88	Sensor fault	184	Signal fault, general-purpose sensor
5	Regenerative braking	89	Signal fault, (feedback) sensor 1	185	Unknown sensor type
6	Mains fault	90	Signal fault, speed sensor	186	Signal fault, power meter sensor
7	Too many hardware shutdowns	91	Signal fault, temperature sensor 1	187	Signal fault, energy meter
8	PWM switching frequency reduced	92	Calibration fault, (feedback) sensor	188	Signal fault, user-defined sensor
9	Phase sequence reversal	93	Signal fault, sensor 2	189	Signal fault, level sensor
10	Communication fault, pump	94	Limit exceeded, sensor 1	190	Limit exceeded, sensor 1 (e.g. alarm level in WW application)
11	Water-in-oil fault (motor oil)	95	Limit exceeded, sensor 2	191	Limit exceeded, sensor 2 (e.g. high level in WW application)
12	Time for service (general service information)	96	Setpoint signal outside range	192	Limit exceeded, sensor 3 (e.g. overflow level in WW application)
13	Moisture alarm, analog	97	Signal fault, setpoint input	193	Limit exceeded, sensor 4 (e.g. low level in WW/tank filling application)
14	Electronic DC-link protection activated (ERP)	98	Signal fault, input for setpoint influence	194	Limit exceeded, sensor 5
15	Communication fault, main system (SCADA)	99	Signal fault, input for analog setpoint	195	Limit exceeded, sensor 6
16	Other	100	RTC time synchronisation with GSM occurred	196	Operation with reduced efficiency
17	Performance requirement cannot be met	102	Dosing pump not ready	197	Operation with reduced pressure
18	Commanded alarm standby (trip)	103	Emergency stop	198	Operation with increased power consumption
19	Diaphragm break (dosing pump)	104	Software shutdown	199	Process out of range (monitoring/estimation/calculation/control)
20	Insulation resistance low	105	Electronic rectifier protection activated (ERP)	200	Application alarm
21	Too many starts per hour	106	Electronic inverter protection activated (EIP)	201	External sensor input high
22	Moisture switch alarm, digital	110	Skew load, electrical asymmetry	202	External sensor input low
23	Smart trim gap alarm	111	Current asymmetry	203	Alarm on all pumps
24	Vibration	112	Cos $\phi$ too high	204	Inconsistency between sensors
25	Setup conflict	113	Cos $\phi$ too low	205	Level float switch sequence inconsistency
26	Load continues even if the motor has been switched off	114	Motor heater function activated (frost protection)	206	Water shortage, level 1
27	External motor protector activated (e.g. MP 204)	115	Too many grinder reversals or grinder reversal attempt failed	207	Water leakage
28	Battery low	116	Grinder motor over temperature	208	Cavitation
29	Turbine operation (impellers forced backwards)	118	Signal fault, hydrogen sulfide H <sub>2</sub> S sensor	209	Non-return valve fault
30	Change bearings (specific service information)	119	Signal fault, analog input AI4	210	High pressure
31	Change varistor(s) (specific service information)	120	Auxiliary winding fault (single-phase motors)	211	Low pressure
32	Overvoltage	121	Auxiliary winding current too high (single-phase motors)	212	Diaphragm tank precharge pressure out of range
33	Soon time for service (general service information)	122	Auxiliary winding current too low (single-phase motors)	213	VFD not ready
34	No priming water	123	Start capacitor, low (single-phase motors)	214	Water shortage, level 2

Code	Description	Code	Description	Code	Description
35	Gas in pump head, deaerating problem	124	Run capacitor, low (single-phase motors)	215	Soft pressure build-up time-out
36	Discharge valve leakage	125	Signal fault, outdoor temperature sensor	216	Pilot pump alarm
37	Suction valve leakage	126	Signal fault, air temperature sensor	217	Alarm, general-purpose sensor high
38	Vent valve defective	127	Signal fault, shunt relative pressure sensor	218	Alarm, general-purpose sensor low
39	Valve stuck/defective	128	Strainer clogged	219	Pressure relief not adequate
40	Undervoltage	144	Motor temperature 3 (Pt100, t_mo3)	220	Fault, motor contactor feedback
41	Undervoltage transient	145	Bearing temperature high (Pt100), in general or top bearing	221	Fault, mixer contactor feedback
42	Cut-in fault (dV/dt)	146	Bearing temperature high (Pt100), middle bearing	222	Time for service, mixer
45	Voltage asymmetry	147	Bearing temperature high (Pt100), bottom bearing	223	Maximum number of mixer starts per hour exceeded
48	Overload	148	Motor bearing temperature high (Pt100) in drive end (DE)	224	Pump fault (due to auxiliary component or general fault)
49	Overcurrent (i_line, i_dc, i_mo)	149	Motor bearing temperature high (Pt100) in non-drive end (NDE)	225	Communication fault, pump module
50	Motor protection function, general shutdown (MPF)	150	Fault (add-on) pump module	226	Communication fault, I/O module
51	Blocked motor/pump	151	Fault, display (HMI)	227	Combi event
52	Motor slip high	152	Communication fault, add-on module	228	Night flow max. limit exceeded
53	Stalled motor	153	Fault, analog output	229	Water on floor
54	Motor protection function, 3 sec. limit	154	Communication fault, display	230	Network alarm
55	Motor current protection activated (MCP)	155	Inrush fault	231	Ethernet: No IP address from DHCP server
56	Underload	156	Communication fault, internal frequency converter module	232	Ethernet: Auto-disabled due to misuse
57	Dry running	157	Real-time clock out of order	233	Ethernet: IP address conflict
58	Low flow	158	Hardware circuit measurement fault	234	Backup pump alarm
59	No flow	159	CIM fault (Communication Interface Module)	235	Gas detected
60	Low input power	160	GSM modem, SIM card fault	236	Pump 1 fault
64	Overtemperature	161	Sensor supply fault, 5 V	237	Pump 2 fault
65	Motor temperature 1 (t_m or t_mo or t_mo1)	162	Sensor supply fault, 24 V	238	Pump 3 fault
66	Temperature, control electronics (t_e)	163	Measurement fault, motor protection	239	Pump 4 fault
67	Temperature too high, internal frequency converter module (t_m)	164	Signal fault, LiqTec sensor	240	Lubricate bearings (specific service information)
68	External temperature/water temperature (t_w)	165	Signal fault, analog input 1	241	Motor phase failure
69	Thermal relay 1 in motor (e.g. Klaxon)	166	Signal fault, analog input 2	242	Automatic motor model recognition failed
70	Thermal relay 2 in motor (e.g. thermistor)	167	Signal fault, analog input 3	243	Motor relay has been forced (manually operated/commanded)
71	Motor temperature 2 (Pt100, t_mo2)	168	Signal fault, pressure sensor	244	Fault, On/Off/Auto switch
72	Hardware fault, type 1	169	Signal fault, flow sensor	245	Pump continuous runtime too long
73	Hardware shutdown (HSD)	170	Signal fault, water-in-oil (WIO) sensor	246	User-defined relay has been forced (manually operated/commanded)
74	Internal supply voltage too high	171	Signal fault, moisture sensor	247	Power-on notice (device/system has been switched off)
75	Internal supply voltage too low	172	Signal fault, atmospheric pressure sensor	248	Fault, battery/UPS
76	Internal communication fault	173	Signal fault, rotor position sensor (Hall sensor)	249	User-defined event 1
77	Communication fault, twin-head pump	174	Signal fault, rotor origo sensor	250	User-defined event 2

Code	Description	Code	Description	Code	Description
78	Fault, speed plug	175	Signal fault, temperature sensor 2 (t_mo2)	251	User-defined event 3
79	Functional fault, add-on module	176	Signal fault, temperature sensor 3 (t_mo3)	252	User-defined event 4
80	Hardware fault, type 2	177	Signal fault, Smart trim gap sensor	253	SMS data from DDD sensor not received within time
81	Verification error, data area (RAM)	178	Signal fault, vibration sensor	254	Inconsistent data model
82	Verification error, code area (ROM, FLASH)	179	Signal fault, bearing temperature sensor (Pt100), general or top bearing		
83	Verification error, FE parameter area (EEPROM)	180	Signal fault, bearing temperature sensor (Pt100), middle bearing		

Subject to alterations.





**Argentina**

Bombas GRUNDFOS de Argentina S.A.  
Ruta Panamericana km. 37.500 Centro  
Industrial Garin  
1619 Garin Pcia. de B.A.  
Phone: +54-3327 414 444  
Telefax: +54-3327 45 3190

**Australia**

GRUNDFOS Pumps Pty. Ltd.  
P.O. Box 2040  
Regency Park  
South Australia 5942  
Phone: +61-8-8461-4611  
Telefax: +61-8-8340 0155

**Austria**

GRUNDFOS Pumpen Vertrieb Ges.m.b.H.  
Grundfosstraße 2  
A-5082 Grödig/Salzburg  
Tel.: +43-6246-883-0  
Telefax: +43-6246-883-30

**Belgium**

N.V. GRUNDFOS Bellux S.A.  
Boomsesteenweg 81-83  
B-2630 Aartselaar  
Tél.: +32-3-870 7300  
Télécopie: +32-3-870 7301

**Belarus**

Представительство ГРУНДФОС в  
Минске  
220125, Минск  
ул. Шафарьянская, 11, оф. 56, 5Ц  
(«Порт»)  
Тел.: +7 (375 17) 286 39 72/73  
Факс: +7 (375 17) 286 39 71  
E-mail: minsk@grundfos.com

**Bosnia and Herzegovina**

GRUNDFOS Sarajevo  
Zmaja od Bosne 7-7A,  
BH-71000 Sarajevo  
Phone: +387 33 592 480  
Telefax: +387 33 590 465  
www.ba.grundfos.com  
e-mail: grundfos@bih.net.ba

**Brazil**

BOMBAS GRUNDFOS DO BRASIL  
Av. Humberto de Alencar Castelo Branco,  
630  
CEP 09850 - 300  
São Bernardo do Campo - SP  
Phone: +55-11 4393 5533  
Telefax: +55-11 4343 5015

**Bulgaria**

Grundfos Bulgaria EOOD  
Slatina District  
Iztochna Tangenta street no. 100  
BG - 1592 Sofia  
Tel. +359 2 49 22 200  
Fax. +359 2 49 22 201  
email: bulgaria@grundfos.bg

**Canada**

GRUNDFOS Canada Inc.  
2941 Brighton Road  
Oakville, Ontario  
L6H 6C9  
Phone: +1-905 829 9533  
Telefax: +1-905 829 9512

**China**

GRUNDFOS Pumps (Shanghai) Co. Ltd.  
10F The Hub, No. 33 Suhong Road  
Minhang District  
Shanghai 201106  
PRC  
Phone: +86 21 612 252 22  
Telefax: +86 21 612 253 33

**COLOMBIA**

GRUNDFOS Colombia S.A.S.  
Km 1.5 vía Siberia-Cota Conj. Potrero  
Chico,  
Parque Empresarial Arcos de Cota Bod.  
1A.  
Cota, Cundinamarca  
Phone: +57(1)-2913444  
Telefax: +57(1)-8764586

**Croatia**

GRUNDFOS CROATIA d.o.o.  
Buzinski prilaz 38, Buzin  
HR-10010 Zagreb  
Phone: +385 1 6595 400  
Telefax: +385 1 6595 499  
www.hr.grundfos.com

**GRUNDFOS Sales Czechia and Slovakia s.r.o.**

Čajkovského 21  
779 00 Olomouc  
Phone: +420-585-716 111

**Denmark**

GRUNDFOS DK A/S  
Martin Bachs Vej 3  
DK-8850 Bjerringbro  
Tlf.: +45-87 50 50 50  
Telefax: +45-87 50 51 51  
E-mail: info\_GDK@grundfos.com  
www.grundfos.com/DK

**Estonia**

GRUNDFOS Pumps Eesti OÜ  
Peterburi tee 92G  
11415 Tallinn  
Tel: + 372 606 1690  
Fax: + 372 606 1691

**Finland**

OY GRUNDFOS Pumput AB  
Trukkikuja 1  
FI-01360 Vantaa  
Phone: +358-(0) 207 889 500

**France**

Pompes GRUNDFOS Distribution S.A.  
Parc d'Activités de Chesnes  
57, rue de Malacombie  
F-38290 St. Quentin Fallavier (Lyon)  
Tél.: +33-4 74 82 15 15  
Télécopie: +33-4 74 94 10 51

**Germany**

GRUNDFOS GMBH  
Schlüterstr. 33  
40699 Erkrath  
Tel.: +49-(0) 211 929 69-0  
Telefax: +49-(0) 211 929 69-3799  
e-mail: infoservice@grundfos.de  
Service in Deutschland:  
e-mail: kundendienst@grundfos.de

**Greece**

GRUNDFOS Hellas A.E.B.E.  
20th km. Athinon-Markopoulou Av.  
P.O. Box 71  
GR-19002 Peania  
Phone: +0030-210-66 83 400  
Telefax: +0030-210-66 46 273

**Hong Kong**

GRUNDFOS Pumps (Hong Kong) Ltd.  
Unit 1, Ground floor  
Siu Wai Industrial Centre  
29-33 Wing Hong Street &  
68 King Lam Street, Cheung Sha Wan  
Kowloon  
Phone: +852-27861706 / 27861741  
Telefax: +852-27858664

**Hungary**

GRUNDFOS Hungária Kft.  
Park u. 8  
H-2045 Törökbálint,  
Phone: +36-23 511 110  
Telefax: +36-23 511 111

**India**

GRUNDFOS Pumps India Private Limited  
118 Old Mahabalipuram Road  
Thoraipakkam  
Chennai 600 096  
Phone: +91-44 2496 6800

**Indonesia**

PT. GRUNDFOS POMPA  
Graha Intirub Lt. 2 & 3  
Jln. Cililitan Besar No.454. Makasar,  
Jakarta Timur  
ID-Jakarta 13650  
Phone: +62 21-469-51900  
Telefax: +62 21-460 6910 / 460 6901

**Ireland**

GRUNDFOS (Ireland) Ltd.  
Unit A, Merrywell Business Park  
Ballymount Road Lower  
Dublin 12  
Phone: +353-1-4089 800  
Telefax: +353-1-4089 830

**Italy**

GRUNDFOS Pompe Italia S.r.l.  
Via Gran Sasso 4  
I-20060 Truccazzano (Milano)  
Tel.: +39-02-95838112  
Telefax: +39-02-95309290 / 95838461

**Japan**

GRUNDFOS Pumps K.K.  
1-2-3, Shin-Miyakoda, Kita-ku,  
Hamamatsu  
431-2103 Japan  
Phone: +81 53 428 4760  
Telefax: +81 53 428 5005

**Korea**

GRUNDFOS Pumps Korea Ltd.  
6th Floor, Aju Building 679-5  
Yeoksam-dong, Kangnam-ku, 135-916  
Seoul, Korea  
Phone: +82-2-5317 600  
Telefax: +82-2-5633 725

**Latvia**

SIA GRUNDFOS Pumps Latvia  
Deglava biznesa centrs  
Augusta Deglava iela 60, LV-1035, Rīga,  
Tālr.: + 371 714 9640, 7 149 641  
Fakss: + 371 914 9646

**Lithuania**

GRUNDFOS Pumps UAB  
Smolensko g. 6  
LT-03201 Vilnius  
Tel: + 370 52 395 430  
Fax: + 370 52 395 431

**Malaysia**

GRUNDFOS Pumps Sdn. Bhd.  
7 Jalan Peguam U1/25  
Glenmarie Industrial Park  
40150 Shah Alam  
Selangor  
Phone: +60-3-5569 2922  
Telefax: +60-3-5569 2866

**Mexico**

Bombas GRUNDFOS de México S.A. de  
C.V.  
Boulevard TLC No. 15  
Parque Industrial Stiva Aeropuerto  
Apodaca, N.L. 66600  
Phone: +52-81-8144 4000  
Telefax: +52-81-8144 4010

**Netherlands**

GRUNDFOS Netherlands  
Veluwezoom 35  
1326 AE Almere  
Postbus 22015  
1302 CA ALMERE  
Tel.: +31-88-478 6336  
Telefax: +31-88-478 6332  
E-mail: info\_gnl@grundfos.com

**New Zealand**

GRUNDFOS Pumps NZ Ltd.  
17 Beatrice Tinsley Crescent  
North Harbour Industrial Estate  
Albany, Auckland  
Phone: +64-9-415 3240  
Telefax: +64-9-415 3250

**Norway**

GRUNDFOS Pumper A/S  
Strømsveien 344  
Postboks 235, Leirdal  
N-1011 Oslo  
Tlf.: +47-22 90 47 00  
Telefax: +47-22 32 21 50

**Poland**

GRUNDFOS Pompy Sp. z o.o.  
ul. Klonowa 23  
Baranowo k. Poznania  
PL-62-081 Przeźmierowo  
Tel: (+48-61) 650 13 00  
Fax: (+48-61) 650 13 50

**Portugal**

Bombas GRUNDFOS Portugal, S.A.  
Rua Calvet de Magalhães, 241  
Apartado 1079  
P-2770-153 Paço de Arcos  
Tel.: +351-21-440 76 00  
Telefax: +351-21-440 76 90

**Romania**

GRUNDFOS Pompe România SRL  
Bd. Biruintel, nr 103  
Pantelimon county Ilfov  
Phone: +40 21 200 4100  
Telefax: +40 21 200 4101  
E-mail: romania@grundfos.ro

**Russia**

ООО Грундфос Россия  
109544, г. Москва, ул. Школьная, 39-41,  
стр. 1  
Тел. (+7) 495 564-88-00 (495) 737-30-00  
Факс (+7) 495 564 88 11  
E-mail grundfos.moscow@grundfos.com

**Serbia**

Grundfos Srbija d.o.o.  
Omladinskih brigada 90b  
11070 Novi Beograd  
Phone: +381 11 2258 740  
Telefax: +381 11 2281 769  
www.rs.grundfos.com

**Singapore**

GRUNDFOS (Singapore) Pte. Ltd.  
25 Jalan Tukang  
Singapore 619264  
Phone: +65-6681 9688  
Telefax: +65-6681 9689

**Slovakia**

GRUNDFOS s.r.o.  
Prievozská 4D  
821 09 BRATISLAVA  
Phona: +421 2 5020 1426  
sk.grundfos.com

**Slovenia**

GRUNDFOS LJUBLJANA, d.o.o.  
Leskoškova 9e, 1122 Ljubljana  
Phone: +386 (0) 1 568 06 10  
Telefax: +386 (0)1 568 06 19  
E-mail: tehniko-si@grundfos.com

**South Africa**

GRUNDFOS (PTY) LTD  
Corner Mountjoy and George Allen Roads  
Wilbart Ext. 2  
Bedfordview 2008  
Phone: (+27) 11 579 4800  
Fax: (+27) 11 455 6066  
E-mail: lsmart@grundfos.com

**Spain**

Bombas GRUNDFOS España S.A.  
Camino de la Fuentecilla, s/n  
E-28110 Algete (Madrid)  
Tel.: +34-91-848 8800  
Telefax: +34-91-628 0465

**Sweden**

GRUNDFOS AB  
Box 333 (Lunnagårdsgatan 6)  
431 24 Mölndal  
Tel.: +46 31 332 23 000  
Telefax: +46 31 331 94 60

**Switzerland**

GRUNDFOS Pumpen AG  
Bruggacherstrasse 10  
CH-8117 Fällanden/ZH  
Tel.: +41-44-806 8111  
Telefax: +41-44-806 8115

**Taiwan**

GRUNDFOS Pumps (Taiwan) Ltd.  
7 Floor, 219 Min-Chuan Road  
Taichung, Taiwan, R.O.C.  
Phone: +886-4-2305 0868  
Telefax: +886-4-2305 0878

**Thailand**

GRUNDFOS (Thailand) Ltd.  
92 Chaloen Phrakiat Rama 9 Road,  
Dokmai, Pravej, Bangkok 10250  
Phone: +66-2-725 8999  
Telefax: +66-2-725 8998

**Turkey**

GRUNDFOS POMPA San. ve Tic. Ltd. Sti.  
Gebze Organize Sanayi Bölgesi  
İhsan dede Caddesi,  
2. yol 200. Sokak No. 204  
41490 Gebze/ Kocaeli  
Phone: +90 - 262-679 7979  
Telefax: +90 - 262-679 7905  
E-mail: satis@grundfos.com

**Ukraine**

Бізнес Центр Європа  
Столичне шосе, 103  
м. Київ, 03131, Україна  
Телефон: (+38 044) 237 04 00  
Факс.: (+38 044) 237 04 01  
E-mail: ukraine@grundfos.com

**United Arab Emirates**

GRUNDFOS Gulf Distribution  
P.O. Box 16768  
Jebel Ali Free Zone  
Dubai  
Phone: +971 4 8815 166  
Telefax: +971 4 8815 136

**United Kingdom**

GRUNDFOS Pumps Ltd.  
Grovebury Road  
Leighton Buzzard/Beds. LU7 4TL  
Phone: +44-1525-850000  
Telefax: +44-1525-850011

**U.S.A.**

GRUNDFOS Pumps Corporation  
17100 West 118th Terrace  
Olathe, Kansas 66061  
Phone: +1-913-227-3400  
Telefax: +1-913-227-3500

**Uzbekistan**

Grundfos Tashkent, Uzbekistan The Repre-  
sentative Office of Grundfos Kazakhstan in  
Uzbekistan  
38a, Oybek street, Tashkent  
Телефон: (+998) 71 150 3290 / 71 150  
3291  
Факс: (+998) 71 150 3292

Addresses Revised 05.12.2016

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