SIEMENS

Totally Integrated Automation

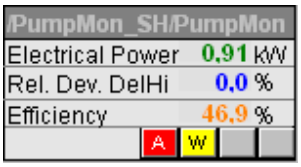
PCS 7 PumpMon V1.0

Operating and Control

Version 2.1

PumpMon: Operating and Monitoring

Block icon



-> ***siPoElec*** (electrical power)
-> ***RelDelHi*** (relative distance to characteristic)
-> ***QEta*** (efficiency)

Faceplate

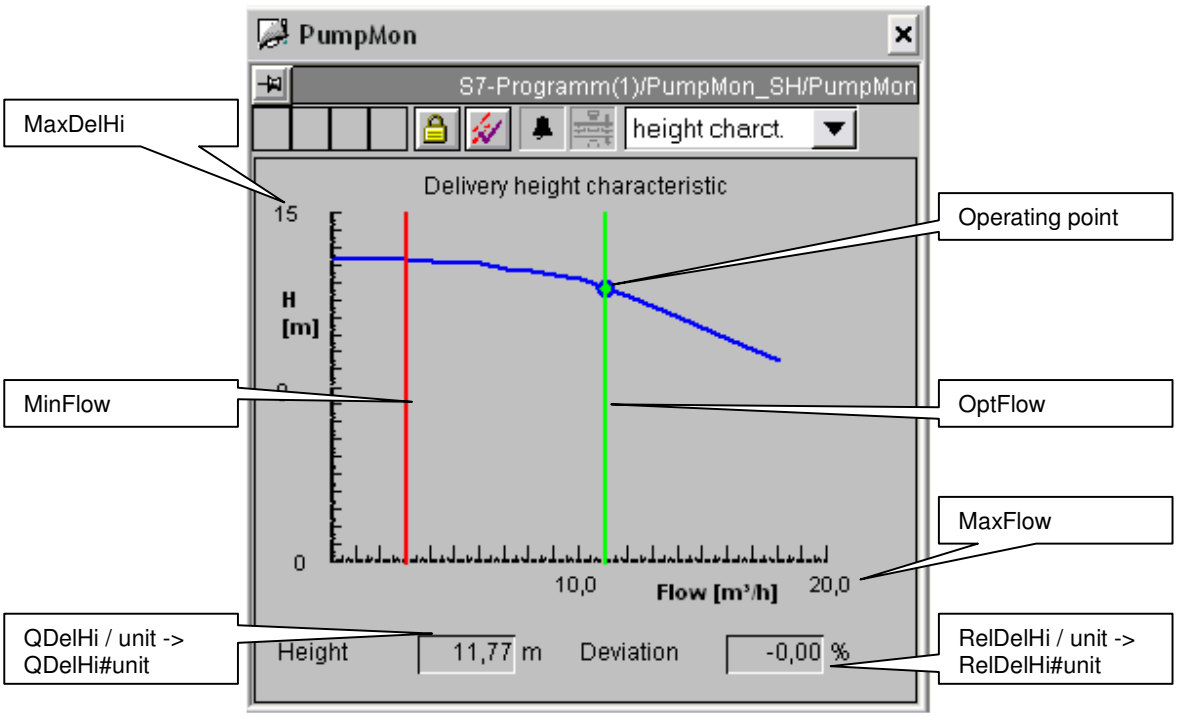
The faceplate is described in this section.
The following views are available:

Description	View
H/Q characteristic	DelHeightCharacteristic
P/Q characteristic	PowerCharacteristic
NPSH/Q characteristic	NpshCharacteristic
Histogram	HISTOGRAM
Power	POWER
Parameters	PARAMETERS
Nodes for characteristics	ParTable
Teach function	TEACH
Limits	LIMITS
Tolerances	TOLERANCE
Trend	TREND
Warning for reset	Note
Messages	
Batch	BATCH

The file name is structured as follows: @PG_PUMPMON_<view>.PDL
The PCS 7 standard picture is used for the messages view.
The structure of the individual faceplate views is described below.

The typical picture @PCS7TypicalsPumpMon.pdl is also available for automatically creating the block icon.

H/Q characteristic (DelHeightCharacteristic)



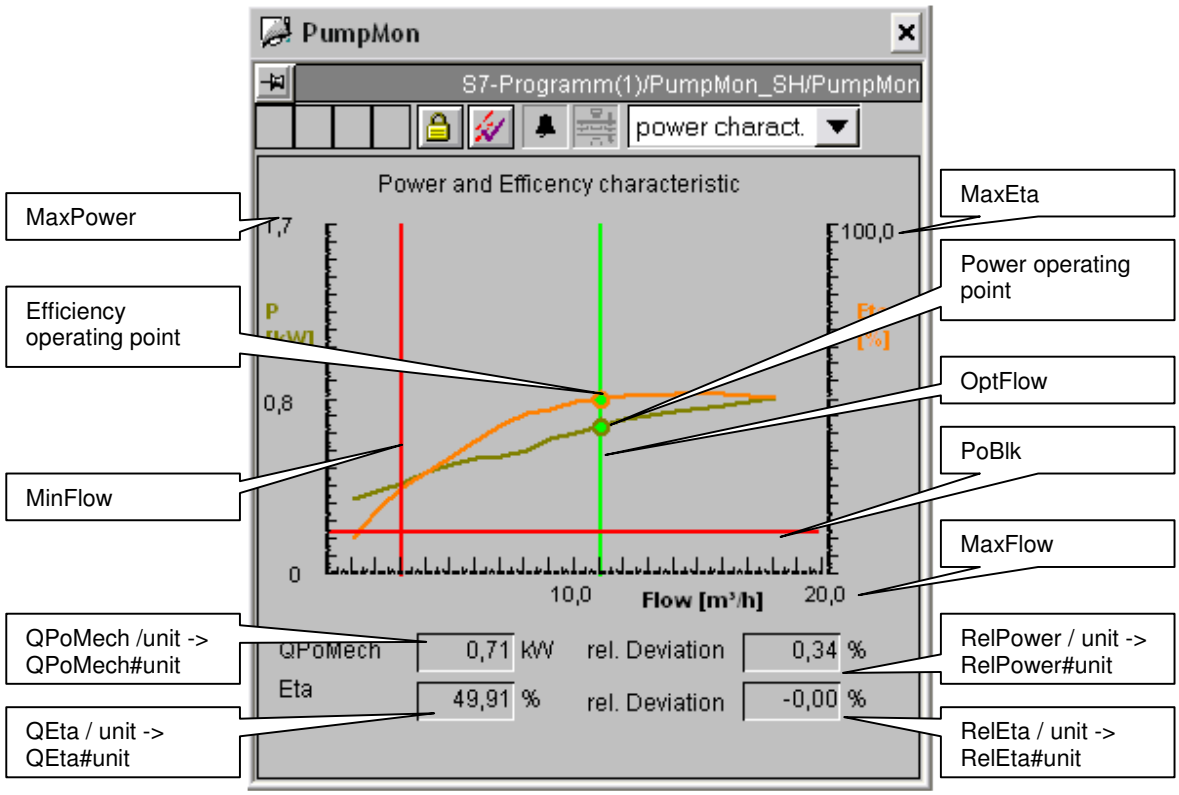
This view shows the H/Q characteristic (delivery height) with the operating point. The support points for the characteristic are entered in the "Nodes for characteristics" (ParTable) view.
If the distance between the current operating point and the characteristic exceeds a predefined tolerance, the color of the operating point changes from green to red and an alarm is triggered.
The red line indicates the minimum permissible flow rate, while the green line indicates the optimum flow rate.
The red line is only displayed if ***MinFlow*** is > 5% of ***MaxFlow***.

In the case of variable-speed pumps, for ergonomic reasons as well as to optimize the computing time and refresh speed, , the characteristic is not re-calculated every time the speed changes but, instead, the influence of the speed change is factored into the positions of the operating points. This occurs in accordance with the following dependencies:

- ***Flow_New(i) = Flow(i) * siSpeed / SpdRate***
- ***DelHi_New(i) = DelHi(i) * (siSpeed / SpdRate)2***
- ***Npsh_New(i) = Npsh(i) * (siSpeed / SpdRate)2***
- ***Power_New(i) = Power(i) * (siSpeed / SpdRate)3***

This re-scaling allows to use the original characteristic, although the scaling of the x and y axis must be hidden as a result. The positions of the lines indicating the minimum and optimum flow rate are adjusted accordingly.

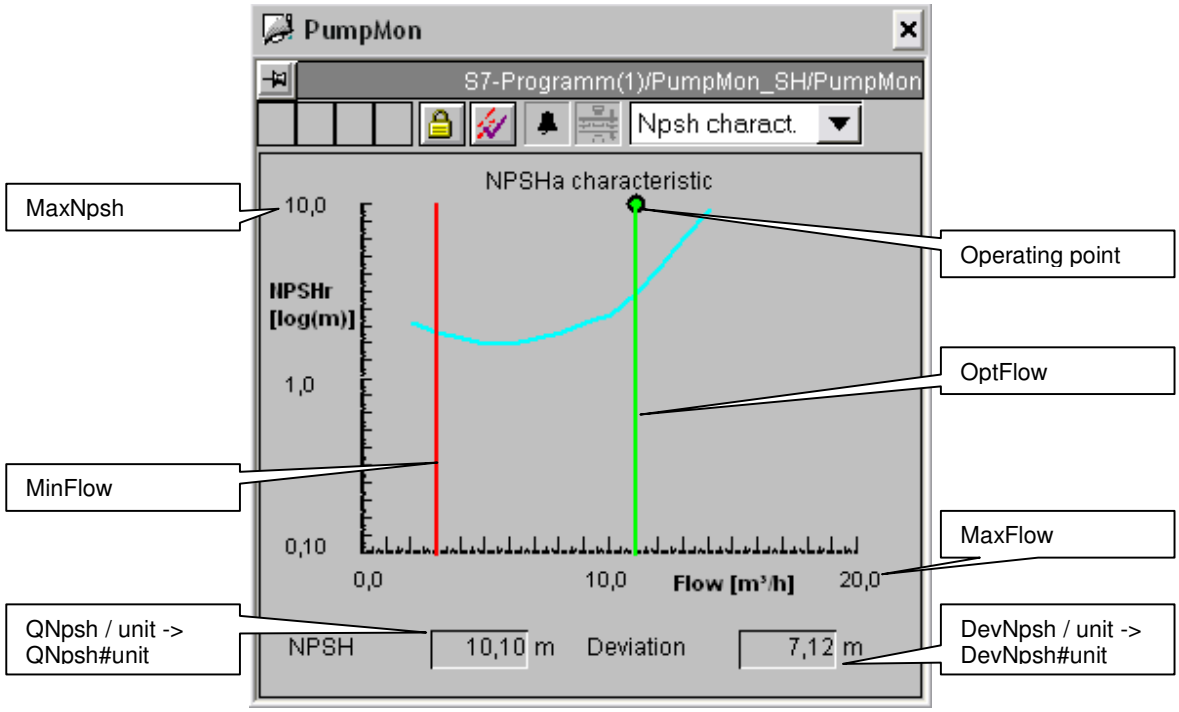
P/Q characteristic (PowerCharacteristic)



This view shows the power and efficiency (Eta) characteristics.
Again, the color of the operating points changes to red when the distance between the operating point and the characteristic exceeds a predefined tolerance, and corresponding alarms are also triggered.

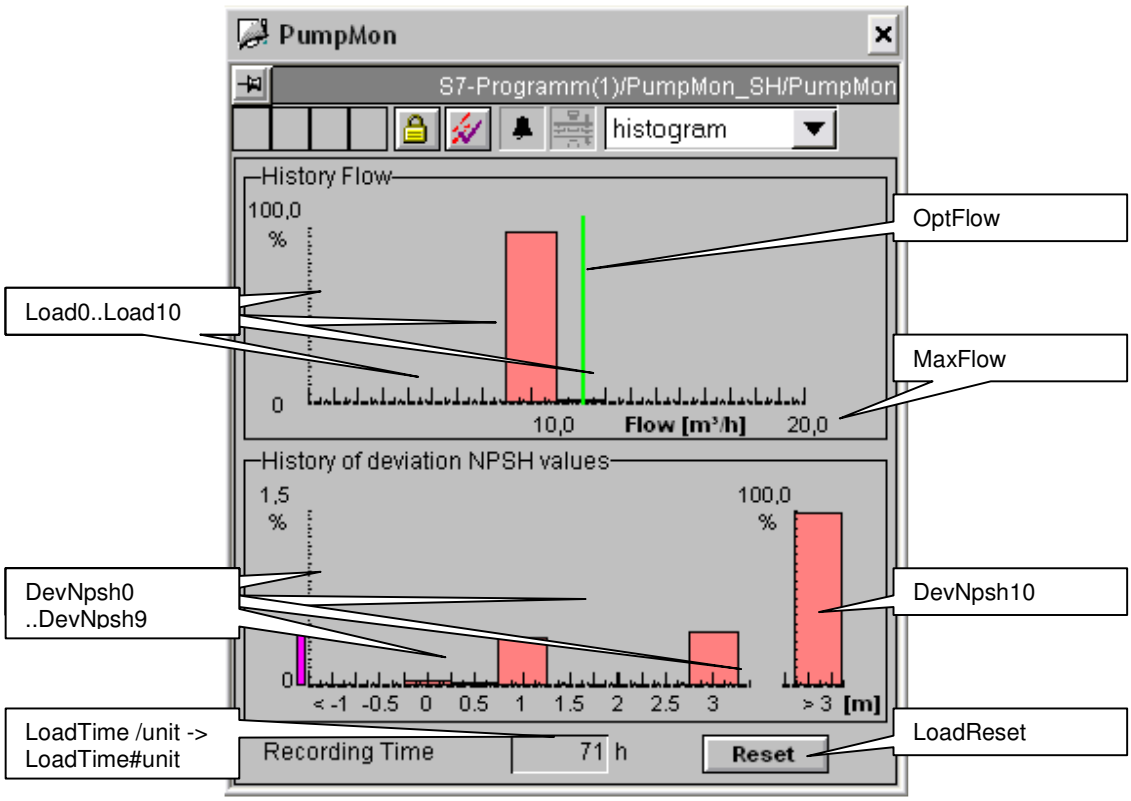
A horizontal red line appears in addition to the lines indicating the optimum and minimum flow rate. This indicates the (speed-dependent) limit value ***PoBlk***, that is, a blockage is present if the recorded power undershoots this value.

NPSH/Q characteristic (NpshCharacteristic)



The NPSH value is shown semi-logarithmically. An alarm is triggered and the color of the operating point changes when the current operating point is at a certain, parameterizable distance from the characteristic (default: +0.5m).
The minimum and optimum flow rate is indicated in the same way as in the other characteristics.

Histogram (HISTOGRAM)



These histograms show the "load profile" to which the pump was subjected. The first bar on the left (purple) indicates the idle times.
The green line indicates the optimum flow rate.

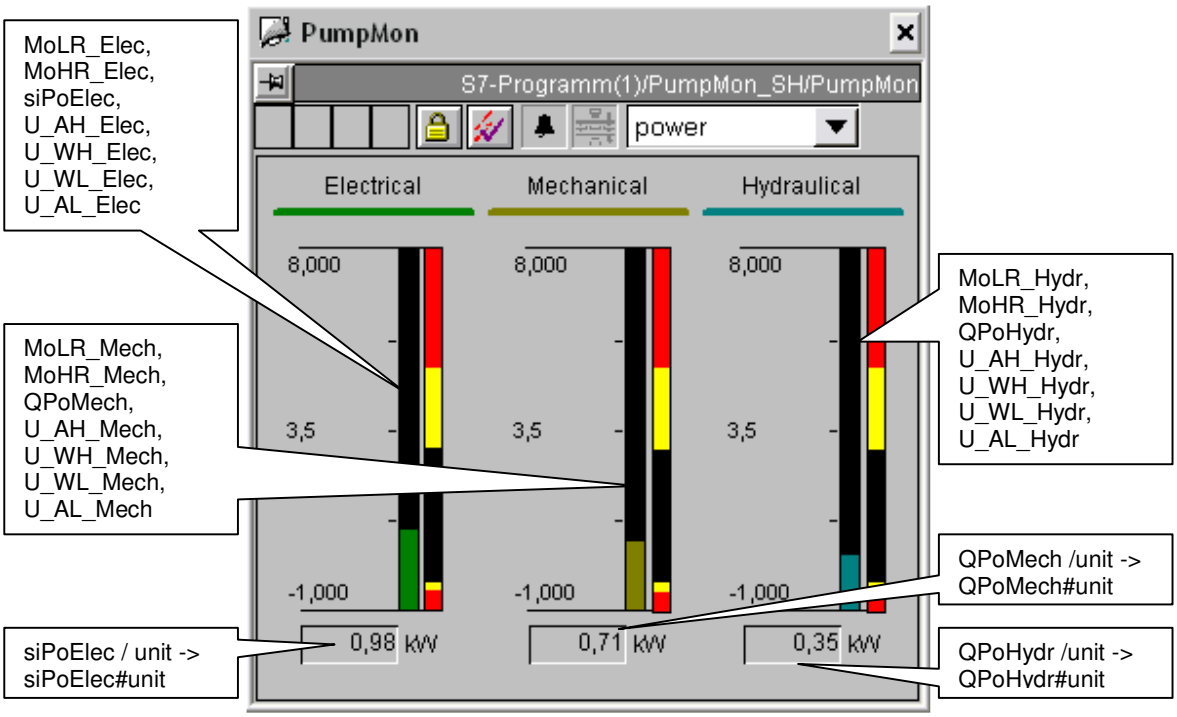
The histogram showing the deviation from the NPSH value is divided into two bar diagrams. The counters 0 to 9 (***DevNpsh0…DevNpsh9***) are shown in the diagram on the left, while the tenth counter (***DevNpsh10***) is shown in the diagram on the right. The diagram is divided into two because, under normal circumstances, the deviation from the NPSH characteristic at 99% is > 3m. The other counters would then be too small to appear in the diagram. For this reason, the maximum value of the Y axis in the diagram on the left is derived from the difference of the tenth counter (***DevNpsh10***) from 100%. When ***DevNpsh10*** = 99%, therefore, the Y axis on the left is shown with a maximum value of 1% and the values of the other counters, which together comprise 1% of the total recording time, can be displayed and analyzed.

The "*Recording Time:*" field shows the period during which these statistics were collected. When you press the reset button, all the saved values are reset to zero and the collection is restarted. As a result, the statistics collected previously are lost.
The following message is displayed prior to this:

Note: When the upper limit of the flow rate range (***MaxFlow***) is changed, the counters are also reset.

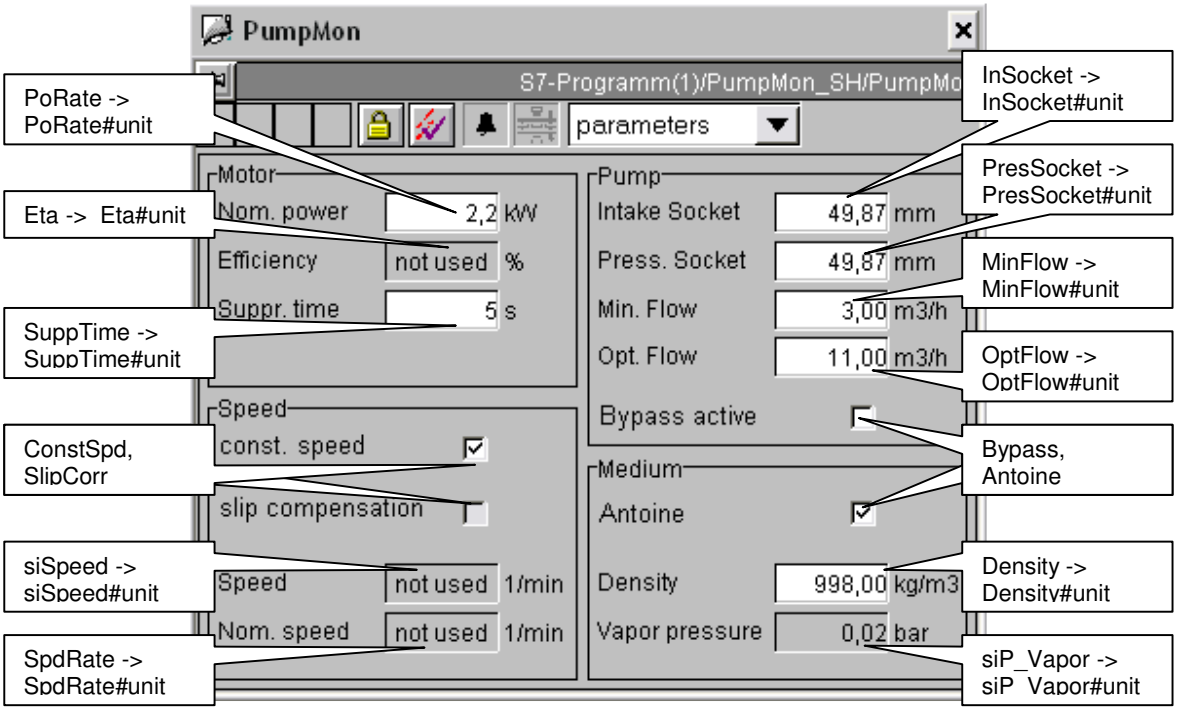
The histograms are updated when the screen is called up and then cyclically every five seconds.

Power (POWER)



The power view shows the three types of power with their warning and alarm levels.

Parameters (PARAMETERS)



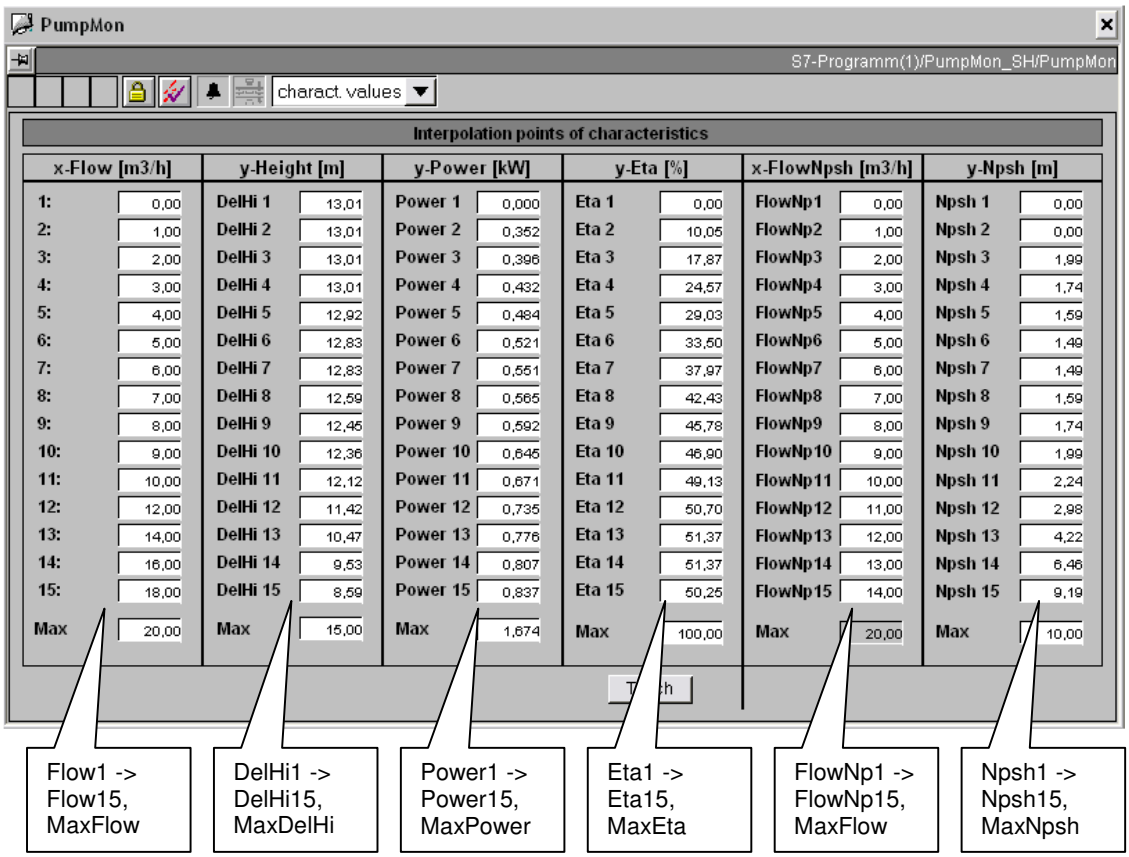
In this view, basic data for the motor, pump, and pumped medium are entered.

In the case of pumps with a constant speed, the slip correction and the current / nominal speed are not required. For this reason, the entry fields for slip compensation and speed are deactivated and "not used" is shown for the current and nominal speed.

Note: If one of the bits for "converter active" (***ConvAct***) or "polynominal active" (***PolyAct***) is set, "not used" also appears in the field for entering the efficiency.

The cavitation monitoring requires the knowledge of the vapor pressure of the medium. For a wide range of media, the vapor pressure can be calculated as a function of the temperature by the Antoine equation. The supplied default parameters apply for water in the range 1°C to 100°C. For other media, the Antoine coefficients must be changed accordingly.
If the Antoine equation is not to be used, deactivate the "Antoine" checkbox. In this case, the vapor pressure has to be calculated externally and supplied via the input ***P_Vapor***. This input can be interconnected and so cannot be changed via the faceplate.

Nodes for characteristics (ParTable)



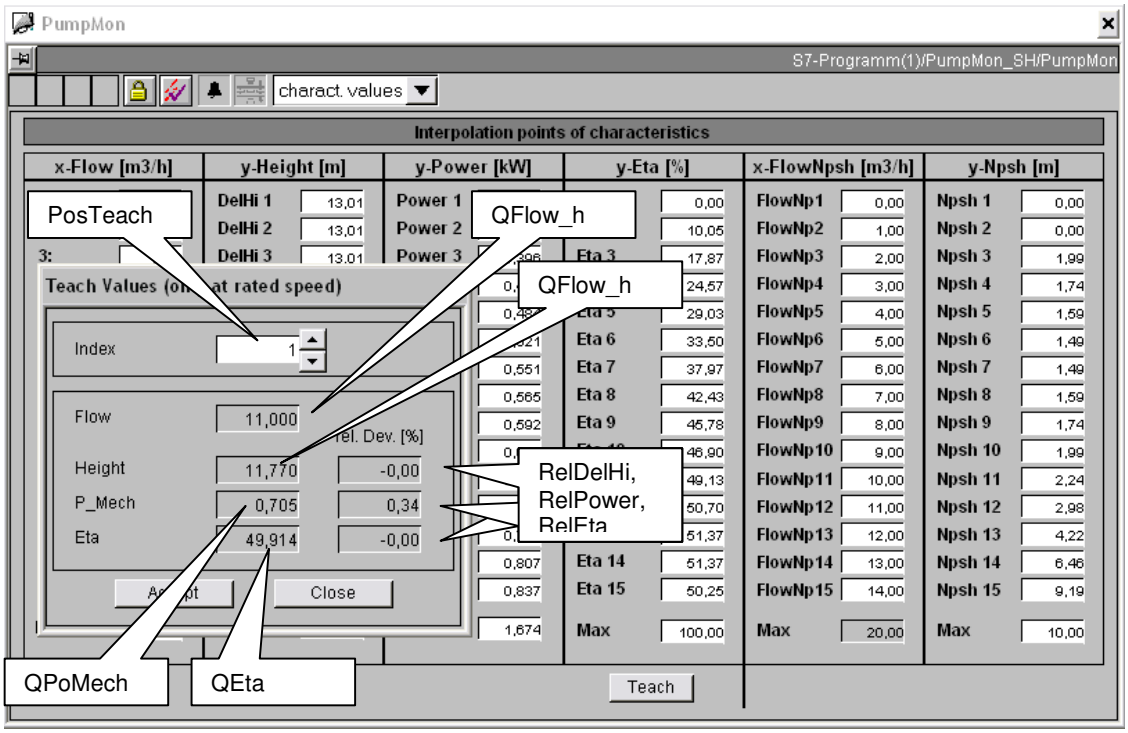
The nodes for the characteristics must either be taken from the data sheet for the pump and entered here, or taught by means of the teach function (see below). The former scenario provides a direct comparison with the theoretical optimum pump behavior. The latter scenario, on the other hand, can also be used to record the "reference status" under non-ideal circumstances (e.g. pressure measurement not taken directly at the pump outlet, etc.) to obtain a reference for later deviations.

Manual input

Individual nodes can be entered manually in this screen. The following values can be entered: 15 values for the flow rate (x values) and the associated values (y values) for the delivery height, power characteristic, Eta efficiency, and NPSH value, as well as the corresponding maximum values.
The data is displayed in the range 0 <= ***Flow1*** <= ***Flow2*** <=, ..., <= ***Flow15*** <= ***MaxFlow***. The nodes do not have to be equidistant, but the ***TimeBase*** parameter on the CFC block must be used to specify the time basis to which the x values relate (e.g. ***TimeBase*** = 3600 for ***Flow#unit*** = m3/h).

Nodes at the beginning or end of the characteristic with the value "zero" are not shown.

Teach function

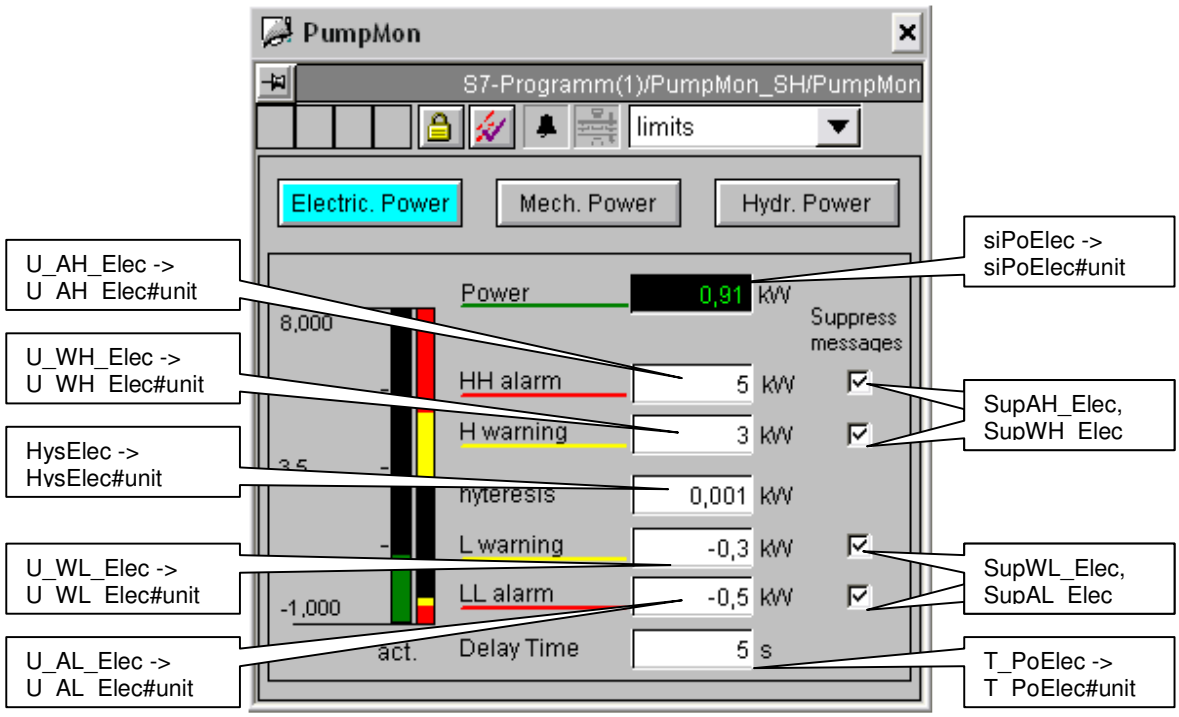


When the teach function is used (the "Higher operator process control" access level is required), the calculated characteristic values as derived from the measured values for an operating point are used as nodes. The respective flow must be set and, once the steady state is reached, the position (1..15) of the data record must be specified.
An "undo" function is not available, which means that incorrect entries must be reset individually. The teach function should only be used for operation under rated speed. The teach function cannot be used if a bypass is enabled.
The NPSH characteristic cannot be configured by means of the teach function, which is why it is assigned separate x values for the flow rate.

Note: Under certain circumstances, the characteristic can exhibit an hysteresis. This means that the operating points may be different even though the flow rate values are the same, depending on the direction in which the characteristic is tracked. If this is the case, the mean value of these operating points should be used as the node and taken into account when the limit values for the tolerances are chosen.

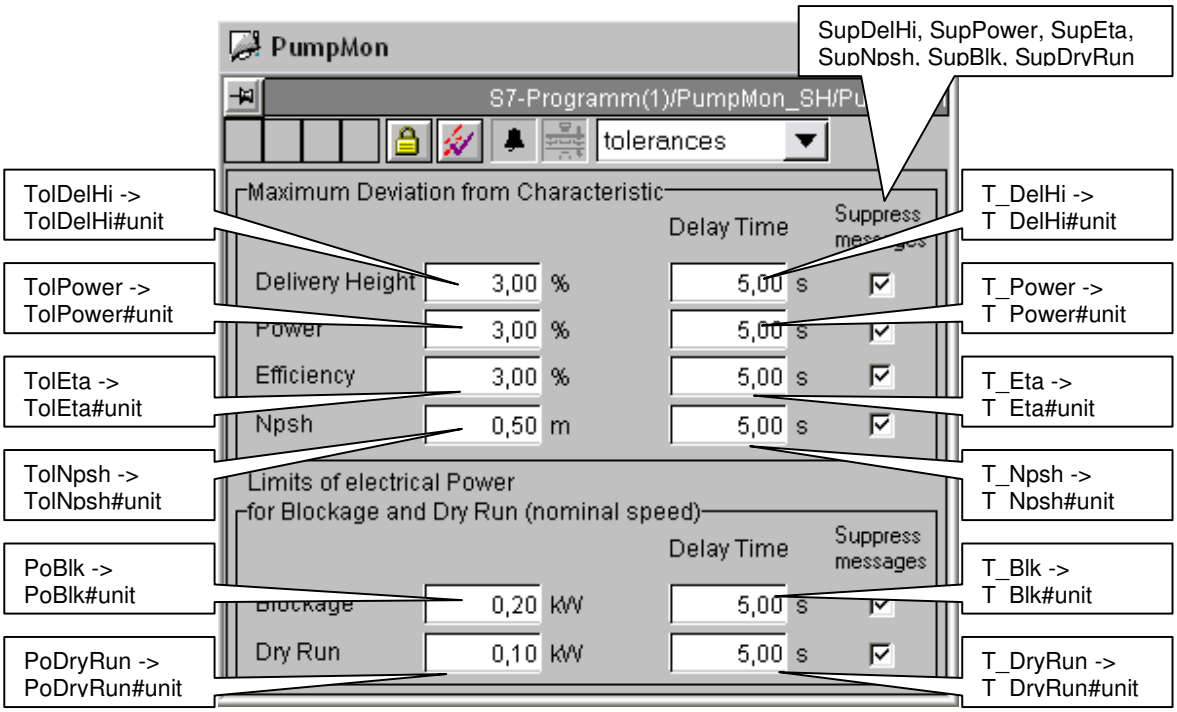
When ***MaxFlow*** is changed, the values saved in the histograms are lost. Therefore the same alarm message that is displayed when you press the reset button in the histogram view is also displayed here before any changes to ***MaxFlow*** are made.

Limits (LIMITS)



This screen can be used to configure the electrical, mechanical, and hydraulic power limits.
The buttons can be used to change the corresponding reference variables.
The limit values, including the associated hysteresis and delay times, can be entered for each variable (the "Higher operator process control" access level is required). The alarms can be suppressed by selecting the relevant checkboxes.

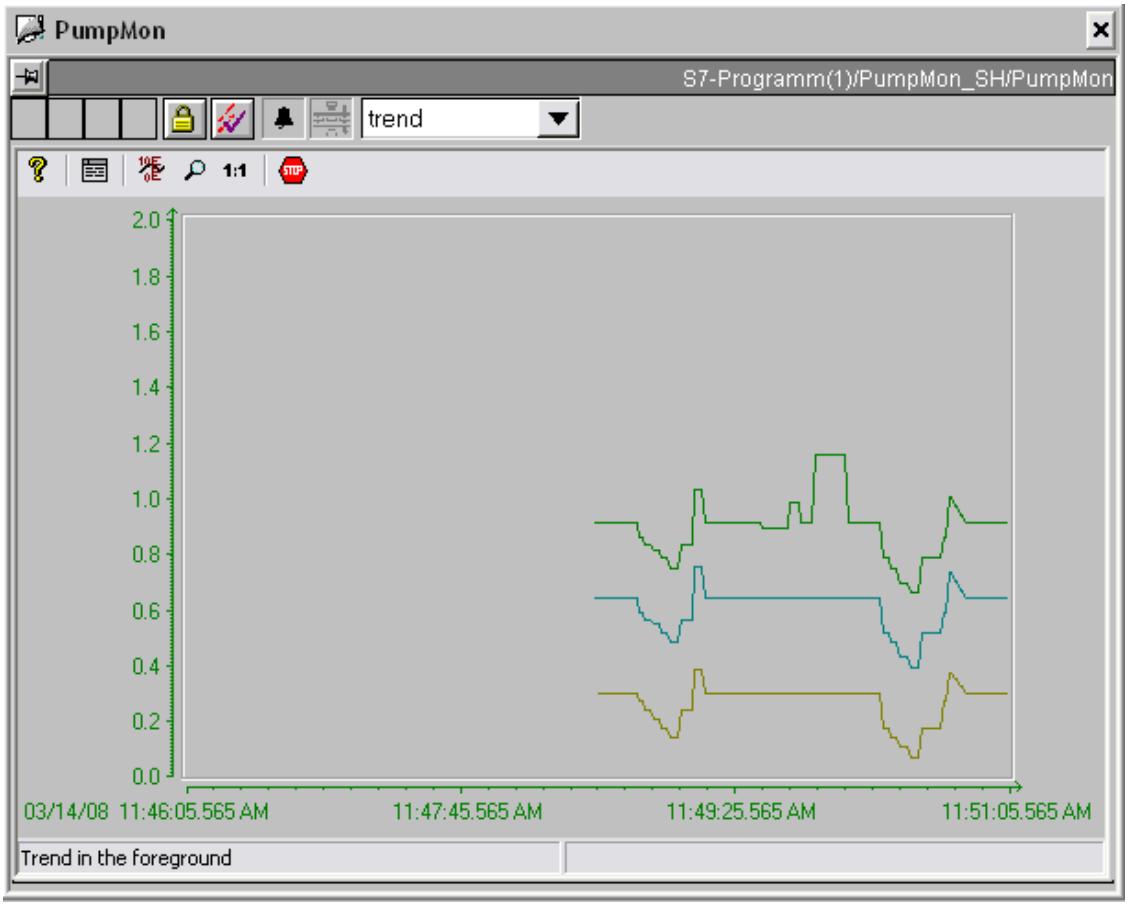
Tolerances (TOLERANCE)



This screen can be used to enter the maximum permissible deviation between the operating points and the characteristics, as well as the limit values for the electrical power if a blockage occurs or during dry running, including the associated delay times (the "Higher operator process control" access level is required). The alarms can be suppressed by selecting the relevant checkboxes.
The related hysteresis values must be changed accordingly on the block in the CFC plan.

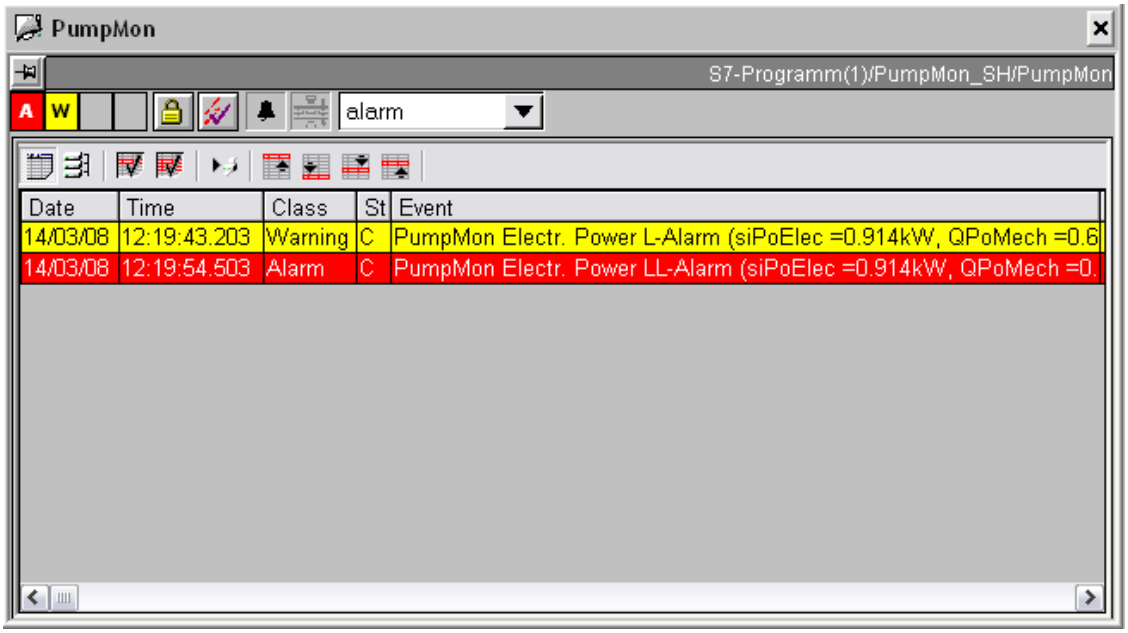
Note: The entries apply to operation under rated speed. With variable-speed drives, the limits are changed in accordance with the speed.

Trend (TREND)



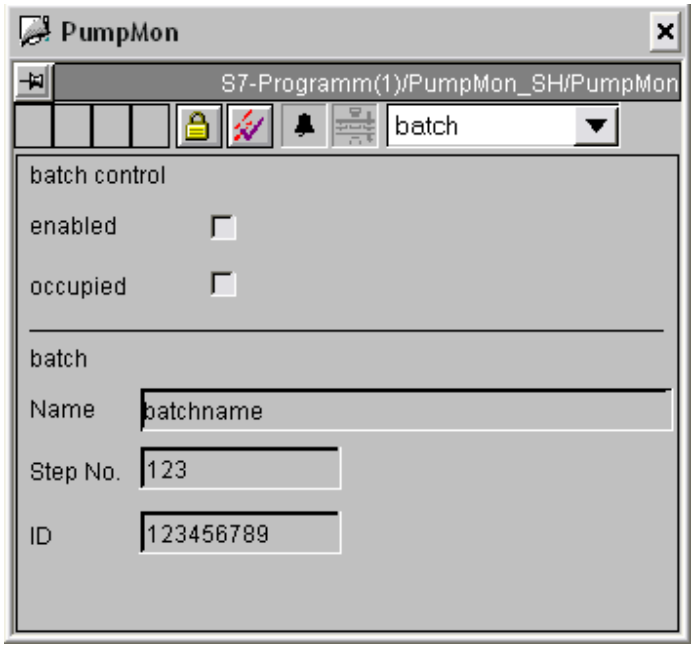
The trend view displays the three values for the electrical, mechanical, and hydraulic power.

Alarms



The message view is the same as the default view in PCS 7.

Batch



The batch view is the same as the default view in PCS 7.