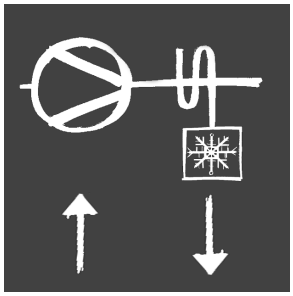
VISONIK®

BPS plant control

Function sheet



The VISONIK BPS plant control coordinates and implements all the control functions of the building services systems assigned according to the plant operating program created by engineering.
This document describes the elements and principle of operation of plant control.

Use

Examples of control functions

Control functions in building services systems such as HVAC plants are carried out chiefly as the result of certain events. The latter can be triggered by very varied influences either inside or outside the plant. The following are some typical examples:

Influence	Event ⇒ control function
Time	07:00 is reached: ⇒ Change ventilation from night to day operation.
Heating requirement	Maximum heat output reached at Boiler 1: ⇒ Turn on Boiler 2.
Outside temperature	Temperature falls below the frost protection limit: ⇒ Trigger the frost protection functions.
Degree of pollution	The pressure difference between the two sides of the filter is too high: ⇒ Output maintenance alarm “Replace filter mat”.
Operating hour	Twin pump “A” reaches the operating hour limit: ⇒ Switch to twin pump “B”.
Plant elements	Fan contactor is defective / No “ON” feedback message: ⇒ Switch off plant.
Energy requirement	External heat surplus in the “south” plant part while there is a heating demand in the “north” plant part: ⇒ Carry out energy-optimized demand switchovers.
Room occupancy	Spontaneous evening event in the assembly hall: ⇒ Set the plant setpoint manually to day operation.

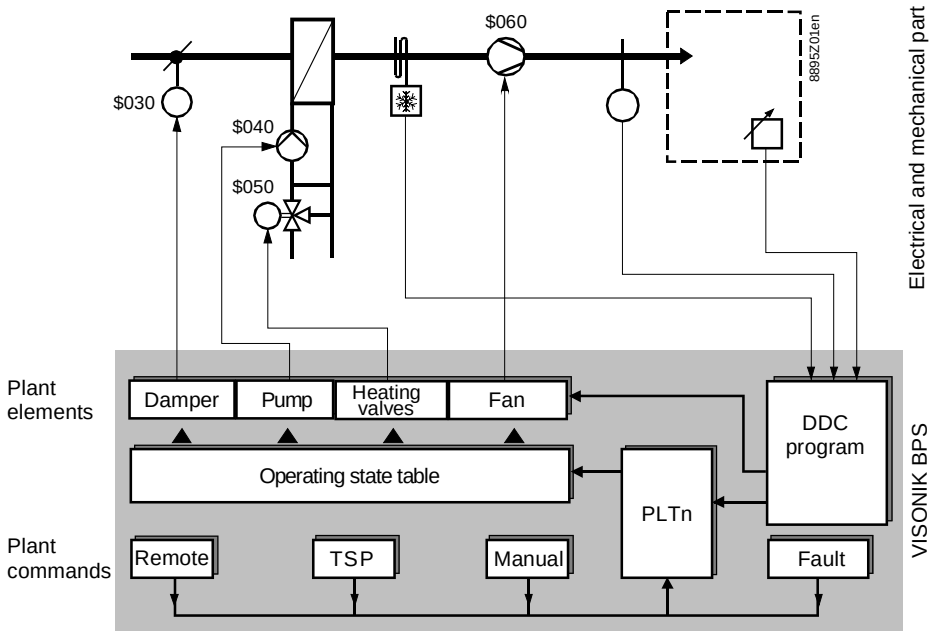
Implementation

The VISONIK BPS implements the control functions using its basic and processing functions, and according to the conditions for the participating elements set down by engineering.

Plant control elements

Example

The following illustration shows the plant control elements in the electrical and mechanical plant and in the VISONIK BPS.



Explanations (illustration)

The plant control elements shown are:

Elements	Description
Plant elements	All plant elements such as dampers, pumps, heating valves, etc. are shown in the VISONIK BPS process image as physical data points and are controlled via the DDC program. For simplicity's sake, only those plant elements addressed by plant control are shown as data points together with their addresses (damper $030, pump $040, etc.).
Plant commands	Plant commands come from various sources and have an effect on the operating state of the plant, for example: – Remote: VISONIK DCS data and communication server. – TSP: VISONIK BPS time switch program. – Manual: Operator input to the VISONIK BPS. – Fault: Error in plant / plant faults.
PLTn	All interventions influencing plant operation are run by a single data point, the PLTn plant point. The DDC program uses the plant point to calculate the valid desired plant state cyclically and forwards this calculation to the operating state table. The PLTn plant point is a virtual point, i.e. its address is "n" and it has assigned parameters; however, it has no hardware of its own in the electrical and mechanical plants. Each plant has its own PLTn.
Operating state table	The operating state table gives the various desired plant states (ON, OFF, etc.) for each plant element. The plant elements are operated according to the valid set plant state.
DDC program	The DDC program controls and coordinates all activities for the plants controlled by the VISONIK BPS according to the individual plant tasks (in the DDC program) and the current state of sensors, setpoint units, and plant commands.

Definition of the plant functions

Set plant states

Before the control of a building services system can be programmed, all the states a plant must assume have to be defined in a first step. The outcome of these considerations gives the list of set plant states. These could be the following for the example previously shown:

- Plant OFF.
- Day operation (controlled to comfort temperature).
- Night operation (controlled to reduced temperature).
- FROST

Plant element operating states

In a second step, the operating states of the plant elements (valves, air dampers, fans, pumps, etc.) for the individual set plant states must be determined. Example:

The plant elements must assume the following operating states for the set plant state FROST.

- Damper Closed (0)
- Pump ON (1)
- Heating valve Open (100 = 100% stroke)
- Fan OFF (0)

Operating state table

The previous considerations are summarized in the operating state table. If the operating states for the defined, set plant states have been determined for all the plant elements, a matrix like the following results:

Set plant states / PSTA / Plant elements		Plant OFF 0	Operation DAY 1	Operation NIGHT 2	Frost 3	
Damper	($ 030.ADR)	0	1	1	0	
Pump	($ 031.ADR)	0	1	1	1	
Heating valve	($ 050.ADR)	0	w_1	w_2	100	
Fan	($ 060.ADR)	0	1	1	0	
w_1, w_2 = Reference variable						8995Z01en

PSTA parameter

PSTA (= **P**lant **STA**te) is a PLTn plant point parameter. It receives the set plant state valid in each case as a numerical value, for example, PSTA=3 for FROST. The PSTA parameter is calculated cyclically from the current plant commands and the priorities assigned during programming.

Implementation of the plant task

During engineering, a plant task is created as part of the overall plant operating program. When this task is created, the following must be taken into consideration:

– Which influences and events must be acquired and where must they be collected to allow the defined plant state to be detected or specified?
– What elements are used for this (sensors, switches, programs, manual control operations, local/remote)?
– Which VISONIK BPS measuring and control commands (basic and processing functions) must be used to achieve the required operating states?

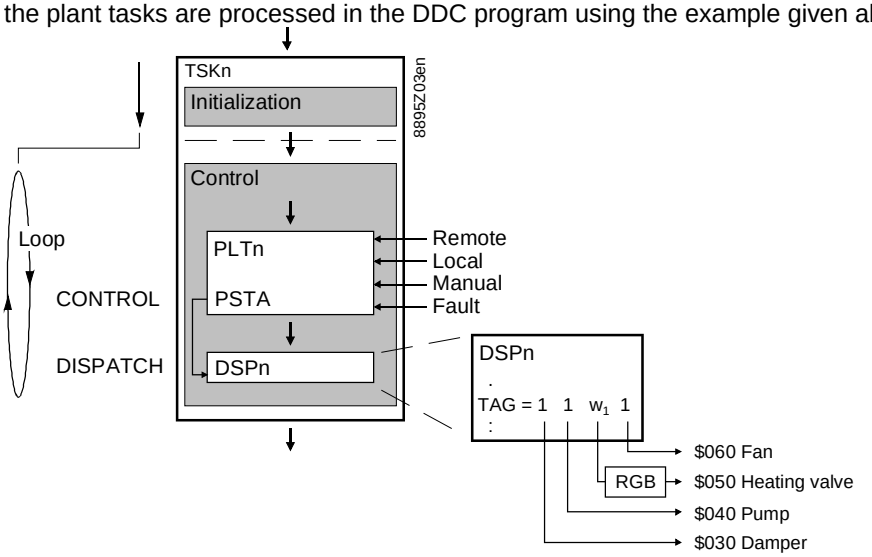
After that, the software tools are created using:

– Function blocks from program libraries, predefined and tested.
– COLBAS commands for special, user-specific functions (COLBAS stands for Control-Oriented Language for Building Automation Systems).

Plant task

Block diagram

The plant tasks created are loaded and started when the VISONIK BPS is commissioned. The following illustration is a simplified schematic presentation of how the plant tasks are processed in the DDC program using the example given above.



Elements and functions

The following elements and functions are involved in processing the plant task:

Element	Function
Initialization	This part contains the start conditions for the plant. The initialization process is only implemented during commissioning and program start.
Control	This part is processed cyclically (loop). It contains all the data and functions necessary for plant control.
PLTn	The plant commands are acquired from the various sources: – "Remote" from the VISONIK data and communication server (DCS), e.g., a command from the VISONIK peak demand limiting program. – "Local" from the VISONIK BPS, e.g., the TSP time switch program. – "Manual" = Operator input via the VISONIK BPS or VISONIK DCS. – "Fault" = Error in plant/plant faults.
CONTROL	The COLBAS instruction CONTROL triggers a calculation of the new PSTA set plant state at every cycle.
PSTA	The set plant state is determined at each polling according to the current plant commands and their priorities, and then assigned to the PSTA parameter. The PSTA is subsequently transmitted to the DISPATCH system procedure.
DSPn	Dispatcher point: The virtual data point assigned to the PLTn plant point. It contains, among other things, the operating state table.
DISPATCH	The DISPATCH plant procedure selects the values assigned to the set plant state (here DAY) from the operating state table and assigns them to the plant elements or the RGB controller block. The RGB then uses these values to generate the corresponding manipulated variable for the heating valve.
RGB	Controller block (virtual data point), here for the supply air temperature. The controller block controls the supply air temperature to the predefined setpoint for DAY operation.

Additional information

Refer to the following documents for more information on this topic:

Document No.	Title
CM2B8301E	BPS user's guide
CM2T8567E	VISONIK System Basics (expert documentation)