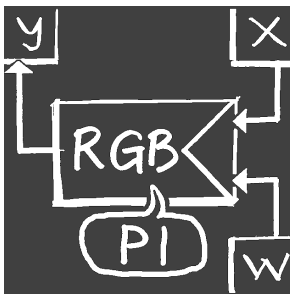
VISONIK®

BPS control functions

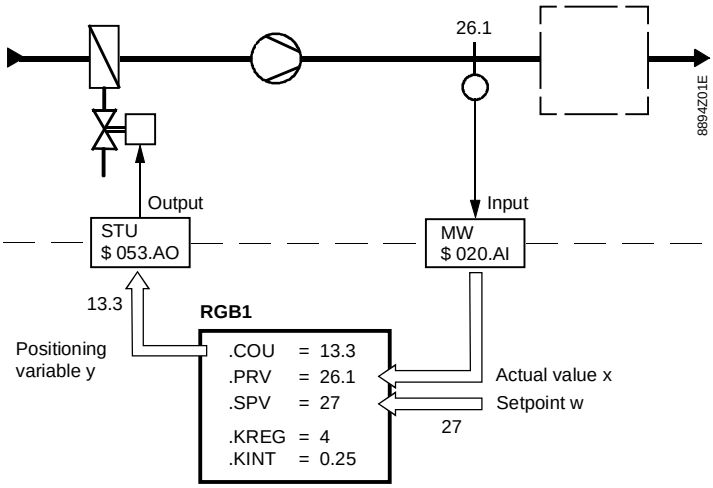
Function sheet



From the onset of building automation, controllers have been an integral part of the application functions. Earlier, individual devices were used; today, software blocks are often used in automation stations. This function sheet describes the structure of these blocks in the VISONIK BPS and the various control functions.

Use

The following illustration shows supply air control with a fixed setpoint. In the VISONIK BPS, the conventional controller has been replaced by two I/O modules (MW, STU) and one controller block (RGB1):



Explanations (illustration)

The controller blocks RGBn represent virtual data points in the BPS's process image. Each of the max. 254 controller blocks contains the associated functions and process variables in the form of software parameters. The table below contains a few examples from the above illustration:

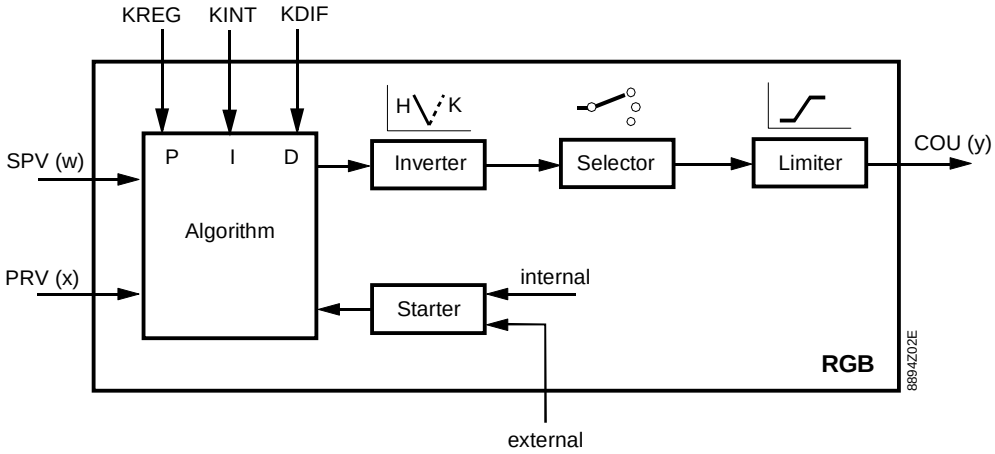
Designation	Description
$ 020.AI	Analog input of address $020 (point type MW, measured value module)
$ 053.AO	Analog output of address $053 (point type STU, positioning command module)
RGB1 .COU	Controller output variable/positioning variable; here: 13.3
.PRV	Control variable/actual value; here: 26.1
.SPV	Controller setpoint; here: 27
.KREG	Controller amplification (proportional amplification); here: 4
.KINT	Integral portion (integral action); here: 0.25

Individual controller RGB

The RGB controller block contains an individual controller with positioning output and various additional functions.

Block circuit diagram

The following diagram shows a simplified version of the controller block circuit diagram:



Elements and functions

The above elements and functions of the controller block are:

Element	Function
Algorithm	The controller block contains a PID control algorithm. Entering the associated values in the controller parameters defines the controller type (P, PI, PID, or PD) and the control response of the closed control loop: – KREG for proportional amplification (P) – KINT for the integral portion (I) – KDIF for the differential portion (D) If KINT or KDIF are set to 0, the associated portions are inactive, i.e., for a PI controller, KDIF is set to 0.
Inverter	To define the direction of control action: Heating mode (H) or cooling mode (C)
Selector	Used to select the controller status: Controller mode active (automatic mode = normal status), manual controller mode, controller mode OFF
Limiter	Used to define the upper and/or lower limits of the controller output
Starter	Defines the start values at which the controller should work on start-up or changeover operations (internal and external values).

Call-up and processing

The controller blocks are calculated cyclically for the respective plant on program execution. This is done using the REG function in the COLBAS program as shown in the following samples lines:

```
9100  @RGB2.SPV:=21
9110  @RGB2.PRV:=$020.AI
9120  $053.AO:=REG(RGB2.TA)
9999  WAIT DURING Z-MOD(TIME,Z);GOTO...
```

Line	Interpretation
9100	The setpoint SPV is read by controller block RGB2
9110	The actual value PRV of input $020.AI is read into the controller block
9120	The REG function calculates controller block RGB2 and assigns the resultant positioning variable directly to output $053.AO.
9999	After completing the entered cycle time Z, the control loop is restarted (general values are 10 to 30 seconds).

COLBAS = **C**ontrol-**O**riented **L**anguage for **B**uilding **A**utomation **S**ystems

Complex controllers SEQ and STR

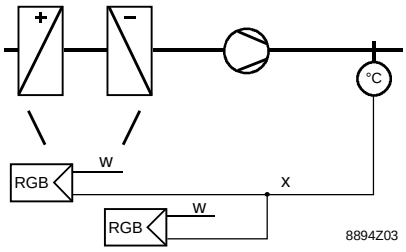
The VISONIK BPS has the following two complex controllers:

- SEQ sequence controller
- STR adaptive controller

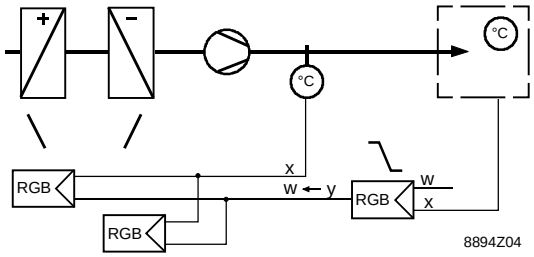
SEQ sequence controller

Sequence controllers SEQ allow for creating the following controls through combination with RGB controller blocks:

Sequence



Cascade/sequence



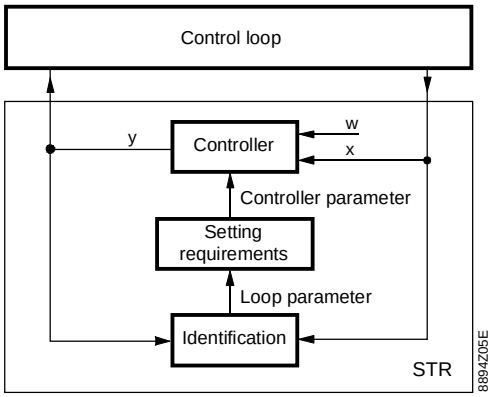
Features

Below is a list of the primary features of the two control types:

Control	Features	Properties
Sequence	Several actuators in sequence/own controller block for each actuator	The controller parameters of each portion can individually be adjusted to the different amplifications and time responses. (e.g., heating and cooling elements, mixing dampers, etc.)
Cascade/ sequence	Reference controller plus auxiliary control loop with one or several sequential controllers	The reference controller defines the setpoint for the sequential controller(s). For the reference control loop, an upper and lower limit can be defined. Influencing variables in the auxiliary control loop (e.g. supply air) are controlled before reaching the primary control loop (e.g. room).

STR adaptive controller

The STR (Self Tuning Regulator) adaptive controller is based on the RGB controller block. The controller parameters are set to meaningful basic values and then adjusted cyclically and automatically to the current states in the control loop via function STR:



Function and use

The following steps occur on each call-up of function STR:

1. Identification of the control loop
2. Adjustment of the controller parameters via saved settings
3. Calculation and output of positioning variable y by the controller

Adaptive controllers are used in control loops that vary due to the impact of various influencing variables. However: Even adaptive controllers cannot handle all complex control loops (e.g., loops with long dead times).

Overview of control functions

In the VISONIK BPS, the control functions can roughly be distinguished as follows:

- Functions implemented in the BPS
- Procedures loaded into the BPS via the plant operating program

Functions

The following table provides a list of functions. These include the above controllers, supplemented by further basic elements for control tasks:

Element	Functions	Notes
Controller block (RGB)	Modulating controller: – Fixed setpoint – P-algorithm – PI/PID algorithm	The setpoint can be controlled; see elements and procedures below.
Adaptive controller (STR)	Same as RGB plus: – Self-adaptation	
Sequence controller (SEQ)	Same as RGB plus: – Sequences, 2 or more – Cascade	Each sequence has its own RGB. Reference controller + sequences
Positioning (POS)	Converts input variable x to output variable y in a specific range	– For setpoint shifts For several positioning sequences on **one** controller output
Minimum value (MIN)	Supplies the smallest value from one or several variables	
Maximum value (MAX)	Supplies the greatest value from one or several variables	For example for defining the min. ZL portion for damper control
Hysteresis (HYS)	ON/OFF switching function with selectable switching difference	Results in 2-position controller output
PTM1.2Y250T-M	Positioning module 3-position	Results in 3-position controller output

Procedures

Procedures are predefined and tested COLBAS subroutines for specific functions or applications. The table below contains the procedures for control tasks:

Procedure	Function	Notes
CASCREG	Room supply air cascade	Based only on RGB
COMPENSATION	Room temperature compensation	Summer or winter, based on outside temperatures
DAMPREG + ENTHALPY	Control of circulating air dampers following temperature or enthalpy comparison	h;x control strategy
SCALE	Setpoint shift	Summer compensation, flow temperature in dependence of outside temperature, etc.
SEQREG	Sequence controller	For limit value control

Further documentation

In addition to this function sheet, the following documents contain further information on the VISONIK BPS control functions:

Document no.	Title
CM2Z8567E	VISONIK Point Types and Parameters (expert documentation)
CM2T8567E	VISONIK System Basics (expert documentation)
CM2Z8387E	COLBAS Language Description
UXPS0703E	VISOTOOL 4.0 Procedure Library (on request)