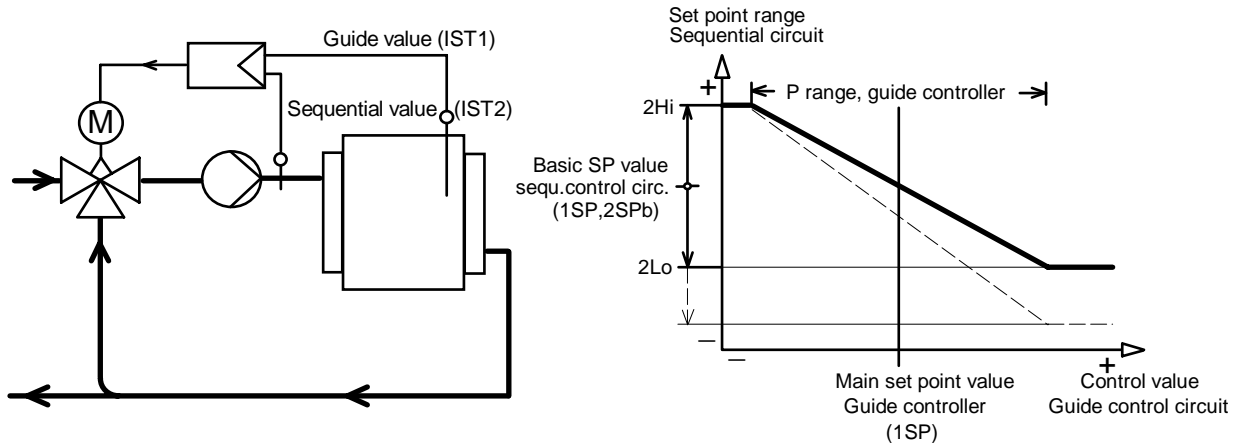


**Function:**

For cascade controllers, the basic unit of the standard version serves as a sequential controller, acting on the control output. The function extension consists of an additional guide control circuit with its own measuring input, the output of which acts on the set point value of the sequential controller. A deviation between set point and actual value of the guide control circuit (e.g. product temperature) increases or decreases the basic set point value of the sequential control circuit (e.g. supply temperature or combustion chamber temperature) within an adjustable range.

In the basic version 991k, only the set point value for the guide control circuit is set. It also serves as basic set point value for the sequential circuit. In version 991kb the possible change of the set point value is limited by the adjusted minimum and maximum absolute values. In version 991ku the guide controller set point value and sequential controller basic set point value are set independently from each other.

Version 991kdt provides a so called dt-control, to monitor the difference between the guide- and sequential actual value. Upon exceeding the adjusted difference value will influence the cascade to reduce the difference below the adjusted value.

**Control behaviour, equipment:**

Sequential controller:

Guide controller:

as desired, depending on the selected basic version  
PI (PID), with especially modified integral action

**Versions:**

Standard version  
the same, with limitable sequential setpoint value range  
Standard version, with dt-control  
the same, difference value heating / cooling separately adjustable  
separate set point values  
Guide control circuit can be switched off permanently by menu  
(sequential controller measuring input actual value 3)

**List No.:**

991k..  
991kb..  
991k..dt  
991k..dt2  
991ku..  
991k..(3)m

Addition for measuring input of guide controller, if different from sequential controller:

Pt100 DIN, 0...400°C  
Pt100 DIN, 0...100°C  
Thermal element NiCr-Ni (Typ K) 0...1200°C  
Thermal element Fe-CuNi (Typ J) 0... 900°C  
Thermal element PtRh-Pt (Typ S) 0...1700°C  
Rheostatic teletransmitter 0...100/1000Ω  
Standard signal 0(4)...20mA, 0(2)...10V  
Combined input PT100 DIN, -200..800°C or standard signal  
Actual value transferred by digital interface in place of measuring input

..0 or without  
..1  
..n  
..f  
..p  
..w  
..e  
..q  
..x

### Characteristic features of cascade controller

|                    |   |
|--------------------|---|
| Guide value =      | Input IST1 (Terminal 1-3 / a1-a5)*<br>alternative: by digital interface                 |
| Sequential value = | Input IST2 (Terminal 4-6 / a6-a8)*<br>alternative: Input IST3 (Terminal 7-9 / a11-a15)* |

### Set point value setting:

|            |   |
|------------|---|
| <b>1SP</b> | Guide controller set point value, also basic set point value for sequential controller (except for type 991ku)            |
| <b>2SP</b> | Display: current sequential controller set point value<br>= total of basic set point value and guide controller influence |

### Parameter level 1 (supplement):

Factory setting: Notes:

|             |   |    |     |
|-------------|---|----|-----|
| <b>CH</b>   | Channel selection of guide controller / sequential controller = CH1 / CH2   |    |     |
| <b>FUE</b>  | Only CH2: temporarily switch off guide controller influence (only for optimization) or permanently (An = on, Aus = off) | An | ___ |
| <b>2SPb</b> | Basic set point value for sequential controller (only for type 99ku)  | 0  | ___ |

### Parameter level 2 (supplement):

|                    |  |        |     |
|--------------------|--|--------|-----|
| <b>2Lo / 2HI</b>   | admissible maximum difference of the sequential controller set point value   | -50/50 | ___ |
| <b>2FLo / 2FHI</b> | minimum / maximum limit of sequential controller set point value   | ##     | ___ |
| <b>dt</b>          | Difference value between guide - and sequential actual value (0 ... #)<br>Adjustment 0 will cause the deactivation of the function (type 991kdt only)<br>(#= controller range) | 0      | ___ |
| <b>dt1/2</b>       | the same, difference value for heating / cooling separately adjustable   | 0/0    | ___ |

### Configuration level (supplement):

|             |   |     |     |
|-------------|---|-----|-----|
| <b>1 ib</b> | Integration range of the guide controller:<br>0...100% of the proportional band | 100 | ___ |
|-------------|---|-----|-----|

### Commissioning

Prior to optimizing the control behaviour, correct the factory set set point value range limitations of the sequential circuit, if necessary. The admissible range of the sequential circuit set point value is dependent upon various factors (e.g. maximum heating surface temperature, design of the heating surfaces, etc.) and should be individually set for each machine system. The values "2Lo" for the bottom and "2Hi" for the upper limit are set in parameter level 2 as a *difference* to the basic set point (also refer to the function diagram). The factory setting for thermostats is -50K / +50 K, for controllers with signal input 0.0. In version 991kb is to adjust additional an upper and lower absolute limit value.

Once the sequential control circuit limit values are set, optimize the sequential control circuit *without* influence on the guide control circuit. For this purpose, switch off the guide controller function (parameter level 2: CH2, FUE AUS). Now undertake the standard optimization of the control parameters.

Subsequently, switch on the guide controller function again and optimize the parameter for the guide control circuit, taking into consideration that the guide control circuit often reacts more sluggish than the sequential circuit. Therefore, it can usually be operated as proportional action controller *without* integral action (value for I at 0.0) or with a relatively long integral action time (several minutes). As an option, the integration range may be limited with parameter ib.

### Deviating reaction to error messages:

At Err 1 the guide controller element does not function,  
the sequential controller element continues to operate as standard controller with the set set point value.

At Err 2\* the configured safety circuit reacts (Factory setting: relay off or control signal on 0)

\* depending on version