7. Operating mode

7.1 Slave proportional mode

7.1.1 Applications

Control from external controller or manually controlled potentiometer.

7.1.2 EC fan control

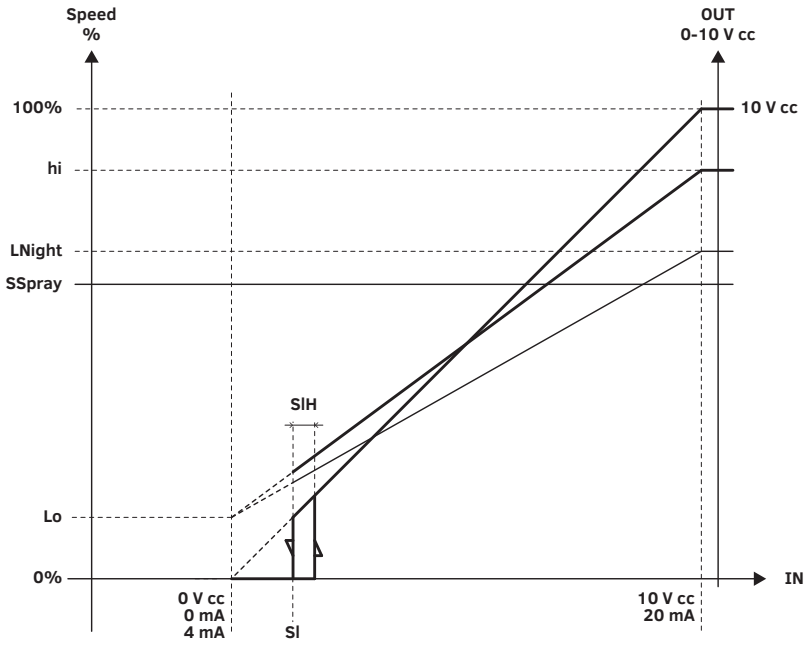
The control command value for fans **Co**, and possibly the **OUT** output voltage increases or decreases in proportion to the prevalent input **IN** based on the status of the **S1** input. The **Lo** minimum and **Hi** maximum speed limits are active, with forcing at 0% and relative hysteresis (**Sl**+**SlH**).

If the maximum night limit of % RPM **LNight** is activated (input **S5** = closed), **LNight** prevails over **Hi** only if the value is lower. If constant speed forcing is activated with the spray activated (input **S6** = closed), **Co** is equal to **SSpray**. If both functions are active, the lower value between **LNight** and **SSpray** prevails.

Control jumps (**JH1** + **JL1** and **JH2** + **JL2**) are activated to avoid particularly noisy zones, "Speed band" on page 52

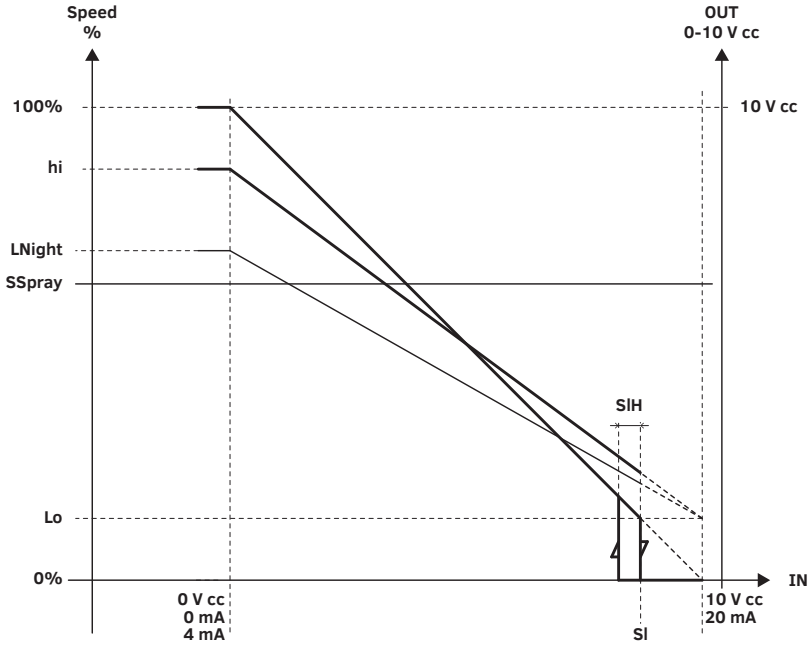
7.1.3 Direct Slave control for EC fans

S1 contact = *open*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***



7.1.4 Reverse Slave control for EC fans

S1 contact = *closed*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***



7.1.5 Spray unit control

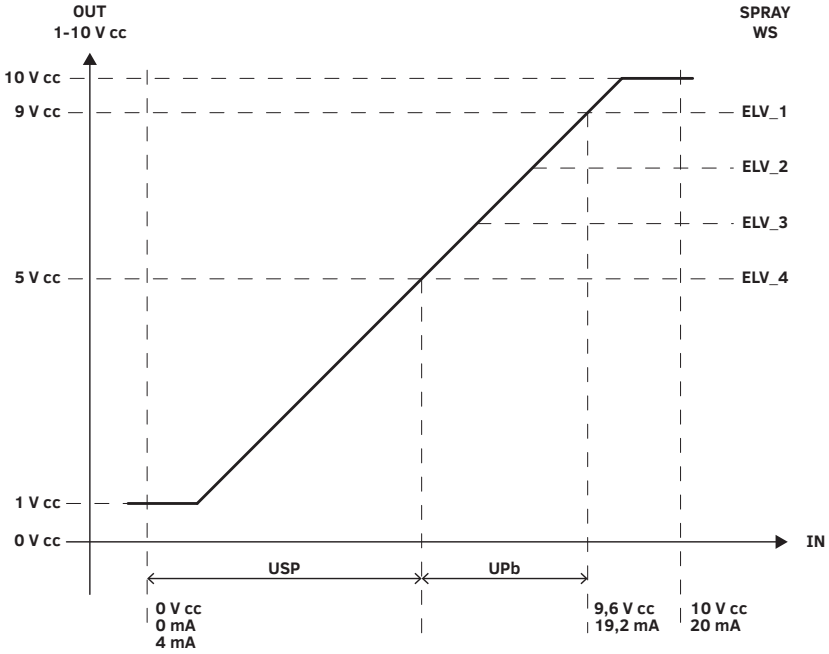
The controller enables a second work zone with independent setpoint **USP** and **UPb** proportional band. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** varies in proportion to the prevalent input (**IN**). The signal never reaches zero but is always between 1 and 10 V.

The **RL1** relay is On when input **IN** is greater than **USP** + **UPb/2**, it is Off when input **IN** is less than **USP** - **UPb/2**.

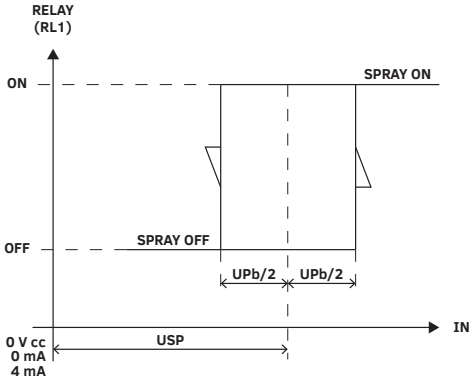
7.1.6 Slave control for spray with OUT output

*menu **4: SETUP** > **C7/C8** = **SPRAY 1-10V***



7.1.7 Slave control for spray with relay RL1

*menu **4: SETUP** > **C6** = **RL1=off -> Spray OFF***



Operating example

Following is an example of spray unit control via relay.

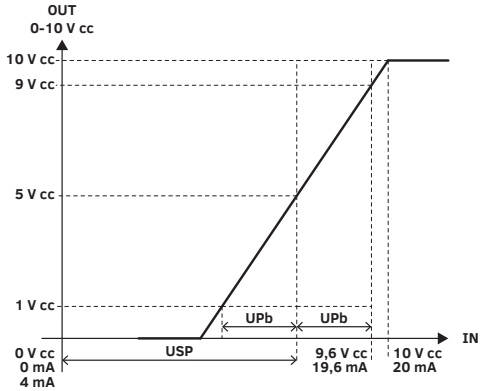
Configuration	Spray unit setpoint	Proportional band	Effect on relay
rS-020	**USP** = 15 mA	**UPb** = 4.2 mA	Relay On with **IN1** or **IN2** = 15+4.2/2 = 17.1 mA Relay Off with **IN1** or **IN2** = 15-4.2/2 = 12.9 mA
rS-420	**USP** = 15 mA	**UPb** = 4.2 mA	Relay On with **IN1** or **IN2** = 15+4.2/2 = 17.1 mA Relay Off with **IN1** or **IN2** = 15-4.2/2 = 12.9 mA
rS-010	**USP** = 7.5 V	**UPb** = 2.1 V	Relay On with **IN1** or **IN2** = 7.5+2.1/2 = 8.55 V Relay Off with **IN1** or **IN2** = 7.5-2.1/2 = 6.45 V

7.1.8 Slave regulation on OUT output to directly control a motorized valve actuator

*menu **4: SETUP** > parameter **C7/C8**= **USP-DIR 0-10V***

The controller enables a second work zone with independent setpoint **SP-USP** and proportional band **UPb**. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** increases and decreases in direct proportion to the signal of the input **IN**.

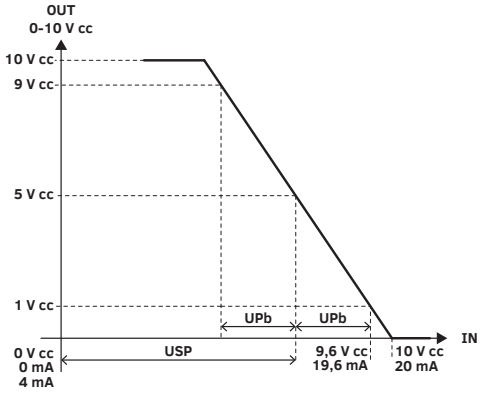


7.1.9 Slave regulation on OUT output to reversely control a motorized valve actuator

*menu **4: SETUP** > parameter **C7/C8**= **USP-REV 10-0V***

The controller enables a second work zone with independent setpoint **USP** and **UPb** proportional band. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** increases and decreases in direct proportion to the signal of the input **IN**.



7.2 Master proportional mode

7.2.1 Applications

Signals from temperature sensors or transducers.

7.2.2 EC fan control

The control command value for the fans **Co**, and possibly the **OUT** output voltage varies to keep the magnitude measured by the transducer with prevalent signal (**IN**) inside its **Pb** proportional band. Based on the status of input **S1**, **Co** increases or decreases proportionally to the prevalent input.

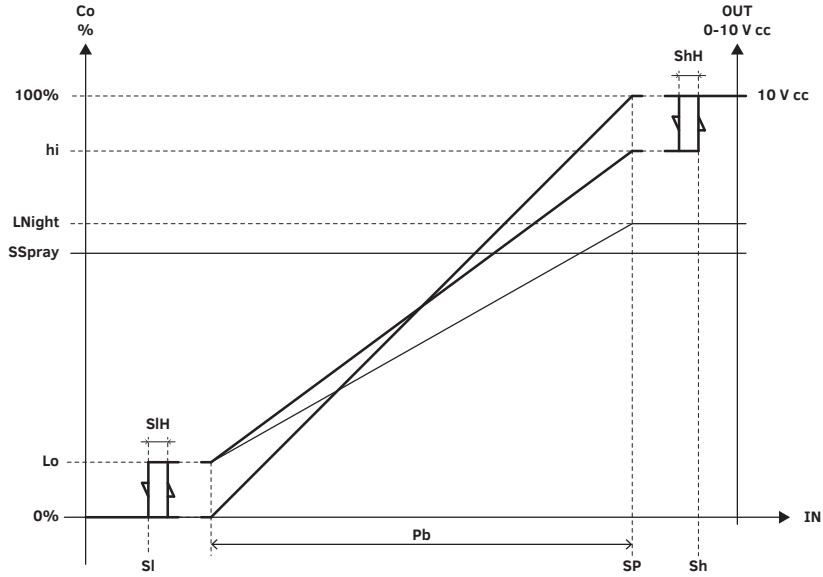
The setpoint **SP** can be at the limit of minimum (**Lo**) or maximum (**Hi**) speed for the control command value (parameter **C4** = **Lo**/**Hi**). Forcing is active at 0% and 100%, and the relative hysteresis (**SI**+**SIH** and **Sh**+**ShH**).

If the maximum night limit of % RPM **LNight** is activated (input **S5** = closed), **LNight** prevails over **Lo** only if the value is lower. If constant speed forcing is activated with the spray activated (input **S6** = closed), **Co** is equal to **SSpray**. If both functions are active, the lower value between **LNight** and **SSpray** prevails.

Control jumps (**JH1** + **JL1** and **JH2** + **JL2**) are activated to avoid particularly noisy zones, "Speed band" on page 52

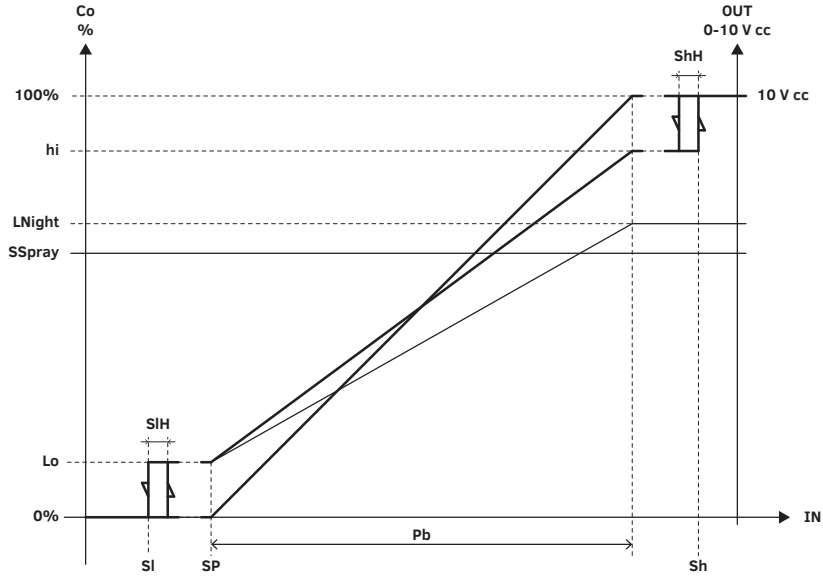
7.2.3 Direct Master control for EC fans, SP at the maximum limit (default)

S1 contact = *open*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***, ***C4*** = ***hi***



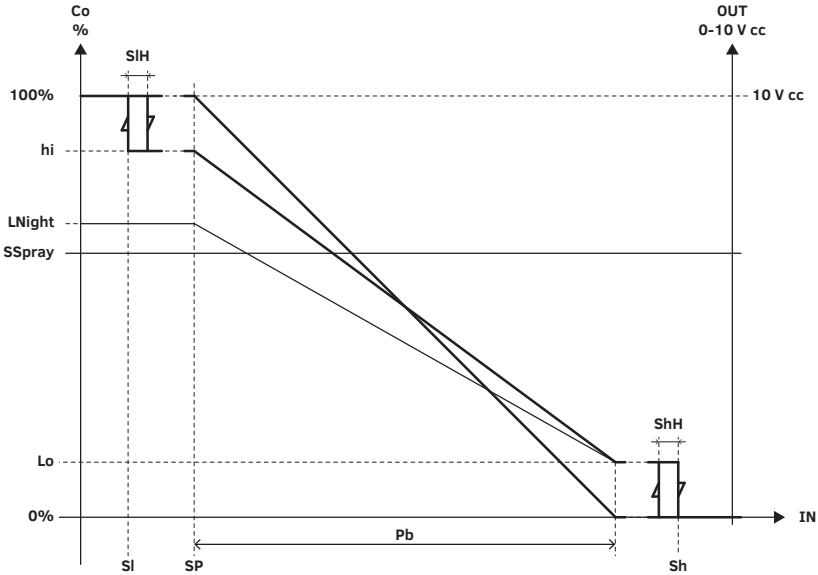
7.2.4 Direct Master control for EC fans, SP at the minimum limit

S1 contact = *open*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***, ***C4*** = ***Lo***



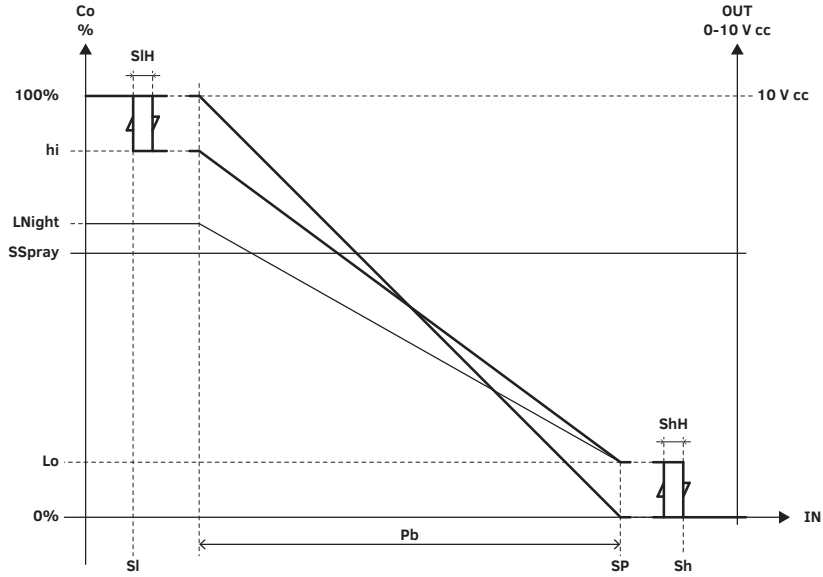
7.2.5 Reverse Master control for EC fans, SP at the maximum limit

S1 contact = *closed*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***, ***C4*** = ***hi***



7.2.6 Reverse Master control for EC fans, SP at the minimum limit

S1 contact = *closed*
menu ***4: SETUP*** > *parameter* ***C7/C8*** = ***SLAVE 0-10V***, ***C4*** = ***Lo***



7.2.7 Spray unit control

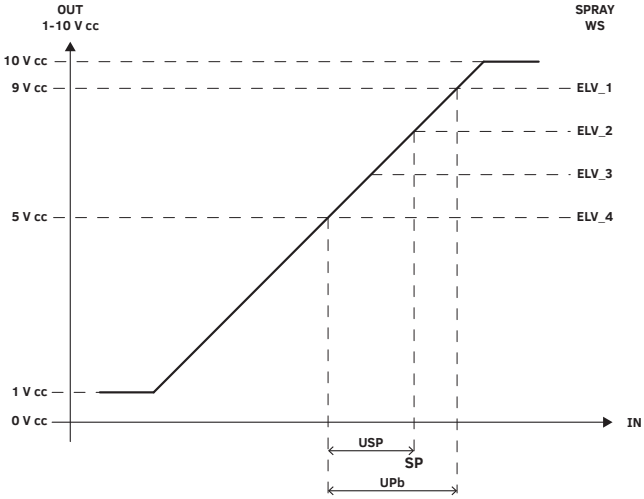
The controller enables a second work zone with independent setpoint **SP-USP** and proportional band **UPb**. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** varies in proportion to the prevalent input (**IN**). The signal never reaches zero but is always between 1 and 10 V.

The **RL1** relay is On when input **IN** is greater than **SP**+**USP**+**UPb/2**, it is Off when input **IN** is less than SP+**USP** - **UPb/2**.

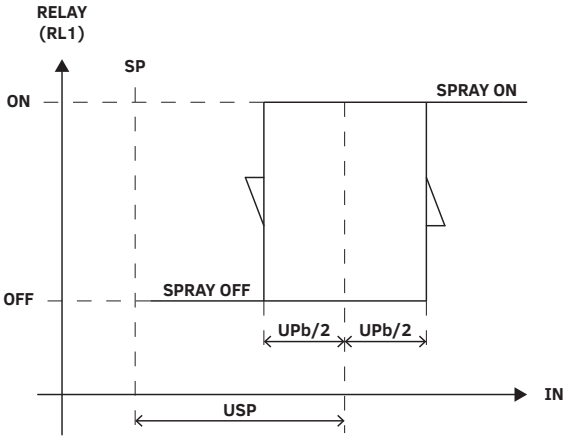
7.2.8 Master control for spray with OUT output

*menu **4: SETUP** > parameter **C7/C8** = **SPRAY 1-10V***



7.2.9 Master control for spray with relay RL1

*menu **4: SETUP** > parameter **C6** = **RL1=off -> Spray OFF***



Operating example

Following is an example of spray unit control via relay with the controller in **rtE-01** configuration.

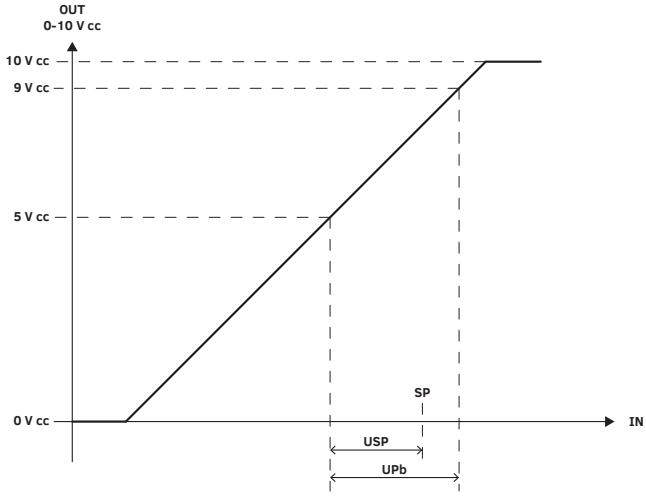
Controller setpoints	Spray unit setpoint	Proportional band	Effect on relay
SP = 45.0 °C	**USP** = - 1,0 °C	**UPb** = 4,0 °C	Relay On with **IN1** or **IN2** = 46.0 °C Relay Off with **IN1** or **IN2** = 42.0 °C
SP = 50.0 °C	**U.S.P.** = 3,0 °C	**U.P.b.** = 3,0 °C	Relay On with **IN1** or **IN2** = 54.5 °C Relay Off with **IN1** or **IN2** = 51.5 °C

7.2.10 Master regulation on OUT output to directly control a motorized valve actuator

*menu **4: SETUP** > parameter **C7/C8**= **USP-DIR 0-10V***

The controller enables a second work zone with independent setpoint **SP-USP** and proportional band **UPb**. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** increases and decreases in direct proportion to the signal of the input **IN**.

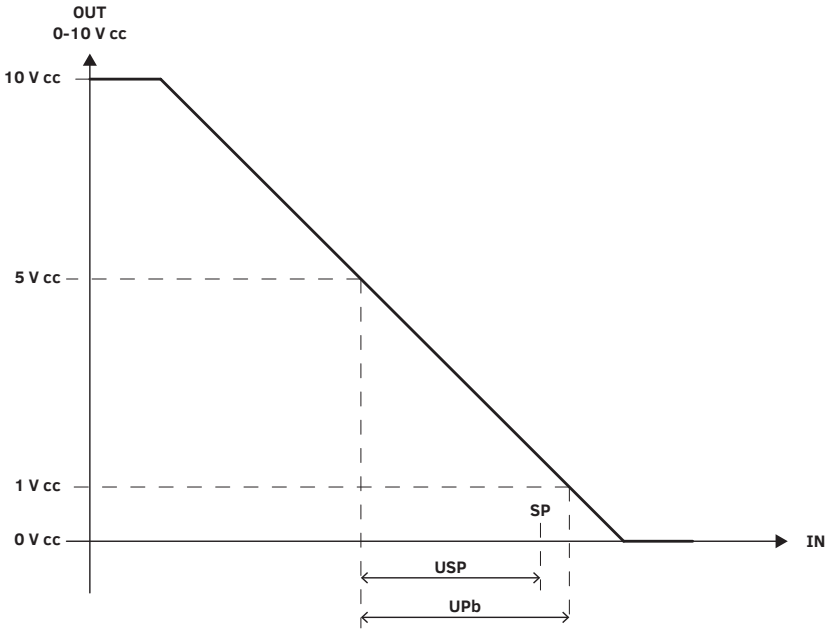


7.2.11 Master regulation on OUT output to reversely control a motorized valve actuator

*menu **4: SETUP** > parameter **C7/C8**= **USP-REV 10-0V***

The controller enables a second work zone with independent setpoint **SP-USP** and proportional band **UPb**. The work zone uses the same **IN** input signal and overlaps the fan work zone.

The voltage of output **OUT** increases and decreases in direct proportion to the signal of the input **IN**.



7.3 Master PID mode

7.3.1 Applications

Signals from temperature sensors or transducers.

7.3.2 EC motor control

The control command value for the fans **Co**, and possibly the **OUT** output voltage varies to keep the magnitude measured by the transducer with prevalent signal (**IN**) at the setpoint value (**SP**).

***Note**: for correct PID control operation, accurately set the specific parameters.*

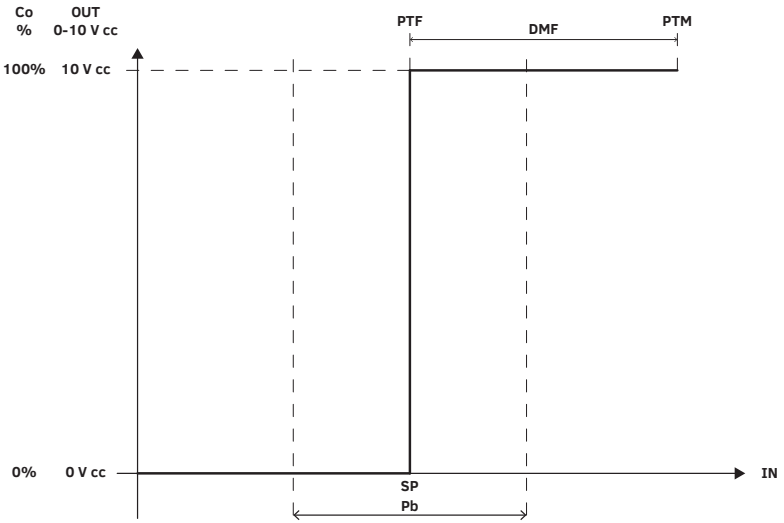
At full potential, meaning once the settlement transitions are depleted and far from the minimum and (**Lo**) and maximum (**Hi**) limits, the PID controller maintains the value of the magnitude measured by the prevalent transducer at input at **SP**. **Co** can have a free value that ranges from 0% to 100%, as a function of what is required to maintain the working setpoint.

During the transitions, if **IN**, it moves inside the **SP** but remains within the proportional band **Pb**, **Co** varies from 0% to 100% to return **IN** to **SP**.

Instead, if **IN** is outside the **Pb**, the motor control gradually moves to 0% or 100%, according to what is needed.

The minimum (**Lo**) and maximum (**hi**) speed limits are enabled, with forcing at 0% and relevant hysteresis at 100% (**SI**+**SIH** and **Sh**+**ShH**).

Control jumps (**JH1** + **JL1** and **JH2** + **JL2**) are activated to avoid particularly noisy zones, "Speed band" on page 52



***NOTICE**: to avoid unwanted activation, do not connect the spray unit or pay careful attention to the parameter settings when the regulator works in Master PID mode.*

Key

Following is the description of the graph parameters used for setting the setpoint (**SP**) and the proportional band (**Pb**):

Variable	Description
PTF	Minimum working temperature or pressure restricted by system conditions. Set the setpoint to the same value as PTF to obtain greater compressor energy savings.
PTM	Maximum working temperature or pressure restricted by system conditions.
DMF	Temperature or pressure difference (**PTM**-**PTF**). Movement of the input from **PTF** to **PTM** occurs due to an increase in ambient temperature.

7.3.3 Spray unit control

See "Spray unit control" on page 47.

7.3.4 Command control of an actuator for a motorized valve

See "Master regulation on OUT output to directly control a motorized valve actuator" on page 49 and "Master regulation on OUT output to reversely control a motorized valve actuator" on page 49.

7.4 Speed band

7.4.1 Control jumps

Control jumps (**JH1** + **JL1** and **JH2** + **JL2**) can be defined to avoid particularly noisy zones.

