Arcus-EDS

Application Description

SK08-BFTLFT

KNX Sensor Soil Humidity/Temperature and
Air Humidity/Temperature Measurement and Control

Operating Principals and Areas of Application:

The production series S8 uses sensors and controllers for a number of physical and chemical measurements for indoor and outdoor areas.

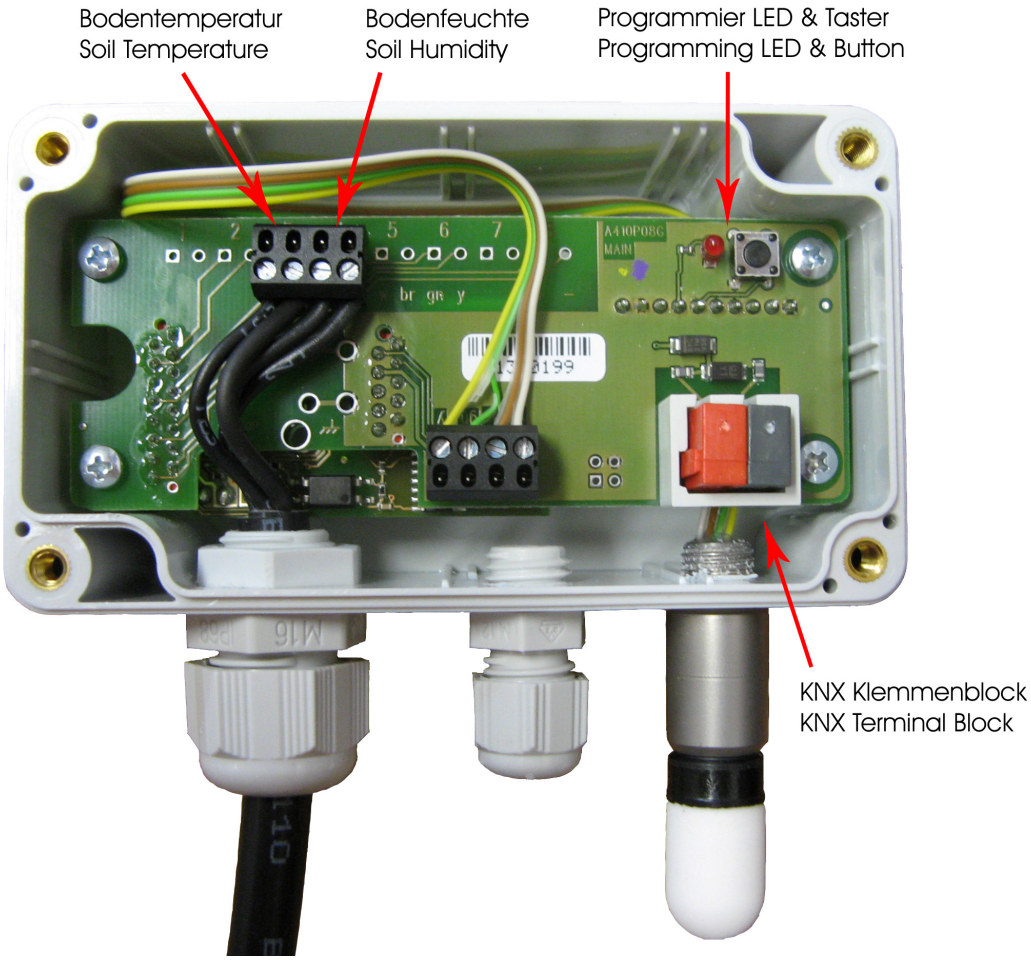
The measuring system SK08-BFTLFT records the soil humidity which is measured by the Watermark®-Sensor as well as the soil temperature. There are additional sensors for air temperature and humidity which enable a comprehensive understanding of the current situation in the garden or greenhouse.

The measured values can be displayed and used for controlling functions.

The integrated controller allows automatic watering of areas dependent on the actual needs of the landscaping. The user must make sure the device is correctly set, as the demands of the landscaping and soil structure are very diverse and a general setting for all uses cannot be proposed. Previous experience with manual watering length and amount is an acceptable way to set the parameters of the device. Using the sensor does not replace regular inspection of the watering process.

A number of controller models with various functions are available.

The devices in the series SK08-BFT are surface mounted.



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Application and Functions:

KNX sensors are set up using the ETS (KNX Tool Software) with the associated application program SK08-BFTLFT. The device is delivered unprogrammed. All functions are parameterized and programmed by ETS. The controller can be switched on or off by activation or locking via the KNX bus.

Functions:

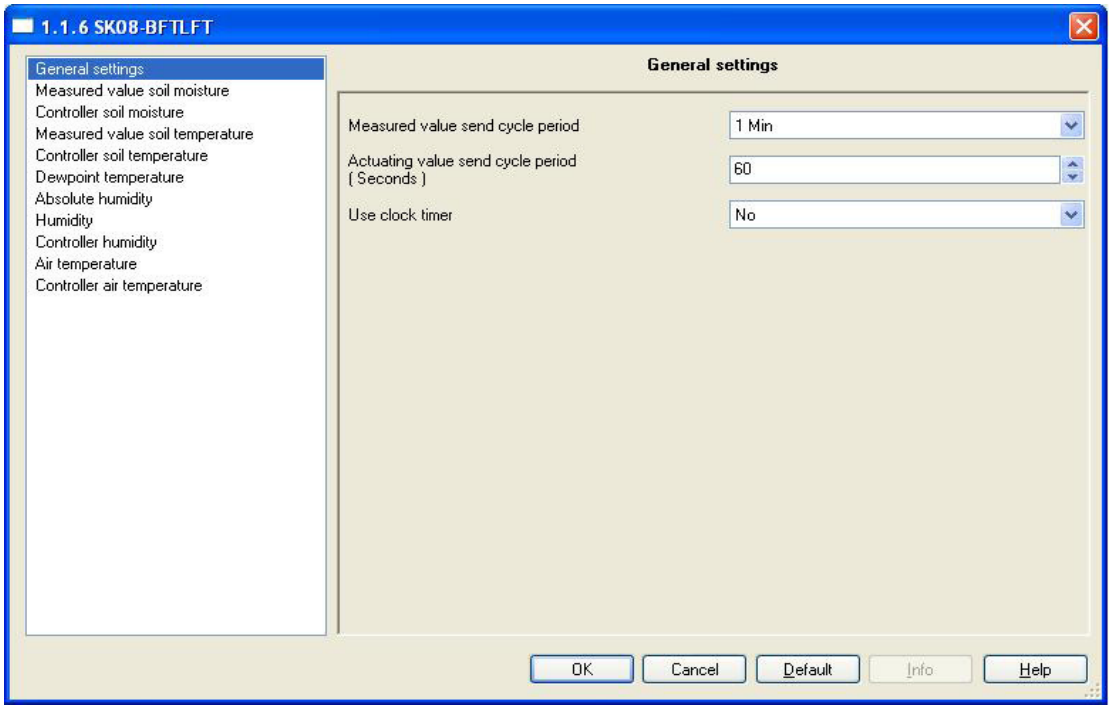
- Measured Values :
  - Soil Humidity (Suction Power in Pa)
  - Soil Temeperature
  - Air Temperature
  - Relative Humidity
- Arithmetic Value :
  - Dew Point Temperature
  - Absolute Humidity
- Two position controller with switch and pulse 1-bit output or
- PI controller with continuous 8-bit or pulse-width modulated 1-bit output
- Measured Value can be periodically displayed or when value changes
- Adjustable periodic display of control variable : no periodic display /10-250 seconds
- Adjustable release and lock with all controllers
- Threshold alarm for upper and lower thresholds
- Auxiliary quantity of set value or threshold via the bus
- Calibration of the sensor (offset setting)

General Settings:

Periodic Measured Data Cycle: Measured data to be periodically displayed can be configured from a length of 1 to 120 minutes.

Periodic Actuating Variable Cycle: The control variable can be displayed between 10 and 250 seconds.

To display the measured data periodically use the measured data settings; to display the control variable periodically use the controller settings.



When using the **time switch** 2 additional functions are available: date and time. The output of the individual temperature controllers can be disabled depending on the time of day. The user sets the timer for the hours of operation. The timer for a particular controller is set using the controller settings.

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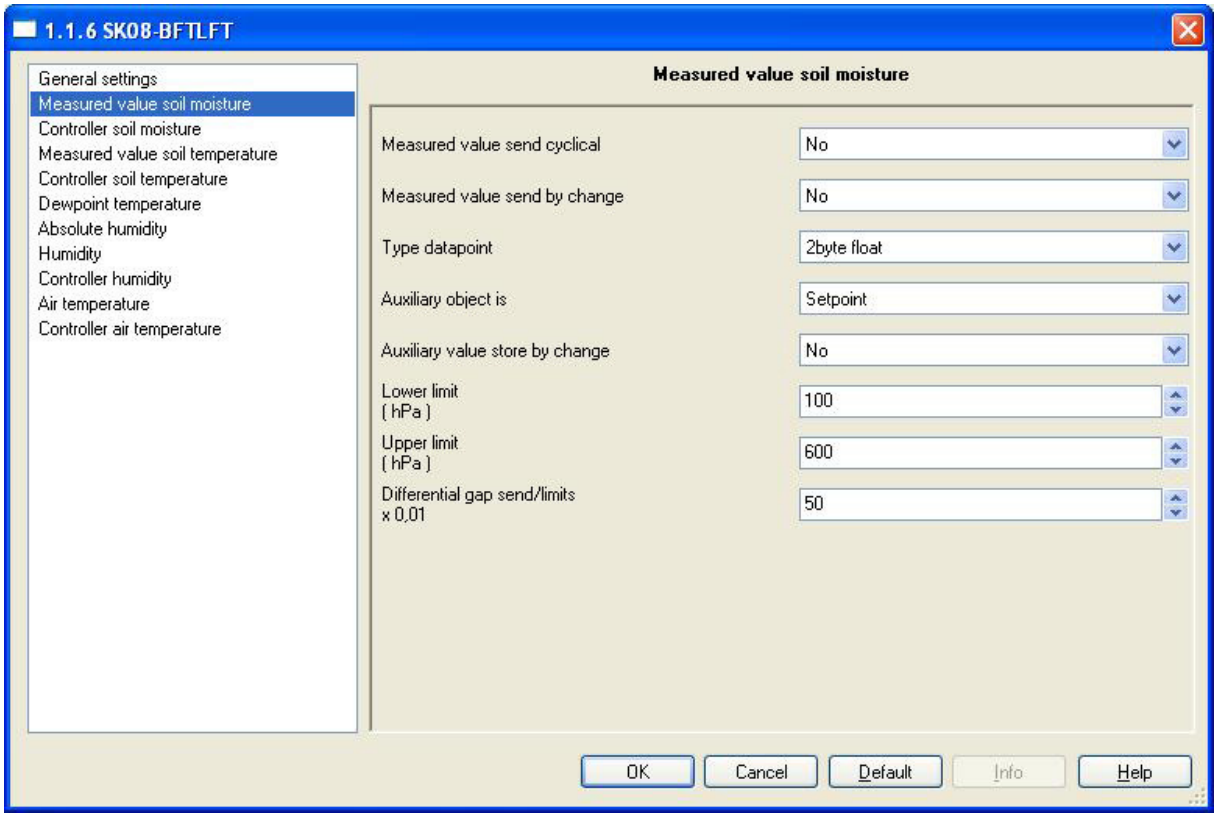
Measured Value Soil Humidity:

Periodic Display: Yes/No The display period is set in General Settings.

Display when change occurs: Yes/No Required changes are defined in "Display Differential Gap/Threshold".

Value Type: 2-byte Integer /2-byte float/4-byte float Measured Data Output and Auxiliary Quantity are defined concurrently.



Auxiliary Quantity is: Set point/Upper Threshold/Lower Threshold Every controller has an auxiliary quantity which can control either the set point of the controller or the limit values.

Save Auxiliary Quantity when change occurs: Yes/No When the auxiliary quantity is changed the new value is carried over to EEPROM and saved in case of a bus voltage breakdown. This should be used only when the set point is not frequently changed as EEPROM has only a limited memory cycle.

Lower Threshold: 0 … 2000 hPa

Upper Threshold: 0 … 2000 hPa

Display Differential Gap/Threshold: 0 … 1000 hPa To reduce the bus load when a value is changed and to avoid multiple switching between measured data and thresholds, a hysteresis between 10 and 100 hPa should be used.

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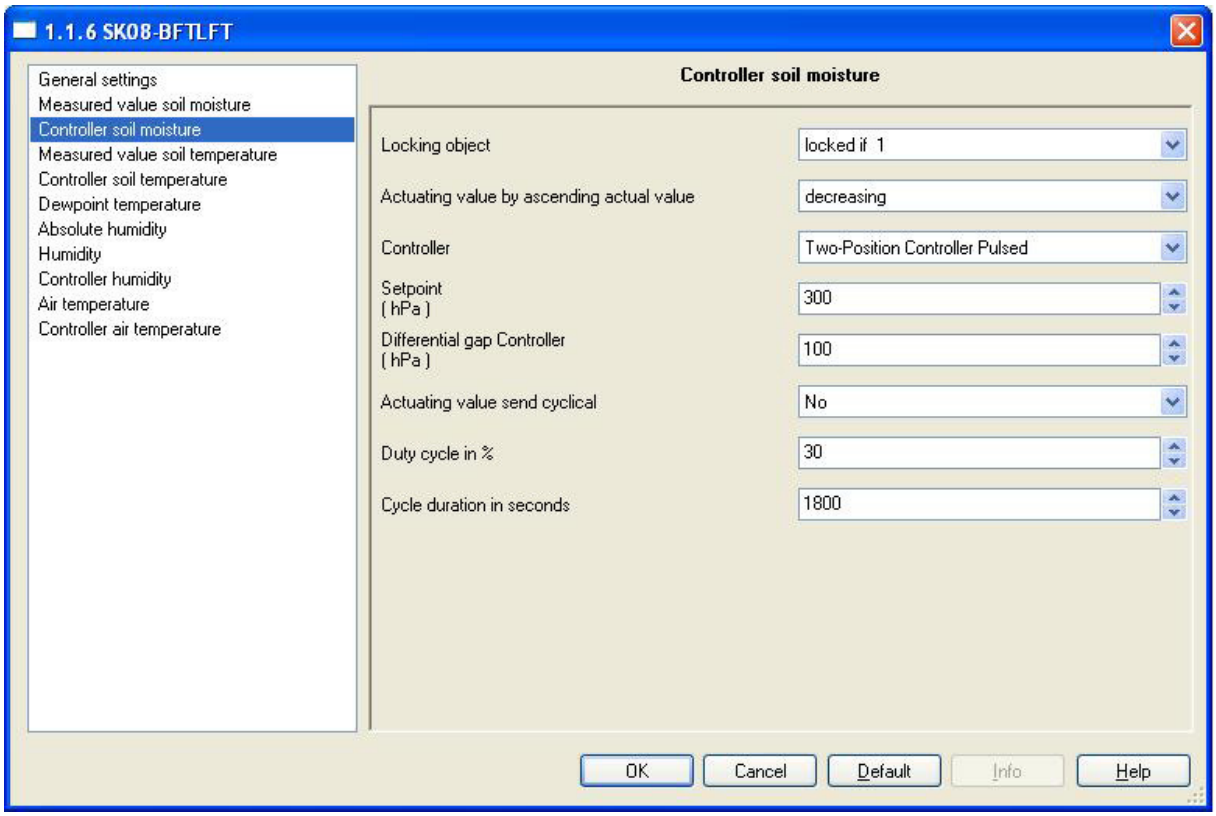
Soil Humidity Controller:

Lock: lock with 0/lock with 1 When using the lock function the controller output is deactivated. The lock function can be set up for "release" or "lock".



Controlled Variable with increasing actual value: decrease/increase The Actuating direction of the controller can be adapted to the characteristics of the controlled system.

Set point: 0 ... 2000 hPa

Controller: Two-position Controller / Pulsed Two-position Controller / Continuous PI Controller / Switching PI Controller These controller models and their applicable parameters are covered in the section "Controller Algorithms".

Display controller value periodically: Yes/No The display period is set in "General Settings"

Control Variable border spacing in %: 0...50 When the lower threshold is surpassed 0% is displayed, when the upper threshold is surpassed 100% will be displayed. This is important for actuators which do not operate reliably at threshold levels.

Time Switch On: Yes/No The time switch (timed controller output) can be activated/deactivated for every channel.

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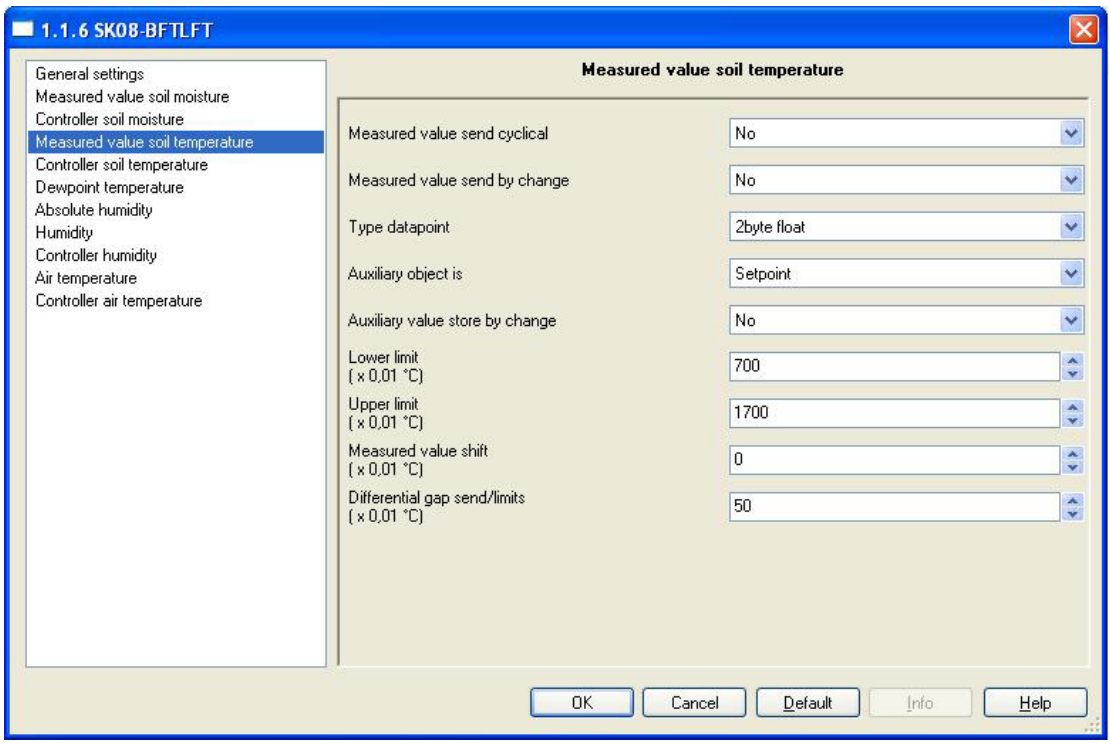
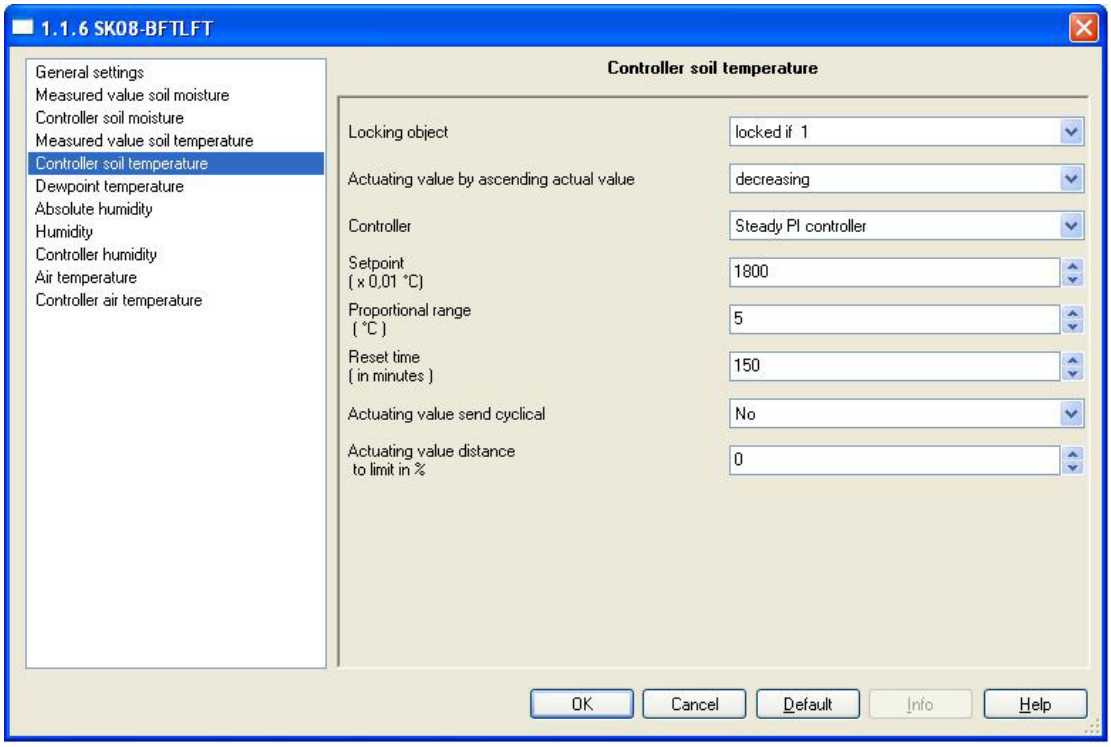
Measured Value Soil Temperature:



The settings for the data of the soil temperature are analogue for the measured value of the soil temperature. The rates for thresholds and hysteresis should be done in steps of 0,01°.

Soil Temperature Controller:



The settings for the soil temperature controller are analogue for the measured value of the soil temperature. The rates for set points, differential gap and proportions should be done in steps of 0,01°.

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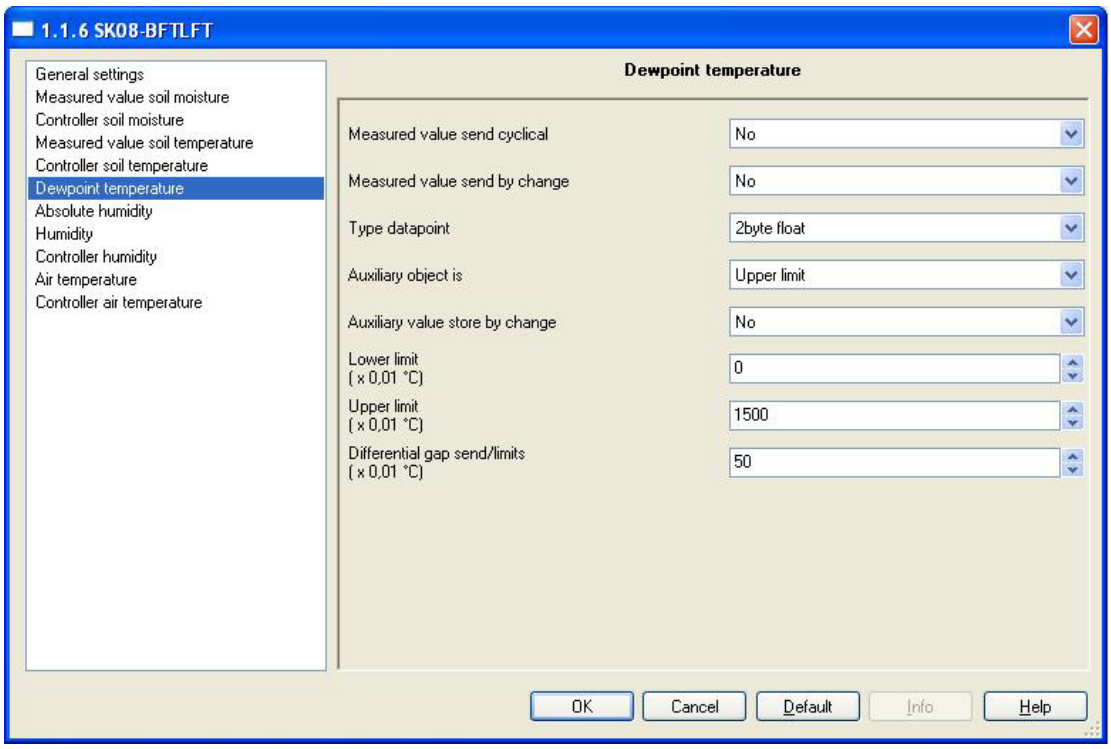
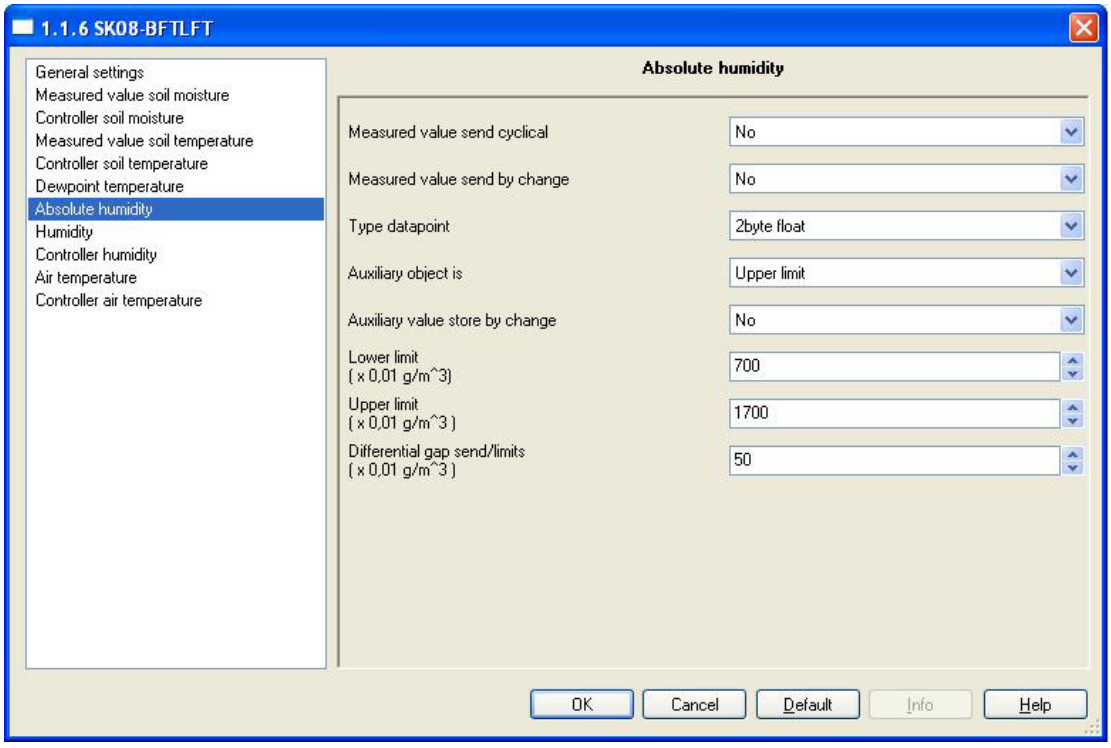
Arithmetic Value Dew Point Temperature:



The settings for the arithmetic value of the dew point temperature are analogue for the measured value of dew point temperature. The rates for thresholds and hysteresis should be done in steps of 0,01°.

Arithmetic Value Absolute Humidity:



The settings for the arithmetic value of the absolute humidity are analogue for the measured value of absolute humidity. The rates for thresholds and hysteresis should be done in steps of 0,01 g/m^3 .

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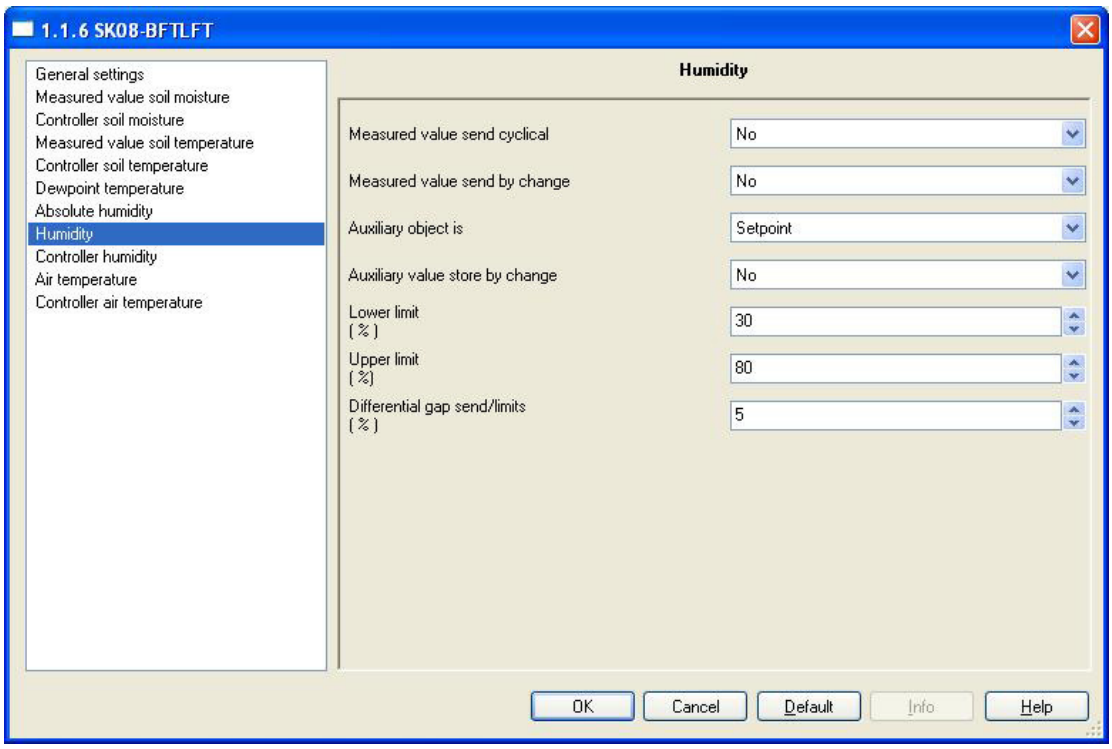
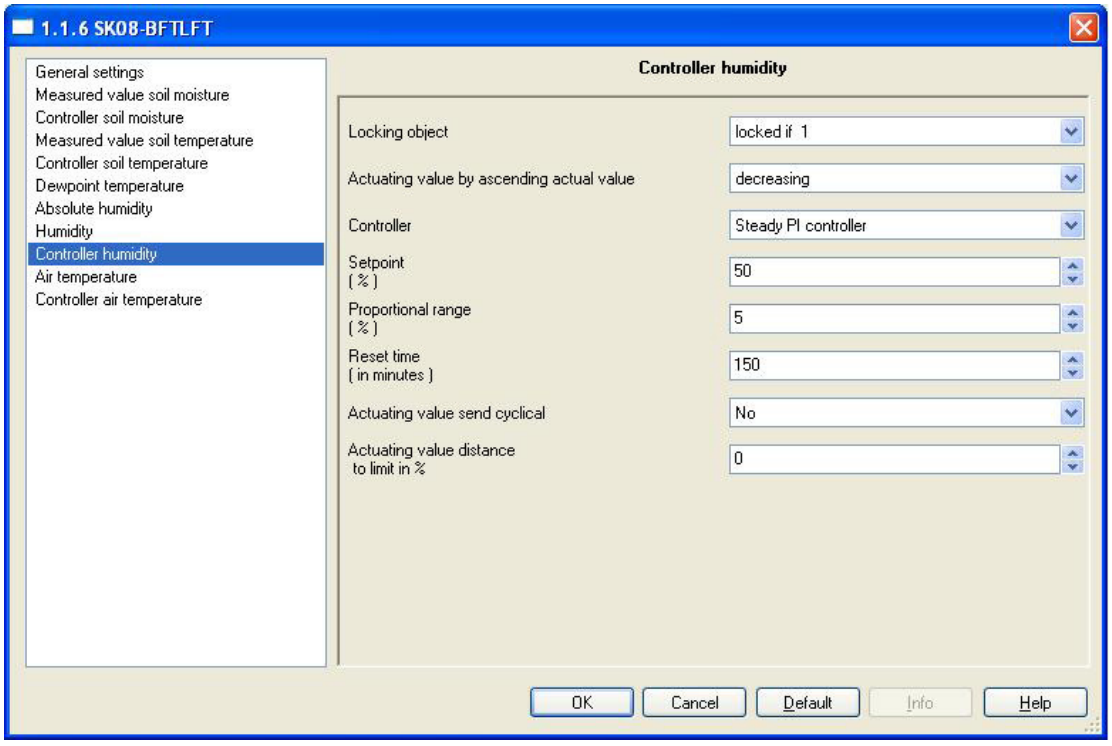
Measured Value Relative Humidity:



The settings for the data of relative humidity are analogue for the measured value of soil humidity. The rates for thresholds and hysteresis should be done in steps of 1%.

Relative Humidity Controller :



The settings for the relative humidity controller are analogue for the soil humidity controller. The rates for set points, differential gap and proportions should be done in steps of 1%.

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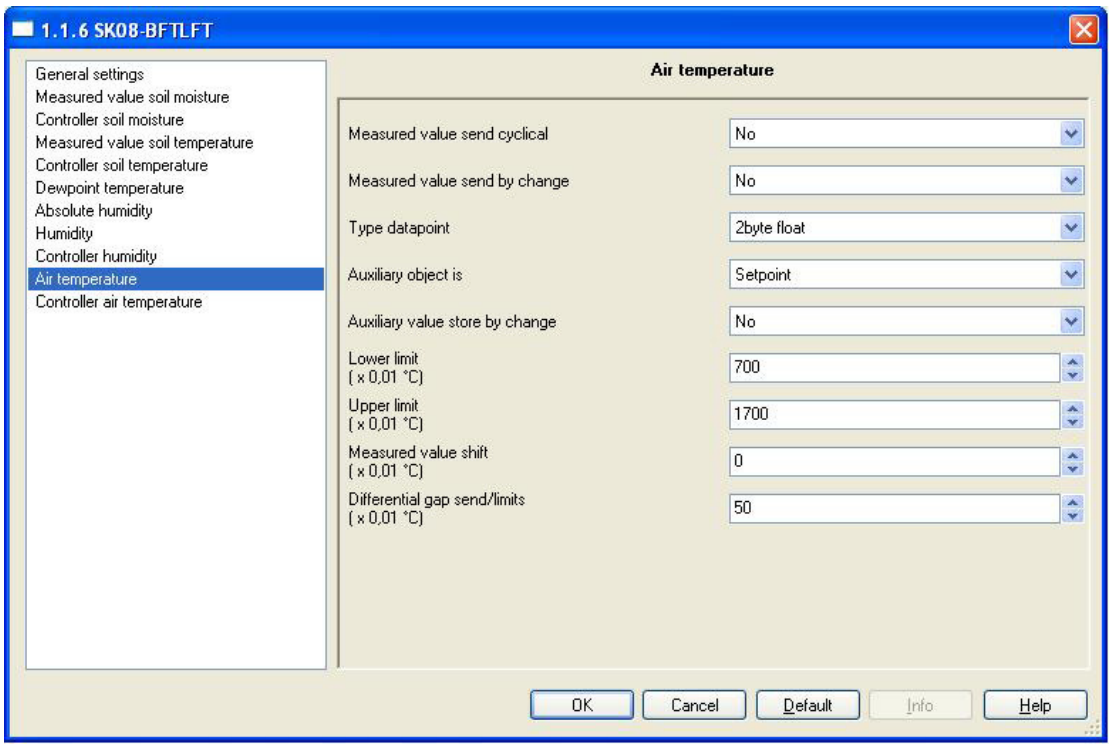
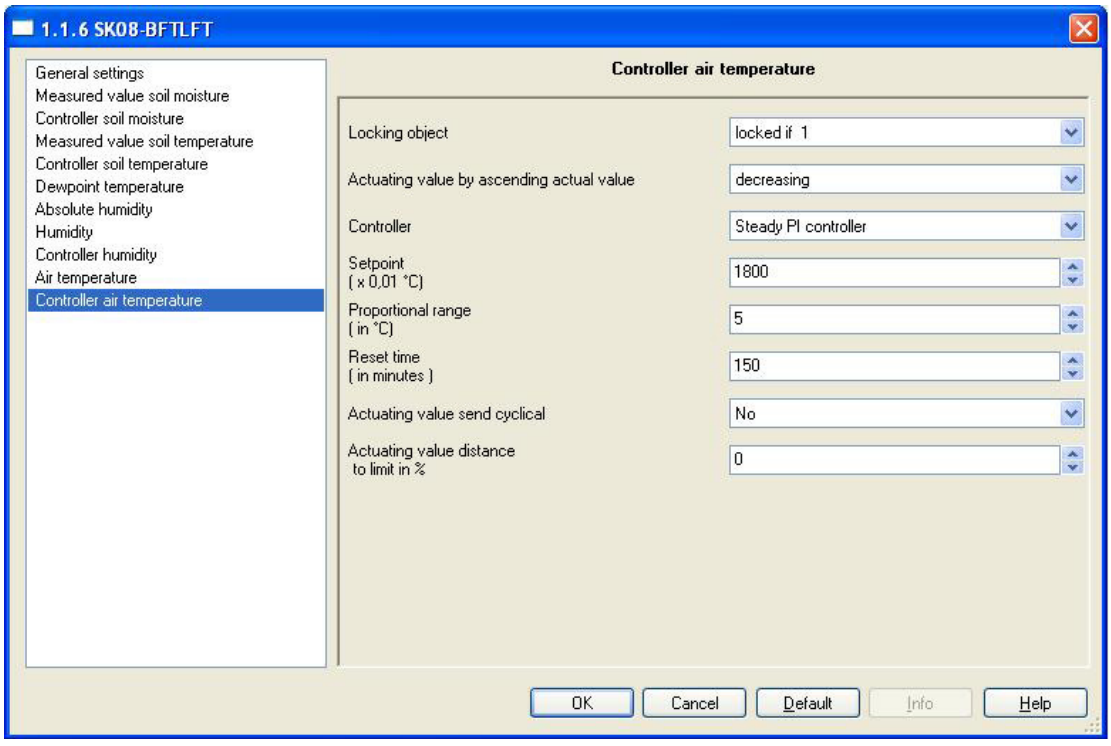
Measured Value Air Temperature :



The settings for the measured value of air temperature are analogue for the measured value of soil humidity. The rates for the thresholds and hysteresis should be done in steps of 0,01°.

Air Temperature Controller:



The settings for the measured value of air temperature are analogue for the measured value of soil humidity. The rates for set points, differential gap and proportions should be done in steps of 0,01°.

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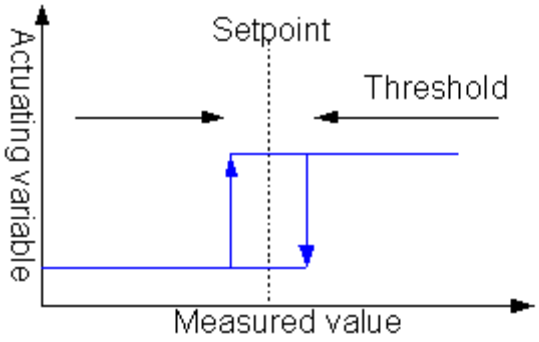
Controller Algorithms:

Controller models available are the PI controller or a two-position controller. Both controllers are equipped with pulsed output. The pulsed two-position controller works with constant duty cycle, which like the cycle duration is parameterized. The duty cycle of the pulsed PI controller is variable and depends on the control variable (pulse-width modulation).

Two-Position Control:

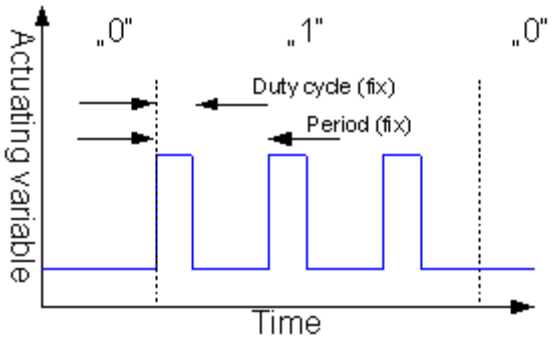
Two-position control is a very simple way of controlling. Once the actual value (+/- half the switching difference) exceeds or falls below the set point a switch-on or switch-off command is sent to the bus. Set the differential gap large enough to keep bus load to a minimum. Configure the differential gap small enough to avoid extreme actual value fluctuations.

The two-position controller is parameterized using the set point and the switching difference.



Two-Position Control with Pulsed Output:

The controller works in combination with the two-position controller, the actuating variable emits pulses.



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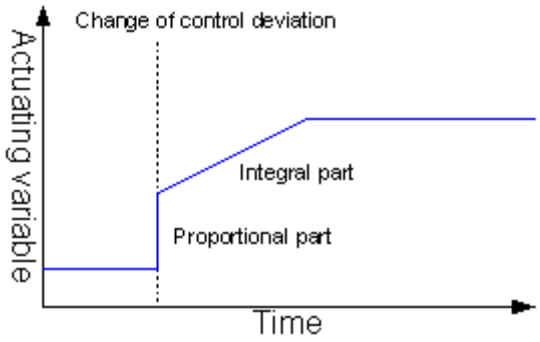
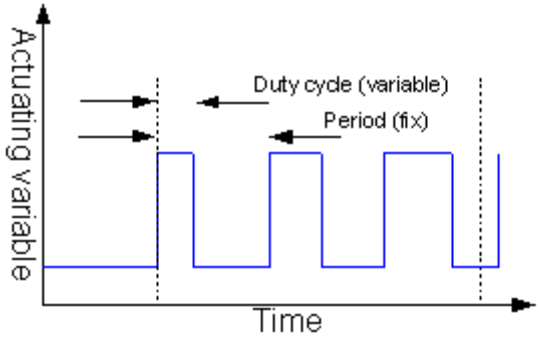
Continuous PI Control:

To understand a PI controller one should think of an algorithm consisting of a proportional and integral part. By combining these two parts it is possible to get a quick yet exact adjustment of the actuating variable. The controller calculates the control variable every second. It can constantly be updated and is displayed periodically (value parameterized) by the PI controller. Through the integral part an offset is adjusted to 0 over a certain period of time.



Continuous PI Control with Pulsed Output (PWM):

The controller works in combination with the PI controller, the actuating variable emits pulses. PWM control sets the cycle duration of the transmission interval. This allows a permanent on and off within the cycle time with function 15, which reaches on average a constant valve position. When the control variable reaches 40% in a cycle time of 10 minutes it will repeatedly turn on for 4 minutes and turn off for 6 minutes.



General Rules for Adjusting the PI Parameter:

The reset time must be significantly larger than the delay time of the control system. The proportional area corresponds to the reinforcement of the control circuit. The smaller the proportional area, the larger the reinforcement is.

Parameters	**Effect**
Low Proportional Area	Large overshooting of set point balance (potential for constant vibration), quick set point reset
High Proportional Area	Little or no overshooting, but slow reset
Short Integration Time	Quick adjustment of control deviations (based on conditions) danger of constant vibration
Long Integration Time	Slow adjustment of control deviations

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Function Table for Application SK08-BFT:

Number	Name	Object Function	Length
0	Output, Error code	Error code	1 Byte
2	Output, measured value soil moisture	Measured value	2 Byte
3	Input, auxiliary object soil moisture	Auxiliary object	2 Byte
4	Output, upper limit soil moisture	Exceeding limit	1 bit
5	Output, lower limit soil moisture	Undercut limit	1 bit
6	Output, controller soil moisture	Actuating value	1 bit
7	Input, enable/lock controller	Enable/lock	1 bit
8	Output, status object soil moisture	Status	1 Byte
9	Output, soil temperature	Measured value	2 Byte
10	Input, auxiliary object soil temperature	Auxiliary object	2 Byte
11	Output, upper limit soil temperature	Limit	1 bit
12	Output, lower limit soil temperature	Limit	1 bit
13	Output, controller soil temperature	Actuating value	1 Byte
14	Input, enable/lock soil temperature	Enable/lock	1 bit
15	Output, status object soil temperature	Channel status	1 Byte
30	Output, measured value dewpoint temperature	Calculated value	2 Byte
31	Input, auxiliary object dewpoint temperature	Auxiliary object	2 Byte
32	Output, upper limit dewpoint temperature	Limit	1 bit
33	Output, lower limit dewpoint temperature	Limit	1 bit
37	Output, measured value absolute humidity	Calculated value	2 Byte
38	Input, auxiliary object absolute humidity	Auxiliary object	2 Byte
39	Output, upper limit absolute humidity	Limit	1 bit
40	Output, lower limit absolute humidity	Limit	1 bit
44	Output, measured value relative humidity	Measured value	2 Byte
45	Input, auxiliary object relative humidity	Auxiliary object	2 Byte
46	Output, upper limit relative humidity	Limit	1 bit
47	Output, lower limit relative humidity	Limit	1 bit
48	Output, controller relative humidity	Actuating value	1 Byte
49	Input, enable/lock relative humidity	Enable/lock	1 bit
50	Output, Object status relative humidity	Channel status	1 Byte
51	Output, measured value air temperature	Measured value	2 Byte
52	Input, auxiliary object air temperature	Auxiliary object	2 Byte
53	Output, upper limit air temperature	Limit	1 bit
54	Output, lower limit air temperature	Limit	1 bit
55	Output, controller K8	Actuating value	1 Byte
56	Input, enable/lock air temperature	Enable/lock	1 bit
57	Output, Object status air temperature	Channel status	1 Byte

The Status Functions 8/50/57 are coded as follows:

Description	**Bit Number**	**Hexadecimal value**
Upper Threshold Exceeded	0	0x01
Lower Threshold Surpassed	1	0x02
Actuating Variable does not equal 0	2	0x04
Lock Active	4	0x08
Save Auxiliary Quantity	5	0x10
Time Switch Off active	6	0x20

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