


SK08-BFT-WMT		Soil Moisture / Temperature	Product Group 10
EIB/KNX, Indoor / Outdoor, IP65		Document: 3500_ex_SK08-BFT.pdf	Article No.
	SK08-BFT-WMT incl. Watermark® soil moisture probe	KNX-Sensor / controller for monitoring and control of soil moisture and soil temperature. (PT1000) with Watermark®-WM (maintenance free) soil moisture probe. The integrated controller allows automatic irrigation dependent on the real demands of water. Plastic housing: (115 x 65 x 55) mm Connection cable Watermark®-WM: 5m Other lengths available (see rubric Z, Components / Replacment Parts)	30805001



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5.1 Application Description

Operating Principles 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-BFT-WMT** records the soil humidity which is measured by the Watermark[®]-Sensor as well as the soil temperature.

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 made. 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.

KNX sensors are set up using the ETS (KNX Tool Software) with the associated application program.

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 value Soil Humidity (Suction Power in Pa) and Soil Temperature

- 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 (parameterized)
- Adjustable release and lock with all controllers (parameterized)
- Threshold alarm for upper and lower thresholds
- Auxiliary quantity of set value or threshold via the bus
- Calibration of the sensor (offset cancellation)

5.2 KNX Parameter

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5.2.1 General Settings

General Settings - SK08-BFT-WMT

Parameter	Setting	Description
Measured value send cycle period	1 .. 120 minutes	The transmission period of the measurement values that are to be sent cyclically. In the parameter set „Measured value x“ you can determine if the measurement values are sent periodically.
Actuating value send cycle period (Seconds)	10 .. 250	The transmission period of the correcting variables of the controller that are to be sent cyclically. In the parameter set „Controller x“ you can determine if the measurement values are sent periodically.
Use clock timer	<ul style="list-style-type: none"> • No • Yes 	When the timer is used, two additional parameters (timer from / to) and the objects 58 „device time“ and 59 „device date“ are available.
Timer from Timer until	0 .. 24 hour	The controller output can be locked depending on the time of day. The time in which the controller is unlocked must be entered here. In the parameter set „Controller x“ you can determine if the timer function is to be used for a specified controller.

5.2.2 Measured Value Soil Moisture

General settings	Measured value soil moisture
Measured value soil moisture	Measured value send cyclical: No
Controller soil moisture	Measured value send by change: No
Measured value soil temperature	Type datapoint: 2byte float
Controller soil temperature	Auxiliary object is: Setpoint
	Auxiliary value store by change: No
	Lower limit (hPa): 100
	Upper limit (hPa): 600
	Differential gab send/limits x 0,01: 50

Measured Value Soil Moisture - SK08-BFT-WMT

Parameter	Setting	Description
Measured value send cyclical	• No • Yes	The transmission period can be parameterized in the parameter set „General Settings“.
Measured value send by change	• No • Yes	The necessary change can be set in the parameter „Differential gab send / limits“.
Type datapoint	• 2-Byte float • 4-Byte float	Measured Data Output and Auxiliary Data are defined concurrently.
Auxiliary object is	• Setpoint • Upper limit • Lower limit	Every controller has an auxiliary object which can control either the set point of the controller or the limit values.
Auxiliary value store by change	• No • Yes	When the auxiliary data 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 data is not frequently changed as EEPROM has only a limited memory cycle.
Lower Grenzwert in hPa	0 .. 1400	If the measured value corresponds with the preset value, the object 5 „Output, Lower Limit soil moisture“ will be set.
Upper Grenzwert in hPa	0 .. 1400	If the measured value corresponds with the preset value, the object 4 „Output, Upper Limit soil moisture“ will be set.
Differential gab send / limits in hPa	0 .. 1400	To reduce the bus load when a value is changed and to avoid multiple switching between measured data and thresholds, a hysteresis between 10hPa and 100hPa should be used.

5.2.3 Controller Soil Moisture

Controller soil moisture	
General settings	
Measured value soil moisture	
Controller soil moisture	
Measured value soil temperature	
Controller soil temperature	
Locking object	locked if 1
Actuating value by ascending actual value	increasing
Controller	Switched PI controller (PwM)
Setpoint (hPa)	300
Proportional range (hPa)	100
Reset time (in minutes)	150
Actuating value send cyclical	No
Actuating value distance to limit in %	0
Cycle duration in seconds	60
Use clock timer	No

Controller Soil Moisture - SK08-BFT-WMT

Parameter	Setting	Description
Locking object	<ul style="list-style-type: none"> locked if 1 locked if 0 	When using the Locking object 7 „Input, enable / lock controller“ the controller output is deactivated. The lock function can be set up for „release“ or „lock“.
Actuating value by ascending actual value	<ul style="list-style-type: none"> increasing decreasing 	The actuating direction of the controller can be adapted to the characteristics of the controlled system.
Controller	<ul style="list-style-type: none"> Steady PI Controller Switched PI Controller (PWM) Two-Position Controller Two-Position Controller Pulsed 	The different controller types and the corresponding parameters are described in chapter 5.4 Notes .
Setpoint in hPa	0 .. 1400	Setpoint setting
Proportional range in hPa	0 .. 1400	see chapter 5.4 Notes - General Rules for Adjusting the PI Parameter
Reset time (in minutes)	0 .. 255	see chapter 5.4 Notes - General Rules for Adjusting the PI Parameter
Actuating value send cyclical	<ul style="list-style-type: none"> No Yes 	The cycle period is set in „General Settings“.

Controller Soil Moisture - SK08-BFT-WMT (continue)

Parameter	Setting	Description
Actuating value distance to limit in %	0 .. 50	When the lower threshold is surpassed 0% is set, when the upper threshold is surpassed 100% will be set. This is important for actuators which do not operate reliably at threshold levels.
Cycle duration in seconds	0 .. 65535	Total time of On and Off state.
Differential gap Controller in hPa	0 .. 1400	see chapter 5.4 Notes - Two-Position Control
Duty cycle in %	0 .. 50	duty cycle = pulse duration / cycle duration x 100 see chapter 5.4 Notes - Two-Position Control with Pulsed Output
Use clock timer	<ul style="list-style-type: none"> • No • Yes 	The use of the clock timer can be enable / disable for each channel separately.

5.2.4 Measured Value Soil Temperature

Measured Value Soil Temperature - SK08-BFT-WMT

Parameter	Setting	Description
Measured value send cyclical	<ul style="list-style-type: none"> • No • Yes 	The transmission period can be parameterized in the parameter set „General Settings“.
Measured value send by change	<ul style="list-style-type: none"> • No • Yes 	The necessary change can be set in the parameter „Differential gap send / limits“
Type datapoint	<ul style="list-style-type: none"> • 2-Byte float • 4-Byte float 	Measured Data Output and Auxiliary Data are defined concurrently.
Auxiliary object is	<ul style="list-style-type: none"> • Setpoint • Upper limit • Lower limit 	Every controller has an auxiliary object which can control either the set point of the controller or the limit values.
Auxiliary value store by change	<ul style="list-style-type: none"> • No • Yes 	When the auxiliary data 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 data is not frequently changed as EEPROM has only a limited memory cycle.
Lower limit (x 0,01 °C)	-9999 .. +9999	If the measured value corresponds with the preset value, the object 12 „Output, Lower Limit soil temperature“ will be set. (Please mind the factor !)

Measured Value Soil Temperature - SK08-BFT-WMT (continue)

Parameter	Setting	Description
Upper limit (x 0,01 °C)	-9999 .. +9999	If the measured value corresponds with the preset value, the object 1 „Output, Upper Limit soil temperature“ will be set. (Please mind the factor !)
Measured value shift (x 0,01 °C)	-32768 .. +32767	A calibration / offset adjustment of the sensors can occur when the measured displacement is offset due to cable length or other known external influences. (Please mind the factor !)
Differential gab send / limits (x 0,01 °C)	-9999 .. +9999	To reduce the bus load when a value is changed and to avoid multiple switching between measured data and thresholds, a hysteresis between 0,1°C and 1°C should be used. (Please mind the factor !)

5.2.5 Controller Soil Temperature

Controller Soil Temperature - SK08-BFT-WMT

Parameter	Setting	Description
Locking object	<ul style="list-style-type: none"> • locked if 1 • locked if 0 	When using the Locking object 14 „Input, enable / lock soil temperature“ the controller output is deactivated. The lock function can be set up for „release“ or „lock“.
Actuating value by ascending actual value	<ul style="list-style-type: none"> • increasing • decreasing 	The actuating direction of the controller can be adapted to the characteristics of the controlled system.
Controller	<ul style="list-style-type: none"> • Steady PI Controller • Switched PI Controller (PWM) • Two-Position Controller • Two-Position Controller Pulsed 	The different controller types and the corresponding parameters are described in chapter 5.4 Notes .
Setpoint (x 0,01 °C)	-9999 .. +19999	Setpoint setting (Please mind the factor !)
Proportional range (x 0,01 °C)	-9999 .. +19999	see chapter 5.4 Notes - General Rules for Adjusting the PI Parameter
Reset time (in minutes)	0 .. 255	see chapter 5.4 Notes - General Rules for Adjusting the PI Parameter

Controller Soil Temperature - SK08-BFT-WMT (continue)

Parameter	Setting	Description
Actuating value send cyclical	<ul style="list-style-type: none"> • No • Yes 	The cycle period is set in „General Settings“.
Actuating value distance to limit in %	0 .. 50	When the lower threshold is surpassed 0% is set, when the upper threshold is surpassed 100% will be set. This is important for actuators which do not operate reliably at threshold levels.
Cycle duration in seconds	0 .. 65535	Total time of On and Off state.
Differential gab Cotroller (in °C)	-9999 .. +19999	see chapter 5.4 Notes - Two-Positon Control
Duty cycle in %	0 .. 50	duty cycle = pulse duration / cycle duration x 100 see chapter 5.4 Notes - Two-Positon Control with Pulsed Output
Use clock timer	<ul style="list-style-type: none"> • No • Yes 	The use of the clock timer can be enable / disable for each channel separately.

5.3 KNX Objects

Objects - SK08-BFT-WMT

No.	Label	Data Point Type	Function
0	Output, Error code	DPT 4 Byte	Error code
2	Output, measured value soil moisture	DPT adjustable	Measured value
3	Input, auxiliary object soil moisture	DPT adjustable	Auxiliary object
4	Output, upper limit soil moisture	DPT 1.002 Bool 1 Bit	Exceeding limit
5	Output, lower limit soil moisture	DPT 1.002 Bool 1 Bit	Undercut limit
6	Output, controller soil moisture	DPT	Actuating value
7	Input, enable/lock soil moisture	DPT 1.002 Bool 1 Bit	Enable/lock
8	Output, status object soil moisture	DPT 1 Byte	Status
9	Output, soil temperature	DPT adjustable	Measured value
10	Input, auxiliary object soil temperature	DPT adjustable	Auxiliary object
11	Output, upper limit soil temperature	DPT 1.002 Bool 1 Bit	Limit
12	Output, lower limit soil temperature	DPT 1.002 Bool 1 Bit	Limit
13	Output, controller soil temperature	DPT adjustable	Actuating value
14	Input, enable/lock soil temperature	DPT 1.002 Bool 1 Bit	Enable/lock
15	Output, status object soil temperature	DPT 1 Byte	Channel status
58	Equipment time	DPT 10.001 Time of day 3 Byte	Time
59	Equipment date	DPT 11.001 day of month 3 Byte	Date

Object Description - SK08-BFT

No.	Label	Description																												
0	Output, Error code	An error code other than 0 indicates a sensor malfunction.																												
8	Output, status object soil moisture	The values of the individual bits are added and transmitted to the bus. The status functions monitor the controller status for purposes of reporting and troubleshooting.																												
15	Output, status object soil temperature																													
		<table border="1"> <thead> <tr> <th>Status:</th> <th>Bit-No.</th> <th>Hexadecimal</th> <th>Decimal</th> </tr> </thead> <tbody> <tr> <td>upper limit too large</td> <td>0</td> <td>0x01</td> <td>1</td> </tr> <tr> <td>lower limit underrun</td> <td>1</td> <td>0x02</td> <td>2</td> </tr> <tr> <td>setpoint not equal to zero</td> <td>2</td> <td>0x04</td> <td>4</td> </tr> <tr> <td>lock activ</td> <td>3</td> <td>0x08</td> <td>8</td> </tr> <tr> <td>auxiliary is stored</td> <td>4</td> <td>0x10</td> <td>16</td> </tr> <tr> <td>timer activ</td> <td>5</td> <td>0x20</td> <td>32</td> </tr> </tbody> </table>	Status:	Bit-No.	Hexadecimal	Decimal	upper limit too large	0	0x01	1	lower limit underrun	1	0x02	2	setpoint not equal to zero	2	0x04	4	lock activ	3	0x08	8	auxiliary is stored	4	0x10	16	timer activ	5	0x20	32
Status:	Bit-No.	Hexadecimal	Decimal																											
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lock activ	3	0x08	8																											
auxiliary is stored	4	0x10	16																											
timer activ	5	0x20	32																											

Application Description

SK08-BFT-WMT Soil Moisture / Soil Temperature

5.4 Notes

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).

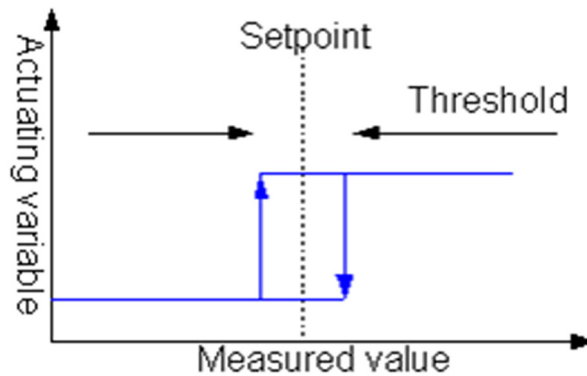
Two-Position Control

Two-position control is a very simple way of controlling.

Once the actual value (\pm 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 and configure the differential gap small enough to avoid extreme actual value fluctuations.

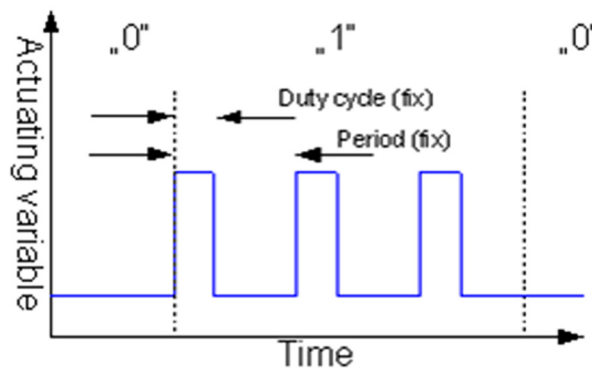
The two-position controller is parameterized using the set point and the switching threshold.

**Two-Position Control with Pulsed Output**

The controller works analogous to the two-position controller.

The actuating variable emits pulses with fixed duty cycle.

When the control variable reaches 40% in a cycle time of 10 minutes it will repeatedly turned on for 4 minutes and turned off for 6 minutes.



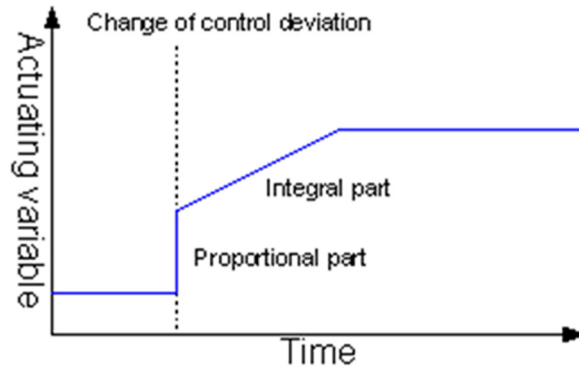
Continuous PI Control

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 and 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.



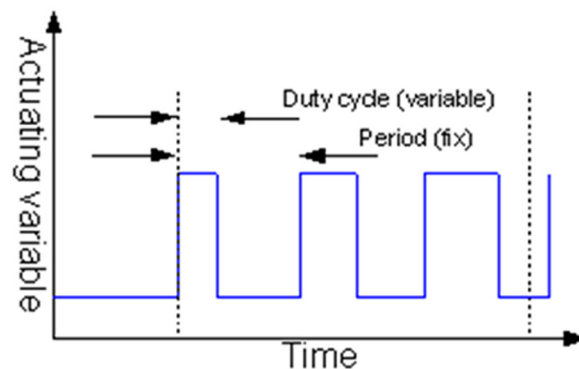
Continuous PI Control with Pulsed Output (PWM)

The controller works analogous to the PI controller, but the actuating variable emits pulses with a variable duty cycle.

PWM control sets the cycle duration of the transmission interval.

This allows a permanent on and off within the cycle time, which reaches an average valve position.

The duty cycle is determined indirectly via the integration time.



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	Quick adjustment to the setpoint. Strong overshoot when setpoint is compensated (continuous oscillation possible).
High Proportional Area	Slow correction of control deviations. No or few overshoots.
Short Integration Time	Rapid correction of control deviations. Danger of continuous oscillation.
Long Integration Time	Slow correction of control deviations. Little danger of overshoots or continuous oscillation.

5.5 Product Page

The KNX Sensor Soil Humidity / Temperature **SK08-BFT-WMT** is a sensor / controller from the series S8 for recording the soil humidity and the soil temperature.

The sensor / controller is equipped with an external sensor device which is inserted into the ground at the area to be measured.

The device has an integrated KNX bus coupler and does not require additional voltage.

The transducer is located in a high-strength, extremely robust stable impact ABS plastic housing. Cover and base have a revolving groove and tongue system with neoprene gasket. The housing is IP65.

In the application software a separate controller (2-position or PI controller with continuous or pulsed output) is available for every channel.

Other functions include maximum and minimum thresholds and a help key where the set point and thresholds can be switched.

The sensor is configured with ETS (KNX Tool Software) and the application program. Controlling functions such as signal threshold and diverse adjustments are set using ETS (KNX Tool Software).



Areas of Application

- Decentralized irrigation and watering control for gardens and landscaping
- Active sprinkling control for flat roofs with vegetation
- Industrial soil humidity controller for areas such as snail and insect breeding
- Recording of soil humidity and soil temperature
- Sprinkling control via integrated control functions
- Environmentally friendly and timed sprinkling control (early afternoon)
- Alarm when upper or lower threshold for soil humidity is surpassed

<p>Applicable Sensors Inside the soil humidity probe is a sealed plastic tube with the Watermark® Granular Matrix Sensor 200SS and a PT1000 element.</p> <p>Measuring range Watermark®: 1 .. 2000 hPa/mbar, 1 .. 200.000 Pa PT1000: -25 .. +45°C</p> <p>Accuracy Watermark®: 0,01 hPa/mbar, 1 Pa PT-1000: ± 1°C</p> <p>Operating Voltage: 21 .. 32VDC Power Consumption: approx. 240mW (at 24VDC)</p> <p>Operating Temperature: -20 .. +55°C Storage Temperature: -20 .. +85°C</p> <p>Sensor connectors pointing down</p> <p>Protection class: IP65</p>	
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5.6 Technical Data

Technical Data - SK08-BFT-WMT

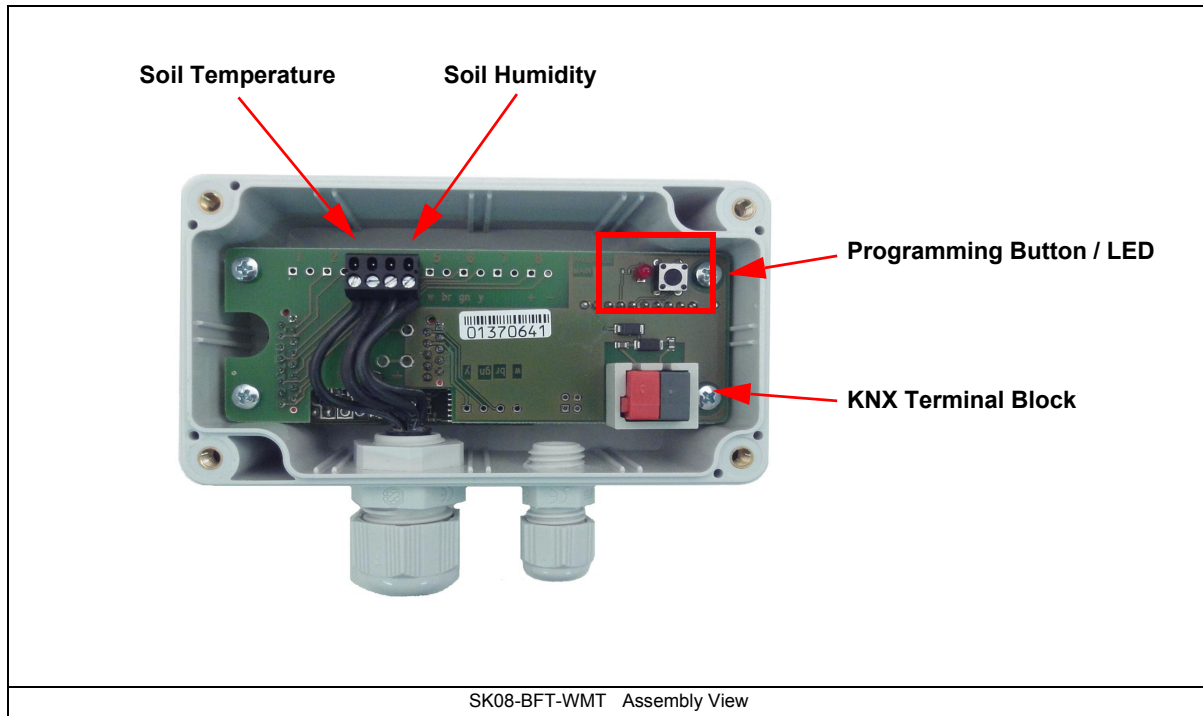
Measured Data	Soil moisture (suction power), soil temperature
Sending Options	no sending, cyclical sending when change occurs
Parameter	Periodic sending with variable cycle duration, sending when change occurs with variable hysteresis
Object type soil moisture	2-Byte float, 4-Byte float
Object type soil temperature	2-Byte float, 4-Byte float
Controller Modi	Steady PI controller Switched PI controller (PWM) Two-Position controller Two-Position controller Pulsed
Parameter Steady PI controller	Setpoint, reset time, proportional factor, controller mode
Parameter Switched PI controller (PWM)	Setpoint, reset time, proportional factor, controller, cycle duration, threshold pitch
Parameter Two-Position controller	Setpoint, differential gap, controller mode
Parameter Two-Position controller Pulsed	Setpoint, differential gap, controller mode , cycle duration, duty cycle
Lock Function	All controller parameterizable as enable or lock
Controller Variables Output	depends on Controller Modi 1-Byte unsigned, 1-Bit Switch
Setpoint value send cyclical	None or 10-250 seconds, parameterizable
Limits	Lower limit, Upper limit
Auxiliary value	Setpoint, Upper limit or Lower limit
Bus power failure	Saving changed auxiliary quantities, parameterizable
Measured value shift	Soil temperature

Technical Data - SK08-BFT-WMT (continue)

Ambient Temperature Electronic Measuring Equipment Casing	Operation: -20 .. +55°C Storage: -20 .. +85°C
Ambient Humidity	0 .. 95% rH not condensating
Ambient Temperature Watermark®	Storage: -30 .. +55°C Operation: -25 .. +45°C
Ambient Temperature Watermark®	0 .. 99% rH
Measuring range soil moisture	1 .. 2000 hPa/mbar, 1 .. 200.000 Pa
Accuracy soil moisture	1 hPa/mbar, 200.000 Pa
Resolution soil moisture	0,01 hPa/mbar, 1 Pa
Measuring range soil temperature	-25 .. +45°C
Accuracy range soil temperature	± 1°C
Operating Voltage	EIB/KNX bus voltage 21 .. 32VDC
Power Consumption	approx. 240mW (at 24VDC)
Auxiliary Supply	not required
Bus Coupler	integrated
Start-up with ETS	ARC_S8.VD2 Product: S8-BFT
Curcuit Points	EIB-2-pole clamps (red / black)
Protection Class	IP65
Assembly Type Transducer	Assembly with 2 screws finery
Casing Transducer	ABS plastic grey
Casing Dimensions	(115 x 65 x 55) mm (L x W x H)
Article Number	30805001
Probe	Watermark®-WMT Connecting cable 5m

5.7 Startup

The KNX Sensor is set up using the ETS (KNX Tool Software) and the applicable application program.
The sensor is delivered unprogrammed.
All functions are programmed and parameterized with ETS.
Please read the ETS instructions.



5.8 Assembly

The Sensor **SK08-BFT-WMT** is for outdoor and (moist) indoor areas. It fulfills protection class IP65.
The sensor is attached to the wall with two screws
The transducer lid is opened by loosening the screws.

The cable for the external measuring probe (soil humidity / temperature) is inserted into the PG connection slot and assembled as shown above. The probe wires are numbered (Watermark[®] Sensor: 1-2; PT1000: 3 and shrink hose tagged wire). After mounting the sensor to the wall or ceiling, lead the KNX bus cable through the PG connection slot. Remove the bus clamps. Connect the wires to the bus clamp and then reattach the clamps to the sensors. Once the device is successfully programmed, screw the lid back on.

In order to fulfil IP65 protection class the gasket ring must be carefully placed in the lid.

Be careful not to damage the electronics with tools and cable heads.

In Case of Bus Voltage Recurrence

All changes made using the help key for the KNX/EIB bus are saved if the device has been correctly parameterized. The controller and outputs start with their current values and the ETS parameter settings are saved.

Discharge Program and Reset Sensor

In order to delete the programming (projecting) and to reset the module back to delivery status, it must be switched to zero potential (disconnect the EIB bus coupler).

Press and hold the programming button while reconnecting the EIB bus coupler and wait until the programming LED lights up (approx. 5-10 seconds).

Now you can release the programming button.

The module is ready for renewed projecting.

If you release the programming button too early, repeat the aforementioned procedure.

Imprint

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Safety Regulations

Attention! Installation and mounting must be carried out by a qualified electrician.

The buyer/operator of the facility has to make sure that all relevant safety regulations, issued by VDE, TÜV and the responsible energy suppliers are respected. There is no warranty for defects and damages caused by improper use of the devices or by non-compliance with the operating manuals.

Warranty

We take over guarantees as required by law.

Please contact us if malfunctions occur. In this case, please send the device including a description of the error to the company's address named below.

Manufacturer



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