

Arcus-EDS

Application description

SK01-Bxxxx



KNX-Sensor soil moisture SK01-BF

KNX-Sensor soil moisture / temperature SK01-BFT

KNX-Sensor soil moisture / temperature + humidity /
temperature SK01-BFTLFT

Active principle and field of application:



The SK01-Bxxxx sensor series are specially designed to measure the soil moisture with a KNX-bus interface. The internal actuator enables to control an automatic irrigation system. Depending on the environment the sensor is used it is necessary to adjust the configuration to the environment. Due to the different soil conditions it is impossible to use a pre-adjustment. The settings for the amount of water and the duration of the automatic irrigation should be according to the manual irrigation experience. The usage of the sensor can't replace the regular verification of the soil moisture condition.

The heart of the SK01-BF is a tensiometer which detects the absorption rate of a column of water, by measuring its suction power in units of pressure. The suction power decreases while the soil humidity increases. This measurement is done by a pressure measurement bridge witch translates the pressure into voltage. To ensure this proper function a regularly refill is necessary.

The high precision tensiometer is not frost-proof, but reaches a high precision. It operates at a pressure between 10 and 600 hPa/mBar (1000 – 60000 Pa).

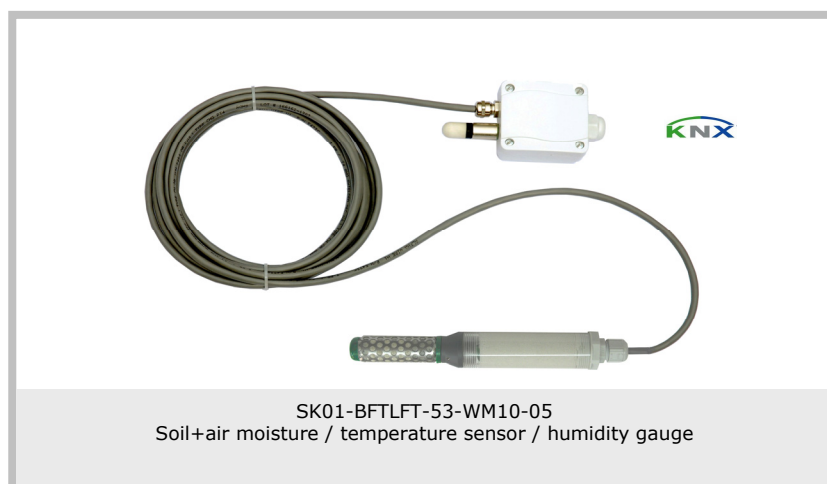
The sensor SK01-BFT, and SK01-BFTLFT, use a Watermark® sensor from Irrrometer Co. www.irrometer.com. His resistance depends on the soil`s suction power. These sensors are not suitable for acidic soil because it may provoke the early destruction of the matrix material.

The Watermark® sensors are frost-proof and therefore there is no need to remove them for the winter time. Its precision is lower then the precision of the tensiometer, but operates at higher pressure between 10 and 2000 hPa/mBar (1000 – 200000 Pa).

The sensor SK01-BFT, and SK01-BFTLFT, have also a temperature sensor which measurements can be displayed and used for control tasks. Internal these values, in combination with the resistance value of the Watermark® sensor, are necessary to calculate the exact soil moisture.

The SK01-BFTLFT also comes with an air temperature and air humidity sensor to get a complete picture of the situation in the garden or greenhouse.

For outdoor use of the sensors the irrigation should be stopped for the noon time in regard to an economic usage of water. To automate this function it is necessary to daily synchronise the internal clock of the device.



Application and function description:

The setup of the KNX-Sensor

At the time of delivery there is no program stored on the device. To setup the device you can use the ETS (EIB Tool Software) in combination with the related application software.

All functions are parameterized and programmed by ETS. Some controllers and maximum value functions are switched on or off by activation or blocking via the KNX bus.

Functions:

- Indicators:
 - Soil moisture (suction energy in Pa)
 - Soil temperature (only SK01-BFT and SK01-BFTLFT)
 - Air temperature (only SK01-BFTLFT)
 - Relative air humidity (only SK01-BFTLFT)
- Measurement values can be send periodically and/or by variation of value
- Two-level controller for soil moisture with adjustable time and duration of the irrigation
- External adjustment of the set-point by 1-bit data point
- 2 logical AND/OR linkable external locking objects (1-Bit) for the irrigation control
- 1 external locking object, (2-Byte Float) to control the irrigation by a given set point
 - To avoid a frequent switching there is a delay of five minutes after measurement value drops under the set point value.
- 1 internal locking object soil temperature (only SK01-BFT and SK01-BFTLFT)
- 1 internal locking object air temperature (only SK01-BFTLFT)
- 1 enforce irrigation object
- Time controlled switch
- Alert over the KNX-bus by reaching the upper or lower limit value of the suction power
-

The soil moisture regulator:

The suction power of the soil complies with the force the plant has to employ to gain for the growth needed amount of water. This energy depends on the soil texture and the rate of saturation. The suction power decreases while the soil humidity increases. The expected value for saturated soil is between 100 to 1,000 Pa, for dry soil about 100,000 Pa. The permanent wilting point is about 1,500,000 Pa.

Measurement range:

The tensiometer sensor:

SK01-BF-TMxx und SK01-BFTLFT-TMxx

The measurement range of the tensiometer depends on the used probe lies between 1,000 to 60,000 Pa.

The Watermark® Granularmatrix Sensor:

SK01-BFT-WMxx and SK01-BFTLFT-WMxx

The measurement range of the Watermark® Granularmatrix Sensor 200SS lies between 1,000 to 200,000 Pa.

Therefore the wilting point is way above the measurement range. A setting between 10,000 and 50,000 Pa (100-500 hPa) will suffice most plantings.

It takes some time until the moisture reaches deeper ground and the sensor needs also time to react on the moisture changes, therefore the settings for the irrigation have to apply to the soil texture and the irrigation system.

KNX-Sensor I soil moisture

Parameters:

General settings

Send all values periodically	Do not send periodically	Values are not sent periodically
	1-120 min	Values are transmitted every x minutes
Cycle-time of irrigation		Duration of the irrigation-cycle. For example 60 min, duration of the irrigation 50% Alternating every 30 min between irrigation and rest
	Without limit	Cycle-time is unlimited and irrigation-time 100%
	15-600 min	Cycle-time
Irrigation On-time (% of cycle-time)	0 - 100	Irrigation-time within the irrigation-cycle
Locking objects		The irrigation can be interrupted temporarily.
	No locking object	There is no locking object in use.
	1 Locking object	1 transmitted to this object and the irrigation will be interrupted.
	2 Locking objects AND	1 transmitted to both objects and the irrigation will be interrupted.
	2 Locking objects OR	1 transmitted to only one of the objects and the irrigation will be interrupted.
Force irrigation object	Active/inactive	This data point can be used for unconditional irrigation; it overwrites all locks and ignores the measured soil moisture values.
Locking function limit value		This parameter enables the use of an external or internal value to lock the irrigation. A typical use is the employment of a global radiation sensor to protect the plants against burns provoked from sprinkling under sun radiance.
	No locking function	The locking function is deactivated.
	Internal locking function soil temperature	(Only SK01-BFT and SK01-BFTLFT) The lock depends on the soil temperature.
	Internal locking function air temperature	(Only SK01-BFTLFT) The lock depends on the air temperature.
	External locking object	The lock depends on the value set for the locking object.
Limit value of locking object	-32768 .. 32767	Integer value, 25 corresponds to e.g. 25 °C
Irrigation over limit value	Lock/allow	Adjustment to define if the lock starts above or below the limit value.
Locking at air-temperature below (in °C)	-5 .. 20 °C	(Only SK01-BFTLFT) Irrigation can be optimized restricting the watered areas.
Locking at soil-temperature below (in °C)	-5 .. 20 °C	(Only SK01-BFT and SK01-BFTLFT) Below a soil temperature of 2°C it is not possible to measure the soil moisture, so the irrigation should be stopped.

Soil moisture

Suction power(kPa)

Send measured value at variation of (in % of actual value)	Not transmitted	Measured value is not transmitted by variation. This does not affect the periodical transmitting.
	1 - 20	When the suction power value is changed to the programmed value, a 2-Byte value is displayed to the correspondent data point.
Suction power limit value Upper limit value (in kPa)	1 - 200	When the upper limit is surpassed, a 1 appears on data point 1, if the value is under the limit, then a 0 is displayed.
Suction power limit value Lower limit value (in kPa)	1 - 200	When the lower limit is surpassed, a 1 appears on data point 2, if the value is above the limit, then a 0 is displayed.
Set point (in kPa)	1 - 200	Set point Setting of the soil moisture sensor
Set point Increase (in kPa)	1 - 200	Set point increase, selection with data point 5
Set point Decrease (in kPa)	1 - 200	Set point decrease, selection with data point 6
Send Set point	Send/Not Send	The actual calculated set point can be displayed in data point 4.
Differential Gap (in kPa)	1 - 200	Selection of the hysteresis of the controller. A value of approx. 10 % of the set point value is a good choice. A too small differential gap can lead to unwanted frequent switching, a too large value can provoke too intense irrigation.

Soil temperature

(Only SK01-BFT and SK01-BFTLFT)

Send measured value at variation of (Factor x 0.1 K)	0	Measured value is not transmitted by variation. This does not affect the periodical transmitting.
	1 - 255	When the temperature is changed to the programmed value, a 2-Byte value is displayed on data point 13.
Temperature correction value (Factor x 0.1 K)	-50 - +50	Adjustment of the sensors temperature value, if it is known, that the measured value differs from the average due to its place of installation.

Air temperature/Humidity

(Only SK01-BFTLFT)

Air temperature, send measured value at variation of (in K)	Not transmitted	Measured value is not transmitted by variation. This does not affect the periodical transmitting.
	0.1 -2.0	When the temperature is changed to the programmed value, a 2-Byte value is displayed on data point 14.
Temperature correction value (Factor x 0.1 K)	-50 - +50	Adjustment of the sensors temperature value, if it is known, that the measured value differs from the average due to its place of installation.
Humidity, send measured value at variation of (in % rel. humidity.)	Not transmitted	Measured value is not transmitted by variation. This does not affect the periodical transmitting.
	1 - 20	When the humidity is changed to the programmed value, a 2-Byte value is displayed on data point 15.
Humidity correction value (in % rel. humidity.)	-20 - +20	Adjustment of the sensors temperature value, if it is known, that the measured value differs from the average due to its place of installation.

Calibration

Recalibration value 1	0	The calibration will not be changed.
	-1	Reset to the manufacturers pre-adjustment.
	-32768 .. 32767	The calibration will not be changed. A previous calibration will get lost. The calibration depends on the sensor and you can find the value in the manual or on the sensor itself.
Recalibration value 2	0	The calibration will not be changed.
	-1	Reset to the manufacturers pre-adjustment.
	-32768 .. 32767	The calibration will not be changed. A previous calibration will get lost. The calibration depends on the sensor and you can find the value in the manual or on the sensor itself..

Internal clock

Internal clock	Active	With data point 17 can you set the internal clock and use it to put the locking time interval. The internal clock cannot be used.
	Inactive	
No irrigation between	2:00 ... 11:00	Beginning locking time
And	13:00 ...3:00	End locking time

Data points:

Data Point Table KNX- Sensor / Soil - Moisture					
	Data point	Function	Name	Type	Flag
0	Output, Suction power, Measured value	Actual suction power value in Pa	Measured value	2 Byte	KL - Ü -
1	Output, Suction power, Upper limit	Alarm, when upper limit is exceeded	Exceeding upper limit	1 bit	KL - Ü -
2	Output, Suction power, Lower limit	Alarm, when lower limit is exceeded	Exceeding lower limit	1 bit	KL - Ü -
3	Output, Soil moisture controller, two-level output	Actuating variable soil moisture controller	Switching output	1 bit	KL - Ü -
4	Output, soil moisture Controller, set point	Actual set point in Pa	Set point	2 Byte	KL - Ü -
5	Input, soil moisture-controller, set point increase	Change set point specifications	Set point increase	1 bit	K - S - -
6	Input, soil moisture-controller, set point decrease	Change set point specifications	Set point decrease	1 bit	K - S - -
7	Input, Irrigation on-time	Change irrigation on-time	Irrigation on-time	2 Byte	KLS - A
8	Input, soil moisture-controller, set point specifications	Change set point specifications	Set point specifications	2 Byte	KLS - A
9	Input, locking object 1	Locking irrigation 1	Locking object 1	1 bit	K - S - -
10	Input, locking object 2	Locking irrigation 2	Locking object 2	1 bit	K - S - -
11	Input, force irrigation object	Force irrigation	Force activation	1 bit	K - S - -
12	Input, locking function, Limit value	External locking	Locking function, limit value	2 Byte	KLS - A
13	Output, Soil temperature	Actual value (Only SK01-BFT and SK01-BFTLFT)	Measured value	2 Byte	KL - Ü -
14	Output, air temperature	Actual value air temperature (SK01-BFTLFT)	Measured value	2 Byte	KL - Ü -
15	Output, rel. air humidity	Actual value air humidity (Nur SK01-BFTLFT)	Measured value	2 Byte	KL - Ü -
16	Output Status	Actual status	Status	1 Byte	KL - Ü -
17	Input internal clock	Clock time adjustment	Internal time	3 Byte	K - S - -

KNX-Sensor I soil moisture

N...	Name	Object Function	Group ...	Length	C	R	V	T	U	I
0	Output, suction power measured value	Measured value	10/0/0	2 Byte	C	R	-	T	-	-
1	Output, suction power upper limit	Exceeding upper limit	10/0/1	1 bit	C	R	-	T	-	-
2	Output, suction power lower limit	Exceeding lower limit	10/0/2	1 bit	C	R	-	T	-	-
3	Output, humidity two-level control	Actuating variable	10/0/3	1 bit	C	R	-	T	-	-
4	Humidity setpoint	Setpoint	10/0/4	2 Byte	C	R	-	T	-	-
5	Input, humidity control increase setpoint	Setpoint increase	10/0/5	1 bit	C	R	W.	-	U	-
6	Input, humidity control decrease setpoint	Setpoint decrease	10/0/6	1 bit	C	R	W.	-	U	-
7	Irrigation On-time	On time	10/0/7	1 Byte	C	R	W.	-	U	-
8	Input, humidity control setpoint	Setpoint value	10/0/8	2 Byte	C	R	W.	T	U	-
9	Input, Locking object	Locking	10/0/9	1 bit	C	R	W.	-	U	-
11	Input, force activation	Force Irrigation	10/0/10	1 bit	C	R	W.	-	U	-
12	Input, locking function limit value	External locking	10/0/11	2 Byte	C	R	-	T	-	-
13	Output, soil temperature	Soil temperature	10/0/12	2 Byte	C	R	-	T	-	-
14	Output, Airtemperature	Measured value	10/0/13	2 Byte	C	R	-	T	-	-
15	Output, rel. Airhumidity	Measured value	10/0/14	2 Byte	C	R	-	T	-	-
16	Output, status	Status	10/0/15	1 Byte	C	R	-	T	-	-
17	Uhrzeit	Internal time	10/0/16	3 Byte	C	-	W.	-	-	-

Data Point Table from ETS

Annotations to the Data Points:

- Suction power will be represented as 2-Byte-Float (DPT_TYPE 9 alias EIS5) in Pa.

- Temperature and air humidity will be displayed as 2-Byte-Float (DPT_TYPE 9 alias EIS5) in °C and % rel. humidity respectively.

- The transmitted status is an 8-bit value and contains the following information:

Bit 0: The lock is active

Bit 1: The condition for irrigation is reached by regulator

Bit 2: The irrigation object is active

Bit 3: The upper limit value of the suction power is surpassed

Bit 4: The lower limit value of the suction power is surpassed

Bit 5: Error in soil moisture sensor

→SK01-BF: tensiometer dry, transducer or cable defect

→SK01-BFTLFT und SK01-BFT: transducer or cable defect

Bit 6: Soil temperature sensor outside of measurement range

→SK01-BFT und SK01-BFTLFT: transducer or cable defect.

Note: Without an exact measurement of the soil temperature there will be a deviation in the value of the measured suction power by 1.8% every °C difference from 24°C.

KNX-Sensor I soil moisture

Montage:

The sensor SK01-BFT and SK01-BFTLFT are delivered in a 100mm tubular housing to bury as whole or with 300mm tubular housing to stick up the ground.

For the installation of the soil moisture sensor read the instructions manual supplied with the Tensiometer (SK01-BF) or the Watermark® (SK01-BFT and SK01-BFTLFT).

For the installation of the logic device with bus coupler read the instructions manual supplied with the device.

Behavior on bus voltage recovery:

The settings for the objects 7 (irrigation duration) and 8 (input set point for the moisture regulator) will keep its current value. All other values will be set to the primarily setting done by the ETS.

The clock has to be set again.

Product image:



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