SK01-S8-AN2		Analog Modul 2-fold	Product Group 1
EIB/KNX, Indoor / Outdoor, IP65		Document: 3800_ex_SK01-S8-AN2.pdf	Article No.
	SK01-S8-AN2	KNX Dataconverter / controller for monitoring and control of two analog voltages. Input range 0 .. 12 VDC. Plastic housing: 72 x 64 x 40 mm For indoor / outdoor and damp room IP65	30806200

8.1 Application Description

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 measurement system SK01-S8-AN2 measures and controls two analog voltage values in the range of 0 to max. 12 VDC. The measured voltage value will then be digitalized and output to the KNX bus.

The upper value of the measuring range can be set using a potentiometer.
To that end, a reference voltage is required that corresponds with the upper value of the measuring range.
More detailed information on how to adjust the measuring range and the specification of the digital output can be found in the product sheet “Assembly“.

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.

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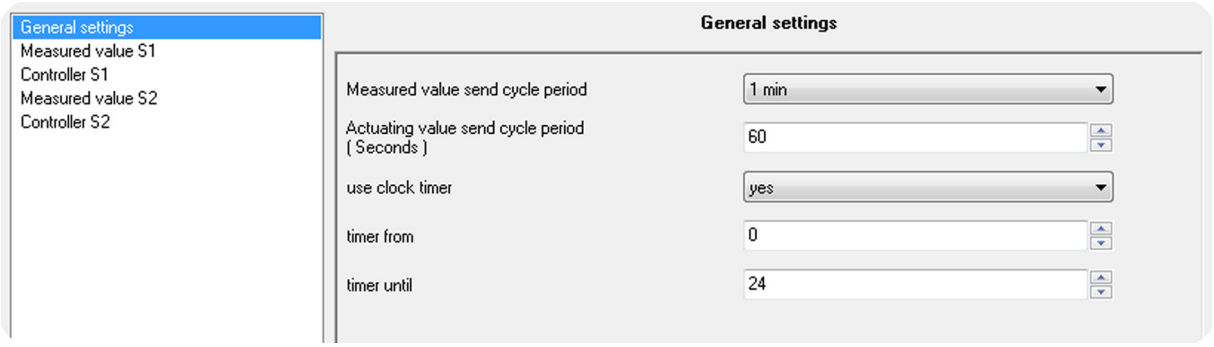
Functions

Voltage measurement with

- 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)
- Adjustment the measurement range from 0 to maximum 12VDC

8.2 KNX Parameter

8.2.1 General Settings



General Settings - SK01-S8-AN2

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.

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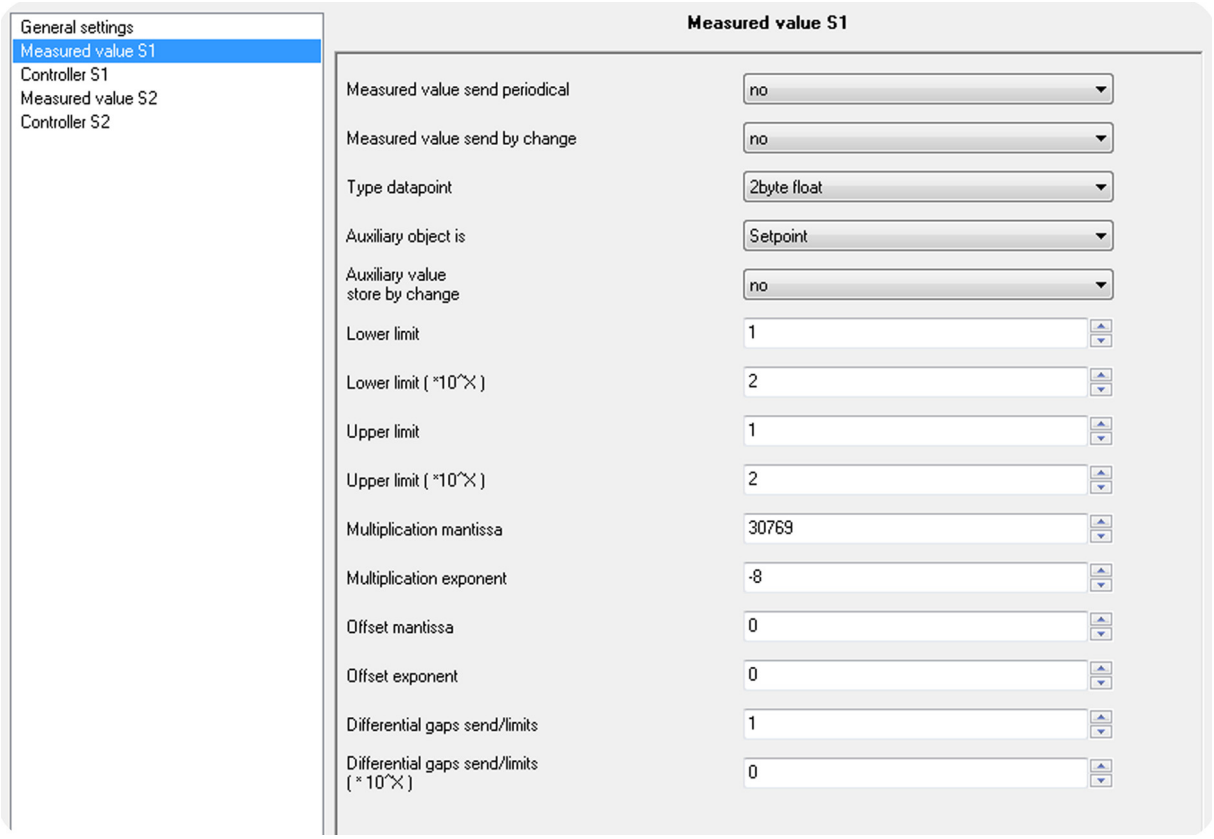
General Settings - SK01-S8-AN2 (continue)

Parameter	Setting	Description
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	• 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.

8.2.2 Measured Value S1 .. S2



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Measured Value S1 .. S2 - SK01-S8-AN2

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 limit	-999 .. +999	Here the lower limit is set. If the lower limit is exceeded 1 is sent on the object 5 / 12 „Output, Lower Limit“ and if crossed again 0 is sent.
Lower limit (*10^X)	-100 .. 100	Sets the exponent for the Lower limit.
Upper limit	-999 .. 999	Here the upper limit is set when the measured value blow this a 1 is set on the 4 / 11 „Output, Lower Limit“, exceeds the measured value again a 0 sent.
Upper limit (*10^X)	-100 .. 100	Sets the exponent for the Upper limit.
If selected at “Auxiliary Object is” (section Measured Value), this value can be changed later by the KNX object auxiliary object.		
Multiplication mantissa	-32768 .. 32767	The measured value is multiplied by this value and is available at the Object measured Value. (Example see after Offset Exponent)
Multiplication exponent	-100 .. 100	Sets the Exponent of the Multiplier. (Example see after Offset Exponent)
Offset mantissa	-32768 .. 32767	This value is added to the measured value and is available at the Object measured Value. (Example see after Offset Exponent)
Offset exponent	-100 .. 100	Sets the Exponent of the Offset.

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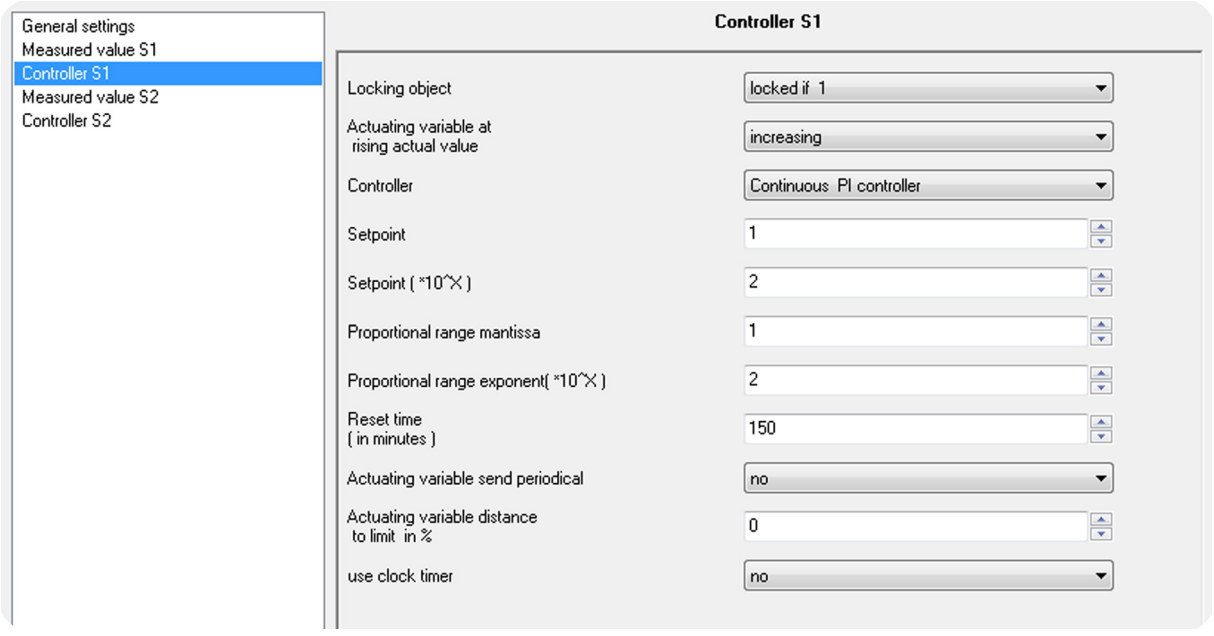
Measured Value S1 .. S2 - SK01-S8-AN2 (continue)

Parameter	Setting	Description
Example: Multiplication mantissa Multiplication exponent Offset mantissa Offset exponent	 5 3 -25 2	With these settings, the measured value is multiplied by 5000 and then 2500 of them removed. (KNX-Value = (Measured value * 5000) -2500)
Differential gaps send/limits	-999 .. 999	To reduce the bus load when a value is changed and to avoid multiple switching between measured data and thresholds should be made accordingly a hysteresis.
Differential gaps send/limits exponent (*10^X)	-100 .. 100	Sets the exponent for the Differential gap.
In order to limit the busload when the values change and to avoid multiple switching within the range of the limits, an appropriate hysteresis value should be applied.		

8.2.3 Controller S1 .. S2



Controller S1 .. S2 - SK01-S8-AN2

Parameter	Setting	Description
Locking object	• locked if 1 • locked if 0	When using the Locking object 7 „Input, enable / lock Sx“ the controller output is deactivated. The lock function can be set up for „release“ or „lock“.

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Controller S1 .. S2 - SK01-S8-AN2 (continue)

Parameter	Setting	Description
Actuating variable at rising actual value	• increasing • decreasing	The actuating direction of the controller can be adapted to the characteristics of the controlled system.
Controller	• 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 *8.4 Notes* .
Setpoint	-999 .. 999	Set the Setpoint value. If selected at „Auxiliary Object is" (section Measured Value), this value can be changed later by the KNX object auxiliary object.
Setpoint (*10^X)	-100 .. 100	Sets the exponent for the Setpoint.
Proportional range mantissa	-999 .. 999	see chapter *8.4 Notes* - General Rules for Adjusting the PI Parameter
Proportional range exponent (*10^X)	-100 .. 100	Exponent for prorortional range
Reset time (in minutes)	0 .. 255	see chapter *8.4 Notes* - General Rules for Adjusting the PI Parameter
Actuating variable send periodical	• 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	-999 .. 999	see chapter *8.4 Notes* - Two-Positon Control
Differential gab Cotroller (*10^X)	-100 .. 100	Exponent for differential gab controller
Duty cycle in %	0 .. 50	duty cycle = pulse duration / cycle duration x 100 see chapter *8.4 Notes* - Two-Positon Control with Pulsed Output
Use clock timer	• No • Yes	The use of the clock timer can be enable / disable for each channel separately.

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8.3 KNX Objects

SK01-S8-AN2 Objects

Nr.	Name	Datenpunkttyp				Funktion
0	Input, calibration object	DPT				Calibration object
1	Input, calibration	DPT				Calibration value
2	Output, measured value S1	DPT		adjustable		Measured value
3	Input, auxiliary object S1	DPT		adjustable		Auxiliary value
4	Output, upper limit S1	DPT	1.002	Bool	1 Bit	Exceeding limit
5	Output, lower limit S1	DPT	1.002	Bool	1 Bit	Undercut limit
6	Output, controller S1	DPT		adjustable		Actuating value
7	Input, enable/lock S1	DPT	1.001	Switch	1 Bit	Enable/lock
8	Output, Object status S1	DPT			1 Byte	Status
9	Output, measured value S2	DPT		adjustable		Measured value
10	Input, auxiliary object S2	DPT		adjustable		Auxiliary value
11	Output, upper limit S2	DPT	1.002	Bool	1 Bit	Exceeding limit
12	Output, lower limit S2	DPT	1.002	Bool	1 Bit	Undercut limit
13	Output, controller S2	DPT		adjustable		Actuating value
14	Input, enable/lock S2	DPT	1.001	Switch	1 Bit	Enable/lock
15	Output, Object status S2	DPT			1 Byte	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

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SK01-S8-AN2 Object Description

<table>
<tr><th>No.</th><th>Label</th><th colspan="4">Description</th></tr>
<tr><td>0

1</td><td>Input, calibration object

Input, calibration</td><td colspan="4">Through these two calibration objects, it is possible to change the Parameter settings predefined multiplier and offset via KNX bus.
To change this setting via the bus, proceed as follows:

1. Send a key (see table at the end of this section) to the object calibration object (Nr. 0). This willset the parameter changed in the next step.
2. Send the requested change to the object calibration. Thus, the mantissa of the parameter is changed.

Example:
The offset of the measured value S2 should be changed. In the parameter the offset was predefined to 100 times 10 to -3.
As a key 0xA2 is entered, and by repeatedly sending a +5, the value to 105 -> 110 -> 115 etc. changed the exponent (-3) remains unchanged.</td></tr>
<tr><td></td><td>Key</td><td>Offset S1
Multiplication S1
Offset S2
Multiplication S2</td><td colspan="3">0xA0 (160_d)
0xA1 (161_d)
0xA2 (162_d)
0xA3 (163_d)</td></tr>
<tr><td>8

15</td><td>Output, Object status S1

Output, Object status S2</td><td colspan="4">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.</td></tr>
<tr><td></td><td></td><td>Status:
Upper treshold exceeded
Lower treshold surpassed
Actuating Varable not equal 0
Lock active
Save auxiliary quantity</td><td>Bit-No.
0
1
2
4
5</td><td>Hexadecimal
0x01
0x02
0x04
0x10
0x20</td><td>Decimal
1
2
4
16
32</td></tr>
</table>

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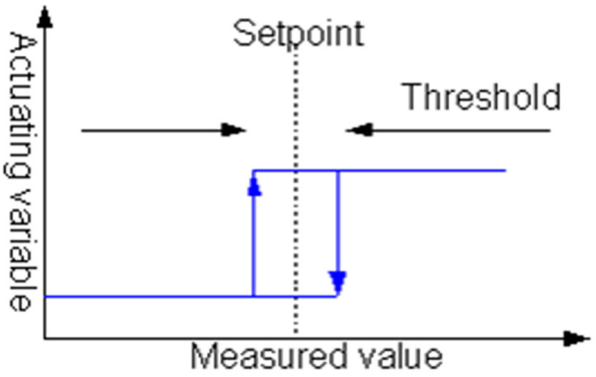
8.4 Notes

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 (± 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.

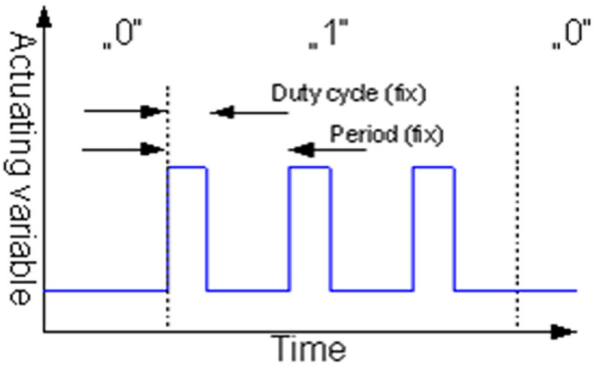
The two-position controller is parameterized using the set point and the switching threshold.



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.



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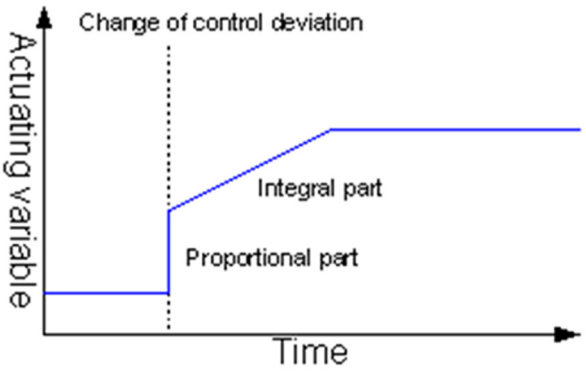
Continuous PI Control

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 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.

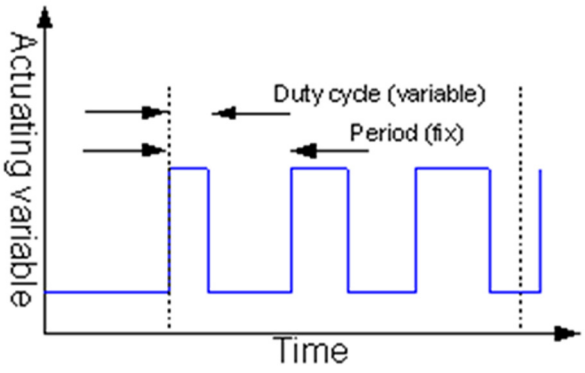


Continuous PI Control with Pulsed Output (PWM)

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.



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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.

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8.5 Product Page

The KNX controller **SK01-S8-AN2** is part of the S8 device series and serves to measure two analog voltage values between 0 and max. 12VDC.

The sensor / controller has two ports, each with a ground, a signal input and a supply voltage pin (e.g. for a sensor).

The device has an integrated KNX bus coupler and required, depending on the measurement electronics and configure, an additional voltage between 9 and 30 volts.

The transducer with the bus coupler is enclosed in a durable, sealed, glass ball-reinforced plastic casing which fulfils protection degree IP65.

In the application software there are several controllers available (two-position or PI controller with continuous or pulsed output) separately for both channels.

Additional functions include the display of upper and lower thresholds and switching between the set point and threshold.

The sensor is configured by ETS (KNX Tool Software) and the application program. Controlling functions such as signal threshold and other adjustments are parameterized by the ETS (KNX Tool Software).

Article-No.: 30806200

SK01-S8-AN2
2 Channel Analog Module
0 .. 12 VDC

Areas of Application

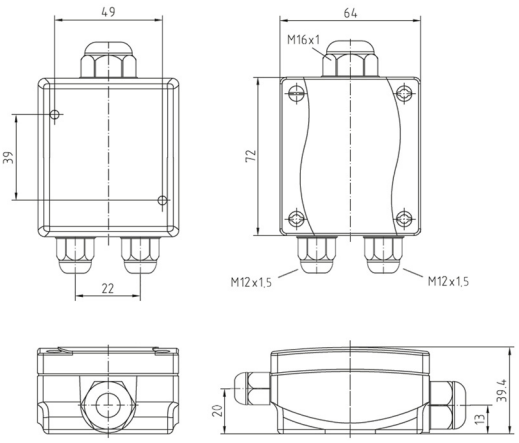
- Measurement of two analog voltage values between 0 and 12V (e.g. pressure sensors)
- Surveillance and control of chemical and physical measurements, sensor technology with voltage output.

Analog Module for measurement of two analog voltage values (e.g. pressure sensors etc.)

Measurement Range Input Voltage:

adjustable 0 .. max. 12VDC

Operating Voltage:	21 .. 32 VDC
Power Consumption:	approx. 240mW (bei 24VDC)
Auxiliary Voltage:	Depending on used measuring electronics (e.g. 9 .. 30 VDC)
Operation Temperature:	-20 .. +55 °C
Storage Temperature:	-20 .. +85 °C
Protection Class:	IP65



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8.6 Technical Data

Technical Data - SK01-S8-AN2

Measured Value	Analog voltage
Sending Options	no sending, cyclical sending when change occurs
Parameter	Cyclical sending with variable periods, sending when change occurs with hysteresis
Objekttyp S1 .. S2	1-Byte unsigned, 1-Byte signed 2-Byte unsigned, 2-Byte signed, 2-Byte float 4-Byte unsigned, 4-Byte signed, 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 S1 .. S2	Upper limit, Lower limit
Auxiliary Value	Setpoint, Lower limit or Upper limit
Bus power failure	Saving changed auxiliary quantities, parameterizable
Measurement range adjustment	Yes
Ambient Temperature Electronic Measuring Equipment Casing	Operation: -20 .. +55 °C Storage: -20 .. +85 °C
Ambient Humidity	0 .. 95% rH not condensating

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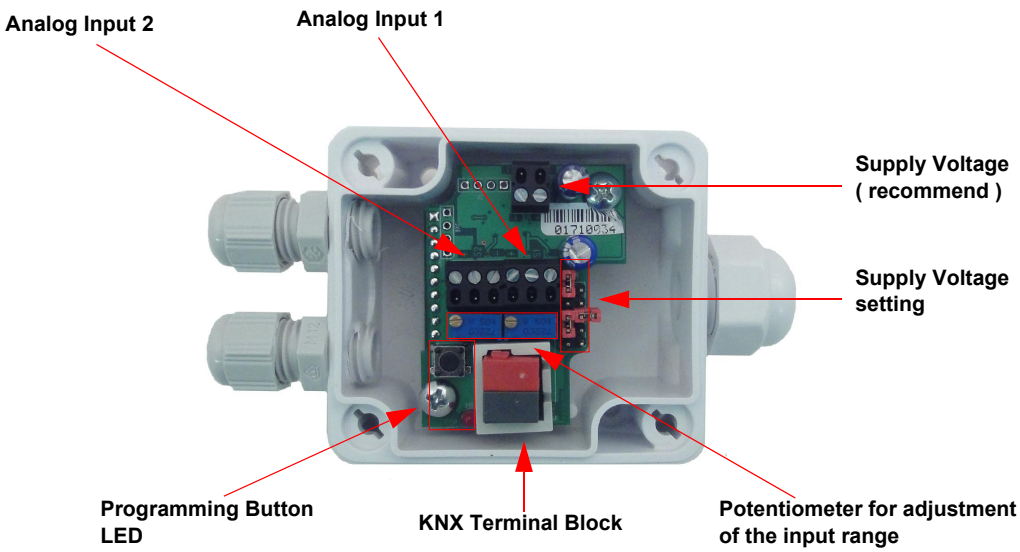
Technical Data - SK01-S8-AN2 (continue)

Operating Voltage	EIB/KNX bus voltage 21 .. 32 VDC
Power Consumption	approx. 240mW (at 24VDC)
Auxiliary voltage	Depending on used measuring electronics 9 .. 30 VDC
Bus Coupler	integrated
Inbetriebnahme mit der ETS	**ARC_S8.VD2 Produkt: S8-AN2**
Curcuit Points	EIB-2-pole clamps (red / black)
Protection Class	IP65
Assembly Type Transducer	Assembly with 2 screws
Casing Transducer	Plastic grey
Casing Dimensions	72 x 64 x 40 mm (L x W x H)
Article number	30806200

8.7 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.



SK01-S8-AN2 Assembly View

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Assignment and Labelling of Connecting Terminals

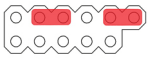
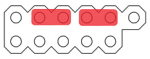
External supply voltage 9 .. 30 VDC	Two-pole connection block	(+) (-)	Input positiv (Common)
Secondary supply voltage (e.g. for external sensors)	Three-pole connection block	(+) S1,S2 (-)	Output positiv Input measuring signal (Common)

Secondary Supply Voltage (+) Connection

The two-rowed pin header on the circuit board is used to set the secondary supply voltage.
The jumper settings on the pin header effect both channels.
It is not possible to set the channels separately.

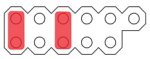
Electrically Isolated (recommend)

In this mode, the measurement and KNX page is completely isolated.
Benefits include lower susceptibility to interference and high power supply available for external sensors.

Row Connector Model	Description	External Supply 9 .. 30 VDC
	At the (+) connections there is no additional voltage available.	Yes
	**Factory setting** The external supply voltage is connected to the (+) connections.	Yes
	At the (+) connections, 5V are applied. A maximum total of 200mA can be drawn from the two outputs.	Yes
	At the (+) connections, 3,3V are applied. A maximum total of 200mA can be drawn from the two outputs.	Yes

Not Electrically Isolated

In this mode, measurement and KNX parts are not isolated.
Disadvantages are higher susceptibility and lower available current.

Row Connector Model	Description	External Supply 9 .. 30 VDC
	At the (+) connections there is no additional voltage available.	No
	At the (+) connections, 3,3V are applied. A maximum total of 5mA can be drawn from the two outputs.	No

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Input Adjustment

According to factory settings both input range are set to 0-10 V. If you need other then this the ranges can be set between 0-2 V and 0-12 V via the potentiometer behind each channel connector pinhead, separately for each one.
The default settings in the ETS application are set at levels so the maximum measurable voltage (set by potentiometer (to factory settings 10 V)) corresponds to a 10 as 2 byte float on the KNX bus.

Now if you want a range of 0-12 V you should proceed as following:

1. Connect device to KNX Bus.
2. Apply an 12 V reference voltage between the sensor pin (S1 and / or S2), and "-" Pin.
3. Open ETS with SK01-AN2 application (default settings in the parameters).
4. Select desirable channel and read it.
5. Now turn the potentiometer until the value 10 is read.

For other value ranges it is exactly the same procedure only the right reference voltage has to be selected i.e. for an range of 0-3 V the reference voltage have to be 3V.
The values available on the KNX Bus can be retouched via Parameter settings so for Example measured values between 0 an 10 V corresponds to an KNX value Range of -2.5 to 2.5.

8.8 Assembly

The Sensor **SK01-S8-AN2** 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 cables of the measured signals are connected to the illustrated place in the Figure. Run the KNX bus cable through the housing openings (PG Connection), after the sensor was attached to the wall or ceiling.
Pull the KNX bus terminal block from the device. After connecting the cable to the bus terminal block, this may again be attached to the sensor assembly.
After programming the lid is sealed with the cover screws. In order to comply with protection class IP65, the supplied gasket is carefully inserted 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.

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Safety Regulations

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

KNX arcus-eds electronic design services gmbh

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