Analog I/O Module: Technical Description

1. General Information

The Analog I/O Module is designed to provide analog-to-digital and digital-to-analogue conversion of signals of 0-10V/2-10V or 0-20mA/4-20mA standards. The device is available in two versions which differ by the number of independent channels:
- UAS-01.B (1 channel, mounting into an electrical junction box);
- UAS-04 (4 channels, DIN rail mounting).

2. How to Choose a Device Version

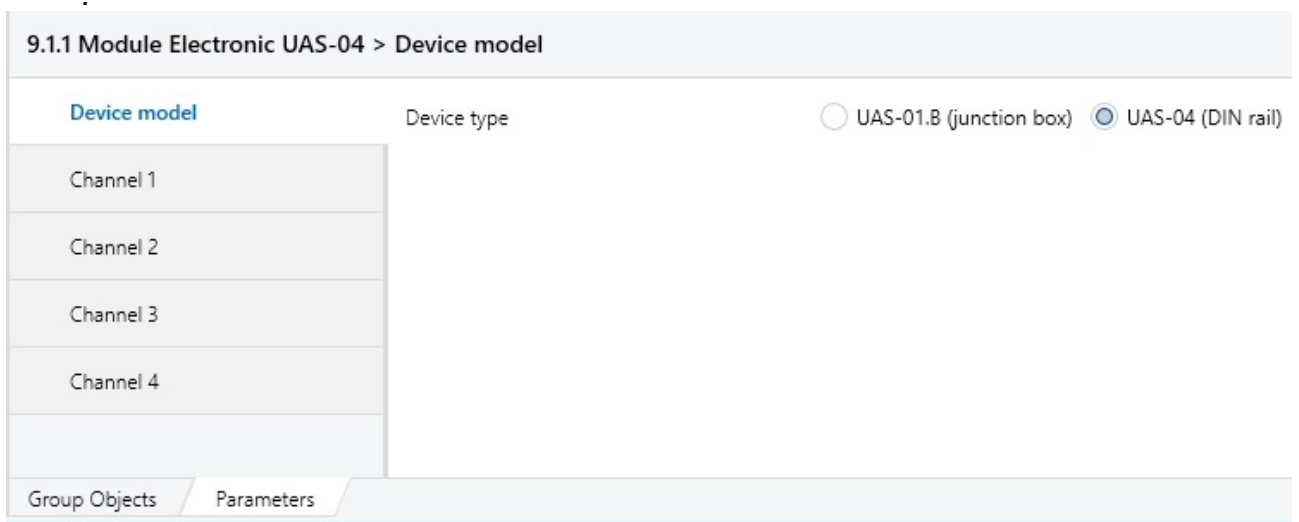*The option menu allows to select one of two models*

Fig. 1. "Device Model" tab

Depending on the selected version, the corresponding number of tabs for each of the channels available in the selected version is displayed in the settings menu.

T, °C

3. Setting Parameters in AI Mode

The device settings menu consists of individual tabs for each channel. The appearance of tabs depends on the selected channel function.

9.1.1 Module Electronic UAS-04 > Channel 1

Device model	Channel function	Input
Channel 1	Sensor type	4..20 mA
Channel 2	Sensor correction (-10.00 .. +10.00 mA)	0 mA
Channel 3	Output object datatype	9.001 Temperature (°C)
Channel 4	Lower limit of the scale 4 mA = (-100,00..+300,00 °C)	-30 °C
	Upper limit of the scale 20 mA = (-100,00..+300,00 °C)	70 °C

Send status value:

- on change of (0 - don't send)   2   % of full scale
- every (0 - don't send)   1   minutes

Alarm when the value goes out of bounds   ○ Don't send   ⦿ Send
- when temperature <   -10   °C
- when temperature >   50   °C

Group Objects   Parameters

Fig. 2. "Channel 1" tab, the channel functions as an analog input (AI).

3.1.   Channel Function

The parameter disables the channel or transfers it to AI or AO mode. The remaining channel setting parameters are displayed in the "Input" or "Output" positions.

3.2.   Sensor Type

The parameter allows selecting one of the standard input operation modes, depending on the type of sensor connected to this input: "0..10 V", "2..10 V", "0..20 mA", "4..20 mA ". When selecting "2..10 V" or "4..20 mA" options, the device is able to monitor the sensor open circuit, and the corresponding output object becomes available.

3.3. Sensor Correction

This parameter allows correcting the sensor readings. The specified value is added to the measured device.

3.4. Output Object Datatype

The parameter sets the datatype which the device will use to output the measured sensor readings.

9.001 Temperature (°C)	▼
5.001 Percentage (0..100%)	
9.021 Current (mA)	
9.001 Temperature (°C)	✔
9.004 Illuminance (lx)	
9.005 Speed (m/s)	
9.006 Pressure (Pa)	
9.007 Humidity (%)	
9.008 Parts/million (ppm)	

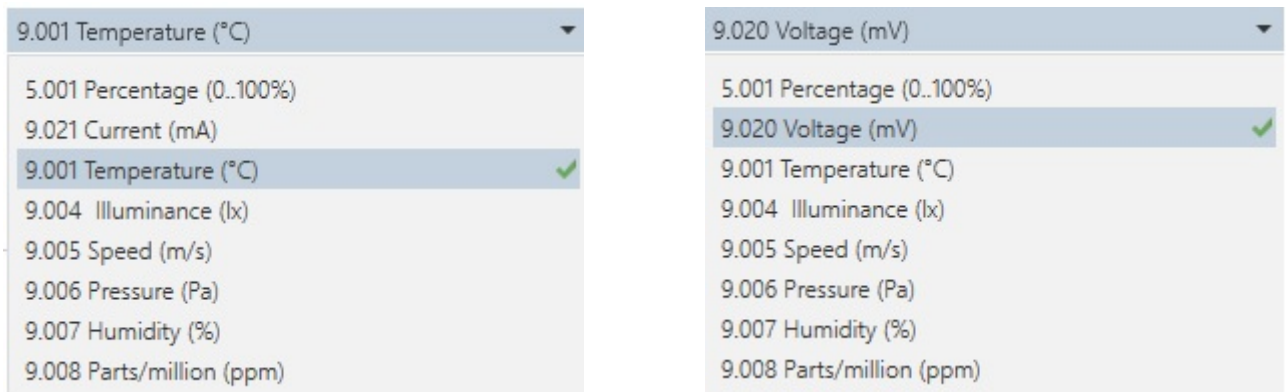| 9.020 Voltage (mV)	▼
5.001 Percentage (0..100%)	
9.020 Voltage (mV)	✔
9.001 Temperature (°C)	
9.004 Illuminance (lx)	
9.005 Speed (m/s)	
9.006 Pressure (Pa)	
9.007 Humidity (%)	
9.008 Parts/million (ppm)	

Fig. 3 and 4. Output object datatype selection depending on the sensor type (current or voltage).

- "Percentage": readings are displayed as a percentage of the sensor full scale, 0% corresponds to the lower limit of the scale, 100% - to the upper limit;
- "Current" or "Voltage" (depending on the selected sensor type): readings are displayed directly in milliamperes or volts;
- if one of the remaining options is selected, the readings are displayed as the corresponding physical values. The setting parameters for the values corresponding to the lower and upper limits of the scale become available (ref. to par. 3.5).

3.5. Physical Values Corresponding to the Lower and Upper Limits of the Scale

The parameters become available when selecting any datatype, excluding "Percentage", "Amperage" or "Voltage". The parameters allow setting the physical values corresponding to the lower and upper limits of the measurement scale.
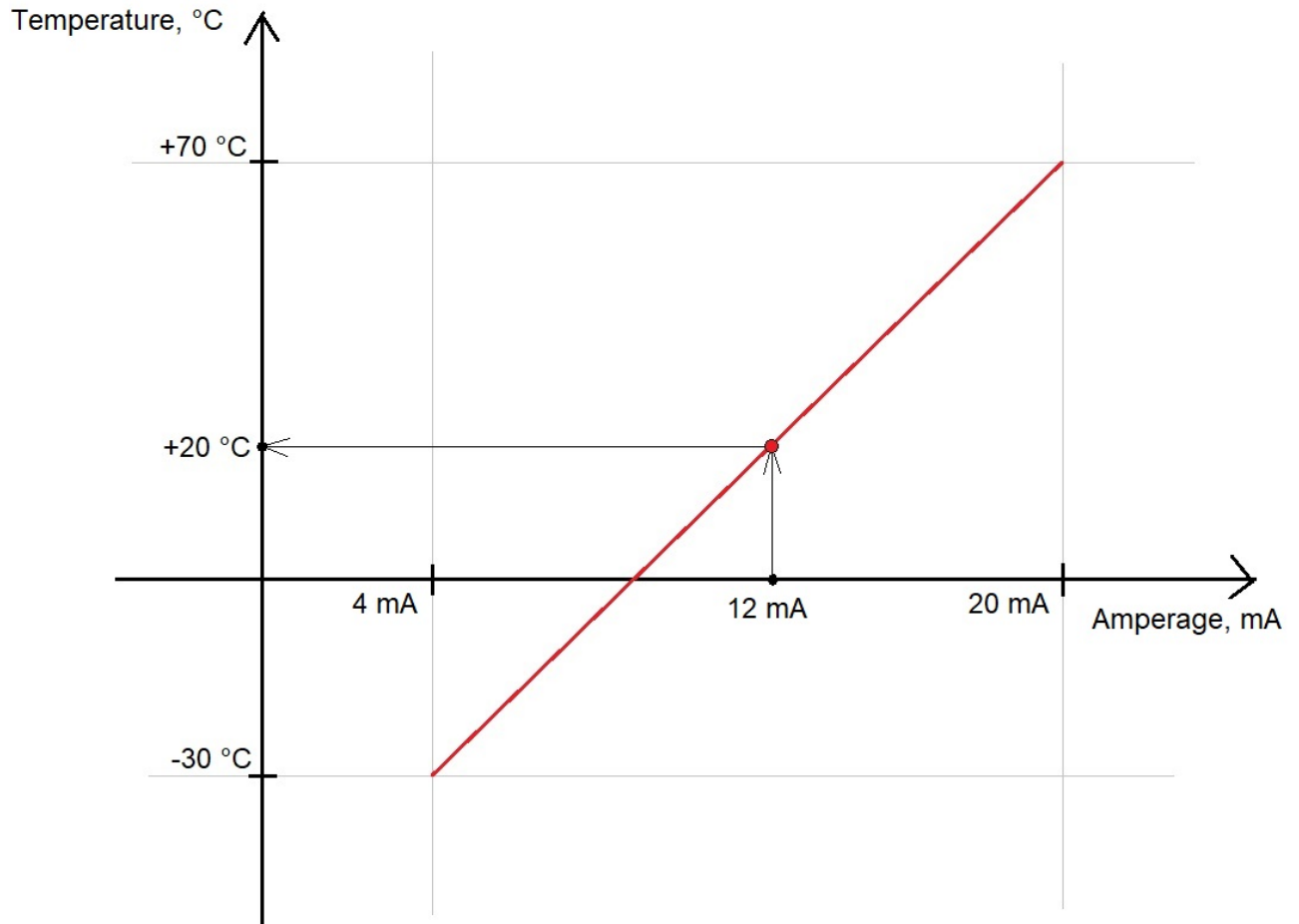

Fig. 5. Conversion of the measured sensor readings into physical values.

The measured sensor readings are converted into physical values as per the linear law.

3.6. Send Status Vales on Change

This parameter allows setting automatic sending of the measured values on their change by more than the selected percentage of the full scale. The allowable value range is 0..100. If "0" is selected, then the automatic sending is not performed upon the change of values.

3.7. Send Status Vales at Regular Intervals

The parameter allows setting automatic regular sending of measured values, regardless of their change. The sending interval is set in minutes. The allowable value range is 0..60. If "0" is selected, then the automatic regular sending is not performed.

3.8. Alarm when the Value Goes out of Bounds

When "Send" is selected, "Alarm «Upper»" and "Alarm «Lower»" output objects become available, as well as the parameters that enable setting the lower and upper alarm thresholds. The allowable threshold value ranges depend on the selected type of physical value.

4. Setting Parameters in AO Mode

Fig. 6. "Channel 1" tab, the channel functions as an analog output (AO).

4.1. Minimum and Maximum Output Voltage

The parameters allow limiting voltage at the device output. The values are specified in millivolts, the allowable value range is 0..10000 mV.

4.2. Rise Time of the Output Voltage from 0 V to 10 V

The parameter allows controlling the output voltage change rate. The allowable value range is 0..100 seconds. If "0" is selected, the output voltage changes immediately when a telegram is received. If a non-zero value is selected, the output voltage changes at the rate corresponding to the change within the full range (0..10 V) in the selected time.

4.3. Output Direction

When "Normal" is selected, the value of "0 mV" in a telegram corresponds to 0 V at the output, and the value of "10000 mV" corresponds to 10 V at the output. When "Inverted" is selected, the value of "0 mV" in a telegram corresponds to 10 V at the output, and the value of "10000 mV" corresponds to 0 V at the output.

4.4. Input Object Datatype

The parameter allows selecting the format which will be used to send telegrams to the device: millivolts or percentage of the full scale.

4.5. Number of Steps

The parameter allows setting the quantity of binary input objects which can be used to set the preset levels at the output. The allowable value range is 0..8.

4.6. Voltage (value) of Steps 1..8

These parameters allow (depending on the selected datatype, ref. to par. 4.4) setting preset values for the steps 1..8, either in millivolts (allowable value range 0..10000 mV), or in percentage of the full scale (allowable value range 0..100%). The preset values are subject to restrictions set by the parameters "Maximum and minimum output voltage" (ref. to par. 4.1).

4.7. Channel Locking

If a channel locking is enabled, both the "Channel locking" input object and the parameters for setting the channel response to locking/unlocking become available. When a channel is disabled, it can't be controlled neither directly, nor by the step objects.

4.8. Output State when Channel is Locked

The parameter defines the device response following receiving the "Lock" telegram: either don't change the current output state, or set a set value.

4.9. Output State when Channel is Unlocked

The parameter defines the device response following receiving the "Unlock" telegram: don't change the current output state, or set a set value, or set a pre-lock value.

4.10. Output State after Reset

The parameter determines the state of the device output after reset or loss and further restoration of communication with the KNX bus: either set a set value, or set a pre-reset value.

5. Output Objects in AI Mode

Depending on the settings, the device in the input mode activates and supports up to 4 independent output objects for each channel.

	Number ▲	Name	Object Function	Description	Group Address	Length	C	R	W	T	U	Data Type	Priority
	13	Channel 1	Temperature (°C)			2 bytes	C	R	-	T	-	temperature (°C)	Low
	37	Channel 1	Alarm "Upper"			1 bit	C	R	-	T	-	alarm	Low
	41	Channel 1	Alarm "Lower"			1 bit	C	R	-	T	-	alarm	Low
	81	Channel 1	Sensor break			1 bit	C	R	-	T	-	alarm	Low

Fig. 7. Output objects of the channel 1 in AI mode.

5.1. Measured Value

Depending on the selected sensor type (ref. to par. 3.2) and datatype (ref. to par. 3.4), the device activates and supports a readable output object of the corresponding type. Values are sent automatically, with regular intervals and/or on change of the value at the input, through the same output object.

5.2. Alarm "Upper" and Alarm "Lower"

Output objects become available, if the "Alarm when the value goes out of bounds" parameter is set to "Send". The alarm "Upper" is sent, when the value at the input exceeds the upper threshold, and the alarm "Lower" is sent when the value at the input is below the lower threshold (ref. to par. 3.8). The output object type is 1.005 "Alarm". The object is read-only.

5.3. Sensor Break

The output object becomes available, if 2..10 V or 4..20 mA sensors are selected in the "Sensor type" parameter (ref. to par. 3.2). The alarm "Sensor break" is sent, when the value at the input is lower than 2 V or 4 mA, respectively. The output object type is 1.005 «Alarm». The object is read-only.

6. <u>Input Objects in AO Mode</u>

Depending on the settings, the device in the output mode activates and supports up to 11 independent input objects for each channel.

	Number	Name	Object Function	Description	Group Address	Length	C	R	W	T	U	Data Type	Priority
	5	Channel 1	Voltage (mV)			2 bytes	C	R	W	T	U	voltage (mV)	Low
	45	Channel 1	Channel locking			1 bit	C	-	W	-	U	switch	Low
	49	Channel 1	Step 1			1 bit	C	-	W	-	U	switch	Low
	53	Channel 1	Step 2			1 bit	C	-	W	-	U	switch	Low
	57	Channel 1	Step 3			1 bit	C	-	W	-	U	switch	Low
	61	Channel 1	Step 4			1 bit	C	-	W	-	U	switch	Low
	65	Channel 1	Step 5			1 bit	C	-	W	-	U	switch	Low
	69	Channel 1	Step 6			1 bit	C	-	W	-	U	switch	Low
	73	Channel 1	Step 7			1 bit	C	-	W	-	U	switch	Low
	77	Channel 1	Step 8			1 bit	C	-	W	-	U	switch	Low
	85	Overload/Short curcuit	Overload/Short curcuit			1 bit	C	R	-	T	-	alarm	Low

Fig. 8. Input objects of the channel 1 in AO mode.

6.1.   Set Value

An input object is designed to send the value to be set at the output to the device. Depending on the selected datatype (ref. to par. 4.4), the input object has the type following type: 9.020 «voltage (mV)» or 5.001 «percentage (0,,100 %)».

6.2.   Channel Locking

The input object becomes available, if channel locking is enabled (ref. to par. 4.7). The channel is locked when "Enabled" is sent, and unlocked when "Disabled" is sent. When the channel is locked, it can't be controlled by other input objects. The input object type is 1.001 «Switch». The object is write-only.

6.3.   Step 1 - Step 8

The input objects become available depending on the selected number of steps (ref. to par. 4.5). When "On" is sent, the corresponding preset value is set at the output (ref. to par. 4.6). The value set at the output can't go beyond the selected limits of the maximum and minimum output voltage (ref. to par. 4.1). The input objects type is 1.001 "Switch". The objects are write-only.

6.4. Overload/Short Circuit

The input object is common to all the device channels and is available, when minimum one channels is in the AO mode. When an overload or short circuit is detected in one and/or several channels that are in the output mode, the device sends the "Alarm" value to this object. The input object type is 1.005 "Alarm". The object is read-only.

7. Device Behavior after the Initial Loading of the Software Application

After the initial loading of the software application the device is in the following state:
- all channels are inactive (parameters 3.1 "Channel function" of all channels in the "Inactive" position);
- all channels are physically switched to the input; voltage is not applied to the outputs;
- all settings: default values.

8. Device Behavior after Loss and Further Restoration of Communication with the KNX Bus

When communication with the KNX bus is lost (when voltage in the bus is below the allowable level), voltage is removed from all the channels set to work in the AO mode.
When communication with the KNX bus is restored (when voltage in the bus returns to the allowable range), voltage is supplied to all the channels set to work in the AO mode, depending on the value of the "Output state after reset" parameter (ref. to par. 4.10).