eValveco UVC10x

Handbook

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Document revisions

Date	Edition Rev./Ver.	Content of changes	Chapter	Page
01.11.2018	1.0	New document	All	All
01.04.2021	2.0	BACnet MS/TP added	All	All

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Information

Relevant information to handle the product.

Call to action

The reader is called to act.

Internet link

Important links or websites in the internet.

Warning

Warnings are precede the action.

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1 Introduction

This technical manual contains detailed technical information about the SAUTER UVC102, UVC103 and UVC106 product ranges.

The reader is encouraged to read the Installation and Commissioning Manual first, as it contains a more high-level and introductory description of products. It is available in different languages.

In addition the technical specifications of the products can be consulted in the datasheets.

The UVC102 and UVC103 products will be delivered with two temperature sensors and in 2 or 3 ports version. Further specific information for the UVC106 system are described too. This manual describes both versions. Depending on your product version, some functionality may not be available.

2   Principle of operation

The SAUTER UVC102, UVC103 and UVC106 is a motorized control valve with an integrated closed loop flow controller. The flow controller controls the flow though the device by means of a built in ultrasonic flow sensor and actuator. It controls the position of the built-in actuator to obtain the desired flow regardless of pressure variations. Hence hydraulic disturbances from elsewhere in the system are compensated and a perfect hydraulic balance is maintained at all times.

The SAUTER UVC102 and UVC103 is available in 2-port and 3-port versions

The figure below exemplify a typical application for the SAUTER UVC102 and UVC103:
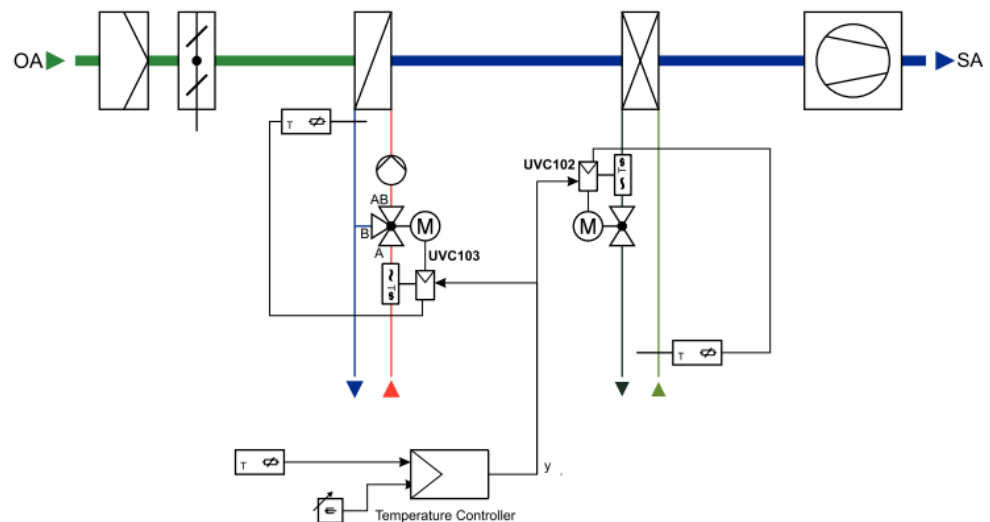
Fig. 1:   Typical 3-port (heating) and 2-port (cooling) application in an Air Handling Unit

The figure below exemplifies a typical application for the SAUTER UVC106:
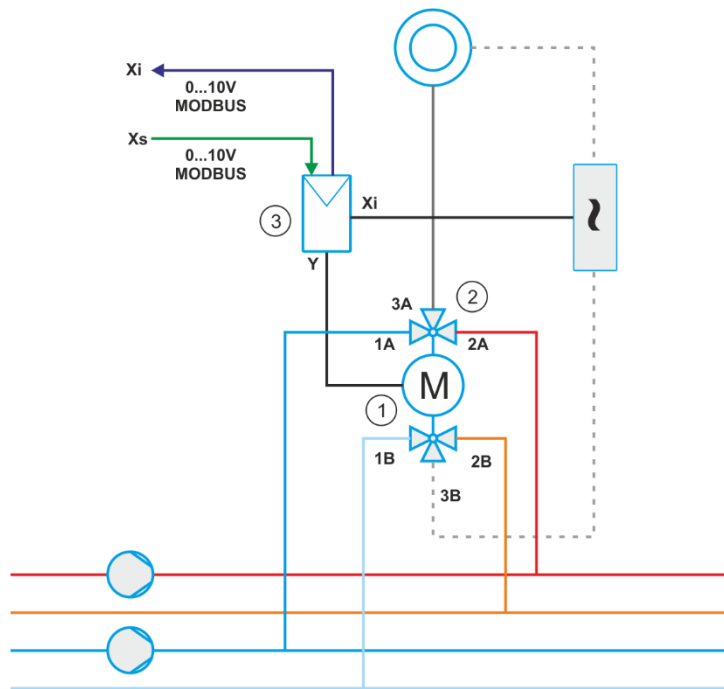
Fig. 2:   Typical 6-port heating and cooling application for chilled beams

2.1   Advantages of flow control

To explain the advantages of flow control, we use the example of a 2-port UVC102.

A conventional motorized control valve receives a control signal from an external controller and sets the valve to a position relative to the control signal. The valve position setpoint is assumed to correspond to a certain, desired flow setpoint. However, as soon as pressure variations occur in the hydraulic network, flow variations will occur, even when the valve remains in the same position. The change in flow will have an impact on the HVAC process that it is controlling, such as for example a change in secondary supply water temperature. The external controller will ultimately pick up the temperature change through a sensor and change its control signal to correct the position of the motor. This correction, however, is coming too late as the effect of temperature change has already occurred. Such a change will generally lead to discomfort and a loss in energy performance. We say that the system is not dynamically balanced.

A two-port UVC102 contains a built-in flow controller. As soon as the flow changes without a change being commanded by the external controller, the internal flow controller of UVC102 will correct the valve position to go back to the original, desired flow. This correction is extremely fast and shorter than the time for an effect on comfort or energy performance to occur.

2.2 System type

The device has a variable that defines the system or application wherein it is installed. The values available for SysType depend on the product version. The installer needs to set the correct SysType in the device.

SysType (selectable by user)	Type of system
0 (Heating) default	Flow control in a heating system
1 (Cooling)	Flow control in a cooling system

Tab. 1: Supported operation modes

The mode determines (1) which type of control is used – flow control and (2) whether the energy consumption (in UVC102/103) will be added to the heating energy variable EnerHeat or the cooling energy variable EnerCool.

As elaborated in the previous section and as the table clarifies, UVC102/103 and UVC106 are essentially flow control devices, either in a heating system or a cooling system.

2.3 Change-over heating/cooling for UVC102/103

In some installations, the pipes carry hot water at one time and cold water at another time. This is called a change-over system.

The device is aware of the mode it is working in – heating or cooling – by implementing a change-over mechanism. This means that it can move from heating to cooling and back depending on the mode in which the system is used. The change-over can be either automatic or not, as selected in the variable CO Auto (change-over control).

When automatic change-over is active (CO Auto = active), then the device will decide the mode it is in depending on the temperature difference between supply and return water. If the supply temperature is higher than the return temperature, then the device will assume it is in heating mode. If the supply temperature is lower than the return temperature, then the device will assume it is in cooling mode. A change-over hysteresis of 0.4°C is used to avoid too frequent change-over cycles. With automatic change-over the SysType will automatically move SysType from Heating to Cooling and back.

When automatic change-over is active (CO Auto = active), the UVC102/103 device needs to know whether it has been installed in the return or in the supply pipe (up to size DN 25) or where its first temperature sensor Tam1 has been installed (size DN32 and upwards). This should be set in the variable Treturn.

For the UVC106 device the installation is defined and does not need any specific configuration in this matter.

When automatic change-over is inactive (CO Auto = inactive) SysType needs to be manually changed upon every change-over from heating to cooling or back. This change can either be controlled by the user or the BMS.

Besides the writable variable SysType the read-only variable ClimStatus reveals more details about the status of the device. The following states are used:

No.	ClimStatus	Description
0	Cooling	The device is currently cooling.
1	Heating	The device is currently heating.
2	Undefined	The device hasn't received a (valid) control signal yet because Y_{1h} and Y_{1c} (or V_{sh} and V_{sc}) haven't changed from their minimum values since start-up of the device. Cf. further for the meaning of these variables. This status will also very briefly occur at every change-over cycle.
3	Error	Error because both the heating and the cooling control signal is different from the minimum.
4	*not used*	Reserved for future use.

Tab. 2: ClimStatus modes (Modbus)

No.	ClimStatus	Description
1	Heating	The device is currently heating.
2	Cooling	The device is currently cooling.
3	Not defined	The device hasn't received a (valid) control signal yet because Y1h and Y1c (or Vsh and Vsc) haven't changed from their minimum values since start-up of the device. Cf. further for the meaning of these variables. This status will also very briefly occur at every change-over cycle.
4	Error	Error because both the heating and the cooling control signal is different from the minimum.
5	Check flow	
6	Flush mode	The device is in Flush mode, cf further.

Tab. 3: ClimStatus modes (BACnet MS/TP)

2.4   Flow control

The SAUTER UVC102, UVC103 and UVC106 controls flow regardless of any pressure variations. There are 2 ways to control the setpoint: (1) the flow is determined directly from a settable flow variable Vsh or Vsc (for heating and cooling), or (2) the flow setpoint is given through values ranging from 0 to 10 in Y1h and Y1c (for heating and cooling). Y1h and Y1c are internally converted to the flow variables Vsh and Vsc.

The Y1h and Y1c signals can be controlled in two ways, depending on the value of the variable CtrlSig:

- CtrlSig = analog:

Y1h and Y1c are controlled through a single analog input signal Y1, typically from the output of a controller. Whether Y1h or Y1c is controlled depends on the value of SysType.

When CtrlSig = analog Y1h and Y1c can be read but not written over MODBUS, BACnet MS/TP or via the LCD screen on UVC102 and UVC103.

- CtrlSig = digital:

Y1h and Y1c are controlled over MODBUS, BACnet MS/TP or via de LCD screen on UVC102 and UVC103. Alternatively, the flow can be set directly through Vsh and Vsc. This is however only recommended for troubleshooting and should not be implemented in the BMS, as it will reduce the life span of the internal memory.

Flow variables

The figure below introduces the different flow variables available. It is important to grasp the meaning of each variable before continuing the reading.
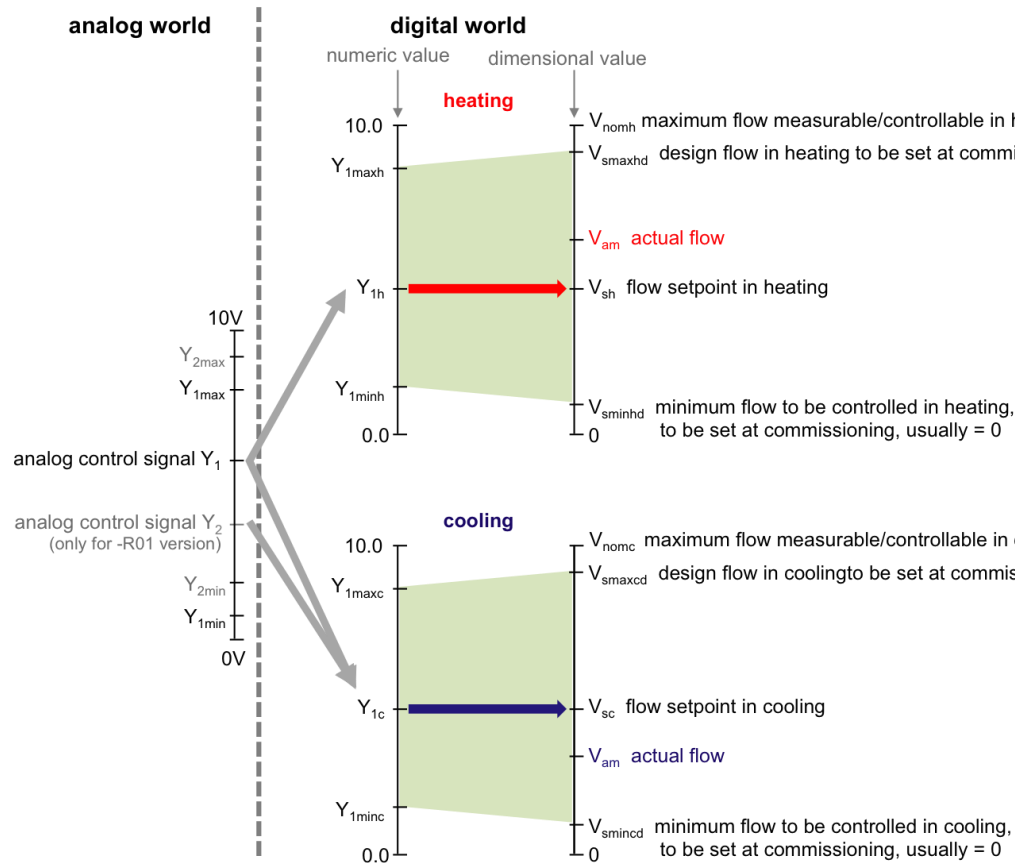
Fig. 3: Flow variables

If the device is used in analog mode, then the analog control signal Y1 is converted into a digital representation Y1h (when SysType=heating) or Y1c (when SysType=cooling). If the device is used in digital mode, then the analog signal Y1 has no influence.

The maximum and minimum values of Y1 (and Y2 in case of the –A01 version) can be set in the variables Y1min, Y1max (and Y2min, Y2max for –A01 version). If the analog signal falls below or above the minimum or maximum, then the Y1h/Y1c value is clamped to the set minimum/maximum. Y1min and Y1max should normally match the signal range of the external controller.

The maximum and minimum values of Y1h and Y1c can be set in the variables Y1minh, Y1maxh, Y1minc, Y1maxc. If the analog signal falls below or above the minimum or maximum, then the Y1h/Y1c value is clamped to the set minimum/maximum. Y1minh, Y1maxh, Y1minc and Y1maxc should normally equal Y1min and Y1max.

> ⚠ **IMPORTANT REMARK IN CASE OF CONTROLLING IN ANALOG MODE**
> In case of long power lines it is advisable to set Y1min different from 0.
> Otherwise noise and spurious signals could add voltage to the Y1 input,
> causing UVC102 and UVC103 to react even if Y1 is supposed to be 0.

Vsmaxhd and Vsmaxcd is the design flow in heating and cooling. It is usually calculated by the consulting engineer as the maximum flow that should occur for that specific device. In every application it is important that Vsmaxhd and Vsmaxcd be set at commissioning time.

Vnomc and Vnomh are the absolute maximum flows the device can cope with, in heating and in cooling. The actual flow should never surpass Vnomh and Vnomc. It is important not to confuse Vsmaxhd and Vsmaxcd (the project-specific design flow) with Vnomh and Vnomc (the factory-defined absolute maximum flow).

Vsh and Vsc are the flow setpoints in heating and cooling. They represent the desired flow at every moment in time. It should not set by the user but is calculated internally in the device on the basis of the control signals Y1c and Y1h. The difference is that Vsh and Vsc represent flows, such as 0.55 m³/h, whereas Y1h and Y1c are unit-less numbers between 0 and 10, or an analog signal between 0 and 10V. Vsh and Vsc on one hand and Y1h and Y1c on the other hand will always be kept consistent internally: when Y1h or Y1c changes then a new Vsh or Vsc will be calculated.

2.5 Control curve

The analog Y1 input signal is internally converted into the Y1c and Y1h variables, which are in turn converted into flow setpoints Vsh or Vsc for the flow controller. The –A01 version has two analog input signals Y1 and Y2, which are directly mapped ontoY1c and Y1h. Which of both setpoints is used depends on the value of SysType This is realized according to a linear or an equal percentage characteristic, as depicted below:
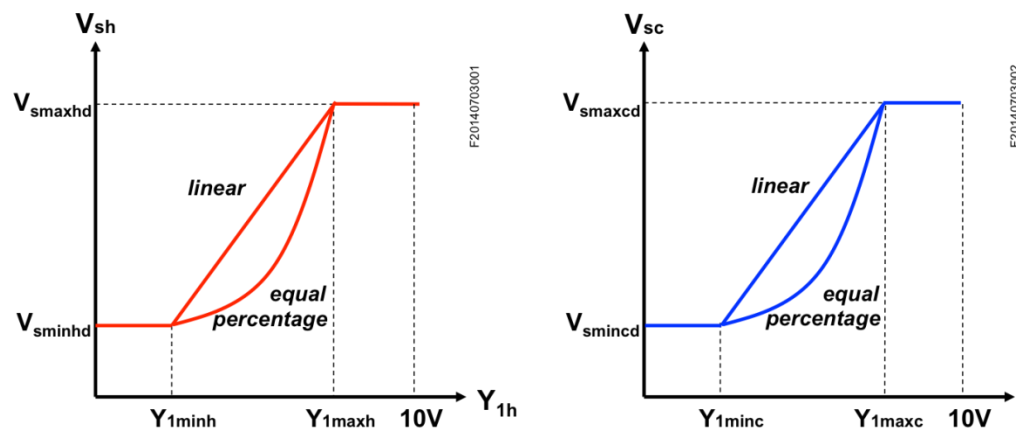
Fig. 4:   Flow control behavior

- Y1minh and Y1maxh (heating) and Y1minc and Y1maxc (cooling) define the lower and upper bounds of the control signal for heating and cooling. They should match the signal range of the external controller. Although the graph shows Y1minh < Y1maxh and Y1minc < Y1minh, it is allowed that Y1minh > Y1maxh and Y1minc > Y1maxc.

- In heating Vsminhd and Vsmaxhd are flow bounds corresponding to the input signals Y1minh and Y1maxh. In cooling Vsmincd and Vsmaxcd are flow bounds corresponding to the input signals Y1minc and Y1maxc.

- Vnom represent the nominal volumetric flow for heating and cooling. Vnom is set in the factory. It represents the absolute maximum peak flow allowed.

- If the control signal Y1h/Y1c is between Y1minh/Y1minc and Y1maxh/Y1maxc then Vsh/Vsc in interpolated linearly or equal percentage (depending on the value of CtrlChar variable) between Vsminhd/Vsmincd and Vsmaxhd/Vsmaxcd.

- If Y1h/Y1c is between 0 and Y1minh/Y1minc then the setpoint becomes Vsh = Vsminhd or Vsc = Vsmincd (depending on SysType being heating or cooling).

- If Y1h/Y1c in between Y1maxh/Y1maxc and 10 then the setpoint becomes Vsh = Vsmaxhd or Vsc = Vsmaxcd (depending on SysType being heating or cooling).

- If Vsh or Vsc is changed directly through the LCD, over the MODBUS or BACnet MS/TP interface, then the Y1h and Y1c variable will reflect the change in Vsh and Vsc.

IMPORTANT REMARK IN CASE OF CONTROLLING IN ANALOG MODE
In case the system is installed with a fairly long power line, a non-negligible voltage drop can occur between the UVC102, UVC103 or UVC106 ground and the controller ground. The consequence is that when the controller sets Y1 = 0, UVC102, UVC103 or UVC106 reads it as a value > 0. In this case it is strongly recommended to set Y1minh/Y1minc > 0, such as Y1minh = Y1minc = 2. In that case, when the controller sets Y1 = 0, the device will still read Y1 as its minimum value.

- When both flow setpoints Vsh and Vsc = 0, then the valve will completely close, even when the flow is already = 0. It can happen that the flow = 0 even when the valve is not closed, notably when the pumps are not running yet. Setting Vsh and Vsc = 0 will then close the valve.

2.6   Flow limiting

Besides controlling the flow to a setpoint, as described above, the device can also be set to limit the flow to a given value. 'Limiting' means that as long as the measured flow is below the set limit the valve will open completely in order to allow the flow to pass with the least restriction. If, however the flow would exceed the limit, the valve will start to close and limit the flow.

In order to enable flow limiting, nothing different has to be configured from the standard flow control mode. It suffices to set Y1h/Y1c or Vsh/Vsc to the desired limit value.

2.7 On/off control with limiting function on UVC102 and UVC103

In addition to the flow function the device can be controlled by a simple potential-free contact (switch or relay) for on/off control, either closing completely (off state) or opening until a limit flow value is reached (on state). In order to achieve this behavior, the following variables should be configured as follows and are available for MODBUS and BACnet MS/TP:

- set Y1minh and Y1minc to 1V
- set Y1maxh and Y1maxc to 1.5V

In addition, the 24Vac power supply should be hard-wired though the potential-free contact of a switch or relay to the Y1 input signal.

2.8 Flush mode

When Flush mode is activated through the variable Flush mode (respectively Flush 6Way on UVC106), the valve will completely open, regardless of the control signals. This minimizes the hydraulic resistance of the device, which is typically useful during flushing.

The device is factory-set to Flush mode active. It will remain in Flush mode until the analog input signal Y1 exceeds 8V or the mode is deactivated via the LCD interface, over the MODBUScommunication protocol or BACnet MS/TPcommunication protocol. If a power cycle occurs before Flush mode is deactivated, then it will still be in Flush mode after the power cycle. If a power cycle occurs after the device has left Flush mode, then it will not power up with Flush mode active again. Also, if the device is ever set back to Flush mode and a power cycles occurs, then it will not power up with Flush mode active either.

Flush mode can always be activated or deactivated by setting the Flush mode variable over the MODBUS, BACnet MS/TP or from the LCD user interface (LCD only for UVC102/103).

2.9 Open loop operation

The device is normally operated in closed loop. This means that the flow controller is active. In some applications the user may desire to operate the device in open loop, for debugging purposes.

Open loop operation is entered by setting the variable OpenLoop = Yes.

In open loop the flow control function in UVC102, UVC103 is bypassed. There is no flow or pressure control but rather position control. In that case the control signal Y1 directly controls the position of the motor.

In open loop the device will still limit the flow to a set maximum flow Vsmaxhd or Vsmaxcd. The variable Limit then reveals whether the device is currently limiting the flow (Limit = 1) or not (Limit = 0).

The UVC106 does not provide open loop operation.

2.10 Control at very small flows

Like all valves, UVC102, UVC103 or UVC106 have a non-zero Minimum Opening Position (MOP). At a position below this MOP the valve isn't able to position itself accurately anymore and the real position of the valve is undefined. This typically occurs when very small flows are being controlled.

Thanks to its built-in flow capabilities UVC102, UVC103 or UVC106 will avoid getting stuck in an undefined position by alternating between fully closed and the MOP. It does that by alternating between the two positions in a controlled way such that the average flow will correspond to the set flow. In this case the display won't show the actual flow, but rather "Va◊Vs". The actual flow can still be read from the corresponding menu item.

3 Power and Energy on UVC102 and UVC103

3.1 Power and energy variables

The device calculates the momentary thermal power consumption and accumulates the total energy consumed.

The momentary thermal power consumption is stored in the variable PWR, expressed in the unit W (Watt).

The total energy consumed is calculated by integrating the power over time. It is stored in the read-only variable EnerHeat (SysType = Heating or dp Heating) or EnerCool (SysType = Cooling or dp Cooling). The energy is stored in the unit Wh (Watt-hours) or in BTU (British Thermal Units), according to the selection in the variable Eunit.

The device will keep on adding to EnerHeat (in heating) and/or EnerCool (in cooling), without ever resetting the number. It stores the values in non-volatile memory every 2 hours in order to preserve the values across electrical power cycles of the device. On occasion of a power cycle, at most the last 2 hours of power consumption can be lost. When the variable reaches it largest possible value (which depends on the exact product type) it wraps back to zero. This will usually not take place before 5 to 20 years of continuous use.

In a typical use pattern, the user reads out the energy variables at regular intervals and subtracts the old value from the new value to derive the energy consumed between the old and the new reading.

3.2 Temperature sensors

In order to calculate the power, the device needs the temperature of the supply and return water (cf. calculations below). If the device is equipped with only one built in temperature sensor (Tam1) either in the return or in the supply, then the user can use the writable variable Text to set the other, externally measured temperature in the device. The device will use that value to derive the power and the energy. If the device is equipped with two external temperature sensors (Tam1 and Tam2), then it will autonomously calculate power and energy. If there is only one temperature sensor present and the Text variable has not been set, then the power variable PWR will contain an invalid value and the energy will not be updated.

The device will always add the energy consumption into the correct variable EnerHeat or EnerCool depending on the value ClimStatus.

It is important to correctly configure the device as for which temperature sensor is installed in the supply pipe and which in the return, to be set in the variable Treturn.

Power calculation

The thermal power consumption is provided through the read-only variable PWR. PWR is proportional to the flow Vam and to the temperature difference between the inlet and outlet temperature ITam2-Tam1I. Internally the thermal power is computed using the following formula:

Formula:

$$PWR = \frac{V_{am}}{3600} \cdot r \cdot c \cdot DT = \frac{V_{am}}{3600} \cdot r \cdot c \cdot \left| T_{am1} - T_{am2} \right| = 1138 \cdot V_{am} \cdot \Delta T$$

(PWR in W, V_{am} in m³/h, ΔT in °C or K)

Constants:

$$\rho = 977.8 \frac{kg}{m^3}$$
$$c = 4191 \frac{J}{kg°C}$$

(ρ the density of water (at 70°C), c the specific heat of water at 70°C)

Example:

$$V_{am} = 1.2 \frac{m^3}{h}$$
$$\Delta T = 20°C$$

$$\Rightarrow PWR = \frac{1.2}{3600} \cdot 977.8 \cdot 4196 \cdot 20 = 27.3 kW$$

If PWR reads 0xFFFF, then either one of the following has happened:

- The power is out of the measurable range. This should not normally occur if the device is used within its specification.
- Tam1 > 95°C or Tam2 > 95°C (temperature out of range)
- Tam2 is not connected and Text = 0 (temperature not set)

4 Warnings and Errors

4.1 Power-on self-test (POST)

At power up the device conducts a self-test, checking the program and data memory. If one of these checks fails, an error bit is set depending on the type of error.

4.2 Warnings

The warning variable is a bit-field:

- b0: Water temperature out-of-range.

  The device was designed to operate within a certain water temperature range, as specified in the datasheet. Whenever outside of the valid range, the control and measurement precision cannot be guaranteed and irreparable damage to the product may result. When the water temperature measured is out of range, b0 (least significant bit) of the variable Warning is set to 1. It is cleared as soon as the temperature is within the specified range again.

4.3 Errors

The error variable is a bit-field:

Bit	Value	Name	Description
b0	1	CRC Error	CRC check failure during boot. The device should be sent to the factory.
b1	2	EEPROM	EEPROM range check failure during boot. The device should be sent to the factory.
b2	4	Parameter error	Invalid variable: This bit is set when a variable is entered outside of the valid range. It is reset as soon as a subsequent variable is entered within the correct range. It is advised to check the variables set by the MODBUS or BACnet MS/TP master one at a time and monitor when the error is triggered.
b3	8	ChangeOver	Change-over conflict: The bit is set when both Y1h and Y1c are both larger than their respective minima Y1minh and Y1minc.
b4	16	Unused	Reserved for future applications
b5	32	Unused	Reserved for future applications
b6	64	DP Calibration error	The last calibration cycle was startewithout flow present, or, the valve was not able to close as part of the calibration process.
b7	128	ADC Calibration	ADC Calibration not done
b8	256	Range Error	Ranges of Y1h/c are incorrectly defined in split-range systems.

b9	512	No Flow sensor	Connection with flow sensor is lost.

Tab. 4: Errors

4.4 Medium temperature out of range

The UVC102 and UVC103 keeps track of the time with the water temperature out of range. The allowed temperature range is +5°C..+90°C.

These variables can be read through MODBUS and BACnet MS/TP, but not from the LCD screen:

- Tbelow_time: number of full minutes the water temperature Tam1 has been recorded to be below the allowed minimum water temperature.
- Tbelow_last: number of hours since the last time Tam1 was below the minimum allowed. The register is initialized at 65535. The counter is limited to the maximum value of 65535 (equivalent to more than 7.48 years ago).
- Tabove_time: similar to Tbelow_time but with temperature Tam1 above the maximum allowed.
- Tabove_last: similar to Tbelow_last but with temperature Tam1 above the maximum allowed.
- When the temperature is out of range, the display will show Err and warning bit b0 will be set.

5 Modbus interface and variables

5.1 Modbus interface

The UVC10xMF variants are equipped with a Modbus RTU interface with which the system can be connected to any Modbus RTU network.

For network wiring see technical datasheet.

Interfaces and communication	Description
Bus protocol	MODBUS RTU, slave
Physical layer	RS485 2-wire twisted pair (+ common wire). The device's MODBUS port is not compatible with the (less common) 4-wire RS485 standard.
Communication settings	9600, 19200 of 38400 Baud even, odd or no parity 8 data bits, 1 stop bit
Load	1/8 load
Topology	Multi-drop bus, max. 1'000m length
Type of cable	Shielded twisted pair STP or FTP
Galvanic separation	UVC102MF / UVC103MF **YES** UVC106MF **NO**

Tab. 5: Modbus specification

5.2 Modbus variables

The device variables are listed and described below. The most important variables are described in detail in other sections.

The variables are exposed to the outside world via the MODBUS communication bus and also most of them via the LCD interface (only UVC102/103MF).

5.2.1 Variable range and data types

Each variable has a defined range of allowed values. When an attempt is made to write a variable value outside of its valid range, then nothing is written and an error bit is set. As soon as the same or any other variable is written within its valid range, the error bit is cleared again. Also see section on error bit.

Three types of variables exist, according to how they are stored:

- Type C – constant: can never be changed
- Type W – writable: can typically be changed (written to). Is non-volatile, i.e.it will hold its value during a power cycle.
- Type V – volatile: can typically be changed (written to). Is volatile, i.e.it will revert back to the default value after a power cycle.

Datatypes:

- uint: 16-bit unsigned integer, corresponding to 1 MODBUS address
- int: 16-bit signed integer, corresponding to 1 MODBUS address
- float: 32-bit IEEE-754 floating point number, corresponding to 2 MODBUS addresses in big-endian format per default (most significant word is the lower address)
- bool: Binary, (yes/no or 1/0) flag, corresponding to 1 MODBUS address

Notes:

- Flow variables are always read and written in the selected unit defined in Vunit. Temperature variables are always read and written in the selected unit defined in Tunit.
- In the standard product version, metric units (SI) are selected by default. The USA and GBR versions have different default units. The units can always be changed.
- Older versions of the products had different registers. In so far as possible these registers have been kept in the newer product versions. However, these registers have been omitted from the documentation.

5.2.2 Modbus variable access

The device is factory set to MODBUS address 247. It can be changed through the variable MBaddress.

When an attempt is made to write a value outside of the applicable variable range, nothing is written and an error flag is set (see the error section).

For MODBUS variables of the type 'float', the single precision standard according to IEEE-754 is used. The value is stored in two registers (32bits).

Big endian representation is adopted per default for all 32bit registers (data types float and uint32), i.e. the most significant word is stored in the register with the lower address.

address n	address n+1
Most significant 16-bit word	Least significant 16-bit word
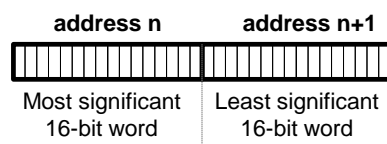
Fig. 5: Multi-register variables are stored in big-endian format per default: most significant word first.

Comment:

By changing the value of the register Endianness, the endianness can be changed to little endian. This is not recommended except when required by the BMS.

There is substantial confusion in literature related to MODBUS registers numbers (always starting at 1) and data addresses (always starting at 0). In the variable table below data addresses (more common) are specified and not register numbers (less common).

There are four types of MODBUS registers used in the UVC102MF and UVC103MF system:

Type	Data type	Read and/or write
Output coils	Binary	Read/write
Discrete input status	Binary	Read only
Input register	Numeric	Read only
Holding register	Numeric	Read/write

Tab. 6: Types of Modbus registers

Modbus variable list UVC102MF / UVC103MF

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
Ctrl Sig	0..1	0	0 = Analog mode 1 = Digital mode	NA	Sets the flow mode of the device to analog (accepts setpoint from external analog input signal) or digital (accepts setpoint from internal parameter). After Ctrl Sig is changed, the control loop state is reset	W	RW	Outp Coil	0	Bool	RW
Reboot	0..1	0	1 to reboot system	NA	Reboots the system: clearing all volatile variables; automatically reset to 0	V	RW	Outp Coil	1	Bool	RW
Reset	0..1	0	1 to reset system	NA	Resets the system: clearing all volatile variables except the reboot counters and registers; automatically reset to 0	V	RW	Outp Coil	2	Bool	RW
T unit	0..1	0	0 = °C 1 = °F	NA	Reporting unit of Tam. Can be degrees Celsius (°C) or degrees Fahrenheit (°F). Default depends on product version.	W	RW	Outp Coil	3	Bool	RW
V unit	0..4	SI = 0 UK = 3 US = 4	0 = m³/h 1 = l/s 2 = l/min 3 = Gpm (UK) 4 = Gpm (US)	NA	Reporting unit of flow parameters. Default depends on product version.	W	RW	Hold Reg	4	Uint	RW
Baud rate	0..2	2	0 = 9600 bit/s 1 = 19200 bit/s 2 = 38400 bit/s	NA	If changed, the devices resets and wakes-up with the new baud rate	W	RW	Hold Reg	5	Uint	RW
Open loop	0..1	0	0 = Closed loop 1 = Open loop	NA	Enables or disables the flow control loop.	W	RW	Outp Coil	6	Bool	RW
Y1 min	0..10	2	0,1	Volt (dc)	The minimum value of Y1 at which the flow control loop starts to operate	W	RW	Hold Reg	6	Uint	RW
Treturn	0..1	1	0 = Tam1 on supply 1 = Tam1 on return	NA	On UVC102MF and UVC103MF devices Tam1 is built in the system. This parameter is used to determine which temperature sensor is used on the supply and which on the return pipes. It's usefull if the user wants to activate the change over function.	W	RW	Outp Coil	7	Bool	RW
Y1 max	0..10	10	0,1	Volt (dc)	The maximum value of Y1 at which the flow control loop still operates.	W	RW	Hold Reg	7	Uint	RW
Flush	0..1	1	0 = Inactive 1 = Active	NA	If 1 then device is in commissioning mode, if 0 in another mode. Can be written to force the device in commissioning mode.	W	RW	Outp Coil	8	Bool	RW

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
Display ON	0..1	0	0 = LCD switches off after 1 min. 1 = LCD is on permanently	NA	If 0 then the LCD switches off after 1 min of being on. If 1 then the LCD stays on permanently.	W	RW	Outp Coil	9	Bool	RW
Ctrl char	0..1	1	0 = Linear 1 = Equal percentage	NA	Defines whether the control characteristic, i.e. the relation between Y1 and Vsh is linear or equal percentage	W	RW	Hold Reg	14	Uint	RW
CO Ctrl	0..1	0	0 = Inactive 1 = Active	NA	Defines whether the valve will automatically change from heating mode to cooling mode and vice-versa depending on the two external temperatures (Tam1 & Tam2)	W	RW	Outp Coil	15	Bool	RW
MB address	0..247	247	1..247	NA	Modbus slave address	W	RW	Hold Reg	18	Uint	RW
X1 mode	0..1	0	0 = Analog mode 1 = Digital mode	NA	In case the X1 output is defined as controlled by Y2, the output will reflect Y2 digital if X1 mode is defined in digital mode.	W	RW	Outp Coil	20	Bool	RW
MB parity	0..2	2	0 = no parity 1 = odd parity 2 = even parity	NA	Modbus parity	W	RW	Hold Reg	24	Uint	RW
Sys type	0..7	NA	0 = Heating 1 = Cooling 2 = Climate 4P 3 = Room control heating 4 = Room control cooling 5 = Room control climate ceiling	NA	The mode will determine whether the energy consumption will be added to the heating energy variable EnerHeat or the cooling energy variable EnerCool. UVC106MF are essentially flow control devices, either in a heating system or a cooling system.	W	RW	Hold Reg	25	Uint	RW
DN	GPM (US): 0,375..6 Other: 15..200	NA	GPM (US): 0,001 Other: 1	NPS inch DN mm	Normalized NPS or normalized DN-dimension of the pipe (Depending of Vunit)	C	R	Inp Reg	25	Uint	R
Area		NA	GPM (US): 0,001 Other: 1	sq in mm²	Inner area op the pipe	C	R	Inp Reg	26	Uint	R
Y1h	Y1minh .. Y1maxh	NA	0,1	Volt (dc)	Setpoint heating. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus.	W	RW	Hold Reg	26	Uint	RW

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
Y1c	Y1minc .. Y1maxc	NA	0,1	Volt (dc)	Setpoint cooling. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus.	W	RW	Hold Reg	27	Uint	RW
Y1 minh	0..10	2	0,1	Volt (dc)	The value of Y1h at which the flow control loop starts to operate.	W	RW	Hold Reg	28	Uint	RW
Y1 minc	0..10	2	0,1	Volt (dc)	The value of Y1c at which the flow control loop starts to operate.	W	RW	Hold Reg	29	Uint	RW
Y1 maxh	0..10	10	0,1	Volt (dc)	The value of Y1h at which the flow control loop still operates.	W	RW	Hold Reg	30	Uint	RW
Y1 maxc	0..10	10	0,1	Volt (dc)	The value of Y1c at which the flow control loop still operates.	W	RW	Hold Reg	31	Uint	RW
Vsh	Type dependent	NA	Depend on Vunit and Vrange	Cf. Vunit	Setpoint used when climate status is in heating mode.	W	RW	Hold Reg	32	Uint	RW
Vsc	Type dependent	NA	Depend on Vunit and Vrange	Cf. Vunit	Setpoint used when climate status is in cooling mode.	W	RW	Hold Reg	33	Uint	RW
Phi	0..100	NA	0,01	NA	Equal percentage curvature	W	RW	Hold Reg	38	Sint	-
Vs minh d	0..Vsmaxhd	0	Depend on Vunit and Vrange	Cf. Vunit	Minimum flow setpoint in climate status heating mode. Will always mirror Vsminh.	W	RW	Hold Reg	41	Uint	RW
Vs minc d	0..Vsmaxcd	0	Depend on Vunit and Vrange	Cf. Vunit	Minimum flow setpoint in climate status cooling mode. Will always mirror Vsminh.	W	RW	Hold Reg	42	Uint	RW
Vs maxh d	Vsminhd..Vnomh	72% * Vnomh	Depend on Vunit and Vrange	Cf. Vunit	Maximum flow setpoint in climate status heating mode. Will always mirror Vsminh.	W	RW	Hold Reg	43	Uint	RW
Vs maxc d	Vsmincd..Vnomc	72% * Vnomc	Depend on Vunit and Vrange	Cf. Vunit	Maximum flow setpoint in climate status cooling mode. Will always mirror Vsminh.	W	RW	Hold Reg	44	Uint	RW
E unit	0..1	0 (SI and UK) 1 (US)	0 = Wh 1 = BTU	NA	Unit for cumulative energy consumption. Default depends on product version.	W	RW	Hold Reg	47	Uint	RW
PWR	0..65535	NA	1	Watt	Power consumption (If PWR = 0xFFFF, error)	V	R	Inp Reg	55	Uint	R

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
ClimStatus	0..5	2	0 = Heating 1 = Cooling 2 = Not defined 3 = Error 4 = Check flow 5 = Flush mode	NA	Status of the current working mode	V	R	Inp Reg	56	Uint	R
Error	0..255	NA	0 = no error ≠0 = error, according to bit field	NA	Cf. corresponding section in user manual	V	R	Inp Reg	60	Uint	R
Warning	0..255	NA	0 = no warning ≠0 = warning, according to bit field	NA	Cf. corresponding section in user manual	V	R	Inp Reg	61	Uint	R
Hh reb	0..65535	NA	1	Hours	Hours since system-reboot (power-up, soft-reboot, power failure,…)	V	R	Inp Reg	65	Uint	R
Mm reb	0..59	NA	1	Minutes	Minutes since system-reboot	V	R	Inp Reg	66	Uint	R
Ss reb	0..59	NA	1	Seconds	Seconds since system-reboot	V	R	Inp Reg	67	Uint	R
Days oper	0..65535	NA	1	Days	Days total in operation	W	R	Inp Reg	68	Uint	R
Y1	Y1min ..Y1max	NA	0,1	Volt (dc)	Setpoint. In analog mode, it's used to define Y1h or Y1c depending on the Sys Type. In digital mode, it's NOT used but it can be readed.	V	R	Inp Reg	69	Uint	R
X1 min	0..10	0	0,1	Volt (dc)	The minimum value of X1 representing NO flow / Y2	W	RW	Hold Reg	70	Uint	RW
X1 max	0..10	10	0,1	Volt (dc)	The maximum value of X1 representing maximum flow / Y2	W	RW	Hold Reg	71	Uint	RW
Xm PWM	0..100	NA	0,005	%	PWM duty cycle of motor control signal (only applicable when PWM control)	V	R	Inp Reg	71	Uint	-
X1char	0..1	0	0 = Linear 1 = Equal percentage	NA	Defines whether the X1 feedback signal should return a value in relation with the flow in a linear or equal percentage way.	W	RW	Hold Reg	72	Uint	RW

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
Sam	0.01..10	NA	0,01	m/s	Actual medium velocity (speed). This is calculated as Vam/Area.	V	R	Inp Reg	74	Uint	R
X1 type	0..2	0	0 = Flow 1 = Pressure (n.a.) 2 = Controlled	NA	Defines the type of output for X1. It can be a representation of the flow, the differential pressure (n.a.) or controlled by an external device like a CO2 analyser (linked to Y2 or Y2 digital).	W	RW	Hold Reg	78	Uint	RW
Xm	0..10	NA	0,1	Volt (dc)	Actuator signal. Range: 0..10V	V	R	Inp Reg	78	Uint	-
Y2 digital	Y2min ..Y2max	NA	0,1	Volt (dc)	Digital voltage of Y2 used to control X1 output. If the user define the X1 Type as "Y2 controlled" and the X1 mode as digital, Y2 digital will be reflected on X1 output.	W	RW	Hold Reg	79	Uint	RW
X1	X1min..X1max	NA	0,1	Volt (dc)	Flow feedback signal, pressure signal (n.a) or Controlled signal (by Y2 or Y2 digital) Range: 0..10V, representing a flow/dp/Y2 control between 0 and Vsmaxd/dpsmax (n.a.)/Y2max by means of a linear or equal percentage relation between voltage and flow/dp/Y2.	V	R	Inp Reg	93	Uint	R
SN	Free text	NA	10 byte string, A..Z/0..9	NA	ASCII representation of serial number	C	R	Inp Reg	0..4	Free Text	R
Tam 1	0° .. + 90°	NA	0,1	°C/°F	Actual medium temperature. Reporting Unit can be °C or °F, depending on value of Tunit.	V	R	Inp Reg	100..101	Float	R
Tam 2	0° .. + 90°	NA	0,1	°C/°F	Actual medium temperature from the 2nd built-in sensor. Reporting Unit can be °C or °F, depending on value of Tunit. Only used when 2 temperature sensors present.	V	R	Inp Reg	102..103	Float	R
Vam	Type dependent	NA	NA (floating point)	Cf. Vunit	Actual medium flow reported in the unit defined by Vunit.	V	R	Inp Reg	108..109	Float	R
Vnomh	Type dependent	NA	NA (floating point)	Cf. Vunit	Nominal heating flow. Is factory set to the highest flow the device can cope with.	C	R	Inp Reg	114..115	Float	R
Vnomc	Type dependent	NA	NA (floating point)	Cf. Vunit	Nominal cooling flow. Is factory set to the highest flow the device can cope with.	C	R	Inp Reg	116..117	Float	R
Ener. heat	Wh:0 .. 4294967295 BTU: 0 .. 1465503606	NA	DXC = Wh : 1 ,BTU : 10 DXM015-065 = Wh : 10, BTU : 100 DXM080-200 = Wh : 100, BTU : 1000	KWh/BTU	Cumulative energy consumption in climate status heating mode.	W	R	Inp Reg	130..131	Uint32	R

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type	User R/W
Ener. cool	Wh:0 .. 4294967295 BTU: 0 .. 1465503606	NA	DXC = Wh : 1 ,BTU : 10 DXM015-065 = Wh : 10, BTU : 100 DXM080-200 = Wh : 100, BTU : 1000	KWh/BTU	Cumulative energy consumption in climate status cooling mode.	W	R	Inp Reg	132..133	Uint32	R
SW rev	Free text	NA	20 byte string, A..Z/0..9	NA	ASCII representation of software version= SW type & revision number. Only the 11 least significant bytes are displayed on the LCD.	C	R	Inp Reg	15..24	Free Text	R
T ext	0° .. + 90°	NA	0,1	°C/°F	Actual medium temperature from an external sensor. Only used when 2nd temperature sensor is NOT present. Reporting Unit can be °C or °F, depending on value of Tunit.	W	RW	Hold Reg	19..20	Uint32	RW
ProdType	Free text	NA	20 byte string, A..Z/0..9	NA	ASCII representation of hardware version= HW type & revision number. Only the 11 least significant bytes are displayed on the LCD.	C	R	Inp Reg	5..14	Free Text	R
KVS		NA	0,01	Cf. Vunit m³/h or US Gpm	Kvs or CV value of the device, depending on the selected unit. CV for US Gpm, Kvs for all other units.	C	R	Inp Reg	50..51	Uint32	R

Tab. 7: Modbus variable list UVC102MF and UVC103MF

Modbus variable list UVC106MF

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type
Ctrl Sig	0..1	0	0 = Analog mode 1 = Digital mode	NA	Sets the flow mode of the device to analog (accepts setpoint from external analog input signal) or digital (accepts setpoint from internal parameter). After Ctrl Sig is changed, the control loop state is reset	W	RW	Outp Coil	0	Bool
Reboot	0..1	0	1 to reboot system	NA	Reboots the system: clearing all volatile variables; automatically reset to 0	V	RW	Outp Coil	1	Bool
Reset	0..1	0	1 to reset system	NA	Resets the system: clearing all volatile variables except the reboot counters and registers; automatically reset to 0	V	RW	Outp Coil	2	Bool

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type
V unit	0..4	SI = 0 UK = 3 US = 4	0 = m³/h 1 = l/s 2 = l/min 3 = Gpm (UK) 4 = Gpm (US)	NA	Reporting unit of flow parameters. Default depends on product version.	W	RW	Hold Reg	4	Uint
Baud rate	0..2	2	0 = 9600 bit/s 1 = 19200 bit/s 2 = 38400 bit/s	NA	If changed, the devices resets and wakes-up with the new baud rate	W	RW	Hold Reg	5	Uint
Y1 min	0..10	2	0.1	Volt (dc)	The minimum value of Y1 at which the flow control loop starts to operate	W	RW	Hold Reg	6	Uint
Y1 max	0..10	10	0.1	Volt (dc)	The maximum value of Y1 at which the flow control loop still operates.	W	RW	Hold Reg	7	Uint
Ctrl char	0..1	1	0 = Linear 1 = Equal percentage	NA	Defines whether the control characteristic, i.e. the relation between Y1 and Vsh is linear or equal percentage	W	RW	Hold Reg	14	Uint
MB address	0..247	247	1..247	NA	Modbus slave address	W	RW	Hold Reg	18	Uint
X1 mode	0..1	0	0 = Analog mode 1 = Digital mode	NA	In case the X1 output is defined as controlled by Y2, the output will reflect Y2 digital if X1 mode is defined in digital mode.	W	RW	Outp Coil	20	Bool
MB parity	0..2	2	0 = no parity 1 = odd parity 2 = even parity	NA	Modbus parity	W	RW	Hold Reg	24	Uint
Sys type	0..7	NA	0 = Heating 1 = Cooling 2 = Climate 4P 3 = Room control heating 4 = Room control cooling 5 = Room control climate ceiling	NA	The mode will determine whether the energy consumption will be added to the heating energy variable EnerHeat or the cooling energy variable EnerCool. UVC106MF are essentially flow control devices, either in a heating system or a cooling system.	W	RW	Hold Reg	25	Uint
DN	GPM (US): 0,375..6 Other: 15..200	NA	GPM (US): 0,001 Other: 1	NPS inch DN mm	Normalized NPS or normalized DN-dimension of the pipe (Depending of Vunit)	C	R	Inp Reg	25	Uint

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type
Area		NA	GPM (US): 0,001 Other: 1	sq in mm²	Inner area op the pipe	C	R	Inp Reg	26	Uint
Y1h	Y1minh .. Y1maxh	NA	0.1	Volt (dc)	Setpoint heating. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus.	W	RW	Hold Reg	26	Uint
Y1c	Y1minc .. Y1maxc	NA	0.1	Volt (dc)	Setpoint cooling. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus.	W	RW	Hold Reg	27	Uint
Y1 minh	0..10	2	0.1	Volt (dc)	The value of Y1h at which the flow control loop starts to operate.	W	RW	Hold Reg	28	Uint
Y1 minc	0..10	2	0.1	Volt (dc)	The value of Y1c at which the flow control loop starts to operate.	W	RW	Hold Reg	29	Uint
Y1 maxh	0..10	10	0.1	Volt (dc)	The value of Y1h at which the flow control loop still operates.	W	RW	Hold Reg	30	Uint
Y1 maxc	0..10	10	0.1	Volt (dc)	The value of Y1c at which the flow control loop still operates.	W	RW	Hold Reg	31	Uint
Vsh	Type dependent	NA	Depend on Vunit and Vrange	Cf. Vunit	Setpoint used when climate status is in heating mode.	W	RW	Hold Reg	32	Uint
Vsc	Type dependent	NA	Depend on Vunit and Vrange	Cf. Vunit	Setpoint used when climate status is in cooling mode.	W	RW	Hold Reg	33	Uint
Phi	0..100	NA	0.01	NA	Equal percentage curvature	W	RW	Hold Reg	38	Sint
Vs minh d	0..Vsmaxhd	0	Depend on Vunit and Vrange	Cf. Vunit	Minimum flow setpoint in climate status heating mode. Will always mirror Vsminh.	W	RW	Hold Reg	41	Uint
Vs minc d	0..Vsmaxcd	0	Depend on Vunit and Vrange	Cf. Vunit	Minimum flow setpoint in climate status cooling mode. Will always mirror Vsminh.	W	RW	Hold Reg	42	Uint
Vs maxh d	Vsminhd..Vnomh	72% * Vnomh	Depend on Vunit and Vrange	Cf. Vunit	Maximum flow setpoint in climate status heating mode. Will always mirror Vsminh.	W	RW	Hold Reg	43	Uint
Vs maxc d	Vsmincd..Vnomc	72% * Vnomc	Depend on Vunit and Vrange	Cf. Vunit	Maximum flow setpoint in climate status cooling mode. Will always mirror Vsminh.	W	RW	Hold Reg	44	Uint
ClimStatus	0..5	2	0 = Heating 1 = Cooling 2 = Not defined	NA	Status of the current working mode	V	R	Inp Reg	56	Uint

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type
			3 = Error 4 = Check flow 5 = Flush mode							
Error	0..255	NA	0 = no error ≠0 = error, according to bit field	NA	Cf. corresponding section in user manual	V	R	Inp Reg	60	Uint
Warning	0..255	NA	0 = no warning ≠0 = warning, according to bit field	NA	Cf. corresponding section in user manual	V	R	Inp Reg	61	Uint
Hh reb	0..65535	NA	1	Hours	Hours since system-reboot (power-up, soft-reboot, power failure,…)	V	R	Inp Reg	65	Uint
Mm reb	0..59	NA	1	Minutes	Minutes since system-reboot	V	R	Inp Reg	66	Uint
Ss reb	0..59	NA	1	Seconds	Seconds since system-reboot	V	R	Inp Reg	67	Uint
Days oper	0..65535	NA	1	Days	Days total in operation	W	R	Inp Reg	68	Uint
Y1	Y1min ..Y1max	NA	0.1	Volt (dc)	Setpoint. In analog mode, it's used to define Y1h or Y1c depending on the Sys Type. In digital mode, it's NOT used but it can be readed.	V	R	Inp Reg	69	Uint
X1 min	0..10	0	0.1	Volt (dc)	The minimum value of X1 representing NO flow/dp(n.a.)/Y2	W	RW	Hold Reg	70	Uint
X1 max	0..10	10	0.1	Volt (dc)	The maximum value of X1 representing maximum flow/dp(n.a.)/Y2	W	RW	Hold Reg	71	Uint
Xm PWM	0..100	NA	0.005	%	PWM duty cycle of motor control signal (only applicable when PWM control)	V	R	Inp Reg	71	Uint
X1char	0..1	0	0 = Linear 1 = Equal percentage	NA	Defines whether the X1 feedback signal should return a value in relation with the flow in a linear or equal percentage way.	W	RW	Hold Reg	72	Uint
Sam	0.01..10	NA	0.01	m/s	Actual medium velocity (speed). This is calculated as Vam/Area.	V	R	Inp Reg	74	Uint
Flush 6Way	0..2	0	0 = Inactive 1 = Flush cooling 2 = Flush heating	NA	In 6 way valves (UVC106MF), The "Flush 6 way" parameter will replace the default "Flush" parameter. Setting to Flush cooling will force the device in commissioning mode on the cooling port (Depend on PortConnection variable), setting to Flush heating will force the device in commissioning mode on the heating port. If it's inactive, the valve will follow the set	W	RW	Hold Reg	76	Uint

Name	Valid range	Default	Resolution values	Unit	Description	Volatile	R/W	Type	Address	Data type
					points					
X1 type	0..2	0	0 = Flow 1 = Pressure (n.a.) 2 = Controlled	NA	Defines the type of output for X1. It can be a representation of the flow, the differential pressure (n.a.) or controlled by an external device like a CO2 analyser (linked to Y2 or Y2 digital).	W	RW	Hold Reg	78	Uint
Xm	0..10	NA	0.1	Volt (dc)	Actuator signal. Range: 0..10V	V	R	Inp Reg	78	Uint
Y2 digital	Y2min ..Y2max	NA	0.1	Volt (dc)	Digital voltage of Y2 used to control X1 output. If the user define the X1 Type as "Y2 controlled" and the X1 mode as digital, Y2 digital will be reflected on X1 output.	W	RW	Hold Reg	79	Uint
X1	X1min..X1max	NA	0.1	Volt (dc)	Flow feedback signal, pressure signal (n.a) or Controlled signal (by Y2 or Y2 digital) Range: 0..10V, representing a flow/dp/Y2 control between 0 and Vsmaxd/dpsmax (n.a.)/Y2max by means of a linear or equal percentage relation between voltage and flow/dp/Y2.	V	R	Inp Reg	93	Uint
SN	Free text	NA	10 byte string, A..Z/0..9	NA	ASCII representation of serial number	C	R	Inp Reg	0..4	Free Text
Vam	Type dependent	NA	NA (floating point)	Cf. Vunit	Actual medium flow reported in the unit defined by Vunit.	V	R	Inp Reg	108..109	Float
Vnomh	Type dependent	NA	NA (floating point)	Cf. Vunit	Nominal heating flow. Is factory set to the highest flow the device can cope with.	C	R	Inp Reg	114..115	Float
Vnomc	Type dependent	NA	NA (floating point)	Cf. Vunit	Nominal cooling flow. Is factory set to the highest flow the device can cope with.	C	R	Inp Reg	116..117	Float
SW rev	Free text	NA	20 byte string, A..Z/0..9	NA	ASCII representation of software version= SW type & revision number. Only the 11 least significant bytes are displayed on the LCD.	C	R	Inp Reg	15..24	Free Text

| ProdType | Free text | NA | 20 byte string, A..Z/0..9 | NA | ASCII representation of hardware version= HW type & revision number. Only the 11 least significant bytes are displayed on the LCD. | C | R | Inp Reg | 5..14 | Free Text |
| KVS | | NA | 0.01 | Cf. Vunit m³/h or US Gpm | Kvs or CV value of the device, depending on the selected unit. CV for US Gpm, Kvs for all other units. | C | R | Inp Reg | 50..51 | Uint32 |

Tab. 8: Modbus variable list UVC106MF

6 BACnet Interfaces and Variables

6.1 BACnet Interfaces

The UVC10xBF variants are equipped with a BACnet MS/TP interface with which the system can be connected to any BACnet MS/TP network.

For network wiring see technical datasheet.

Interfaces and communication	Description
Bus protocol	BACnet MS/TP, slave
Physical layer	RS485 2-wire twisted pair (+ common wire). The device's MODBUS port is not compatible with the (less common) 4-wire RS485 standard.
Communication settings	9600, 19200 of 38400 Baud even, odd or no parity 8 data bits, 1 stop bit
Topology	Multi-drop bus, max. 1'000m length
Type of cable	Shielded twisted pair STP or FTP

Tab. 9: BACnet specification

6.2 BACnet MS/TP PICS

This chapter describes the specified BACnet PICS (Protocol Implemenation Conformance Statement) of the UVC106BF versions. The most important PICS are described in detail in other sections.

6.3 UVC106BF electronic pressure independent 6-port valve

Object Name	Description
Date	April 2020
Vendor name	SAUTER
Vendor Id	80
Product name	eValveco
Product model number	UVC106BF (see table below)
Application software	4.06.09 or higher
Firmware revision	0.8.3 or higher
Product description	Dynamic flow control system with 6-way ball valve
BACnet protocol revision	135-2016 or higher

Tab. 10: UVC106BF specification

6.3.1 Product model number

UVC106BF is a series of 6-port control valves. Depending on the version, some variables may or may not be present in the device. The valve exists in two DN sizes (DN15 and DN25), which use the same BACnet MS/TP PICS.

Product	Description
UVC106BF0 _ _	Version without IRC without energy measurement

Tab. 11:   UVC106BF product model number

6.3.2 BACnet Standardized device profile (Annex L)

- BACnet Application Specific Controller (B-ACS)

6.3.3 Supported BACnet interoperability building blocks (Annex K)

- Data Sharing-ReadProperty (DS-RP-B)
- Data Sharing-WriteProperty (DS-WP-B)
- Device Management-DynamicDeviceBindings(DM-DDB-B)

6.4 Supported Object types and Objects

Object instantiation is static; objects cannot be created or deleted.

Information

Each overview of objects in this chapter only describe the objects that apply to this series of *dynamx*™ valves.

- RW = Read/Write
- R   = Read Only

6.4.1 Binary value

Binary value	
Dynamically creatable using CreateObject service?	No
Dynamically deletable using DeleteObject service?	No
Writable properties that are not otherwise required by the standard	N/A
Conditionally writable properties that are otherwise not required by the standard	N/A
Proprietary properties	N/A

Tab. 12:   Binary value

Supported optional properties

- InactiveText
- ActiveText

Supported Objects

Instance ID	Object Name	Restrictions	Resolution	Value Access Type
0	Ctrl Sig	0..1	0 = Analog mode 1 = Digital mode	Present Value, RW
1	Meas Sig	0..1	0 = Analog mode 1 = Digital mode	Present Value, RW[1]
3	Port 1 Active	0..1	0 = Port 1 is inactive 1 = Port 1 is active	Present Value, R
4	Night Mode	0..1	0 = Night Mode disabled 1 = Night Mode enabled	Present Value, RW[1]
6	DI1 Type	0..1	0 = Normally Closed 1 = Normally Open	Present Value, RW[1]
7	DI2 Type	0..1	0 = Normally Closed 1 = Normally Open	Present Value, RW[1]
12	Reboot	0..1	0 = Inactive 1 = Reboot	Present Value, RW[1]
13	DI3 Type	0..1	0 = Normally Closed 1 = Normally Open	Present Value, RW[1]
14	X1 Mode	0..1	0 = Analog mode 1 = Digital mode	Present Value, RW[1]
15	ObjectValues MB based	0..1	0 = Default Multistate Values 1 = Multistate Values MBbased	Present Value, RW
16	Temp Unit	0..1	0 = °C 1 = °F	Present Value, RW
17	Frost Protection	0..1	0 = Disabled 1 = Enabled	Present Value, RW[1]

Tab. 13: *Supported Objects*

---

[1] Objects accessible / implemented depending on product type

6.4.2 Analog input

Analog input	
Dynamically creatable using CreateObject service?	No
Dynamically deletable using DeleteObject service?	No
Writable properties that are not otherwise required by the standard	N/A
Conditionally writable properties that are otherwise not required by the standard	N/A
Proprietary properties	N/A

Tab. 14:   Analog value

Supported optional properties

- N/A

Supported Objects

Instance ID	Object Name	Restrictions	Resolution	Value Access Type
0	Vam	N/A	Real	Present Value, R
1	Tam1	N/A	Real	Present Value, R[2]
2	Tam2	N/A	Real	Present Value, R[2]
4	Text 1	N/A	Real	Present Value, R[2]
5	Text 2	N/A	Real	Present Value, R[2]
6	Y1	N/A	Real	Present Value, R[2]
7	Y2	N/A	Real	Present Value, R**Fehler! Textmarke nicht definiert.**
8	Warning	N/A	Real	Present Value, R
9	Error	N/A	Real	Present Value, R

Tab. 15:   Supported Objects

Description Analog Input [8] – Warning

Bit	Value	Name	Explanation
b0	1	Temperature	One of the Tam temperature sensors returns an invalid reading
b1	2	Not Used	
b2	4	Not Used	
b3	8	Negative Flow	Flow direction is wrong
b4	16	Manual Mode	Actuator is on manual

Tab. 16:   Description Analog Input [8] – Warning

---

[2] Objects accessible / implemented depending on product type

6.5   Analog value

Analog value	
Dynamically creatable using CreateObject service?	No
Dynamically deletable using DeleteObject service?	No
Writable properties that are not otherwise required by the standard	N/A
Conditionally writable properties that are otherwise not required by the standard	N/A
Proprietary properties	N/A

Tab. 17:   Analog value

Supported optional properties

- N/A

Supported Objects

Instance ID	Object Name	Restrictions	Resolution	Value Access Type
0	Y1h	Y1minh .. Y1maxh; 0,1	Real	Present Value, RW[3]
	Y1minh	0..10; 0,1	Real	Low Limit, RW
	Y1maxh	0..10; 0,1	Real	High Limit, RW
1	Y1c	Y1minc .. Y1maxc; 0,1	Real	Present Value, RW[3]
	Y1minc	0..10; 0,1	Real	Low Limit, RW
	Y1maxc	0..10; 0,1	Real	High Limit, RW
2	Vsh	Type dependent	Real	Present Value, RW[3]
	Vs minhd	0..Vsmaxhd	Real	Low Limit, RW
	Vs maxhd	Vsminhd..Vnomh	Real	High Limit, RW
3	Vsc	Type dependent	Real	Present Value, RW[3]
	Vs mincd	0..Vsmaxcd	Real	Low Limit, RW
	Vs maxcd	Vsmincd..Vnomc	Real	High Limit, RW
4	Tset	14..35°C; 0,1	Real	Present Value, RW[4]

---

[3] Write enabled depending on the Control Signal or Measuring Signal status

5	Tsetcalc	0,1	Real	Present Value, R[4]
6	Setp Modif	N/A	Bitfield; b0: window open b1: away mode b2: night mode b3: condensation b4: frost protection	Present Value, R[4]
7	Tcoolmin	9..35°C; 0,1	Real	Present Value, RW[4]
10	EnerHeat	Wh: 1 ,BTU: 10	Real	Present Value, R[4]
11	EnerCool	Wh: 1 ,BTU: 10	Real	Present Value, R[4]
12	Troom	Troom min .. Troom max	Real	Present Value, RW[3, 4]
	Troom max	0..90°C; 0,1	Real	Low Limit, RW1
	Troom min	0..90°C; 0,1	Real	High Limit, RW1
13	Tsetadj	-Tsetadj max..Tsetadj max; 0,1	Real	Present Value, RW [3, 4]
	Tsetadj max	0..5°C; 0,1	Real	High Limit, RW[4]
14	Test Reg	Limited to test command values	Real	Present Value, RW
15	Command Reg	Limited to command value, to change settings	Real	Present Value, RW
16	Y2 Digital	Y2min ..Y2max	Real	Present Value, R[4]
17	Vsmax h	Vsminhd .. Vsnomh	Real	Present Value, RW
18	Vsmax c	Vsmincd .. Vsnomc	Real	Present Value, RW
20	XM	Motor Position: 0..10; 0,1	Real	Present Value, R[4]

[4] Objects accessible / implemented depending on product type

21	T1 Correction	-5..+5; 0,1	Real	Present Value, RW[4]
22	T2 Correction	-5..+5; 0,1	Real	Present Value, RW[4]
23	Temp Dead band	0,2..6°C; 0,1	Real	Present Value, RW[4]
24	Temp Db Night	0,2..20°C; 0,1	Real	Present Value, RW[4]
25	Window Open	6..35°C; 0,1	Real	Present Value, RW[4]
26	Window Open	6..40°C; 0,1	Real	Present Value, RW[4]
27	Prop band Heating	0,5..6°C; 0,1	Real	Present Value, RW[4]
28	Prop band Cooling	0,5..6°C; 0,1	Real	Present Value, RW[4]
29	Integration Time	50..50000 sec; 1	Real	Present Value, RW[4]

Tab. 18:   *Supported Objects*

6.6   Analog output

Analog Output	
Dynamically creatable using CreateObject service?	No
Dynamically deletable using DeleteObject service?	No
Writable properties that are not otherwise required by the standard	N/A
Conditionally writable properties that are otherwise not required by the standard	N/A
Proprietary properties	N/A

Tab. 19:   Analog output

Supported optional properties

- N/A

Supported Objects

Instance ID	Object Name	Restrictions	Resolution	Value Access Type
0	X1	N/A	Real	Present Value, R[5]

Tab. 20:   Supported Objects

6.7   Multistate value

Multistate Value	
Dynamically creatable using CreateObject service?	No
Dynamically deletable using DeleteObject service?	No
Writable properties that are not otherwise required by the standard	N/A
Conditionally writable properties that are otherwise not required by the standard	N/A
Proprietary properties	N/A

Tab. 21:   Multistate Value

Supported optional properties

- NumberOfStates
- StateText

---

[5] Objects accessible / implemented depending on product type

Supported Objects

Instance ID	Object Name	Restric- tions	Resolution	Value Access Type
0	SysType	1..81	1 = Not used 2 = Not used 3 = Climate 4P 4 = Not used 5 = Not used 6 = Room control climate ceiling 7 = Not used 8 = Not used	Present Value, RW
1	ClimStatus	1..6	1 = Heating 2 = Cooling 3 = Not defined 4 = Error 5 = Check flow 6 = Flush mode	Present Value, R
2	End mode	1..3	1 = Normal behavior 2 = No flow 3 = Flush mode	Present Value, RW
3	6WayFlush	1..3	1 = Inactive 2 = Flush cooling 3 = Flush heating	Present Value, RW
4	Control Char	1..2	1 = Linear 2 = Equal percentage	Present Value, RW

Instance ID	Object Name	Restric- tions	Resolution	Value Access Type
5	DI1 Usage	1..9	1 = DI1 Not used 2 = Window open 3 = Away mode 4 = Counter 5 = Night mode 6 = Not used 7 = Not used 8 = Not used 9 Condensation	Present Value, RW[6]
6	DI2 Usage	1..9	1 = DI2 Not used 2 = Window open 3 = Away mode 4 = Counter 5 = Night mode 6 = Not used 7 = Not used 8 = Not used 9 = Condensation	Present Value, RW[6]
8	DI3 Usage	1..9	1 = DI3 Not used 2 = Window open 3 = Away mode 4 = Counter 5 = Night mode 6 = Not used 7 = Not used 8 = Not used 9 = Condensation	Present Value, RW[6]
9	Text1 Usage	1..3	1 = Pt500 2 = Pt1000 3 = Potentiometer 10k	Present Value, RW[6]

---

[6] Objects accessible / implemented depending on product type

Instance ID	Object Name	Restric-tions	Resolution	Value Access Type
10	Text2 Usage	1..3	1 = Pt500 2 = Pt1000 3 = Potentiometer 10k	Present Value, RW[6]
11	X1 type	1..3	1 = Flow 2 = Not used 3 = Controlled	Present Value, RW[6]
12	X1 char	1..2	1 = Linear 2 = Equal percentage	Present Value, RW[6]
13	Temp Control Type	1..2	1 = P 2 = PI	Present Value, RW[6]

Tab. 22:   Supported Objects

6.8   Network port

Supported properties

Property Identifier	Datatype	Restrictions
Object_Identifier	BACnetObjectIdentifier	
Object_Name	CharacterString	
Object_Type	BACnetObjectType	
Description	CharacterString	
Status_Flags	BACnetStatusFlags	
Reliability	BACnetReliability	
Out_Of_Service	Boolean	
Network_Type	BACnetNetworkType	
Protocol_Level	BACnetProtocolLevel	
Network_Number	Unsigned16	
Network_Number_Quality	BACnetNetworkNumberQuality	
Changes_Pending	Boolean	
Command	BACnetNetworkPortCommand	
MAC_Address	Octet String	
Link_Speed	Real	
Link_Speeds	BACnetARRAY[N] of Real	

Tab. 23:   Supported Objects

Attribute	Description
Segmentation capability	Segmentation requests are not supported
	Segmentation responses are not supported
Data Link layer options	MS/TP master (Clause 9), Baud rates : 9600/19200/38400
	MS/TP slave (Clause 9), Baud rates : 9600/19200/38400
Device address binding	Static device binding is not supported
Networking options	N/A
Character sets supported	ANSI X34
Network Security Options#	Non secure device, is capable of operating without BACnet Network security

Tab. 24:   Network properties

7 Annex A: Variables description list

Object Name	Description	Value Access Type
ClimStatus	Status of the current working mode	Multistate value
Command reg	Internal command register. (to be used by manufacturer only)	Analog value
Control char	Defines whether the control characteristic, i.e. the relation between Y1 and Vsh is linear or equal percentage	Multistate value
Control Sig	Sets the flow mode of the device to analog (accepts setpoint from external analog input signal) or digital (accepts setpoint from internal parameter). After Ctrl Sig is changed, the control loop state is reset.	Binary value
DI1 Type	It defines the digital input 1 contact has normally open or normally closed. It has no impact if the digital input 1 is defined as a counte.	Binary value
DI1 Usage	Bits 0x000F are used as a bitfield to define DI1 Usage. It can be of type window contact, presence detection, night mode active, and condensation. It will have an impact on the SetpModif value. If the user choose the counter, pulses received in the digital input will be recorded into Counter 1 (no effect on SetpModif)	Multistate value
DI2 Type	It defines the digital input 2 contact has normally open or normally closed. It has no impact if the digital input 2 is defined as a counter	Binary value
DI2 Usage	Bits 0x00F0 are used as a bitfield to define DI2 Usage. It can be of type window contact, presence detection, night mode active, and condensation. It will have an impact on the SetpModif value. If the user choose the counter, pulses received in the digital input will be recorded into Counter 2 (no effect on SetpModif)	Multistate value
DI3 Type	It defines the digital input 3 contact has normally open or normally closed. It has no impact if the digital input 3 is defined as a counter	Binary value

Object Name	Description	Value Access Type
DI3 Usage	Bits 0x0F00 are used as a bitfield to define DI3 Usage. It can be of type window contact, presence detection, night mode active, and condensation. It will have an impact on the SetpModif value. If the user choose the counter, pulses received in the digital input will be recorded into Counter 3 (no effect on SetpModif)	Multistate value
Troom min	Actual minimum room temperature	Analog value
Tset	Room temperature setpoint	Analog value
Tsetadj	Room temperature setpoint adjustment	Analog value
TsetadjMax	Room temperature setpoint adjustment limits	Analog value
Tsetcalc	Room temperature setpoint calculated, calculation depends on chosen settings	Analog value
Vam	Actual medium flow reported in the unit defined by Vunit	Analog Input
Vs maxc d	Maximum flow setpoint in climate status cooling mode. Will always mirror Vsminh	Analog value
Vs maxh d	Maximum flow setpoint in climate status heating mode. Will always mirror Vsminh	Analog value
Vs minc d	Minimum flow setpoint in climate status cooling mode. Will always mirror Vsminh	Analog value
Vs minh d	Minimum flow setpoint in climate status heating mode. Will always mirror Vsminh	Analog value
Vsc	Setpoint used when climate status is in cooling mode	Analog value
Vsh	Setpoint used when climate status is in heating mode	Analog value
Warning	Bitfield that displays warning code	Analog Input
Window Open MaxTemp	Maximum temperature when window open	Analog value
Window Open MinTemp	Minimum temperature when window open	Analog value
X1	Flow feedback signal or Controlled signal (by Y2 or Y2 digital). Range: 0..10Vdc, representing a flow /Y2 control between 0 and Vsmaxd/Y2max by means of a linear or equal percentage relation	Analog output

Object Name	Description	Value Access Type
	between voltage and flow/Y2.	
X1 type	Defines the type of output for X1. It can be a representation of the flow or controlled by an external device like a CO2 analyzer (linked to Y2 or Y2 digital)	Analog value
X1 char	Defines whether the X1 feedback signal should return a value in relation with the flow in a linear or in an equal percentage way	Analog value
X1 mode	In case the X1 output is defined as controlled by Y2, the output will reflect Y2 digital if X1 mode is defined in digital mode	Binary Value
Xm	Value indicating the physical drive/valve position	Analog value
Y1	Setpoint voltage level. In analog mode, it's used to define Y1h or Y1c depending on the Sys Type. In digital mode, it's NOT used but it can be read	Analog Input
Y1 maxc	The value of Y1c at which the flow control loop still operates	Analog value
Y1 maxh	The value of Y1h at which the flow control loop still operates	Analog value
Y1 minc	The value of Y1c at which the flow control loop starts to operate	Analog value
Y1 minh	The value of Y1h at which the flow control loop starts to operate	Analog value
Y1c	Setpoint cooling. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus	Analog value
Y1h	Setpoint heating. In digital mode this is a read-write parameter. In analog mode it is set by the external analog input signal and read-only on the UI and bus	Analog value
Y2	Voltage level of second analog input	Analog Input

Tab. 25:   *Variables description list*

8 LCD display and keyboard on UVC102 and UVC103

8.1 Overview

The user interface on UVC102 and UVC103 displays the variables and allows changing some of them. Input is entered by means of three buttons: UP, DOWN and ENTER.
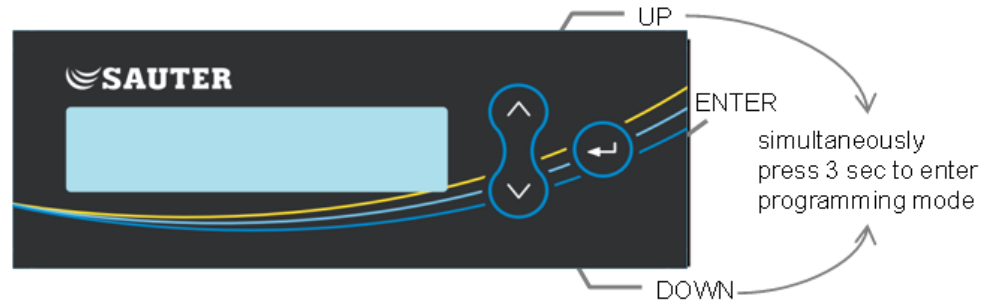

Fig. 6: LCD display and keyboard

The LCD is normally deactivated. When the user presses any of the keys, the LCD and the backlight are activated. When activated the status display is shown, displaying the key operating variables (flow, temperature). If no further key is pressed, the LCD and backlight are deactivated after 1 minute.

If the UP and DOWN buttons are pressed simultaneously during at least 3 seconds when the LCD is active, the user accesses the programming mode menu structure. With the UP/DOWN key the user moves between the menu items. After 60 seconds of inactivity, the display shuts off again, exiting the programming mode.

The menu is structured as a "tree". This means that an item higher up the tree can have two or more "children" below it. That item is called the "parent" of each of its children. If an item does not have any children below it, it is called a "leaf". There are 2 or 3 menu levels, depending on the branch in the tree.

When the user wants to select the menu item displayed on the screen, he presses the ENTER button. If the item has children, then the user arrives one menu level deeper and views the numbered list of children of the selected parent item. If on the other hand the user presses ENTER when at the leaf level, he can edit the variable, if it is editable. If the variable is not editable, nothing happens when pressing ENTER.

The last menu item at each level is "BACK". This brings the user back to the previous level. If the user was already at the highest menu level, then selecting the "BACK" menu item brings him back to the status display.

When editing a variable the word "edit" is displayed. There are two types of editable variables:

(1)   Numerical variable: The user changes 1 digit at a time. The currently active digit is shown blinking. Pressing ENTER moves to the next digit. Pressing UP/DOWN increments/decrements the digit. When the last digit has been entered, the user presses ENTER one more time to exit editing mode and go back to the variable display. If the number can be negative, a sign character "+" or "-" appears before the leftmost digit and can also be changed. The "+" sign disappears once the number is entered.

(2)   List based variable: Can take a value from a finite list of possible values. E.g. "m³/h", "l/m" or "Gpm". By pressing UP/DOWN the user cycles through the values in a loop.

Output (read-only) variables are updated in real-time while there are viewed.

8.1.1   Screen layout

STATUS DISPLAY

This is the default screen. It is divided in 4 sections:

4 sections	
TOP LEFT	**TOP RIGHT**
Shows V_{am}, displayed as "Va".	Shows temperature value, displayed as T_1.
For very small flows, displays "Va→Vs".	Shows "err" in case no sensor attached or temperature out-of-range.
BOTTOM LEFT	**BOTTOM RIGHT**
Shows V_s, displayed as "Vsh" or "Vsc"	When a second temperature sensor is attached, T_2 and the value is displayed.
In flushing mode "Flush" is shown instead.	Otherwise:
In open loop mode the actuator control signal (as %) is shown instead.	When Ctrlsig=analog, shows Y_1 as a % between Y_{1min} and Y_{1max}.
	When Ctrlsig=digital, shows "dfl".
	In flush mode shows Y_1 as voltage.

Tab. 26:   Status display layout

PROGRAMMING MODE

When the user has entered programming mode, the screen is divided in a top line and a bottom line.

Menu or variable number	Menu or variable name
"R" or "RW" or "edit"	Variable value (only at the deepest menu level)

Tab. 27:   Programming mode display layout

8.2 Menu structure

The table below shows the menu structure of the programming mode.

Level 1	Level 2	Level 3
Mode	Ctrl Sig	
	OpenLoop	
	SysType	
	ClimStatus	
	Flush mode	
	CtrlChar	
	CO Auto	
Device	Hydraulic	DN
		Area
		KVS/CV
		Treturn
	Identific	SN
		ProdType
		SWrev
Signal	Analog	Y
		Y
		Ymin
		Ymax

Level 1	Level 2	Level 3
Status	Operation	Error
		Warning
		Reboot
		Reset
		Display ON
		Baud rate
		MBaddress
		MB parity
	Time	hhreb
		mmreb
		ssreb
		DaysOper
Energy	Temp	Tam
		Tam
		Text
		Tunit
	Power	PWR
		EnerHeat
		EnerCool
		E unit

Level 1	Level 2	Level 3
Flow	Flow setp	Vsh
		Vsc
		Vs minhd
		Vs mincd
		Vs maxhd
		Vs maxcd
		Vnomh
		Vnomc
		Vunit
	Flow meas	Vam
		Sam
	Y setpoint	Yh
		Yc
		Yminh
		Ymaxh
		Yminc
		Ymaxc

Level 1	Level 2	Level 3
dp	dp setp	dpsh
		dpsc
		dpsminh
		dpsminc
		dpsmaxh
		dpsmaxc
	dp meas	dpmeas
		dpCalAuto
		dpCalProc
		dpCalStat
Temp control	Tmeas	
	Tmeasmin	
	Tmeasmax	
	Tset	

Fig. 7: Menu structure

ⓘ Depending on the version, the menu structure might be altered to accommodate for the functions available in that specific version. Not all functions shown might be available The menu functions in the section dp are out of function for UVC102 and UVC103.

8.3 LCD heartbeat and always on mode

Periodically the LCD backlight will flash in order to show that the device is powered.

In standard operation the LCD will dim after a certain time-out period. Pressing any button will activate the LCD again. If the variable DisplayON is set, then the LCD and its backlight will remain on continuously and will not switch off after a time-out. Resetting this variable activates the dimming of the LCD again.

9   Troubleshooting

Error	Reason	Activities
Device does not work, LED on the sensor remains dark. (UVC102/103 up to DN50: Display does not work)	The power supply is insufficient.	Check the power supply according to the requirements in the data sheet.
The device heats in cooling mode and vice versa.	Heating and cooling line are connected reversed.	Activate the "Port Connection" register adjust the connection in the firmware.
	Old firmware installed (fixed from firmware v4.06.16 or after production date 2/9/2020).	Contact the Technical Help Desk to update the firmware.
The device has no data connection or the data connection is sporadically lost.	No terminating resistors installed.	Install terminating resistors.
	Is the data GND connected correctly?.	Connect the data GND as described in the mounting instructions.
	Are other Modbus and BACnet MS/TP devices connected in the same line?.	As a test, remove the other Modbus and BACnet MS/TP devices in the same line.
Volume flow (Xi) is not transmitted or transmitted incorrectly.	The device has detected air bubbles in the system and automatically set Xi to 0.	Compliance with the fitting instructions (installation position, inflow sections) Increase the system pressure to make the air bubbles smaller. Activate the rinse mode.
	Insufficient medium quality.	Check for contamination, welding beads, water quality according to VDI2035.
		Do not use the device in media containing glycol.
	Error in data transmission.	Measure the AO "Xi" when opening and closing the drive in manual mode.
LED lights up orange.	Bus communication active.	No error, no correction needed.

| LED flashes orange. | Data transfer in progress. | No error, no correction necessary. |
| LED flashes red. | Internal error: No connection possible with the flow measurement. | Please contact the Technical Help Desk. |

Tab. 28: *Troubleshooting*

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