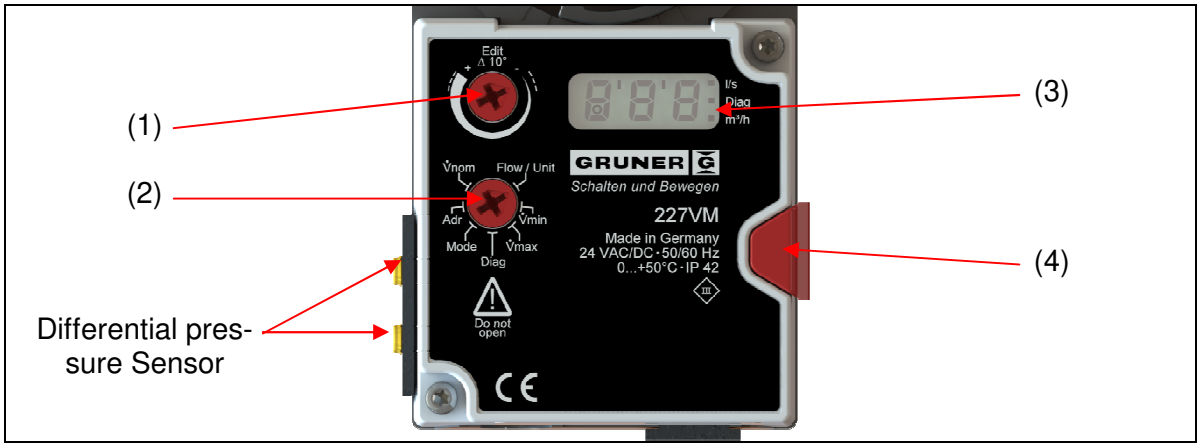
TOC

1. Cover

The cover shows the appropriate units and if diagnostic functions are set. Also there is the 3-digit display (function see 1.1.3) to show selected functions, values and units. The units are printed on the sticker.
On the cover of the actuator there are two selectors the value selector (1) and the function selector (2).

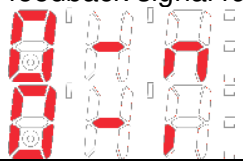
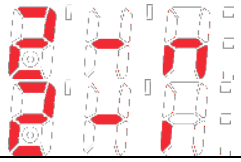


1.1.1. Value selector (Δ10° / Edit)

The value selector allows the changing of values. The position of the arrow shows the value set. The changes are displayed as soon as the selector is moved ±10° from its position. By turning the selector up or down the corresponding values are shown. For change V_{nom} one can select the appropriate thousand separators.

1.1.2. Function selector (2)

The function selector allows choosing the function depending on its position. If there is no function selected the display will show three dashes (- - -).

Function	Description
Flow	Shows the actual flow in m³/h, l/s and Test for diagnosis (activated Test function). This display matches with the feedback signal U. The display starts flashing if the servomotor hits an end stop before matching actual to reference flow. An overflow (higher pressure as 250 Pa = 1.0 inWC) is indicated in the display by a small circle. Turning the value selector allows unit selection. The appropriate dot is toggled as indicator. The units are converted.
V_{min}	Allows to set the desired min. flow for the external reference signal Y=0 V_{DC} or Y=2 V_{DC}. In m³/h or l/s directly of V_{nom}.
V_{max}	Allows to set the desired maximum flow for the external reference signal Y=10 V_{DC} in m^3/h or l/s directly of V_{nom}.
Mode	Allows to set the direction of rotation (normal and inverse) and the input signal range (0…10 V_{DC} or 2…10 V_{DC}) of the reference signal Y. The feedback signal range of U corresponds to Y.  0-10 V_{DC}, normal 0-10 V_{DC}, invers  2-10 V_{DC}, normal 2-10 V_{DC}, invers
Test	Opens the diagnose menu. All input signals on Y are neglected and the controller only operates according to the selected override function. All override functions are disabled after a time-out of 10 hours. The display toggles after the selection of the function between the actual flow (8s showing time) and the function (2s showing time). Selecting another function will disable the Test function and set it automatically to OFF  oP(en) … opens the damper  cL(ose) … closes the damper  Hi(gh) … forces the actuator to V_{max}  Lo(w) … forces the actuator to V_{min}  on … Test mode is switched on. The actuator stays in the current position.  oFF … Test mode is switched off. The actuator starts controlling according to external signal Y. This signal Y shall be shown in the range of 0…100 x10^{-1}V  Adp … adaption drive is switched on. (only for the 15Nm version and Modbus)  123 … Showing the software version V123. After 3s showing the display shows oFF again.

Function	Description	
Adr (only ModBus)	Allows setting the address of the Modbus actuator, by turning the value selector. It is possible to set the address from 1 up to 247.	
		If the value selector is turned to the end-stop "+" the Display shows "2 in", this allows to select the second level. If the second level is chosen, this is indicated in the display by a small circle
	In the second level the functions are as follows	
	Flow	Back to level one
	V_{min} V_{btw} V_{max}	Not in use
	Test	Adaption drive is switched on.
	Mode	Shows the actual position of the angel of rotation (0…255 digital 0...100%)
	Adr.	Allows to select the ModBus parameter (see separate documentation)
	V_{nom}	Allows to set the ModBus delay (see separate documentation)
V_{nom}	Set-up of the V_{nom} according to the flow corresponding to 1 inWC (250 Pa) differential pressure. The Setting of V_{nom} is done in three stages depending on value to be selected. Stage I: 0…995 in steps of 5 Stage II: 1´000…9´950 in steps of 50 Stage II: 10´000…99´500 in steps of 500 Max. 18´000 l/s or 65´500 m³/h For the first set-up no password is needed. After this first set-up one needs to set first the password (255) and wait until the display flashes and allows the setting of a different V_{nom}.	

1.1.3. Display (3)

The display (3) uses 7-segment numbers in full 3-digits. Additional signs include a small circle, three square dots and two rectangular slashes.
The square dots are used with the externally printed text to visualize certain functions or units. It is meant to denote the unit of the value shown in the display.
If the controller tries to match reference and actual flow this is shown as flashing dot of the chosen unit.
If the actuator is turned on (power on) and the damper position feedback is activated the display will show REF. The actuator travels from one end-stop to the other in order to learn the maximum angle.
The Display shows a floating average of the actual flow from the latest 4s. The refresh rate of this value is 1s.

3-digit 7-segment display

Function	Description	
l/s		The Display shows the flow in l/s. (see pic.)
Diag.		If the diagnostic mode is activated, this is indicated by square dot. (see pic.).
m³/h		The Display shows the flow in m³/h. (see pic.)
○	An overflow is indicated in the display by a small circle at the first digit.	

1.1.4. Declutch button (4)

Press and hold down this button and turn the actuator to the desired position. After reaching the desired position release the button.

2. Modbus protocol and registers

2.1.1. Protocol

Transmission protocol	
Protocol:	Modbus / RTU
Baud rate:	1200, 2400, 4800, 9600, 19200, 38400
Byte sequence:	MSB / LSB
Byte format:	8 data bits, 2 stop bits, none parity 8 data bits, 1 stop bits, none parity 8 data bits, 1 stop bits, even parity 8 data bits, 1 stop bits, odd parity
Address range:	1 to 247
Max. Data bytes	N*1
Resistance:	120 Ohm (Software)

Note: Factory settings are indicated bright.

Modbus parameter settings

Baud rate:	19200
Delay:	0
Byte format:	8 data bits, 1 stop bits, even parity
Address range:	1

2.1.2. Holding register customer (parameter table)

-r functions-code 0×03h -w functions-code 0×06h

Name	Address decimal	Data typ	Value range	r/w	Description	memory def. value
Set point	0	WORD	0…10000	r/w	Set point [%] 0 ..100.00 see register 122: '0': set point is read only	RAM
Override control	1	WORD	0…4	r/w	Override control '0' - - - '1' open '2' close '3' min '4' max	RAM
Com-mand	2	WORD	0…4	r/w	Command '0' - - - '1' adaption '2' - - - '3' - - - '4' controller reset	RAM
Device ID	3	WORD	0..3	r	Device ID '0' - - - '1' standard actuator '2' VAV '3' fire damper	EEPROM 2
Relative position	4	WORD	0…10000	r	Relative position [%] 0 .. 100.00 65535 = this function is not supported	RAM
Absolute position	5	WORD	0…65000	r	Absolute position [°] [mm] 0 .. 650.00 65535 = this function is not supported	RAM
Relative flow	6	WORD	0…10000	r	VAV flow [%] 0 .. 100.00	RAM
Absolute flow	7	WORD	0…65535	r	VAV flow [m³/h][l/s][pa]	RAM
sensor value 1	8	WORD	[°C] 0...65535 [mV] 0…10000	r	*external sensor value [Ω] 0 .. 10000 [mV] 0 ..10000 *only supported on hardware with sensor inputs.	RAM
sensor value 2 (optional)	9	WORD	[°C] 0..65535 [mV] 0..10000	r	*external sensor value [Ω] 0 .. 10000 [mV] 0 ..10000 *only supported on hardware with sensor inputs.	RAM
analog output (optional)	10	WORD	[mV] 0…10000	r/w	analog output [mV] 0 ..10000 see register 122	RAM
digital output (optional)	11	WORD	[-] 0…1	r/w	*digital output 0 ..1 *only supported on hardware with digital output.	RAM

2.1.3. Service Values

-r functions-code 0×03h -w functions-code 0×06h

Name	Address decimal	Data typ	Value range	r/w	Description	memory def. value
Serial number 1	100	WORD	101..9912	r	serial number JJMM	EEPROM -
serial number 2	101	WORD	100..3123	r	serial number DDHH	EEPROM -
serial number 3	102	WORD	01..59599	r	serial number MMSSX X = test number	EEPROM -
software version	103	WORD	1..65535	r	software version	EEPROM -
service infor-mation	104	WORD	0..65535	r	see table status-register	RAM
min value relative	105	WORD	0..10000	r/w	min value [%] 0 .. 100.00	EEPROM 0
max val-ue rela-tive	106	WORD	0..10000	r/w	max value [%] 0 .. 100.00	EEPROM 10000
sensor type 1	107	WORD	0..4	r/w	sensor type '0' - - - '1' active sensor [mV], '2' passive sensor [1k] '3' *passive sensor [1…20k] '4' *Digital 0/1 * not implemented	EEPROM 1
bus fail position	108	WORD	0..2	r/w	bus fail position '0' - - - no bus monitoring '1' at timeout position close bus monitoring timeout 120s '2' at timeout position open bus monitoring timeout 120s	EEPROM 0
min value absolute	120	WORD	0..65535	r/w	min value [m³/h][l/s][pa]	EEPROM 0
max value absolute	121	WORD	0..65535	r/w	max value [m³/h][l/s][pa]	EEPROM 98

Name	Address decimal	Data typ	Value range	r/w	Description			memory def. value
mode signal set point analog output	122	WORD	0..3	r/w	Value	Refer-encing signal	Analog Out	EEPROM 0
					0	Analog In 1 [V] 0(2)…10	absolute position [V] 0 .. 10	
					1	commu-nication via Modbus register 0	absolute position [V] 0 .. 10	
					2	commu-nication via Modbus register 0	Value register 10	
					3	Analog IN 1 [V] 0(2)…10	Value register 10	
					4	Analog IN 1 [V] 6 ± 4	absolute position [V] 0 .. 10	
					5	Analog IN 1 [V] 6 ± 4	Value register 10	
V_{nom}	200	WORD	0…30000	r/w	volume nominal value [Pa] 0 ...300.00			EEPROM 25059
V_{nom} unit/function	201	WORD	0…5	r/w	V_{nom} unit Control function VAV '0' [l/s], '1' [m³/h] Control function pressure: '2 [Pa] '3' [Wc] Control function continuous: '4' [°] '5' [mm]			EEPROM 4

2.1.4. Status register

Bit number	Function / Status
bit0	not used
bit1	not used
bit2	not used
bit3	Kat2 free for write
bit4	not used
bit5	! 1=block detected
bit6	not used
bit7	1= motor drive
Bit8	not used
Bit9	not used
Bit10	not used
Bit11	not used
Bit12	not used
Bit13	not used
Bit14	Set point = actual value
Bit15	not used

2.1.5. Mode register

Bit number	Function / Status	
bit0	1= option setpoint 2-10V activ	Override function / control
bit1	1= override Modbus active	
bit2	1= override CLOSE activ	
bit3	1= override OPEN activ	
bit4	1= override Vbetween activ	
bit5	1= override Vmaximum activ	
bit6	1= option reversal activ	
bit7	1= motor off	
Bit8	1= override vmin activ	
Bit9	1= bana_neg activ	analogue input signal
Bit10	1= bana_pos aktiv	
Bit11	1= bana_full aktiv	
Bit12	1= bana_min (0/2V) aktiv	
Bit13	1= bana_max (10v) aktiv	
Bit14	1= bana_gnd (only 2-10V) aktiv	
Bit15	1= Termination resistor* *only supported on hardware.	

2.1.6. Error handling

If the server receives the request, but detects a communication error (parity, LRC, CRC, wrong address...), no response is returned. The client program will eventually process a timeout condition for the request.

If the server receives the request without a communication error, but cannot handle it (for example, if he request is to read a non–existent register), the server will return an exception response informing the client of the nature of the error.

Device response:

Address	Function code +80h	Error code	CRC	End
1 byte	1 byte	1 byte	2byte(CRC_Lbyte, CRC_Hbyte)	3,5 Chars

Error code	Name	Description
01h	Illegal function	The function code received in the query is not an allowable action.
02h	Illegal data address	The data address received in the query is not an allowable register address. Register address are read only.
03h	Illegal data value	A value contained in the query data field is not an allowable value. Wrong number of registers. Register address are read only.
06h	Slave device busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long–duration program command.

2.1.7. Description interface parameter Modbus

Display Number	EEPROM-value	Baudrate	Parity	Stop bits
1	0	1200	none	2
2	1	1200	even	1
3	2	1200	odd	1
4	3	2400	none	2
5	4	2400	even	1
6	5	2400	odd	1
7	6	4800	none	2
8	7	4800	even	1
9	8	4800	odd	1
10	9	9600	none	2
11	10	9600	even	1
12	11	9600	odd	1
13	12	19200	none	2
14	13	19200	even	1
15	14	19200	odd	1
16	15	38400	none	2
17	16	38400	even	1
18	17	38400	odd	1

3. Remarks

The standard value for V_{nom} of the 227VM-024-05-MB model is 250 Pa. If you want to adjust the V_{nom} value to 150 Pa (normal value you're using) there are several ways doing it:

1. Use our VAV software and the interface and change the value to 150 Pa and the air flow, confirm the values by pressing enter.

2. Use a software for the Modbus communication e.g. Modbus poll and write in register 200 the new value e.g. 150 Pa the written value needs to be 15000. Then it is also possible to set a new airflow at this differential pressure. Write the password ($FFFF_h$) in register 1793 to unlock register 523 and write in the desired value. Lock register 523 by writing the value 0 to register 1795.

There are two different possibilities using the actuator in proportional control mode (register 201):

Writing the value 4 into the register 201 (pre-set) and the display will indicate this with the dot on l/s, the second possibility is writing the value 5 in the register this will be indicates with the dot on m^3/h.

In general the actuator can be used as analogue model (register 122 = 0) then it's regulating according to the applied voltage on input Y. The second option is that it's controlled via Modbus (register 122 = 1). Then the desired position can be set in % via register 0, e.g. 10% = 1000.
The feedback signal provides the output signal according to the selected mode (0(2)…10 V) related to the nominal flow.

Example: V_{nom} is 100 l/s @ 250 Pa, V_{act} = 10 l/s ➔ feedback signal (theoretical) = 1 V.