



VAV-Universal VRU-D3-BAC VRU-M1-BAC VRU-M1R-BAC

Contents

<u>Modbus General Notes</u>	<u>2</u>
<u>Modbus Register Overview</u>	<u>3</u>
<u>Modbus Register Description</u>	<u>4</u>

Modbus General Notes

General information	Parameterisation:	Belimo Assistant App
Modbus RTU	Protocol:	Modbus RTU over RS-485
	Baud rate:	9,600, 19,200, 38,400, 76,800, 115,200 Bd <i>Default: 38,400 Bd</i>
	Number of nodes:	Max. 32 (without repeater)
	Address:	1 ... 247 <i>Default: 1</i>
	Transmission formats:	1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1 <i>Default: 1-8-N-2</i>
	Terminating resistor:	120 Ω

Register implementation All data is arranged in a table and addressed by 1..n (register) or 0..n-1 (address). No distinction is made between data types (Discrete Inputs, Coils, Input Registers and Holding Registers). As a consequence, all data can be accessed with the two commands for Holding Register. The commands for Discrete Inputs and Input Registers can be used as an alternative.

Standard commands Read Holding Registers [3]
Write Single Register [6]
Read Discrete Inputs [2]
Read Input Registers [4]
Write Multiple Registers [16]

Command "Read Discrete Inputs" The command reads one or more bits and can alternatively be used for Register No. 105 (Malfunction and Service information).

Example The start address to be used is 1664 → **104** (Register Address) * **16** (Bit) = **1664**

Interpret values in the registers All values in the register are unsigned integer datatypes.

Example Read (Function 03, 1 Register) Value Register No. 12 = 0001'1010'1100'1000₂ = 6'856₁₀
Actual Value = Value * Scaling factor * Unit = 6'856 * 0.01 * m³/h = **68.56 m³/h**

32-Bit values in two registers Values that exceed 65,535 are stored in two consecutive Registers and have to be interpreted as "little endian" / LSW (Least Significant Word) first

Example Register No. 10 (AbsFlow LowWord) = 14,551₁₀ = 0011'1000'1101'0111₂
Register No. 11 (AbsFlow HighWord) = 19₁₀ = 0000'0000'0001'0011₂

AbsFlow HighWord	AbsFlow LowWord
19	14,551
0000'0000'0001'0011	0011'1000'1101'0111

AbsFlow = 0000'0000'0001'0011'0011'1000'1101'0111₂ = 1,259,735₁₀ = **1259.735 l/h**

Math formula:

AbsFlow = (AbsFlow HighWord * 65,536) + AbsFlow LowWord

AbsFlow = (19 * 65,536) + 14,551 = 1,259,735 = **1259.735 l/h**

Deactivated registers If a register is not supported by a device or by a device setting it is indicated with 65'535 (1111'1111'1111'1111₂).

Modbus Register Overview

Operation

No.	Adr.	Register	Access
1	0	Setpoint [%]	R/W
2	1	Override control	R/W
3	2	Command	R/W
4	3	Actuator type	R
5	4	Relative position [%]	R
6	5	Absolute position [°] [mm]	R
7	6	Relative volumetric flow [%]	R
8	7	Absolute volumetric flow [m3/h]	R
9	8	Sensor value 1 [mV] [Ω] [-]	R
10	9	-	-
11	10	Absolute volumetric flow in selected units	LowWord
12	11		HighWord
13	12	Setpoint Analog [%]	R

51	50	Relative delta Pressure [%]	R
52	51	Absolute delta Pressure [Pa]	R
53	52	-	-
54	53	Absolut delta Pressure in selected units	LowWord
55	54		HighWord

Service

No.	Adr.	Register	Access
100	99	Bus termination	R
101	100	Series number 1st part	R
102	101	Series number 2nd part	
103	102	Series number 4th part	
104	103	Firmware version	R
105	104	Malfunction and service information	R
106	105	Min [%]	R/W
107	106	Max [%]	R/W
108	107	Sensor type 1	R/W
109	108	Bus fail position	R/W
110	109	Communication Watchdog	R/W
111	110	Vnom m3/h	R
112	111	-	-
113	112	Nominal volumetric flow in selected units	LowWord
114	113		HighWord
115	114	-	-
116	115	-	-
117	116	Control Mode	R
118	117	Unit Selection Flow	R/W
119	118	Setpoint source	R/W
120	119	Operation Mode	R/W
121	120	-	
122	121	-	
123	122	-	
124	123	Room Pressure Cascade	R
125	124	Application Selection	R
126	125	System Altitude	R/W
127	126	Nominal delta Pressure in selected units	R
128	127	-	
129	128	Nominal delta Pressure in Pa	R
146	145	Unit Selection Pressure	R/W

Modbus Register Description

No.	Adr.	Description Comment	Range / Enumeration	Unit	Scaling	Values Default	Access
1	0	<p>Setpoint</p> <p>The setpoint refers to the demanded flow, pressure or damper position according to the selected application and control mode.</p> <p>The setpoint is active, if the setpoint is controlled by bus (if "Setpoint source" Register No. 119 = 1: Bus)</p> <p>The setpoint is always limited by the settings for "Min" (Register No. 106) and "Max" (Register No. 107)</p> <p>If "Application Selection" Register No. 125 = 0: Flow control, the setpoint is related to the demanded volumetric flow.</p> <p>If "Application Selection" Register No. 125 = 0: Flow control, and "Control Mode" Register No. 117 = 0: Position Control, the setpoint is related to the damper position.</p> <p>If "Application Selection" Register No. 125 = 1: Pressure control, or = 2: Room pressure control, the setpoint is related to the demanded pressure.</p>	0...10'000	%	0.01	0	R/W
2	1	<p>Override control</p> <p>Override setpoint with defined values</p> <p>The override is active for the "Setpoint" Register No. 1, or the "Setpoint Analog" Register No.13 according to the settings on the "Setpoint Source" Register No. 119</p>	0:None 1:Open 2:Close 3:Min 4:- 5:Max	-	-	0	R/W
3	2	<p>Command</p> <p>Initiation of actuator functions for service and testing.</p> <p>After a command has been executed, the register value returns to 0 (None).</p>	0:None 1:Adaption 2: - 3: Sync	-	-	0	R/W
4	3	<p>Actuator type</p> <p>If the selected application does not support a local actuator (Flow measurement, Room Pressure Cascade), the register is inactive (= 65'535).</p>	0:Actuator not connected 1:Air/Water 2:VAV / EPIV 3:Fire 4:Energy Valve 5:6way EPIV	-	-	-	R
5	4	<p>Relative position</p> <p>Related to the adapted mechanical range.</p> <p>If the selected application doesn't support a local actuator (Flow measurement, Room Pressure Cascade), the register is inactive (= 65'535).</p>	0...10'000	%	0.01	-	R
6	5	<p>Absolute position</p> <p>Angular position according to the entire range of rotation.</p> <p>If the selected application does not support a local actuator (Flow measurement, Room</p>	0...9'600	°	0.01	-	R

		Pressure Cascade), the register is inactive (= 65'535).					
7	6	Relative volumetric flow Related to the "Nominal volumetric flow in m3/h" Register No. 111 If the selected application does not support flow measurement (pressure control, room pressure control), the register is inactive (= 65'535).	0...15'000	%	0.01	-	R
8	7	Absolute volumetric flow in m3/h If the selected application does not support flow measurement (pressure control, room pressure control), the register is inactive (= 65'535).	0...65'535	m ³ /h	1	-	R
9	8	Sensor 1 Value Current value of sensor 1, depending on the setting of the Sensor Type (Register 108)	Voltage: 0...65'535 Resistance: 0...65'535	mV Ω 0 / 1	1 1 1	-	R
10	9	-	-	-	-	-	-
11	10	Absolute volumetric flow in selected units Absolute volumetric flow in the unit according to the settings on the "Unit Selection Flow" Register No.118 The register shows the LowWord. Lower 16 bit of 32 bit value. If the selected application does not support flow measurement (pressure control, room pressure control), the register is inactive (= 65'535).	0...500'000'000	UnitSel	0.001	-	R
12	11	Absolute volumetric flow in selected units See Register No. 11 The register shows the HighWord. Upper 16 bit of 32 bit value.					
13	12	Setpoint analog Shows the setpoint in % if the actuator is controlled by analog signal. I.e. the register is active if the "Setpoint Source" Register No.118 = 0: Analog	0...10'000	%	0.01	-	R
51	50	Relative differential pressure Related to the "Nominal differential pressure in Pa" in Register No. 129	0...20'000	%	0.01	-	R
52	51	Absolut differential pressure in Pa	-1000...15000	[Pa]	0.1	-	R
52	51	-	-	-	-	-	-
54	53	Absolut differential pressure in selected units Unit according to the setting on "Unit selection differential pressure" Register No.146 The register shows the LowWord. Lower 16 bit of 32 bit value	-10'000'000...100'000'000	UnitSel	0.001	-	R
55	54	Absolut differential pressure in selected units See Register No 54. The register shows the HighWord. Upper 16 bit of 32 bit value.					

No.	Adr.	Description Comment	Range / Enumeration	Unit	Scaling	Values Default	Access
100	99	Bus Termination Indicates if bus termination (120Ω) is enabled. Bus termination can be set be with service tools.	0: disabled 1: enabled	-	-	0	R
101	100	Series Number 1 st part Each device has an unambiguous series number, which is either impressed on or glued to the housing. The series number consists of 4 segments, although only parts 1, 2 and 4 are displayed on Modbus. Example 00839-31324-064-008 1 st part: 00839 2 nd part: 31324 4 th part: 008	-	-	-	-	R
102	101	Series Number 2 nd part	-	-	-	-	R
103	102	Series Number 4 th part (Known issue: Do not use this register!)	-	-	-	-	R
104	103	Firmware Version	-	-	-	-	R
105	104	Malfunction and Service Information If the specific condition disappears, the status is reset automatically.	Bit0: - Bit1: Mech travel increased Bit2: Mechanical overload Bit3: - Bit4: Error dP Sensor Bit5: Reverse Airflow detected Bit6: Airflow not reached Bit7: Flow in closed position Bit8: Internal activity (Adaptation, Synchronization in progress) Bit9: Gear disengaged Bit10: Bus watchdog triggered Bit11: Actuator doesn't fit to application Bit12: Pressure Sensor wrong connected Bit13: Pressure Sensor not reached Bit14: Error dP Sensor out of Range	-	-	-	R
106	105	Min The min setpoint in % is related to the nominal flow, nominal differential pressure or to the adapted mechanical range of the actuator according to the selected application and control mode "Min" cannot be set higher than the "Max"	0...Max	%	0.01	0	R/W
107	106	Max The max setpoint in % is related to the nominal flow, nominal differential pressure or to the adapted mechanical range of the actuator according to the selected application and control mode Max cannot be set lower than "Min" and must be at least 20%.	2'000...10'000	%	0.01	100	R/W
108	107	Sensor 1 Type If Setpoint Source (Register 119) is analog (Hybrid mode) the sensor type 1 can be set to Active(1) in order to see the Setpoint Analog in mV.	0:None 1:Active 2:Passive 3: - 4:Switch	-	-	0	R/W
109	108	Bus fail position	0...10'000	%	0.01	0	R/W

		<p>In the event of a breakdown in communication, the actuator drives to the given position. The position setpoint relates to the adapted mechanical range and is independent of Min/Max settings.</p> <p>The bus monitoring controls the Modbus communication. If neither the Setpoint (Register1) nor the Override Control (Register 2) is renewed before the Timeout for Bus Watchdog (Register 110), the actuator controls to the "Bus Fail Position".</p> <p>Triggered bus monitoring is indicated in the Malfunction and Service Information (Register 105).</p> <p>In Hybrid Mode, the bus monitoring is inactive.</p>					
110	109	<p>Communication Watchdog</p> <p>Timeout until bus fail is detected. If Bus Fail Position (Register 109) is different from 0, then the timeout is by default 120s (parameterizable).</p>	<p>0...3600</p> <p>0: disabled</p>	s	1	0 (120)	R/W
111	110	Nominal volumetric flow in m3/h	0...60'000	m3/h	1	-	R
112	111	-	-	-	-	-	-
113	112	<p>Nominal volumetric flow in selected unit</p> <p>Unit according to the setting on "Unit selection flow" Register No.118.</p> <p>The register shows the LowWord. Lower 16 bit of 32 bit value</p>	0...60'000'000	UnitSel	0.001	-	R
114	113	<p>Nominal volumetric flow in selected unit</p> <p>See Register No. 113</p> <p>The register shows the HighWord. Upper 16 bit of 32 bit value.</p>					
115	114	-	-	-	-	-	-
116	115	-	-	-	-	-	-
117	116	<p>Control mode</p> <p>Visualization of the control mode selected by the damper manufacturer.</p> <p>If the control mode "Flow control" is selected, the Min/Max limits are related to "Nominal volumetric flow in m3/h".</p> <p>If the control mode "Position control" is selected, the Min/Max limits are related to the adapted mechanical range of the actuator.</p>	<p>0:Position control</p> <p>1:Flow control</p>	-	-	1	R
118	117	<p>Unit selection flow</p> <p>The selected unit is valid for the "Absolute volumetric flow in selected unit" Register No. 11 / 12</p>	<p>0:-</p> <p>1:m³/h</p> <p>2:l/s</p> <p>3:-</p> <p>4:-</p> <p>5:-</p> <p>6:cfm</p>	-	-	1	R/W
119	118	<p>Setpoint source</p> <p>Defines whether the setpoint is controlled by the analog input signal on wire 3 or the by bus signal on the serial communication line D+/D- (Modbus RTU).</p>	<p>0:Analog</p> <p>1:Bus</p>	-	-	1	R/W

		<p>If the "Setpoint source" Register No.119 = 0: Analog, the "Setpoint analog" Register No. 13 is active.</p> <p>If the "Setpoint source" Register No. 119 = 1: Bus, the "Setpoint" Register No. 1 is active.</p>					
120	119	<p>Operation Mode</p> <p>Selection is only available for actuator type VRU-M1R-BAC. It changes the room pressure from positive pressure (default) to negative pressure.</p>	<p>0: Negative Pressure 1: Positive pressure</p>	-	-	1	R/W
121	120	-	-	-	-	-	-
122	121	-	-	-	-	-	-
123	122	-	-	-	-	-	-
124	123	<p>Room Pressure Cascade</p> <p>If the room pressure cascade is enabled, the sensor input S1 will be set as input signal for the room pressure cascade (0-10V).</p> <p>The room pressure cascade is only available if the "Application selection" Register No.125 = 0: Flow control or = 2: Room pressure control.</p> <p>The "Enable Fast" is only available for the VRU-M1R-BAC with a fast running actuator connected.</p>	<p>0: disabled 1: enabled 2: enabled fast</p>	-	-	0	R
125	124	<p>Application selection</p> <p>Visualisation of the application selected by the damper manufacturer.</p> <p>VRU-D3-BAC / VRU-M1-BAC: - Flow control - Pressure control - Flow measurement</p> <p>VRU-M1R-BAC: - Room pressure control</p>	<p>0: Flow control 1: Pressure control 2: Room pressure control 3: Flow measurement</p>			0	R
126	125	<p>System Altitude</p> <p>(m.a.s.l./MüNN)</p>	0...3000	m	1	0	R/W
127	126	<p>Nominal differential pressure in selected unit</p> <p>See register 129 for more information</p> <p>Unit according to the setting on the "Unit selection differential pressure" Register No.146.</p>	<p>D3: 0 ... 50000 M1: 0 ... 60000 M1R: 0 ... 60000</p>	UnitSel	0.1	0	R
128	127	-	-	-	-	-	-
129	128	<p>Nominal differential pressure in Pa</p> <p>The nominal differential pressure is set according to the range of the implemented sensor element.</p> <p>According to the selected application, the nominal differential pressure serves as dp@Vnom, or as a max. limitation for the differential pressure measurement.</p>	<p>D3: 0 ... 500 M1: 0 ... 600 M1R: 0 ... 750</p>	Pa	0.1	-	R

		<p>if "Application selection" Register No.125 =0: Flow control, the setting represents the nominal differential pressure at the nominal volumetric flow in the "Nominal volumetric flow in m3/h" Register No. 111</p> <p>if "Application selection" Register No.125 =1: Pressure control or = 2: Room pressures control, the setting serves as a maximum limitation for the measured differential pressure</p>					
-	-	-	-	-	-	-	-
146	145	<p>Unit selection differential pressure</p> <p>The selected unit is valid for the "Nominal differential pressure in selected unit" Register No.127.</p>	<p>0: pascal</p> <p>1: -</p> <p>2: inches of water</p>	-	-	0	R/W