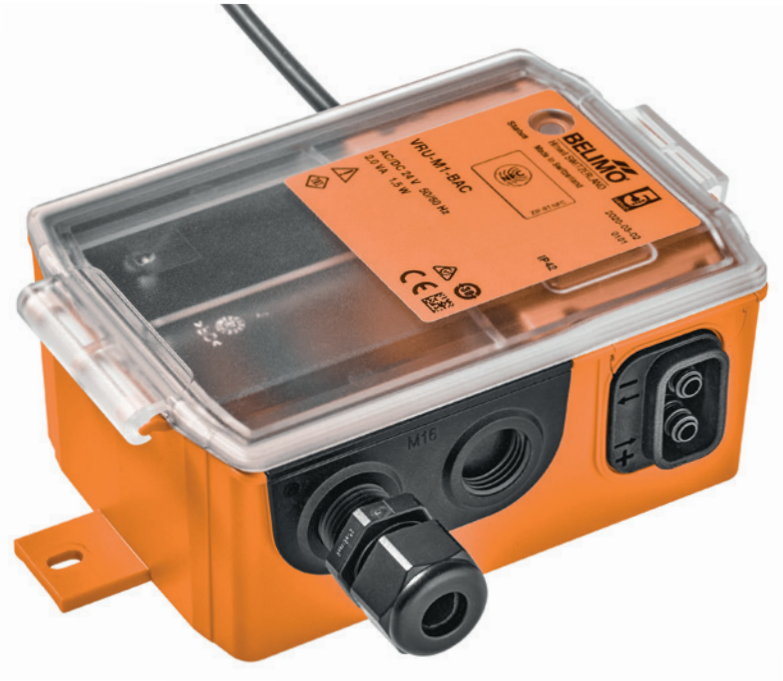

BACnet Interface Description

VAV-Universal

VRU-D3-BAC
VRU-M1-BAC
VRU-M1R-BAC

Controller for VAV/CAV and pressure applications

Edition 2024-09 / V1.04

Contents

Protocol Implementation Conformance Statement – PICS

General information

Date	07.02.2022
Vendor Name	BELIMO Automation AG
Vendor ID	423
Product Name	VRU-D3-BAC, VRU-M1-BAC, VRU-M1R-BAC
Product Model Number	VRU-..-BAC
Application Software Version	01.04.0006
Firmware Revision	14.10.0002
BACnet Protocol Revision	14
Product Description	Controller for VAV/CAV and pressure applications
BACnet Standard Device Profile	BACnet Application Specific Controller (B-ASC)
Segment Capability	No
Data Link Layer Options	MS/TP Manager Node
Device Address Binding	No static device binding supported
Networking Options	None
Character Sets Supported	ISO 10646 (UTF-8)
Gateway Options	None
Network Security Options	Non-secure device
Conformance	Listed by BTL

BACnet Interoperability Building Blocks supported (BIBBs)

Data sharing – ReadProperty-B (DS-RP-B)
Data sharing – ReadPropertyMultiple-B (DS-RPM-B)
Data sharing – WriteProperty-B (DS-WP-B)
Data sharing – COV-B (DS-COV-B)
Device management – DynamicDeviceBinding-B (DM-DDB-B)
Device management – DynamicObjectBinding-B (DM-DOB-B)
Device management – DeviceCommunicationControl-B (DM-DCC-B)

BACnet MS/TP

Baud Rates	9'600, 19'200, 38'400, 76'800, 115'200 (Default: 38'400)
Address	0...127 (Default: 1)
Number of Nodes	Max. 32 (without repeater), 1 full bus load
Terminating Resistor	120 Ω

Parametrisation

Tool	Belimo Assistant 2

Standard object types supported

Object processing

Object type	Optional properties	Writeable properties
Device	Description Location Active COV Subscriptions Max Manager Max Info Frames Profile Name	Object Identifier Object Name Location Description APDU Timeout (1'000...60'000) Number of APDU Retries (0...10) Max Manager (1...127) Max Info Frames (1...255)
Analog Input [AI]	Description COV Increment	COV Increment
Analog Output [AO]	Description COV Increment	Present Value COV Increment Relinquish Default
Analog Value [AV]	Description COV Increment	Present Value COV Increment
Binary Input [BI]	Description Active Text Inactive Text	-
Multi-state Input [MI]	Description State Text	-
Multi-state Output [MO]	Description State Text	Present Value Relinquish Default
Multi-state Value [MV]	Description State Text	Present Value (if marked)

The device does not support the services CreateObject and DeleteObject.

The specified maximum length of writeable strings is based on single-byte characters.
– Object name 32 char
– Location 64 char
– Description 64 char

Service processing

The device supports the DeviceCommunicationControl services.
No password is required.

A maximum of 6 active COV subscriptions with a lifetime of 1...28'800 s. (max. 8 hours) are supported.

All Value Objects (AV/MV) are persistent and are **not** supposed to be written on a regular basis.

BACnet object description

Object name	Object type [Instance]	Description Comment Status_Flags	Values	COV increment	Access
Device	Device [Inst.No.]	–	0...4'194'302 Default: 1	_	R
RelPos	AI[1]	**Relative position in %** Related to the adapted mechanical range Status flags: "Overridden" = true, if gear train is disengaged "Out Of Service" = true, if the selected application is flow measurement or room pressure control cascade.	0...100	0.01...100 Default: 1	R
AbsPos	AI[2]	**Absolute angular position in degree** Angular position according to the entire range of rotation Status flags: "Overridden" = true, if gear train is disengaged "Out Of Service" = true, if the selected application is flow measurement or room pressure control cascade.	0...max angle	0.01...90 Default: 1	R
SpAnalog	AI[6]	**Analog setpoint in %** The analog setpoint in % refers to the demanded flow, pressure or damper position according to the selected application and control mode. The analog setpoint is activ if the setpoint is controlled by the analog input signal (if "SpSource" MV[122] = 1: Analog). If "ApplicationSel" MV [2] = 1: Flow control, the analog setpoint is referred to the demanded flow. If "ApplicationSel" MV [2] = 1: Flow control, and "ControlMode" MV [100] = 1: PosCtrl, the analog setpoint is referred to the demanded damper position. If "ApplicationSel" MV [2] = 2: Pressure control or = 3: Room pressure control, the analog setpoint is referred to the demanded pressure. The analog setpoint is always limited by the settings for "Min" AV[97] and "Max" AV[98] Status flags: Overridden" = true, if gear train is disengaged "Out of Service" = true, if "SpSource" = bus.	0...100	0.01...100 Default: 1	R
RelDeltaP	AI[9]	**Relative differential pressure in %** Related to the nominal differential pressure "DeltaPnom_Pa" [AV122]	0...150	0.01...150 Default: 1	R
RelFlow	AI[10]	**Relative volumetric flow in %** Related to the nominal volumetric flow "Vnom_m3h" [AV112] Status flags: "Out of Service" = true, if the selected application is pressure control or room pressure control.	0...150	0.01...150 Default: 1	R
AbsFlow_m3h	AI[12]	**Absolute volumetric flow in m^3/h** Status flags: "Out of Service" = true, if the selected application is pressure control or room pressure control.	0...60'000	1...60'000 Default: 10	R

Object name	Object type [Instance]	Description Comment Status_Flags	Values	COV increment	Access
DeltaP_UnitSel	AI[18]	**Absolute differential pressure in the selected unit** Unit according to the setting on "UnitSelPressure" –► based on selection in MV[127]	-10'000...100'000	0.001...100'000 Default: 1	R
AbsFlow_UnitSel	AI[19]	**Absolute volumetric flow in the selected unit** Unit according to the setting on "UnitSelAirFlow" –► based on selection in MV[121] Status flags: "Out of Service" = true, if the selected application is pressure control or room pressure control.	0...500'000	0.01...500'000 Default: 1	R
Sens1Analog	AI[20]	**Sensor 1 as Analog Value** Shows the value of the connected sensor according to the settings on the object "Sens1Type" –► based on selection in MV[220] If "Sens1Type" MV[220] = 2: Active, the value is shown as 0-10V signal. If "Sens1Type" MV[220] = 3: Passive, the value shows the measured resistance. The sensor input is not available if the room pressure cascade "RmPCascade" MV[10] = 2: Enabled, or =3: Enabled fast Status flags: "Out of Service" = true, if no sensor or switch type connected.	0...65'535	0.01...1'000 Default: 1	R
DeltaP_Pa	AI[29]	**Absolute differential dressure in Pa**	0...600	0.01...600 Default: 10	R
SpRel	AO[1]	**Relative setpoint in %** The relative setpoint in % refers to the demanded flow, pressure or damper position according to the selected application and control mode. The relative setpoint is active if the setpoint is controlled by bus (if "SpSource" MV[122] = 2: Bus). If "ApplicationSel" MV [2] = 1: Flow control, the relative setpoint is referred to the demanded volumetric flow. If "ApplicationSel" MV [2] = 1: Flow control, and "Control-Mode" MV [100] = 1: PosCtrl, the relative setpoint is referred to the demanded damper position. If "ApplicationSel" MV [2] = 2: Pressure Control or = 3: Room pressure control, the relative setpoint is referred to the demanded pressure. The relative setpoint is always scaled between "Min" AV[97] and "Max" AV[98]. Status flags: "Overridden" = true, if gear is disengaged "Out Of Service" = true, if the selected application is flow measurement or room pressure control cascade.	0...100	0.01...100 Default: 10	C

Object name	Object type [Instance]	Description Comment Status_Flags	Values	COV increment	Access
Min	AV[97]	**Min setpoint in %** 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...100 Default: 1	W
Max	AV[98]	**Max setpoint in %** 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.	20...100	0.01...100 Default: 1	W
Vnom_m3h	AV[112]	**Nominal volumetric flow in m^3/h**	0...60'000	0.01...60'000 Default: 1	R
Vnom_UnitSel	AV[119]	**Nominal volumetric flow in the selected unit** Unit according to the setting on "UnitSelAirFlow" MV[121]	0...250'000	0.01...1'000 Default: 1	R
SystemAltitude	AV[120]	**System altitude above sea level in meter** (m.a.s.l. / MüNN)	0...3'000	1...3'000 Default: 10	W
DeltaPnom_Pa	AV[122]	**Nominal differential Pressure in Pa** The nominal differential pressure is set according to the range of the implemented sensor element. According to the selected application, the nominal differential pressure serves as dp@Vnom, or as a max. limitation for the differential pressure measurement. If "ApplicationSel" MV [2] = 1: Flow control, the setting represents the nominal differential pressure at the nominal volumetric flow "Vnom_m3/h" AV[112]. If "ApplicationSel" MV [2] = 2: Pressure control or = 3: Room pressure control, the setting serves as a maximum limitation for the measured differential pressure.	D3: 0...500 M1: 0...600 M1R: 0...75	1...600 Default: 1	R
DeltaPnom_UnitSel	AV[129]	**Nominal differential pressure in the selected unit** See AV[122] for further information. Unit according to the setting on "UnitSelPressure" –► based on selection in MV[127]		0.01...1'000 Default: 1	R
BusWatchdog	AV[130]	**Timeout for bus watchdog in seconds** If the "BusWatchdog" is not defined as 0, the implementation tracks write procedures to the Present_Values of all output objects: AO[1] "SpRel" => relative setpoint MO[1] "Override" => override control If the "Present_Value" of an output object is written, the timer is reset. Upon timeout the "Priority_Arrays" of the output objects are cleared and "Relinquish_Default" becomes valid. Note: If "SpSource" MV[122] = 1: Analog, the "BusWatchdog" will only track write procedures on the output object "Override" MO[1].	0...3'600 0: disabled	0.01...1000 Default: 1	W

Object name	Object type [Instance]	Description Comment Status_Flags	Values	Access
Sens1Switch	BI[20]	**Status of switch input** Status of the sensor 1 if the sensor 1 type is defined as switch (if "Sens1Type" MV[220] = 5: Switch) Status flags: "Out of Service" = true, if sensor type is not switch.	0: Inactive (Inactive_Text) 1: Active (Active_Text)	R
BusTermination	BI[99]	**Bus termination (120 Ω)**	0: Disabled (Inactive_Text) 1: Enabled (Active_Text) Default: 0	R
SummaryStatus	BI[101]	**Summary status** The summary status summarizes the status of all the status objects: "StatusSensor" MI[103] "StatusFlow" MI[104] "StatusActuator" MI[106] "StatusPressure" MI[109] "StatusDevice" MI[110] If one of the objects is ≠ 1: OK, if the "Summary Status" is = 1: Not OK	0: OK (Inactive_Text) 1: Not OK (Active_Text)	R
ApplicationSel	MV[2]	**Application selection** Visualisation of the application selected by the damper manufacturer. VRU-D3-BAC / VRU-M1-BAC: – Flow control – Pressure control – Flow measurement VRU-M1R-BAC: – Room pressure control	1: Flow control 2: Pressure control 3: Room pressure control 4: Flow measurement Default: 1	R
RmPCascade	MV[10]	**Room pressure cascade** If the room pressure cascade is enabled or enabled fast, the sensor input S1 will be set as input signal for the room pressure cascade (0-10V). The room pressure cascade is only available if the "ApplicationSel" MV [2] = 1: Flow control or = 3: Room pressure control. The "Enable Fast" is only available for the VRU-M1R-BAC with a fast running actuator connected. Status Flags: "Out of Service" = true, if selected application is pressure control or flow measurement.	1: Disabled 2: Enabled 3: Enabled fast (M1R only) Default: 1	R
InternalActivity	MI[100]	**Internal activity** Indicates an active internal activity of the actuator	1: None 2: Test 3: Adaptation 4: Synchronization	R
StatusSensor	MI[103]	**Status of the differential pressure sensor** If the specific condition disappears, the status is reset automatically.	1: OK 2: dP sensor not OK 3: dP sensor out of range 4: dP sensor wrong connected	R

Object name	Object type [Instance]	Description Comment Status_Flags	Values	Access
StatusFlow	MI[104]	**Status flow** If the demanded volumetric flow cannot be reached within 600 s, the "StatusFlow" indicates "Airflow not reached". If the specific condition disappears, the status is reset automatically.	1: OK 2: – 3: Airflow not reached	R
StatusActuator	MI[106]	**Status of the actuator** Mechanical overload e.g. blocked valve, gear train disengaged, etc. If the specific condition disappears, the status is reset automatically. Status flags: "Out Of Service" = true, if the selected application is flow measurement or room pressure control cascade.	1: OK 2: – 3: Gear train disengaged 4: – 5: Actuator doesn't fit to application (only for angular characteristic curve)	R
StatusPressure	MI[109]	**Status differential pressure** If the demanded differential pressure cannot be reached within 180 s, the state changes to "Pressure not reached". If the specific condition disappears, the status is reset automatically.	1: OK 2: – 3: Pressure not reached	R
StatusDevice	MI[110]	**Status device** According to the settings on the Object "BusWatchdog" AV[130], the status device indicates if the bus watchdog is triggered or not. If the specific condition disappears, the status is reset automatically.	1: OK 2: Bus watchdog triggered	R
Override	MO[1]	**Override control** Overrides the current setpoint. Status flags: "Out Of Service" = true, if the selected application is flow measurement.	1: None 2: Open 3: Close 4: Min 5: – 6: Max 7: – 8: – 9: Motor stop Default: 1	C
ControlMode	MV[100]	**Control mode** Visualization of the control mode selected by the damper manufacturer. If the control mode "Flow control" is selected, the Min/Max limits are related to "Nominal volumetric flow in m^3/h". If the control mode "Position Control" is selected, the Min/Max limits are related to the adapted mechanical range of the actuator. Status flags: "Out Of Service" = true, if the selected application is not flow control.	1: PosCtrl 2: FlowCtrl Default: 2	R

Object name	Object type [Instance]	Description Comment Status_Flags	Values	Access
OperationMode	MV[102]	**Operation mode** Selection is only available for actuator type VRU-M1R-BAC. It changes the room pressure from positive pressure (default) to negative pressure. Status flags: "Out Of Service" = true, if the selected application is not room pressure control.	1: Negative pressure 2: Positive pressure Default: 2	W
Command	MV[120]	**Initiate function** Initiation of actuator functions for service and testing. Status flags: "Out Of Service" = true, if the selected application is flow measurement or room pressure control cascade.	1: None 2: Adaptation 3: Test run 4: Synchronization Default: 1	W
UnitSelAirFlow	MV[121]	**Unit selection volumetric flow** The selected unit is valid for "AbsFlow_Unitsel" AI[19] and "Vnom_UnitSel"AV[119].	1: – 2: m^3/h 3: l/s 4: _ 5: – 6: – 7: cfm Default: 2	W
SpSource	MV[122]	**Setpoint source** 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- (BACnet MS/TP). If "SpSource" MV [122] = 1: Analog, the setpoint in the object "SpAnalog" AI[6] is active. If "SpSource" MV [122] = 2: Bus, the setpoint in the object "SpRel" AO[1] is active.	1: Analog 2: Bus Default: 2	W
UnitSelPressure	MV[127]	**Unit selection pressure** The selected unit is valid for "DeltaP_UnitSel" AI[18] and "DeltaPnom_UnitSel" AV[129].	1: Pascal 2: – 3: Inches of water Default: 1	W
Sens1Type	MV[220]	**Sensor 1 type** Defines the connected sensor type. If the "Sens1Type" MV[220] = 2: Active or = 3: Passive, the corresponding value is shown in the object "Sens1Analog" AI[20]. If the "Sens1Type" MV[220] = 5: Switch, the status of the switch is shown in the object "Sens1Switch" BI[20].	1: None 2: Active 3: Passive 4: – 5: Switch Default: 2	W

Description access: R = Read, W = Write, C = Commendable with priority array

All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Damper actuators, control valves, sensors and meters represent our core business.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.

- 5-year warranty
- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

EN – 2024-09/A – Subject to technical modifications

BELIMO Automation AG
Brunnenbachstrasse 1, 8340 Hinwil, Switzerland
+41 43 843 61 11, info@belimo.ch, www.belimo.com

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