

ACA
Rectangular Variable Air Volume Device

Venues Breathe with DOGU HVAC Systems!

DOGU HVAC founded in 1999, and ever since has been manufacturing energy and cost efficient products as Air Handling Units, Air Distribution & Management & Movement Systems [HVAC Components] and constantly enhancing to provide an integrated solution for well-being. DOGU HVAC's core business products which are subsumed under 4 major groups as Air Handling Units, Heat/Energy Recovery Units, Air Distribution & Management Products and Kitchen Ventilation Equipment are all produced under the compliance with EU standarts. Particularly AHU and HRU-ER units are entitled under the "FOUR SEASONS" brand name for domestic and foreign markets. DOGU HVAC's, headquarter in Izmir/Turkey, operates in a large-sized plant spread over 2 factories, in total area of 45.000 sqm in which 25.000 sqm indoor space that enables DOGU HVAC manufactures 140 various type of products. Additionally, DOGU HVAC has a powerful sales network with 4 sales offices located in İstanbul, Ankara, Antalya and Adana in Turkey as well as authorized dealers in many other countries for sales and after sales operations. DOGU HVAC has been exporting to more than 50 countries.

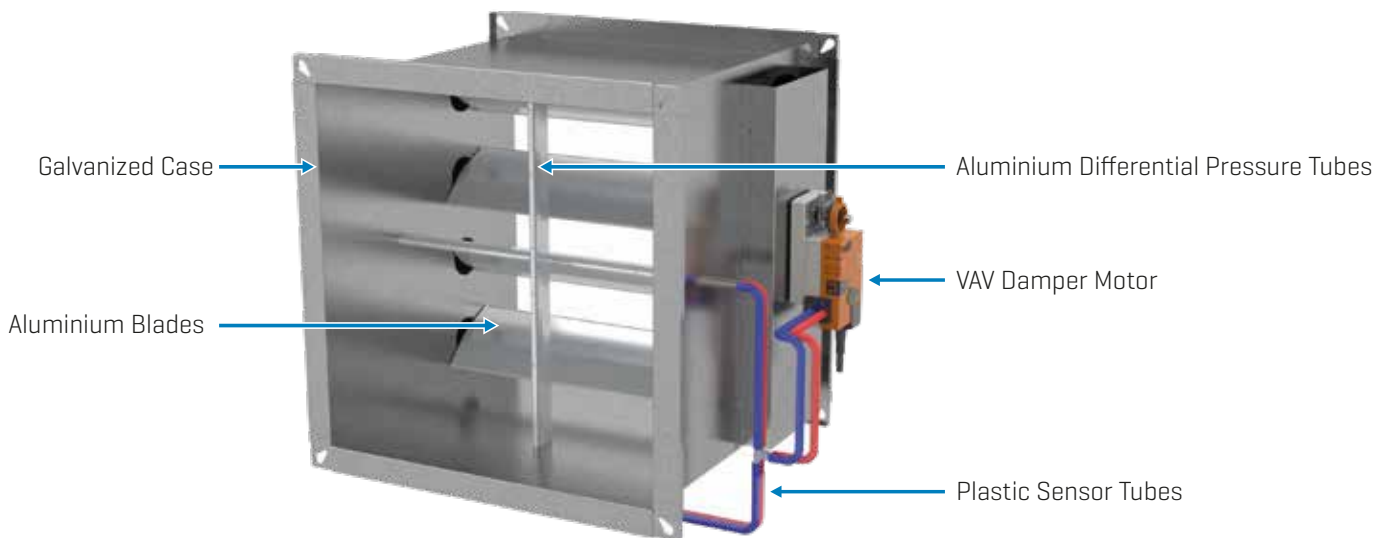
Thanks to our "Customer Satisfaction", "Zero-Defect Policy" motto and reinforced by complete certified products, more than 250 employees. DOGU HVAC R&D center developed exclusive products, such as Double Skin Make-Up Kitchen Hood, Recirculated Laminar Airflow Unit, Single Piece Square Ceiling Diffuser and Ecology Units, for the first time have brought to the sector. DOGU HVAC R&D has the ability to make customized production which can meet the requirement of the customers by means of special software such as "ANSYS FLUENT". DOGU HVAC guaranteed its quality of management by having advantages of ISO 9001, ISO 14001, ISO 18001 certifications. Air Handling Units have EUROVENT, TUV Hygiene [in accordance with DIN1946-4, VDI 6022-1, DIN EN 13053 standarts], CE, TSEK, GOST-R certifications; Fire Dampers have EN 1366-2 and EN 13501-3 CE certifications; Smoke Control Dampers have EN 1366-10 and 12101-8 CE certifications; Kitchen Ventilation Products have TSEK, CE and GOST-R quality certifications.



- ☞ ACA Prismatic Variable Air Volume Unit, operating room, clean room, special processes etc. It is used in prismatic ducts to control air flow in projects with special requirements such as comfort and hygiene. With variable air flow VAV systems, it provides energy savings of up to 50% in the energy consumed by the fan motor.
- ☞ Air flow control is used in ventilation applications, variable air flow systems for each space and duct pressure control applications.
- ☞ Operates at flow rates between 216 - 17000 m³ / h.
- ☞ All VAV units produced are calibrated in the VAV laboratory according to the flow rates specified in the order and their leakage is tested according to DIN EN 1751. In this laboratory, calibration is completed by testing one-to-one field conditions with 7 measuring stations, each with different diameter and nominal flow.
- ☞ Casing leakage is Class B according to DIN EN 1751 standard.
- ☞ ACA has DIN EN 1946/4 and VDI 6022 hygiene standards.
- ☞ ACA has a compact structure. It works efficiently with low pressure loss thanks to its blades working opposite to each other.

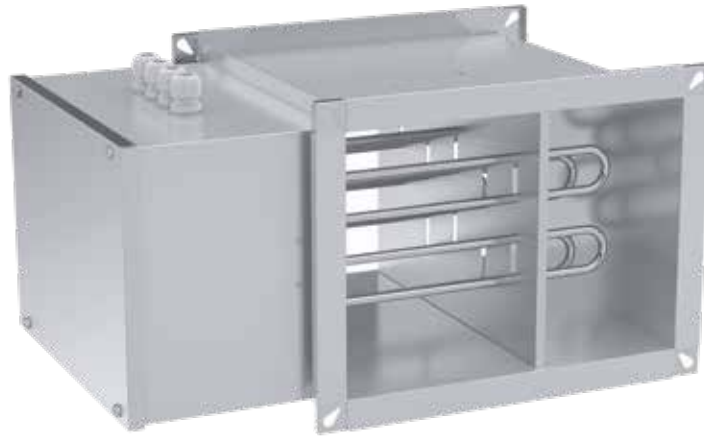
MATERIAL

- ☞ The casing is manufactured from galvanized steel sheet as standard. AISI 304 quality stainless case option is available.
- ☞ Blades and differential pressure tubes are made of aluminum profile.
- ☞ Belimo damper motor is fixed on the case.



ACCESSORIES

- ⚙️ **Acoustic Insulation:** In order to fulfill the acoustic comfort conditions in the selected product, it is insulated with an optional 19 mm thick foamed rubber. Rubber insulation is covered with galvanized sheet.
- ⚙️ **ACQ - Electric Heater:** When an additional heater power is needed for the supply air, an Electric Heater can be added to the output of the ACA.
- ⚙️ **GSX - Prismatic Silencer:** Duct type silencer option is available to meet comfort conditions.



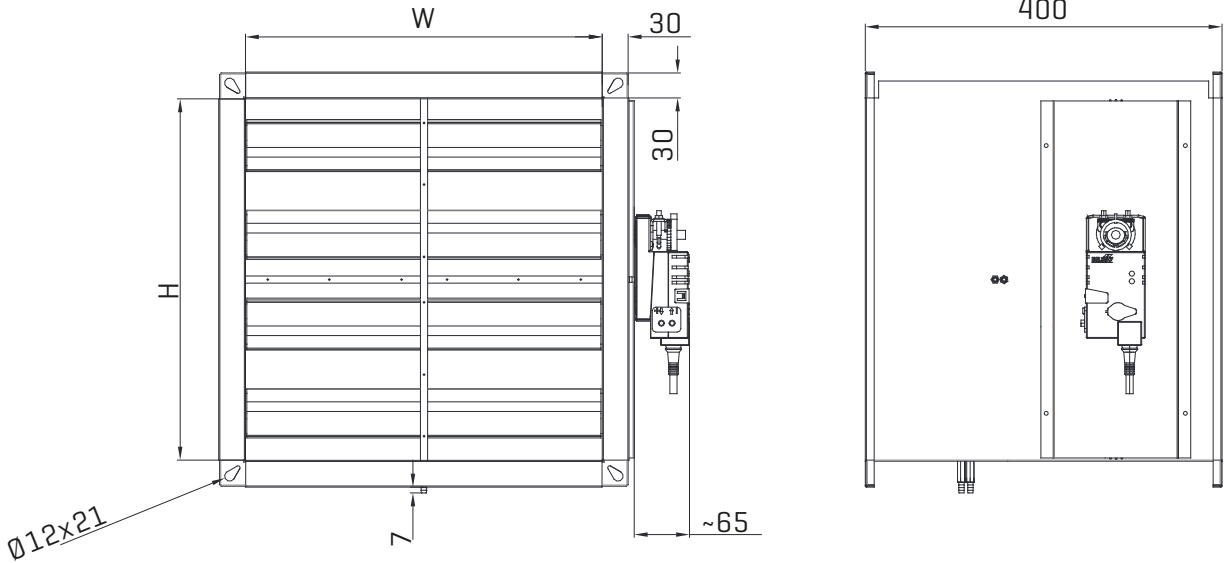
ACE - Electric Heater



GSX - Duct Type Silencer

STANDARD DIMENSIONS

NON-INSULATED



INSULATED

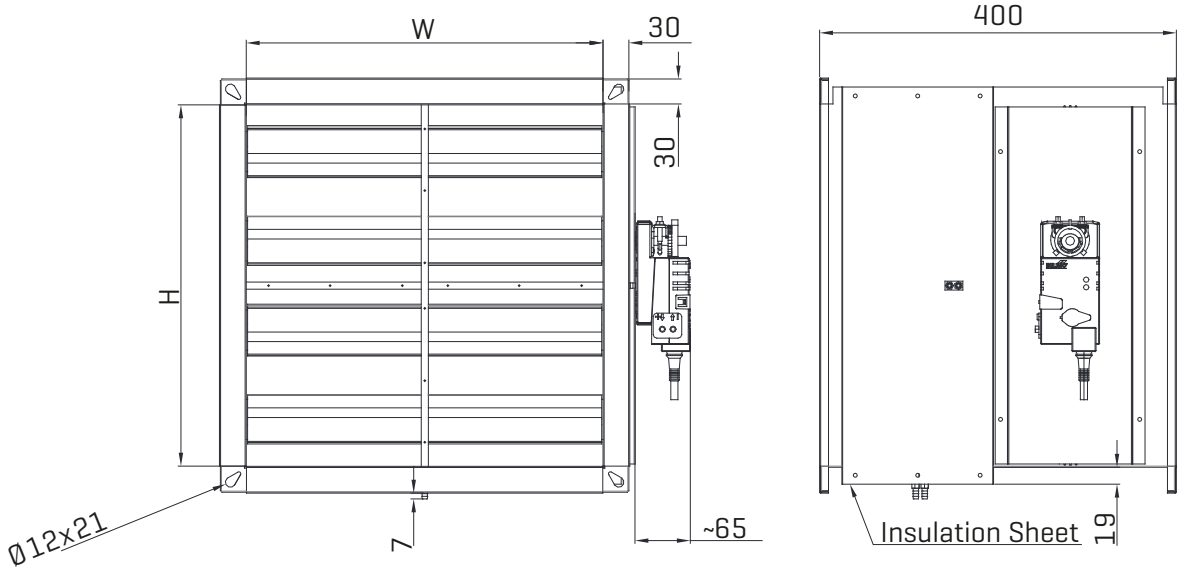


Table 1. Standard Dimensions

W [mm] (Width)	Dimensions between 150 mm and 1000 mm
H [mm] (Fixed Height Dimensions)	150 - 200 - 300 - 405 - 505 - 605 - 705 - 805

FLOW - SIZE RANGE

Table 2. Flow - Size Ranges

Flow Rate [m ³ /h]		H Height (mm)								
		150	200	300	405	505	605	705	805	
W Width (mm)	150	Vmin	162	360	540	720	900	1080	1260	1440
		Vnom	972	2160	3240	4320	5400	6480	7560	8640
	200	Vmin	216	288	432	583	727	871	1015	1159
		Vnom	1296	1730	2600	3460	4320	5190	6050	6920
	250	Vmin	270	360	540	720	900	1080	1260	1440
		Vnom	1620	2160	3240	4320	5400	6480	7560	8640
	300	Vmin	324	440	650	870	1080	1300	1520	1730
		Vnom	1944	2600	3890	5190	6480	7780	9080	10370
	350	Vmin	378	510	760	1010	1260	1520	1770	2020
		Vnom	2268	3030	4540	6050	7560	9080	10590	12100
	400	Vmin	432	580	870	1160	1440	1730	2020	2310
		Vnom	2592	3460	5190	6920	8640	10370	12100	13830
	450	Vmin	486	650	980	1300	1620	1950	2270	2600
		Vnom	2916	3890	5840	7780	9720	11670	13610	15560
	500	Vmin	540	720	1080	1440	1800	2160	2520	2880
		Vnom	3240	4320	6480	8640	10800	12960	15120	17000
	550	Vmin	594	800	1190	1590	1980	2380	2780	3170
		Vnom	3564	4760	7130	9510	11880	14260	16640	19010
	600	Vmin	648	870	1300	1730	2160	2600	3030	3460
		Vnom	3888	5190	7780	10370	12960	15560	17000	17000
650	Vmin	702	940	1410	1880	2340	2810	3280	3750	
	Vnom	4212	5620	8430	11240	14040	16850	19660	22470	
700	Vmin	756	1010	1520	2020	2520	3030	3530	4040	
	Vnom	4536	6050	9080	12100	15120	17000	17000	17000	
750	Vmin	810	1080	1620	2160	2700	3240	3780	4320	
	Vnom	4860	6480	9720	12960	16200	17000	17000	17000	
800	Vmin	864	1160	1730	2310	2880	3460	4040	4610	
	Vnom	5184	6920	10370	13830	17000	17000	17000	17000	
900	Vmin	972	1300	1950	2600	3240	3890	4540	5190	
	Vnom	5832	7780	11670	15560	17000	17000	17000	17000	
1000	Vmin	1080	1440	2160	2880	3600	4320	5040	5760	
	Vnom	6480	8640	12960	17000	17000	17000	17000	17000	

Note: Vmin air speed of 2 m / s, 12 V nom values of air velocity m / s refers to the nominal flow is to pass through a channel according to product size.

Vmax and Vmin values should be determined in the flow rate selection. The Vmin value can be selected between 0% and 100% of the Vnom value. The Vmax value can be chosen between 40% and 80% of the Vnom value. When Vmin and Vmax values are selected the same, the product will operate in constant flow [CAV] mode.

VELOCITY & MINIMUM PRESSURE DROP

The minimum pressure loss is given in Table 3 when the VAV fully open.

Table 3. Velocity & Minimum Static Pressure Drop Data

Air Velocity [m/s]	Pressure Drop [Pa]
2	5
4	9
6	14
8	23
10	38
12	61

Example: 400X405 ACA, minimum pressure loss at 1200 m³ / h flow rate:

Flow area = 0.162 m²

Flow rate = 3.53 m / s

Minimum pressure drop at the desired flow = 8 Pa

FLOW AREA

Table 4. Flow Area by Product Dimensions

Flow Area [m ²]		H Height (mm)							
		150	200	300	405	505	605	705	805
W Width (mm)	150	0,023	0,030	0,045	0,061	0,076	0,091	0,106	0,121
	200	0,030	0,040	0,060	0,081	0,101	0,121	0,141	0,161
	250	0,038	0,050	0,075	0,101	0,126	0,151	0,176	0,201
	300	0,045	0,060	0,090	0,122	0,152	0,182	0,212	0,242
	350	0,053	0,070	0,105	0,142	0,177	0,212	0,247	0,282
	400	0,060	0,080	0,120	0,162	0,202	0,242	0,282	0,322
	450	0,068	0,090	0,135	0,182	0,277	0,272	0,317	0,362
	500	0,075	0,100	0,150	0,203	0,253	0,303	0,353	0,403
	550	0,083	0,110	0,165	0,223	0,278	0,333	0,388	0,443
	600	0,090	0,120	0,180	0,243	0,303	0,363	0,423	0,483
	650	0,098	0,130	0,195	0,263	0,328	0,393	0,458	0,523
	700	0,105	0,140	0,210	0,284	0,354	0,424	0,494	0,564
	750	0,113	0,150	0,225	0,304	0,379	0,454	0,529	0,604
	800	0,120	0,160	0,240	0,324	0,404	0,484	0,564	0,644
900	0,135	0,180	0,270	0,365	0,455	0,545	0,635	0,725	
1000	0,150	0,200	0,300	0,405	0,505	0,605	0,705	0,805	

SOUND LEVEL DATA

Table 5. Sound Level Data

150 Pa Static Pressure difference Air Velocity [m/s]	Flow Sound Level [dB(A)]	Noise Emitted from the Case [dB(A)]	
		Uninsulated	Insulated
2	46	35	22
4	46	39	29
6	47	42	33
8	47	44	36
10	47	46	39

INSTALLATION

It is installed by considering the air flow direction arrow on the ACA. For the differential pressure sensors to function correctly, the following distance rules must be observed. For duct connections such as elbows, branches, tee connections and reductions must conform to EN 1505 design.

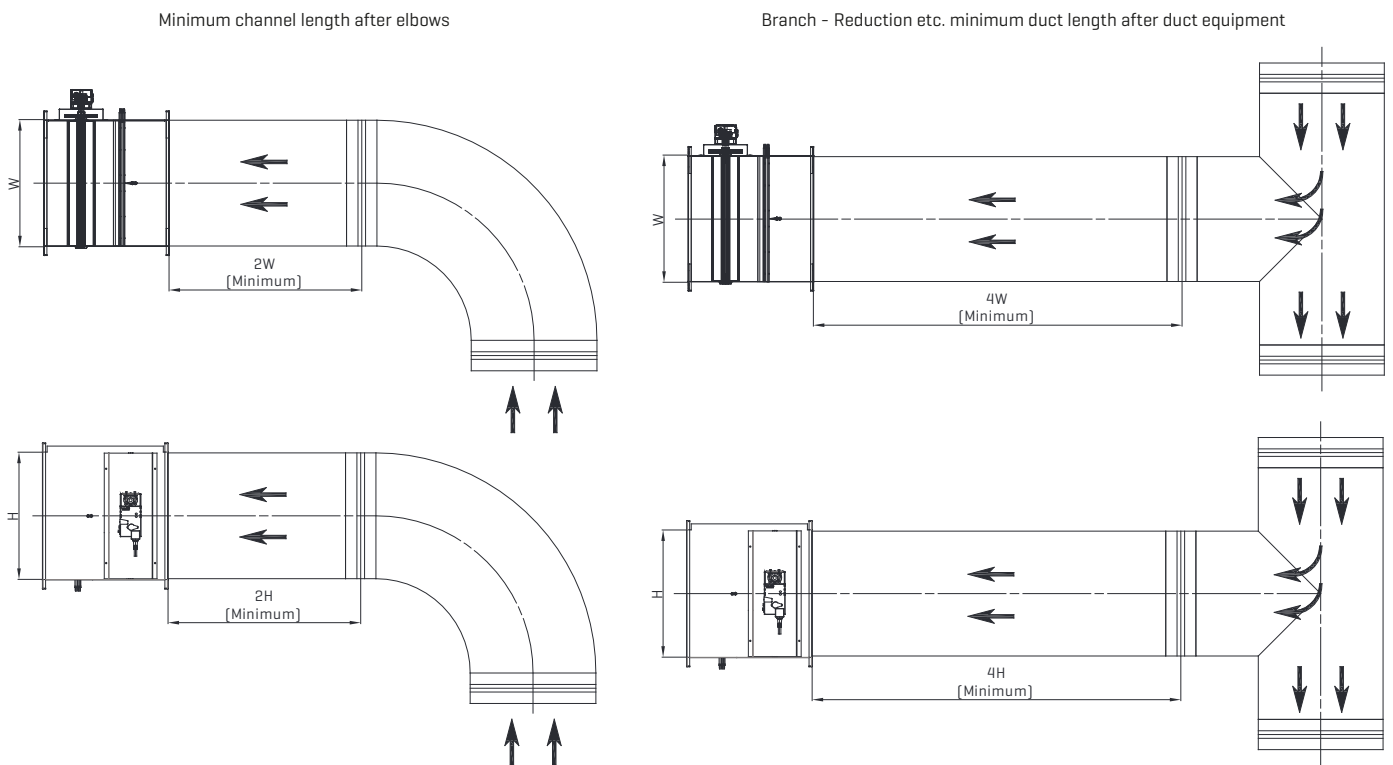


Table 6. Minimum Duct Length Table

Connection	Minimum Duct Length
Elbow	$2 \times W/H$
Other duct equipment [T connection, reduction etc. duct equipment]	$4 \times W/H$
Fire Damper	$4 \times W/H$
Silencer	$4 \times W/H$

VAV COMPACT CONTROLLERS

VAV controllers are equipped as standard with actuators with analog setpoint and feedback signals in DC 2 V... 10 V or DC 0 V... 10 V mode.

MP-BUS, MODBUS and BACnet communication options are available in the control devices.

Control devices are calibrated and adjusted at the factory to the desired flow rate and Vmin Vmax value with ZTH-EU and Belimo PC Tool.

Table 7. VAV Controller Information Table

Order Code	Belimo Motor Code	Flow Volume Adjustment Analog Input	Flow Volume Adjustment via BUS Com.	Controller ^[3] Parameters Setup	Hard Wired Override	Feedback Signal Type	Feedback Values ^[2]	BUS Communicated Variables	Power Supply	Operating Temperature [°C]
S71 S70	LMV-D3-MP (5 Nm) NMV-D3-MP (10 Nm)	DC 0...10 V, DC 2...10 V	MP-BUS	ZTH-EU, PC TOOL, NFC (Android), MP-BUS	Open ^[1] Close Vmin, Vmax	DC 0...10 V, DC 2...10 V, MP-BUS	Actual volume. Damper angle, Actual pressure	Read/Write: Setpoint, Vmin, Vmax, Open, Close Read: Actual volume, Damper angle, Actual pressure, Serial number, Fault/Alarm messages	AC 24 V, DC 24 V	0...+50 °C
S72	LMV-D3-MF (5 Nm)		—	ZTH-EU, PC TOOL		DC 0...10 V, DC 2...10 V		—		
S71 S86	LMV-D3-MOD (5 Nm) NMV-D3-MOD (10 Nm)		MODBUS, BACnet, MP-BUS	ZTH-EU, PC TOOL, MODBUS, MP-BUS		DC 0...10 V, DC 2...10 V, MODBUS, MP-BUS		Read/Write: Setpoint, Vmin, Vmax, Open, Close Read: Actual volume, Damper angle, Actual pressure, Serial number, Fault/Alarm messages		

Note:

- 1) Available on AC 24 supply only.
- 2) Output is analog. Therefore, only one feedback value can be selected.
- 3) Control units are not provided as accessories.

VAV COMPACT CONTROL DEVICE ELECTRIC CONNECTION

S72: LMV-D3-MF (STANDART PRDUCTION)



No.	Wire Colour	Designation	Function
1	Black	⊥-	AC/DC 24 V Supply
2	Red	~+	
3	White	◀Y	Reference Signal
5	Orange	▶U	-Actual Value Signal -Tool Communication

S71: LMV-D3-MP & S70: NMV-03-MP



No.	Wire Colour	Designation	Function
1	Black	⊥-	AC/DC 24 V Supply
2	Red	~+	
3	White	◀Y	Reference Signal
5	Orange	▶U	-Actual Value Signal -Tool Communication

S73: LMV-D3-MOD & S86: NMV-D3-MOD



No.	Wire Colour	Designation	Function
1	Black	⊥-	AC/DC 24 V Supply
2	Red	~+	
3			
5	Orange	▶MFT	MP Connection
6	Pink	D-	BACnet / Modbus [RS485]
7	Gray	D+	

OPTIONAL ADAPTIVE VAV CONTROL SYSTEM

If desired, a product option is available with a fast response VAV servomotor, static pressure sensor and control platform. It provides the adaptive control of the ambient air flow by providing an on-off speed control independent of the duct pressure in 2.5 seconds.

Table 8. VRP-M Regulator Information Table

VRP-M Controller	
Nominal Voltage	24 V AC, 50/60 Hz 24 V DC
Power Supply	1,1 W (Without Servomotor, with VFP-300)
Transmission Signal	Input impedance > 200 kΩ 0...10 / 2...10 V DC or 0...20 / 4...20 mA (with 500 Ω resistance)
Actual Value	0...10 / 2...10 DC, maximum 5 mA
Case Insulation Class	IP 42
Operating Ambient Temperature	0...+50°C
Electromagnetic Compatibility	CE 2004/108/EC
Operating Humidity	5...95% Relative Humidity



VRP-M Regulator

Table 9. VFP-300 Static Differential Pressure Transducer Information Table

VFP-300 Static Differential Pressure Sensor	
Rated Voltage	15 V DC (with VRP-M Regulator)
Measuring Range	0...300 Pa
Output Signal	0...10 V DC
Pressure Connection	Inner Diameter 4...6 mm
Electrical Insulation Class	III [Safe Voltage]
Case Insulation Class	IP42
Operating Ambient Temperature	0...+50°C
Electromagnetic Compatibility	CE 2004/108/EC



VRP-300 Static Differential Pressure Transducer

Table 10. LMQ24A-SRV-ST Servomotor Information Table

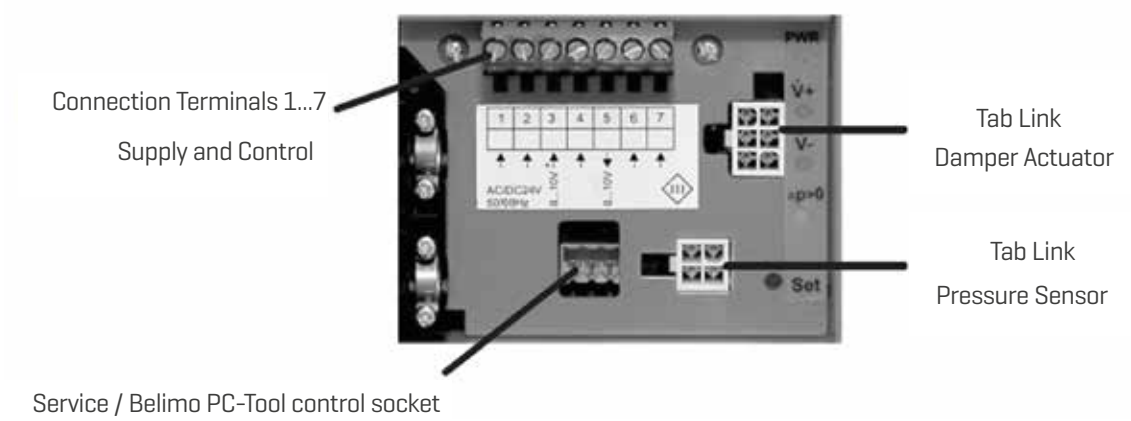
LMQ24A-SRV-ST Servo Motor	
Rated Voltage (with VRP-M Regulator)	24 V AC, 50/60 Hz 24 V DC
Power Consumption	12 W
Electrical Insulation Class	III [Safe Voltage]
Torque	4 Nm
Velocity	2,5 s / 90°
Case Insulation Class	IP54
Operating Ambient Temperature	0...+50°C
Electromagnetic Compatibility	CE 89/336/EEC
Operating Humidity	5...95% RH
Maintenance	Maintenance Free



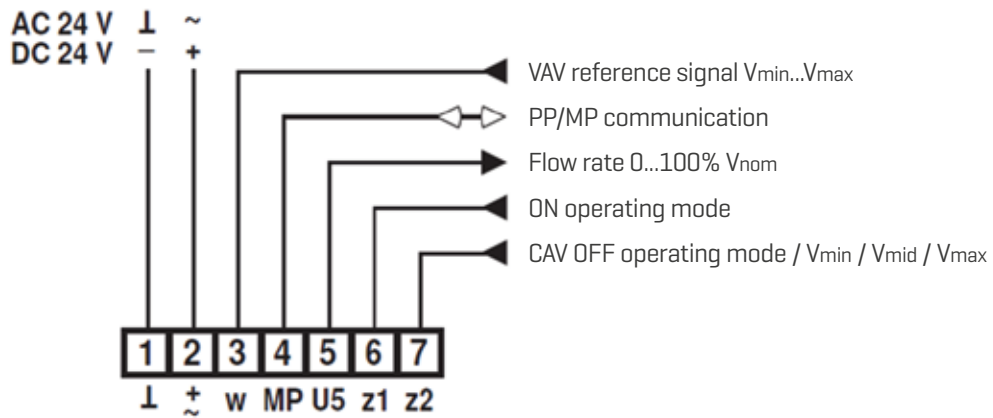
LMQ24A-SRV-ST Servo Motor
NMQ24A-SRV-ST Servo Motor

ADAPTIVE VAV CONTROL SYSTEM COMMISSIONING

PANEL



PANEL CONNECTION TERMINAL FUNCTIONS



PRODUCT SELECTION

The maximum air flow rate of the space is known as V_{max} . V_{max} volume flow rate can be selected between maximum 80% and 40% of the nominal volume flow rate of the damper. V_{min} flow rate can be selected as 30% of the nominal air flow rate of the damper. In 2-10V controller selection, the damper operates at a flow rate of V_{min} at 2V and below. Between 0-10V, the damper has the feature of completely closing. If V_{max} and V_{min} are selected at the same value, the damper will operate in CAV [constant flow rate setting] mode.

Example: The total air flow of a building is determined as $25000 \text{ m}^3 / \text{h}$. 5 VAV devices for the room will be installed in the supply channel. Select your product.

The maximum supply flow rate for each VAV to be used is calculated as $25000/5 = 5000 \text{ m}^3 / \text{h}$. Since $V_{max} = 80\% V_{nom}$ and $V_{max} = 5000 \text{ m}^3 / \text{h}$, it is calculated as $V_{nom} = 6250 \text{ m}^3 / \text{h}$ from the formula. According to the values of V_{min} and V_{max} , the appropriate size is selected from the Table 2. Quick Selection table as $V_{nom} = 6480 \text{ m}^3 / \text{h}$ and duct dimensions $500 \text{ mm} \times 300 \text{ mm}$.

Flow area according to the selected throat size is found as 0.15 m^2 according to Table 4. Flow Area by Product Dimensions table.

Minimum pressure losses from the flow area in the selected V_{min} and V_{max} ranges:

$V_{max} = 5000 \text{ m}^3/\text{h}$, Air velocity is $5000/0.15 / 3600 = 9.26 \text{ m/s}$

If $V_{min} = 30\% V_{nom} = 1875 \text{ m}^3 / \text{h}$ then minimum air velocity = $1875 / 0.15 / 3600 = 3.47 \text{ m / s}$

Approximately the minimum pressure loss is 31 Pa for 9.26 m / s .

Sound values are checked from Table 5. Sound Data Table. Accordingly, the flow noise that will occur in the device at 150 Pa static pressure difference value is 46 dB [A], and the case radiated noise is 36 dB [A]. If additional sound insulation is required in the VAV device, then the case radiated noise is 23 dB [A].

Motor Selection

For commissioning connection information, see the "Vav Compact Controllers Commissioning" section. If the system is required to be fast reactive under special conditions, the adaptive vav control system is preferred.

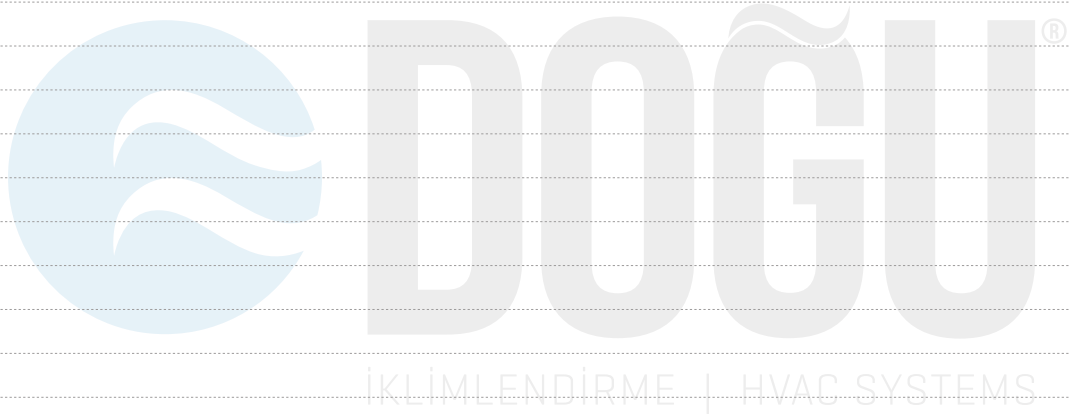
PRODUCT ORDER CODES

ACA. A > . < B > . < C > . 30 . < D > . < E > . < F >

A	Material	
	GAL	Galvanized
	PAS	AISI 304 Stainless Steel
B	Flow Type	
	E	Exhaust Side
	U	Supply Side
C	Controller	
	S70	NMV-D3-MP
	S71	LMV-D3-MP
	S72	LMV-D3-MF
	S73	LMV-D3-MOD
	S86	NMV-D3-MOD
	S97	Adaptive VAV Control System
D	Insulation	
	00	Uninsulated
	04	Acoustic Insulation
E	Width (W) [mm]	
	0000	You can look at the standard sizes.
F	Height (H) [mm]	
	0000	You can look at the standard sizes.

Example; ACA.GAL.E.S72.30.00.0400.0300

NOTES





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