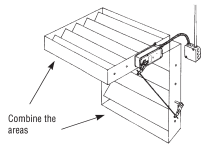
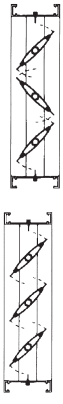
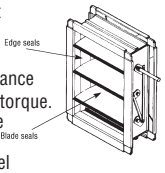
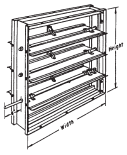
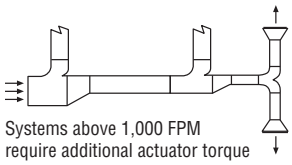
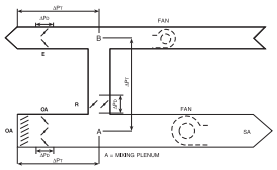
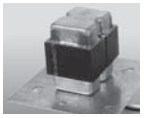
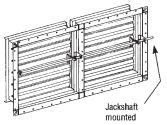
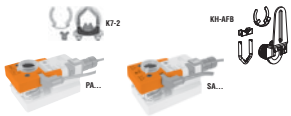
How to Select a Damper Actuator

The "10 questions" method for sizing and selection shown below is recommended as the best method for your actuation requirements. Use the "Application Data" column in this chart as a worksheet to help in the selection process.

APPLICATION INFO		APPLICATION DATA
1 What is the total area of the damper?		_____ sq.ft.
2 Opposed blade or Parallel blade construction?	L" x W" = Total sq. inches/144 = total sq. feet **Opposed Blade w/o seals 3 in-lbs/sq. feet*** **Opposed Blade w/ seals 5 in-lbs/sq. feet** **Parallel Blade w/o seals 4 in-lbs/sq. feet** **Parallel Blade w/ seals 7 in-lbs/sq. feet** ***Less than 1,000 feet per minute** 	❑ Opposed Blade ❑ Parallel Blade
3 Are there blade and edge seals on the damper?	This will impact the proper selection as the seals add resistance requiring more torque. If unknown, use a worst case scenario, parallel blade with seals. 	❑ Yes ❑ No
4 For the damper in question, what does the manufacturer specify as the torque rating?	 If this information is not available refer to the "typical damper requirements and sizing" chart below.	_____ in-lbs/sq.ft.
5 What is the air velocity, static pressure, or design CFM?	 Systems above 1,000 FPM require additional actuator torque	_____W.G. _____CFM _____FPM

ACTUATOR REQUIREMENTS		APPLICATION DATA
6 Is fail-safe actuation required?	 Consider the application. Is the actuator and/or damper exposed to outside air? If yes, use spring return.	❑ Yes ❑ No
7 What is the supply voltage to the actuator? • 24 VAC/DC • 120 VAC • 230 VAC single phase	Do you need a step down transformer? If replacing an oil immersed gear train actuator, is the transformer in the defective actuator? You may need to purchase one. 	❑ 24 VAC ❑ 120 VAC ❑ 230 VAC
8 What is the control signal to the actuator?	 • 2 position • Floating point • Modulating • Sequencing • "Non-standard" voltage signals This will be a critical component to the selection of an actuator. Consider the …MFT actuator product range and the flexibility of its application.	❑ On/Off ❑ Floating Point ❑ 2-10 VDC ❑ 0.5-10 VDC ❑ 4-20 mA ❑ PWM____ range ❑ Other (MFT)
9 Can you direct couple to a damper shaft?	 Direct-coupling has become the industry standard. Some retrofit applications do not allow direct coupling. Refer to the Belimo "Mounting & Methods Guide" for application details.	❑ Yes ❑ No, see accessories page
10 Are there additional accessories required?	 For example, some applications require the addition of an auxiliary switch for proof of position; a retrofit application may require an additional mounting bracket and linkage kit. We advise that you identify these needs prior to leaving the job site or ordering products.	❑ No ❑ Yes, see accessories section or actuator series for details

TYPICAL DAMPER REQUIREMENTS AND SIZING

Square Damper (with square shape): ft² = h x w /144; (h= height, w= width, in inches)

EXAMPLE: Damper Area (8 ft²) x Rated Torque Loading of Damper (4 in-lbs/ft²) = Total in-lbs Required (32 in-lbs) **Belimo LF 35 in-lbs/ LM 45 in-lbs actuators**

		Torque Loading in-lbs/ft²		
	Damper Blade Type	**< 1000 FPM**	**1000-2500 FPM**	**2500-3500 FPM**
SQUARE	Parallel blade/edge seals	**7 (Typical)**	10.5	14
	Opposed blade/edge seals	**5 (Typical)**	7.5	10
	Parallel blade/no edge seals	4	6	8
	Opposed blade/no edge seals	3	4.5	6
	Round	10	14	20

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TYPICAL DAMPER REQUIREMENTS AND SIZING EXAMPLE:

APPLICATION REQUIREMENTS	SQUARE DAMPER	ROUND DAMPER
Damper Length	24"	
Damper Width	12"	
Damper (Round)		12"
Blade Type	Opposed	Round
Edge Seals	Edge Seals	
Design CFM	1800 CFM	700 CFM
Fail-Safe	Yes	Yes
Supply Voltage	24 Volt	24 Volt
Control Signal	2-10 VDC	2-10 VDC
CALCULATIONS		
Damper Area (sq. inches)	24" x 12" = 288 in^2	πr^2 =113.04 in^2
Damper Area (sq. feet)*	288 in^2 x 1ft/12 in x 1ft/12 in = 2 ft^2	113.04 in^2 / 1ft/12in x 1ft/12in= 0.785 ft^2
Velocity	1800 ft^3/min / 2 ft^2 = 900 ft/min	700 ft^3/min / .785 ft^2 = 892 ft/min
	See chart under <1000 FPM (ft/min)	See chart under <1000 FPM (ft/min)
Rated Torque Loading (in-lbs/ft^2)**	Select 5 in-lbs/ft^2 for Opposed Blade/Edge Seals	Select 10 in-lbs/ft^2 for Round Damper
EXAMPLE EQUATION	***Damper Area (sq. ft) x **Rated Torque Loading of Damper (in-lbs/ft^2) = Total in-lbs Required**	
	2 ft^2 x 5 in-lbs/ft^2 = 10 in-lbs Belimo LF24-SR US @ 35 in-lbs	0.785 ft^2 x 10 in-lbs/ft^2 = 7.85 in-lbs Belimo LF24-SR US @ 35 in-lbs

CONTROL SIGNAL OVERVIEW

Belimo actuators are compatible with many control inputs and all direct digital control (DDC) systems. There are many signals to select from with today's controllers.

On/Off or Open-Close: The actuator is able to drive either to its full clockwise (CW) position, or to its full counter-clockwise (CCW) position.

3-point, Tri-State, Floating Point: The actuator has both clockwise (CW) and counter-clockwise (CCW) control inputs. One drives the actuator to its CW, the other to its CCW position. If there is no signal (Null point) on either input the actuator simply stays in its last position.

Modulating (Proportional) Control: The actuator drives to its control signal input throughout its angle of rotation. This control type is usually a variation of VDC with typical ranges of 0.5-10 VDC and 2-10 VDC.

It is common to also have a 4-20 mA output from a controller. This can be very easily converted to 2-10 VDC with a 500 Ω resistor.

Pulse Width Modulation (PWM): The actuator drives to a specified position according to a pulse duration, the "length" of signal. The pulse can originate from a dry contact closure or a triac sink or source controller. An example of PWM control:

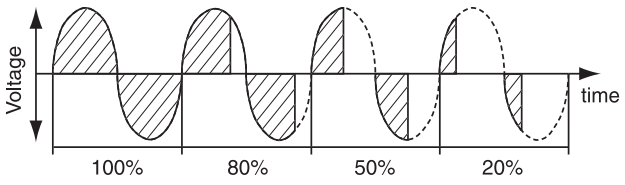
Time base: 0 to 10 seconds

Output pulse: 5 seconds

Actuator position: 50%

See -MFT model actuators.

Phasecut: An actuator drives depending on the power result of a remaining wave. This signal type cuts a portion of an AC sine wave and the actuator recognizes this signal as a modulating movement. See actuator model AFB24-PC.



Multi-Functional Technology (MFT): This technology was developed by Belimo for incorporation into our damper and valve actuators. MFT provides the ability to program certain characteristics of the actuators. Some of the key characteristics to change are:

CONTROL INPUT
Selectable on/off, VDC, PWM or floating point

MOTION VALUES
Selectable running time adjustment

FEEDBACK
Selectable feedback values

0-135 Ω: The actuator drives to a modulating position proportional to the ohm signal of the controller. See actuator model AFB24-MFT95.

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