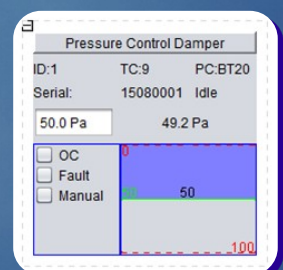
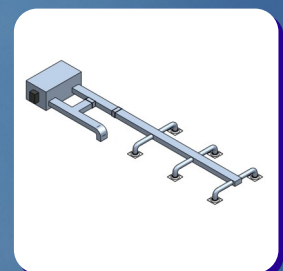
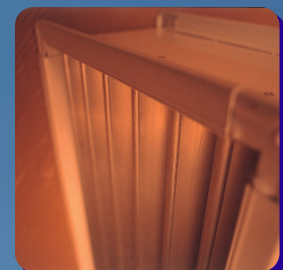
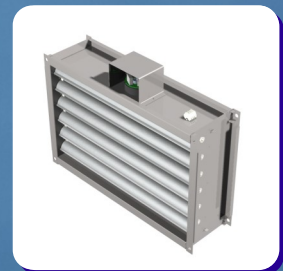


PRESSURE CONTROL DAMPER

20

PCD

- ✱ **NOW** INTEGRATED WITH MLM
- ✱ DESIGNED FOR VAV DIFFUSER SYSTEMS
- ✱ LINEAR CHARACTERISTICS
- ✱ LOW NOISE
- ✱ ELECTRIC ACTUATION
- ✱ NO REGULAR MAINTENANCE REQUIRED
- ✱ PRESSURE SENSOR AND CONTROLLERS
- ✱ FACE OR BYPASS DAMPERS AVAILABLE
- ✱ 2 YEAR MANUFACTURER'S WARRANTY



FEATURES

The RICKARD VARIABLE GEOMETRY Pressure Control Damper (PCD) has been designed to control supply air duct pressures accurately. This accuracy is required in Variable Air Volume Variable Geometry systems since VAV diffusers are sized and set to operate at a constant pressure, independent of air flow. Important factors in PCD design are therefore linear airflow response to actuator movement, reliability of air flow and, low noise regeneration throughout the airflow range.

Opposed blade dampers and variations on the "butterfly-valve" type are not suited for duct static pressure control as they are not designed with these factors in mind. Please see the graph at the end of this section which shows the linear nature of the Rickard PCD.

Rickard's PCD design has been upgraded. A new blade profile has been designed to be more aerodynamic and open further. This has reduced the pressure drop across it though a wider range and makes it quieter close to closed. An improved seal makes it shut down more tightly and a lower friction mechanism makes it more reliable.

We've also integrated it with our MLM controls so that you can manage and monitor it just like our VAV diffusers. Now you can set the pressure, monitor the damper position, monitor the pressure and read and write to the BMS.

SPECIFICALLY DESIGNED FOR VAV DIFFUSER SYSTEMS

LINEAR CHARACTERISTICS

Linear airflow response to actuator movement.

LOW NOISE

Low noise throughout the airflow range.

ELECTRIC ACTUATION

Rickard builds its standard PCD's with a Lindrive Push-Pull Actuator. The Rickard controller supplies a 24VAC 3 point floating signal to control the Actuator. Alternatively a Push-Pull Actuator by others may be specified.

If a 0-10VDC signal is supplied, the Rickard PCD can be supplied with a Rotary Shaft to be driven by a Rotary Actuator by others.

MLM CONTROLS

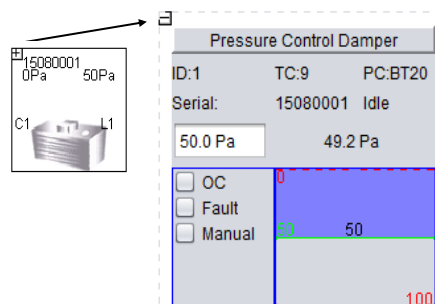
The Rickard PCD is now available with Rickards proven MLM controls.

Standalone or BMS compatible.

Free MLM Software allows the user to:

- Commission PCD's from a laptop.
- Manage the PCD's and Diffusers with one application.
- Surface all PCD information to BMS.
- Use Manual Mode to drive the PCD to any position.
- View Pressure, Set point, Motor position and Status.

PCD DISPLAY ON MLM APPLICATION



MAINTENANCE

No regular maintenance is required

PRESSURE SENSOR AND CONTROLLERS AVAILABLE

WARRANTY

Rickard offers a 2 year manufacturer's warranty on its Pressure Control Dampers. Please see Terms and Conditions for a full description of our Warranty.

APPLICATION

The RICKARD VARIABLE GEOMETRY Pressure Control Damper (PCD) has been designed to control supply air duct pressures accurately. This accuracy is required in Variable Air Volume Variable Geometry systems since VAV diffusers are sized and set to operate at a constant pressure, independent of air flow. Important factors in PCD design are therefore linear airflow response to actuator movement, reliability of air flow and, low noise regeneration throughout the airflow range.

OPERATION

PRESSURE CONTROL

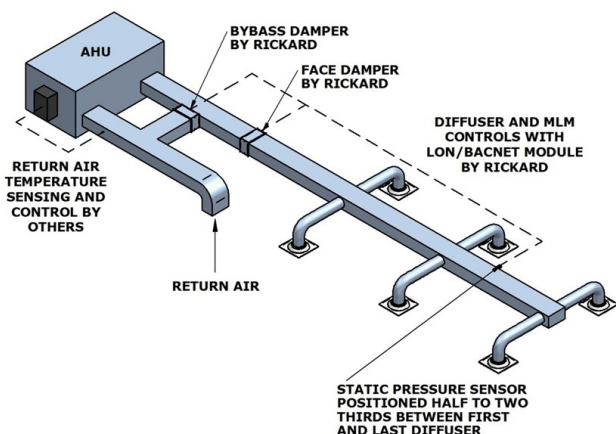
The function of a PCD is to maintain a constant pressure in the system regardless of flow. This constant pressure is to allow the VAV Variable Geometry diffusers to operate correctly as they are sized and set to deliver specific design volumes at a specific duct static pressure. **Note:** Should the duct pressure be very low or zero, the controls will position the damper at the 100% open position.

The RICKARD PCD is supplied with electronic pressure controls. The controller would normally be mounted within an enclosure fitted to the side of the damper casing, while the pressure sensor is supplied loose, to be fitted to the ducting in a suitable position. The interconnecting cable between the controller and the sensor is supplied by Rickard. Although the standard length is 20m, a longer length may be supplied if required. As an alternative, the pressure controller may be supplied loose, suitable for mounting in a remote position. For details of this option, please contact your nearest RICKARD representative.

FACE-AND-BYPASS DAMPER CONTROL

The RICKARD pressure controller may be used to control a face or a bypass damper. Depending on your requirement, the controls can be set as normal or reverse acting depending on the application. If a face and bypass damper are working together to control pressure, one controller can be used to control both dampers. In this case two

actuators will simply be wired in the opposite direction so that the face damper drives open when the bypass drives closed and vice-versa. Please note that it will not be possible to manage and monitor each damper independently in this case. If this is required, please purchase a separate controller for each damper.



CONTROL OPTION

Power: Requires a 230V AC power supply and is supplied with a PVC insulated power cable and plug top. A 230/24V AC transformer is built into the controller. Since each PCD has its own power supply, no separate PSU is needed.

Connection: Multiple PCD's can be daisy chained together and connected with inter-PCD cables. Each inter-PCD cable can be up to 30m in length. Up to 15 PCD's can be connected per MCU channel.

To connect to the MLM network, a USB module or MCU can be used. Diffusers and PCD's can be connected to the same MCU.

*** Termination:** PCD's are daisy chained together. The first and last PCD should be terminated. Termination ensures reliable communications on the network. Please see the last page of this section for termination connection.

Software: Both PCD's and diffusers appear on the same Rickard MLM Software.

BMS options:

- BACnet/IP - Magnetic Ethernet
- BACnet MS/TP - RS485 bus

PRESSURE SENSOR (0-500Pa)

The pressure sensor is supplied loose and is easily fitted to the duct on site. Position the sensor half to two thirds between first and last diffuser as shown above. The pressure sensor should be mounted squarely in the middle of the side of the duct. **NOTE:** Install where you will get a good Static pressure reading. Do not install on or after a bend where the air in the duct is likely to be disturbed.

PRESSURE INDICATION

Pressure can be read and set using the MLM application.

ACTUATION

Rickard builds its standard PCD's with a Lindrive Push-Pull Actuator. The Rickard controller supplies a 24VAC 3 point floating signal to control the Actuator. Alternatively a Push-Pull actuator by others may be specified.

If a 0-10VDC signal is supplied, the Rickard PCD can be supplied with a Rotary Shaft to be driven by a Rotary Actuator by others.

For more details, please contact your local Rickard Sales Representative.

SELECTION

FACE DAMPERS

Usually dampers are sized to match the duct into which they will be fitted. Generally speaking, this is an adequate selection method. Under certain circumstances this can lead to difficulties. Normally at full volume the air velocities in air-conditioning ducting should be between 6 and 9 m/s. If velocities are outside these limits, or if there are any substantial restrictions such as silencers, filters or multiple bends and transformation pieces in the ducting, then a closer examination may be warranted.

The two effects which make a PCD damper's task difficult are the square law relationship between flow and pressure and the fact that a damper cannot actually destroy static pressure - it can only convert static pressure to velocity pressure, then rely on poor static regain to destroy much of this velocity pressure. A typical system has a main/riser duct supplied with conditioned air from a variable speed fan. The fan speed being controlled by a static pressure controller, sensing pressure in the main/riser duct. As a result the static pressure in the duct will be maintained at a constant pressure which is dictated by branch ducting to the diffusers. This ensures that the diffusers are supplied with conditioned air at a constant pressure.

In an air-conditioning system with minimal losses between the PCD damper and the diffusers, we can expect a constant pressure drop across the PCD. This pressure will simply be the main/riser pressure less the diffuser pressure. Although the duct pressure is constant, the flow through the PCD will not be. The flow may change through a range of greater than 3:1 as the diffusers close down from fully open to minimum. To accommodate this change, the PCD should reduce the free area to approximately 30% of that at full flow. This will maintain the velocity across the damper and so maintain the loss in static pressure. There will, however be slight discrepancies between the ratios of free area as the proportion of regained static pressure depends somewhat on the geometry of the damper.

Where systems have substantial restrictions in the ducting between the main/riser and the diffuser outlets, the situation is quite different.

Say, for example, the combined restrictions in the system (disregarding the restriction from the damper itself) result in a pressure loss of 100Pa at full flow. At minimum flow the losses due to these restrictions will then be $100 \times 0.3^2 = 9\text{Pa}$. In this environment, the damper may need to reduce duct pressure by 50Pa at full flow while at minimum, $50 + 91 = 141\text{Pa}$. In addition, it must only pass 30% as much air. These two factors combine to make the change in free area far more than 3:1.

To explore this in more depth:

At full flow a 50Pa reduction corresponds to a velocity of 10m/s, if we assume air at 1kg/m^3 . Taking a basic duct velocity of 6m/s, means that the damper must increase velocity to 16m/s, so have a free area of 37.5% of the basic duct. From this point, the damper will close down as the diffusers need less conditioned air. Firstly, at minimum flow our reduction will not be 50Pa, but 141Pa.

This requires the velocity to rise a further 7 m/s to 23m/s, while also passing only 30% of the air. To do this, we require only 7.8% of the

basic duct free area.

A few more severe examples follow:

1. Say the duct velocity starts very low, perhaps 3m/s. We must now substitute 3m/s into these relationships instead of 6m/s. This results in a duct/damper combination with all other things being

equal, now needing to shut down to 4.5% free area.

2. Let's make the situation worse - take a 3m/s duct system with combined maximum flow loss of 100Pa as before, but needing to reduce 100Pa rather than 50 Pa when fully open. Here the damper must shut down to only 30% of 3m/s ÷ 3 m/s + 2 x(100 + 91) m/s = 4% free area.

The generalised equation relating all these factors is a development of the calculation above and may be expressed as follows:

$$\% \text{ FA} = \frac{\text{Min airflow} \times \text{BDV}}{\text{BDV} + \sqrt{(2 \times P / AD)}}$$

Where:

- FA = Free Area
- Min airflow is the design minimum expressed as a fraction of the maximum, probably 0.3.
- BDV is the basic duct velocity or, to be exact, the velocity of the air at the damper if it were fully open when the diffusers are all passing maximum airflow.
- P is the pressure reduction across the damper at minimum airflow.
- AD is the air density; 1.2 kg/m³ at sea level.

These calculations serve to show that, exceptional circumstances excluded, the RICKARD PCD will adequately fulfil its function. If an extreme situation arises, the damper may be unable to perform perfectly. In these extreme situations it will not be the PCD which is the weak link in the system. When a PCD is operating from 40% to 5% free-area the pressure controller is faced with a far more difficult task. Rather than having a control range on the PCD of perhaps 50mm actuator stroke, it must now control with far less. This means that the PCD responds to controller signals faster which reduce system stability.

NOTE: In the interest of clarity, two major effects have been neglected in these calculations:

1. It has been assumed that no static pressure is regained after a damper.
2. Where the velocity pressure to be destroyed through the damper has been converted to velocity, this velocity was simply added to the BDV, ignoring v² effects.

These two effects tend to cancel one another so the net result is the same.

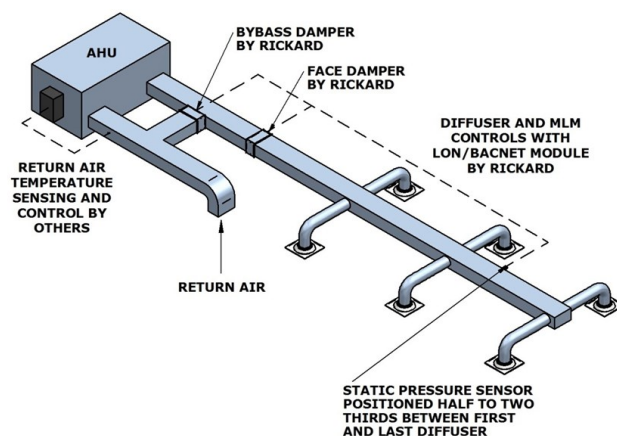
What is important to note from the above explanation is that dampers must not be oversized. If they are, the control may become unstable because the damper is trying to control around the last few millimeters of the stroke where a small movement gives rise to a relatively large change in the air volume. Also, when the damper is almost fully closed, the velocity across the controlling vanes is so high that it could create noise.

BYPASS DAMPERS

Bypass dampers are usually of the tight shut-off type because when the occupied space requires 100% of the supply air, the bypassed air must be reduced to as near to 0% as possible. For this purpose a sealing strip is bonded to each of the vanes.

When sizing a bypass damper, it must be borne in mind that if the diffusers are able to turn down to 30% of maximum air volume, then the bypass damper must be sized to handle 70% of the total supply air quantity. It is recommended that the bypass damper be sized using a maximum face velocity of between 4 and 5 m/s. At higher face velocities the pressure drop across the fully open damper will increase and could get to the point where insufficient air will escape through the damper, causing the static pressure inside the duct to rise above the level at which it has been set to control.

In some cases there is not enough space available to fit an adequately sized bypass damper. In this case it will be necessary to include a face damper to operate in conjunction with the bypass damper, as shown below.



TYPES

CONTROLS

Stand alone or MLM+

ACTUATION

Rickard builds its standard PCD's with a Lindrive Push-Pull Actuator. The Rickard controller supplies a 24VAC 3 point floating signal to control the Actuator. Alternatively a Push-Pull actuator by others may be specified.

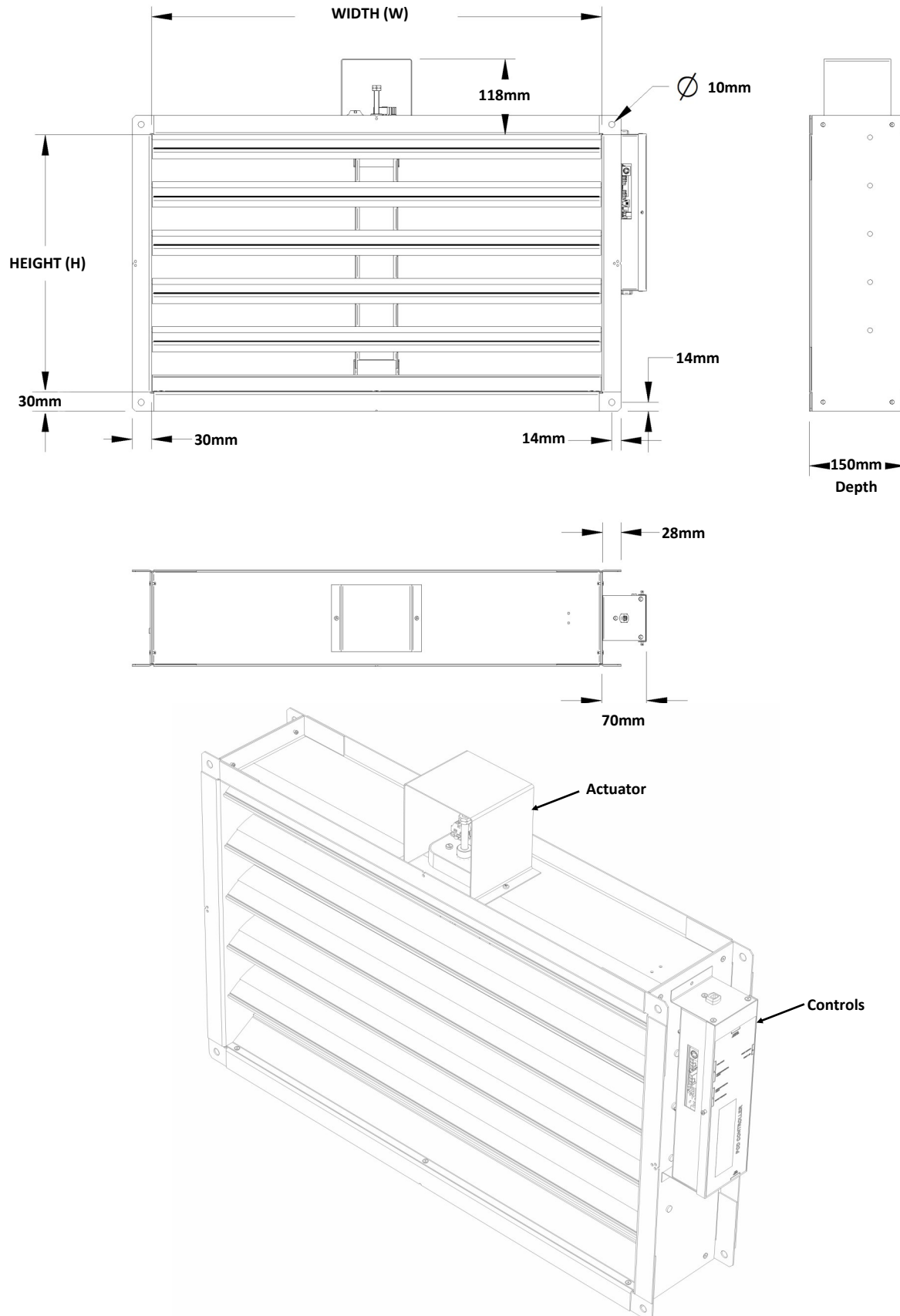
If a 0-10VDC signal is supplied, the Rickard PCD can be supplied with a Rotary Shaft to be driven by a Rotary Actuator by others.

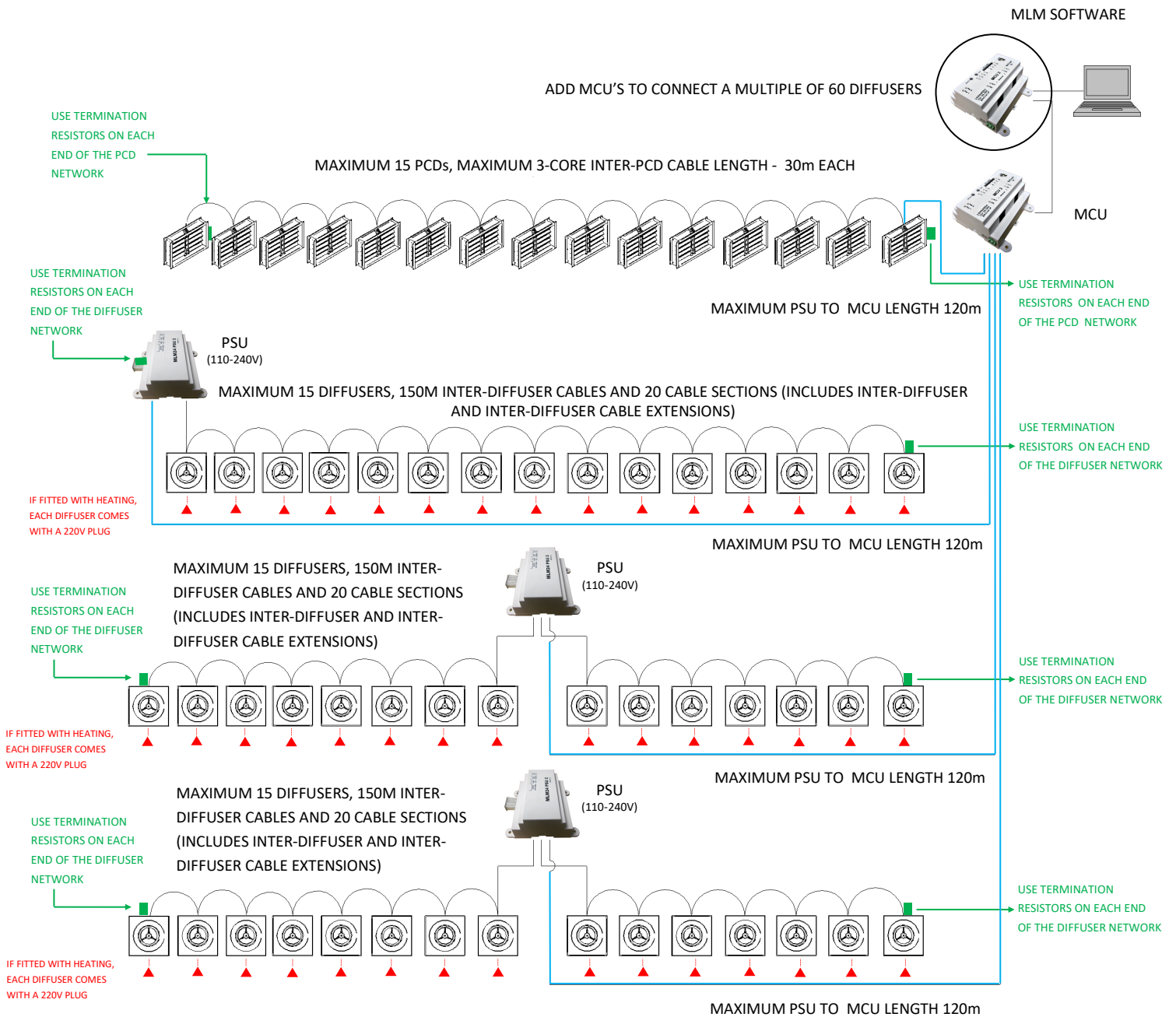
MOUNTING

Standard Flange Mounting: 30mm Flange with 10mm Corner holes for Duct attachment. The PCD can be mounted with the actuator on the top or bottom. Do not mount the PCD with the actuator on the side.

SIZING

200 (minimum width) x 200 (minimum height) x 150 (minimum depth)

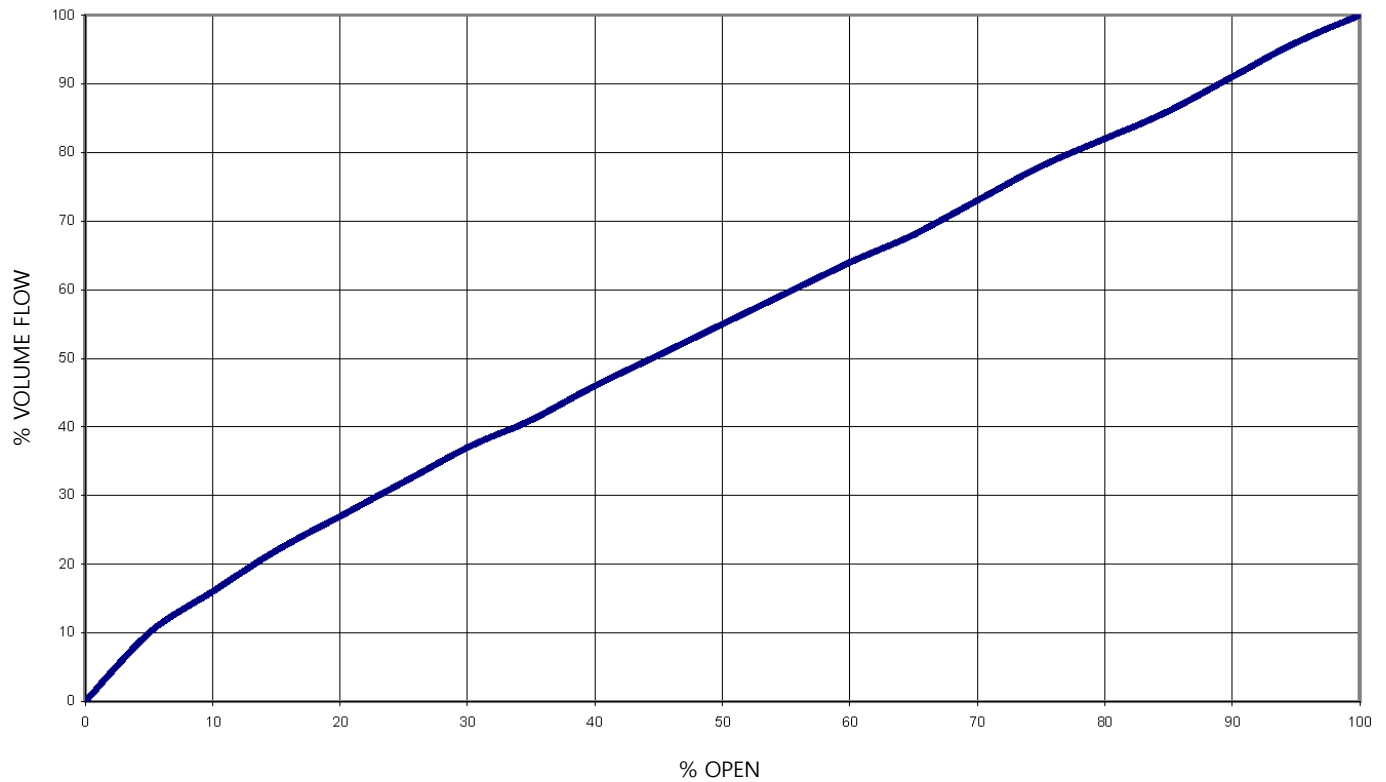




Graph showing the percentage volume flow versus the percentage open for a RICKARD Pressure Control Damper with a constant ΔP of 100 Pa. As can be seen, the air transfer characteristic is near-linear and is ideal for duct static pressure control. Opposed Bladed Dampers have a non-linear characteristic and do not give stable VAV pressure control.

RICKARD PRESSURE CONTROL DAMPER

% VOLUME FLOW vs % OPEN @ 100Pa



Noise data for a damper with a face area of 0,10m², in the fully open position.

VELOCITY (m/s)	PRESSURE DROP (Pa)	SOUND POWER LEVEL (dB)						dBA
		250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
3	7	18	18	17	15	8	-	21
4	11	24	24	23	21	14	2	27
5	18	30	30	29	27	20	8	33
6	26	34	34	33	31	24	12	37
7	36	38	38	37	35	28	16	41
8	48	41	41	40	38	31	19	44
9	60	44	44	43	41	34	22	47
10	72	46	46	45	43	36	24	49

Performance Data applies to Standard Air having a density of 1.2 kg/m³.