DIY Zoning: Dampers

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1. Equipment necessary

1.1. Servos and controllers

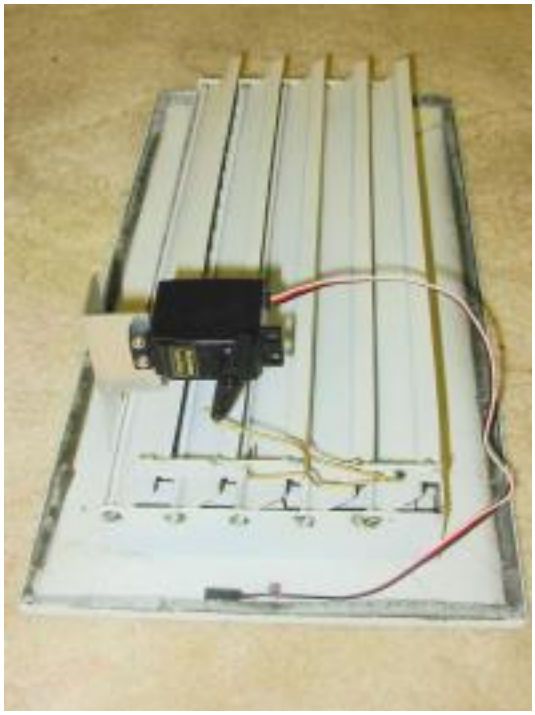
The way I decided to go was to use generic R/C servos and a servo controller with a computer interface. "Standard" servos like Futaba 3003 will do just fine. Phidgets seem to provide the most cost-effective servo controllers (*not anymore, but they're still the best design quality --vt Mar 16 2005*), and since I was writing drivers for them, I can a) vouch for the quality (Chester' s *really* thorough) and b) can fix the driver, if needed :)

1.2. Motorized registers

Generic way to modify the registers for computer control is pretty simple: throw in a generic $10 Futaba servo (S3003, to be exact), couple of pushrods, L-shaped aluminium piece, an extra screw and a nut, 15 minutes of your time - and you have yourself a damper.

There's nothing really complicated to it - loosen the register joints and lubricate them with a thick dust resistant grease (teflon based thick bicycle grease seems to work just fine).

This is how the modified register looks like (click to enlarge):



Compare: in existing zoning systems, the cost per room is anywhere between $600 and $1300, in this case, it is approximately $10 for a servo, and approximately $3 for a sensor, which makes it less than $20, if you count the price for all those small things in there.

Impressive, isn't it?

Initially, there were concerns about the longevity of this device - all in all, neither of the original components (the stock registers and the stock R/C servos) were intended to be used in "always on" mode...

Well, if two years of service are of any importance, here goes. The system was originally set up with five controlled registers, out of which:

- None ever failed.
- None exhibited excessive wind noise.
- No servos developed any growl - this is what I was most concerned about.
- One register developed a minor squeak at the end of one year period - fixed with the same grease that was originally used.
- All became quieter as the time passed - I guess, "break-in" occured.
- Minor dust accumulation was observed - but hey, how many times a year do you clean your registers? :)

Which makes it absolutely satisfactory.

Note:

The grease to be used with this device should not be easily contaminated by dust and oxygen. For me, teflon based thick bicycle grease worked just fine - it was intended to work in exactly the same conditions - exposed to air and dust, lubricating slowly moving parts.

Warning:

Keep in mind that using just the dampers without the control system makes little sense. Also, these dampers **can** work without a bypass valve - balancing and static pressure relief are achieved by the control system. This topic is covered in great depth as a part of the Technical FAQ.

1.3. Motorized Dampers

It is possible to use the servos to control not only wall registers, but the real dampers as well. Of course, you will have to have them installed (or having been installed) to begin with, but the procedure is essentially the same as with registers - a mount for the servo and a linkage from the servo horn to the damper control lever.

You may want to consider a higher torque servo for this purpose and/or experiment with the existing damper to see if a standard servo will work (for $10 for the standard servo and significantly higher price for high torque servos, money spent on the test sample will pay off - and you can return the test sample, too).

And of course, you may need to loosen the damper up and lubricate it (exactly as above).

1.4. Trunk Dampers

Ideally, the dampers must be installed as close to the plenum as possible (however, Honeywell recommends not to install them closer than 3 feet from the plenum) to reduce wind noise and minimize velocity loss.

It is possible to have forks in the ductwork, with parts of the plenum serving more than one zone and long runs between the fork and the supply registers.

For such cases, a stack of dampers may be advisable, with one damper installed next to the fork, and the rest installed at usual locations. For lack of better name, we'll call this construct a *trunk damper*.

1.5. Servo Calibration

It is possible that the full servo movement range will not match with the range required to move your damper from completely open to completely closed position. For such cases, servo calibration is available.

Note:
It is still recommended to design the dampers in such a way that full travel of the damper itself corresponds to 180 degree rotation of the servo - this will give you all available torque, otherwise, you'll be losing some of it (you'll have roughly `${your_range}/180`). So, for 90 degrees, you'll have half of it.

1.5.1. Range Calibration

Advanced controllers (like Phidgets) allow to preset the servo range exactly. This may give you more than 180° of servo travel (though 180° is as much as you'll realistically need).

1.5.2. Limit Calibration

Simpler controllers will not support range calibration. For these cases, it is possible only to limit the range of servo travel, not to extend it.

Note:
Range and limit calibration are mutually exclusive.

1.5.3. Angle Calibration

Servo movement is angular, but damper movement is linear. It may be advisable to transform one to the other, and the best result will be achieved if the servo start and end angle are specified in the configuration.

FIXME (VT):
Include link to servo calibration configuration section.

1.6. Power and signal delivery to the servos

Warning:
Make sure you provide adequate power and signal wiring, otherwise you'll have the servos growling and jittering.

I used 16 gauge speaker wires for ground and power, additionally, I've connected 4700uf capacitors next to the servos, and used servo boosters (see Reference Library for vendor

information). CAT-5 wire was used for signal delivery.

2. Verifying the installation

Now that you have the dampers installed, you need to verify that they work. Best way to do that is to start the ServoMaster debug console and shuffle the sliders.

3. Next Step

Now that you have the dampers working, it's a good time to install the software that controls them: the Core Logic.