# Contractor's Guide to Modulating Zoning to Eliminate Bypass and Improve Comfort in Residential New Construction

## Contractor Benefits

Modulating zoning uses modulating dampers to automatically adjust the distribution of heating and cooling to the upstairs and downstairs zones based on the zone temperatures. Some of the benefits of modulating zoning are shown below.

- Keeps the upstairs and downstairs temperatures within 2ºF.
- Bypass is eliminated because modulating zoning dampers never close.
- Discharge air temperature sensor is eliminated because discharge air temperature is not affected by modulating zoning
- Low power controls and damper actuators allow modulating zoning to be powered from the equipment 24VAC.
- Eliminates the need for a separate 24VAC transformer, electrical box and wiring required with conventional zoning.
- Materials for a modulating zoning installation is about half the cost of materials required for a traditional zoning installation.
- Installation labor is significantly reduced by eliminating the bypass duct and bypass damper, calibrating the bypass, eliminating installing a discharge air temperature sensor and a separate 24VAC transformer.
- Requires only one HERS test rather than three for traditional zoning.
- The simplicity of modulating zoning provides savings to the contractor and greatly simplifies installation.
- Airflow through the equipment, return air temperature and discharge air temperature are the same as when a thermostat controls the equipment and do not cause any degradation in equipment efficiency.
- Integrated thermostats with temperature control and modulating zoning.
- Stand alone modulating zoning controls that work with any simple or smart thermostat.

## Homeowner Benefits

The homeowner can enjoy more comfort and energy savings.

- Provides energy savings by reducing heating and cooling to unoccupied spaces.
- Provides energy savings by eliminating overheating and overcooling one space to make another space comfortable.
- Save energy at night by directing more heating or cooling to the upstairs sleeping space and less to the unoccupied downstairs living space.
- Delivering 30% more heating or cooling to the sleeping space at night can reduce equipment run time by 30% and save energy at night.
- Provides energy savings without degrading comfort.
- Automatic operation keeps the home uniformly comfortable.
- Focus comfort to an upstairs or downstairs office during the day.
- Easy upgrade to WiFi.

## Home Builder Benefits

The builder can be confident that buyers of their 2-story homes and 2 and 3-story town homes will be comfortable.

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## The Problem

In most 2-story homes without some kind of zoning, the upstairs is much hotter than the downstairs in the summer. Many homeowners see a 6 to 10°F difference in the upstairs and downstairs temperatures. In the winter the upstairs may be comfortable but the downstairs is cold.

## A Modulating Zoning Installation

A typical wired modulating zoning installation is shown in figure1 and is used for residential new construction. The thermostat monitors the downstairs temperature using its internal temperature sensor and monitors the upstairs temperature using the low cost temperature sensor. A modulating damper is installed in the trunk feeding the upstairs zone and another modulating damper is installed in the trunk feeding the downstairs zone.

## How Modulating Zoning Works

Every 2 minutes during a heating or cooling call, the thermostat compares the upstairs and downstairs temperatures. If the temperatures differ by 2°F or more, an adjustment is made to direct 2% more heating or cooling to where it is needed. The result is the upstairs and the downstairs are heated or cooled at the same rate and the home is uniformly comfortable.

## How Modulating Dampers Adjust Airflow

The modulating or variable position dampers continuously adjust the distribution of heating and cooling to the upstairs and downstairs based on need. To increase the cooling airflow to the upstairs, the upstairs damper is fully opened and the downstairs damper is partially closed as shown in figure 2. The thermostat adjusts the airflow every 2 minutes until it finds the airflow distribution that keeps the upstairs and downstairs comfortable.

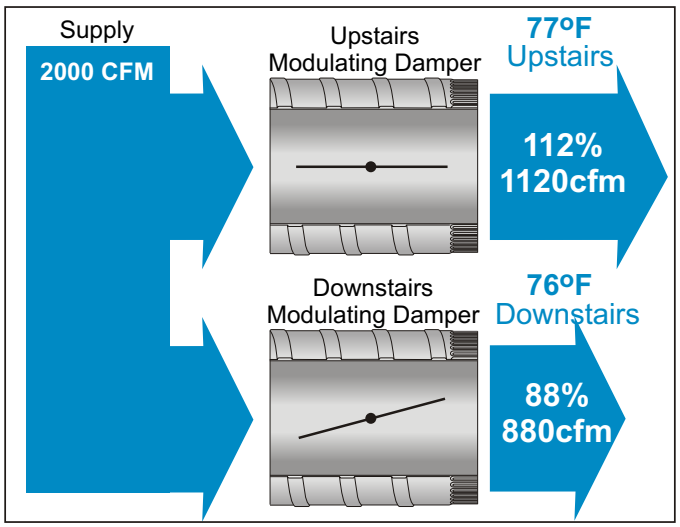


Figure 2. Modulating dampers directing more airflow or cooling to the upstairs.

In the winter more heated airflow is required downstairs. The downstairs damper is fully opened and the upstairs damper is partially closed. This forces more heating downstairs and less upstairs as shown in figure 3.

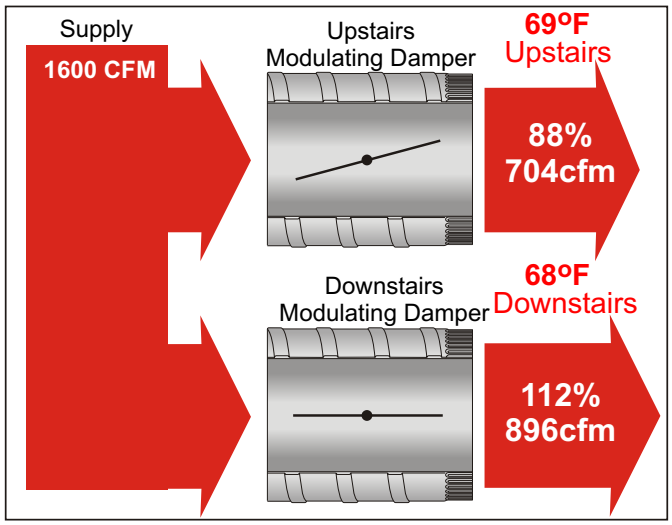


Figure 3. Modulating dampers directing more airflow or heating to the downstairs.

## Modulating Dampers

Dampers are available in Plug&Play and 3-wire models. Dampers use less than 2VA when positioning and 1VA when holding position and twice the torque of most spring return actuators.

The actuator uses a DC motor with electronic control for long life. Tested to over 9 million cycles. Low power allows controls to be powered using the equipment 24VAC.

## Unequal Upstairs and Downstairs Ducts

Modulating zoning is not affected by unequal upstairs and downstairs duct sizes. The control increases or decreases air as a percentage of airflow. An upstairs airflow of 112% indicates 12% more airflow is being directed upstairs. And similarly, a downstairs airflow of 88% indicates 12% less airflow is being directed downstairs.

## Affect of Modulating Zoning on Return Air Temperature

Modulating zoning has no affect on return air temperature. Unlike traditional zoning where excess airflow might be bypassed back to the return air plenum, there is no bypass and equipment operates at its rated efficiency.

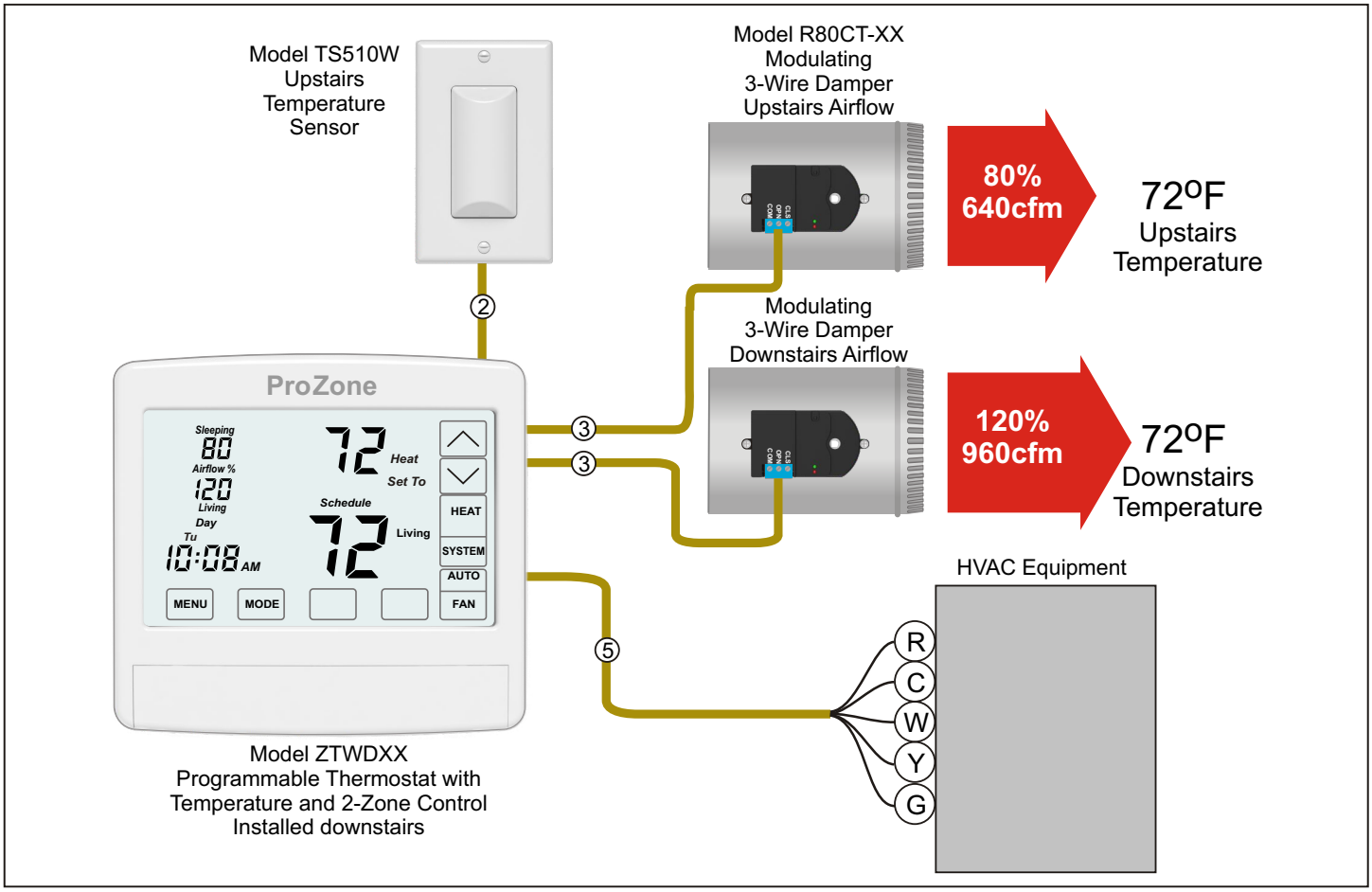


Figure 1. Integrated Temperature and Comfort control for residential new construction.

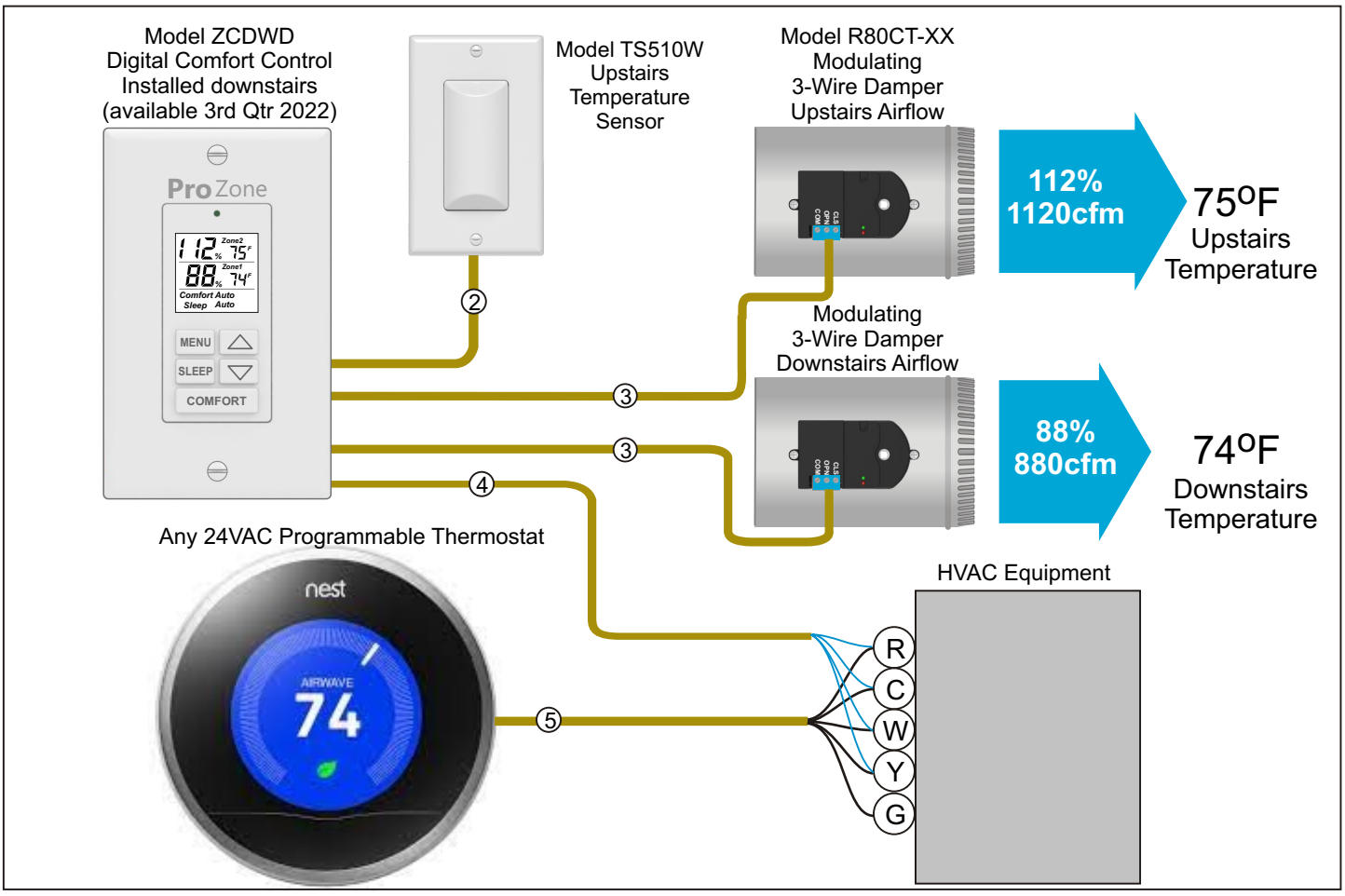


Figure 4. Comfort control for residential new construction.

## Affect of Modulating Zoning on Discharge Air Temperature

Modulating zoning has no affect on the discharge air temperature. This eliminates the need for a discharge air temperature sensor and eliminates the potential problem of rapid cycling the equipment found in traditional zoning.

## Affect of Modulating Zoning on Airflow through the Equipment

Modulating zoning has almost no affect on the airflow through the equipment. When airflow is modulated 30%, a 2 to 3% increase in airflow may be observed.

## Affect of Modulating Zoning on Duct Pressure

Modulating zoning has little affect on the duct pressure. When airflow is modulated 30%, a 4 to 6% increase in duct pressure may occur.

## Modulating Zoning and Smart Thermostats

Figure 4 illustrates a stand alone modulated zoning control that works with any thermostat. The thermostat controls the heating and cooling calls and the ZCDWD controls the distribution of heating and cooling.

## Wired Modulating Zoning Products for RNC Installations

A number of products are available for the residential new construction market that are about half the cost of traditional zoning, eliminate bypass and are much easier to install.

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ZTWD11, ZTWD21, ZTWD21WF
Programmable Thermostat with
Temperature and Airflow Control


TS10W
Temperature
Sensor

R80CT-XX 3-Wire
Modulating Damper

An integrated solution that controls heating, cooling and fan calls and controls the distribution of heating and cooling to the upstairs and downstairs zones.

- Wired modulating zoning for RNC.
- Integrated control of heating, cooling and fan and airflow distribution.
- Automatic or manual distribution of heating and cooling.
- Automatic or manual Night Comfort.

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ZCMWD
Wired 2-Zone Control


DC1
Damper Control


R80CJ-XX Plug&Play
Modulating Damper

A simple 2-Zone control solution that controls the distribution of heating and cooling to the upstairs and downstairs zones.

- Wired modulating zoning for RNC.
- Simple control of airflow distribution.
- Works with any 24VAC thermostat.
- Manual distribution of heating and cooling.
- Manual Night Comfort.

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Model ZCDWD
Digital Comfort Control


TS10W
Temperature
Sensor

R80CT-XX 3-Wire
Modulating Damper

A digital wall mounted control that controls the distribution of heating and cooling to the upstairs and downstairs zones.

- Wired modulating zoning for RNC.
- Control the distribution of heating and cooling to the upstairs and downstairs.
- Works with any 24VAC thermostat.
- Automatic or manual distribution of heating and cooling.
- Automatic or manual Night Comfort.

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These same products are available in wireless versions for replacement installations and eliminate having to install new wiring within the home.