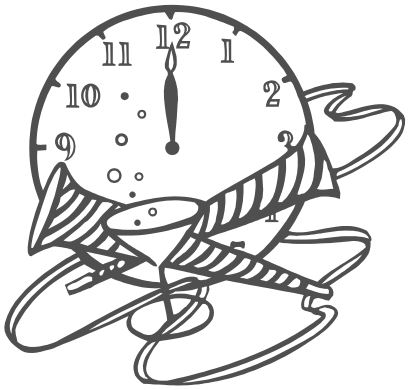
KW Electronic Service Inc.

VIESSMANN

VITOTALK

KW Electronic Service Inc. and Viessmann, partners in heating technology. Controls newsletter, February 2003, Issue 4



Happy New Year!

The upcoming year is going to be another very exciting one! There are lots of things planned for future issues of Vitotalk. We will be covering new topics and reviewing some old ones.

The feedback from past issues has been very positive. As always, if there are any ideas, please e-mail them to KWE.

It has been a while since the last issue of Vitotalk. This is primarily due to some personnel changes at KWE and the busy fall season. However, we endeavor to bring you usable information regarding controls, and how they work.

Have a great year!

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In This Issue:

IN THE MIX

The Vitodens has shown itself to be an extremely versatile boiler. Along with modulating the burner and control of pumping rates, of specific models, the addition of mixing valve controllers adds to the expandability and flexibility of this unique boiler.

Pictured above: Vitotronic 300 Mixing Valve with no Comfortrol interface.
Below shows complete controller accessories.

The most common mixing valve controller used on a single mixing valve Vitodens system is the *Mixing Valve Actuator Accessory Kit* (Vi P/N 7133 392). For the remainder of this article it will be referred to as *the 300MV Control.*

This kit is the same mixing valve control that must be used with the Vitotronic 300, KW3 boiler control. It looks physically similar to that of an HK1 unit, however, it does not have a front mounted Comfortrol display like that of the HK1.

The kit is supplied with a separate power cord, a 145 communication cable (with plugs) and a supply temperature sensor. The 300MV Control has a front mounted power switch and a pump output which accepts a Viessmann pre-wired pump. The 300MV Control communicates with the Vitodens boiler control using the 145 KM-BUS. Inside the controller, there is a dedicated 145 socket for the plug. The opposite end is wired into the Vitodens four terminal X5 plug. Terminals 3 and 4 are used to terminate this 145 KM-BUS connection.

Referring to the Vitodens wiring schematic, there are three options for the X5. 3 and X5.4 connection. It is possible to provide a connection for the 145 KM-BUS, 141 Viessmann 2-wire bus, OR a Solartrol connection.

Once the wiring is finished between the Vitodens and the 300MV Control, it is possible to visually verify the connection with the Comfortrol display. Open the Comfortrol door and select the *System Operating Status* from the various menu choices. Locate the

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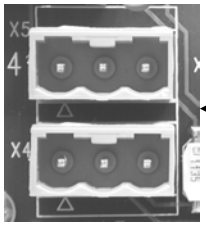
system scan codes and refer to scan 1 in the manual. Pay particular attention to the third and fourth digits. When the 300MV Control is properly recognized, the value will be XX06XX for the middle two scan digits. If these digit values are not visible in the scan, ensure that the correct system is programmed into the Vitodens. Ensure that the 300MV Control is powered on as well.

Vitodens boilers with the built-in variable speed pump will show XX07XX in the scan code display. Ensure that the proper manual is referenced to when working on the different models.

After the 300MV Control has been powered ON, it will perform a self-relay test. The mixing valve will actuate open, then closed and the pump will be cycled on and off. Once this test is completed, the valve will resume its normal control mode operation.



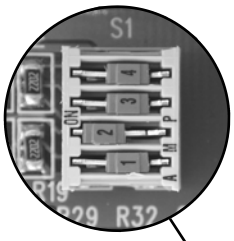
Above: On top 141 plug socket and on bottom 145 socket

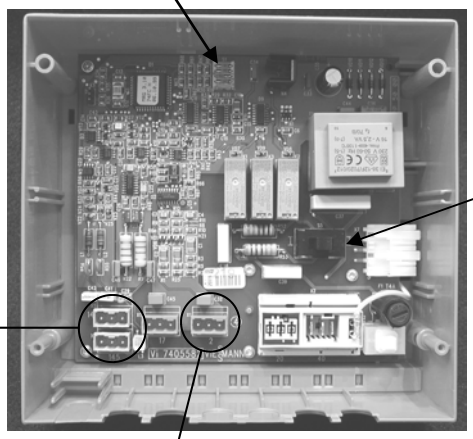
Along with the 300MV Control performing its own relay test, it is possible to do a manual relay test with the Vitodens Comfortrol. By entering the *Diagnostic Menu* through *Installer Setup*, proper valve position and pump operation can be verified. Be sure that you are testing for heat circuit B and not A. Unlike relay tests with the Dekamatik or Trimatik controls, do not rush the Vitodens relay test. The Vitodens needs a little time to communicate to perform the test that was selected.

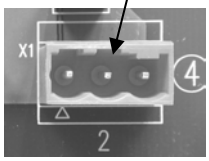
DIP Switch Settings:
A key to the operation of the 300MV control, in conjunction with the Vitodens, are the DIP switch settings. It is important to understand that because this mixing valve controller can be used with the Vitodens, or the Vitotronic 300, KW3 there are specific DIP switch setting requirements. Please reference the manual for alternate settings.

Inside of the 300MV Control, there is one 4 pole DIP switch. The switch is located towards the top of the unit in the middle They move horizontally from left to right. The first two DIP switches from the bottom, determine the type of communication between the 300MV Control and the Vitodens boiler.

When connecting the 300MV Control to the Vitodens, DIP switch 1 must be in the ON position and 2 must be in the OFF position. This switch configuration allows communication to take place using the 145







Supply sensor 2 plug socket for the mixing valve.

KM-BUS. The remaining two switches are left in the OFF, or rightmost position. Note the expanded view of the DIP switches shown.

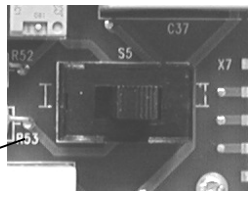
Operation:
The operation of the Vitodens, in combination with the 300MC Control kit is similar to that of the Trimatik-RN. The Comfortrol allows you to view all current temperatures, set points and output statuses. As well, the Comfortrol displays system information such as, boiler operation, heat circuit A (Low Loss Header if installed), heat circuit B (mixing valve) and DHW.

Heating curve adjustments are performed the same way as the Trimatik RN. Select the specific heating circuit and adjust the slope or shift values to achieve the desired result.

As with all Viessmann controls, the boiler set point is based on the highest calculated value from heat circuit A, B, external call for heat or DHW. The adjustable differential setting will ultimately, be added to the greatest set point temperature. The burner will be cycled and modulated to satisfy the set point temperature.

Heating circuit A will allow the Vitodens to satisfy a high temperature supply requirement. These would include such zones as high temperature baseboard or fan coil units. The assumption is made that the heating curve A will be set above that of heating circuit B.

Heating circuit B is responsible for the operation of the 300MV Control. All heating curve adjustments and viewing of set point and actual temperatures are carried out here.



Rotation selector

When commissioning a system with a mixing valve actuator kit, it is necessary to check the proper rotation of the mixing valve. If the valve is found to be opening instead of closing, the direction of the valve must be changed.

Within the 300MV Control, there is a two position switch that allows the mixing valve direction to be reversed. The position of this switch is dictated by how the mixing valve was plumbed. To change the rotation, slide the switch to the opposite position.

The Sun/Moon settings on the front of the Comfortrol affect set point calculations for both A and B heating circuits. Unless a remote Comfortrol or WS/RS sensor is used for the B circuit, a change in Sun/Moon position will recalculate the set point temperature for both circuits. Do not confuse this Sun/Moon adjustment as a parallel shift. It is the WWSD point.

When a remote is installed, whether a WS/RS or Comfortrol, it will be assigned automatically to the B circuit.

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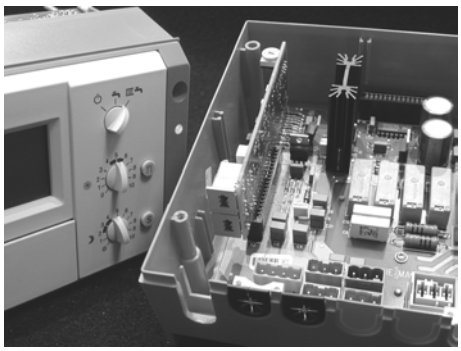
It should be noted that using a remote on high mass systems, such as radiant floor, can cause fluctuations in room temperature and thereby affect your customers comfort. See appendix *A* included in this issue of **VITOTALK**.

RECAP:

- Layout 000:002 w/o DHW
  000:003 w/DHW
- Communication wired into X5.3 and X5.4 in Vitodens. Opposite end of communication wire is plugged into 300MV Control in 145 plug terminals 1 and 2.
- Dip switch 1 ON and 2, 3, and 4 OFF in 300 mixing valve controller.
- Strap-on sensor installed.
- Power switches ON for both Vitodens and 300MV Control.

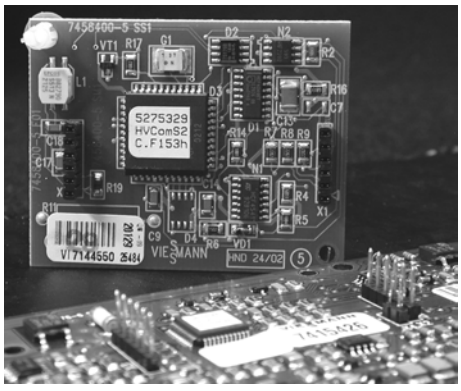
All Mixed Up:

At this point, you may be asking yourself "*Well, what if my customer wants more mixing valves*". The answer to that question is a three letter acronym—HK1. Specifically, the HK1 wall mount (Vi 7133 369) or mixing valve mount (Vi 7133 372) with a communications module.



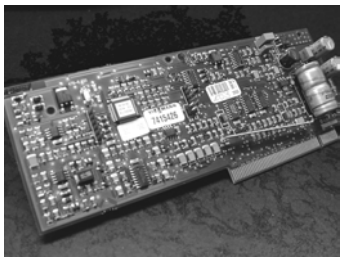
Above: HK1 shown with communication board at left of unit plugged into motherboard

Systems employing more than two mixing valves may require a Vitocontrol Custom Panel. The panels help to consolidate all control function into a single unit with an unlimited selection of options.



Pictured above: Expansion board for communication. Female terminals for connection to VR20 shown above.

Along with the HK1 having a communication module, a similar module is installed in the Vitodens boiler. This extra "Expansion" module (Vi 7134 276) piggybacks the VR20 board and converts the KM-BUS to 141 Viessmann 2 wire BUS communications. The terminal connections within the Vitodens stay the same—X5 plug terminals 3 and 4. Once the new Expansion Module is installed and the Vitodens is powered ON, the new device will be automatically detected. To verify this, look at the scan codes in the *System Operating Status* from the Vitodens Comfortrol menu choices.

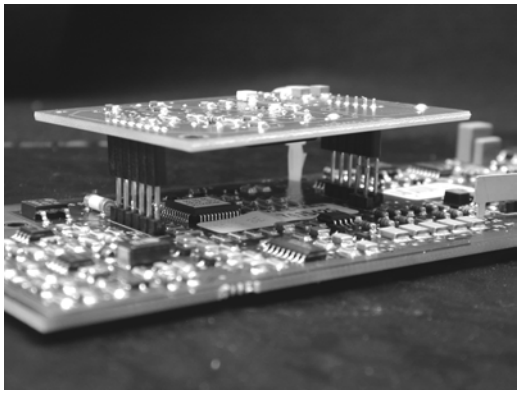


Above: VR20 board from boiler

It is very important to note that the previous scan codes visible in scan 1 have now changed and reverted back to their original scan readings. The smaller Vitodens with the variable speed heating circuit pump will show a value of XX03XX. The larger Vitodens will display a status scan of XX02XX. It must be noted that the 300MV Control is only recognized when connected to the KM-BUS and not the 141 Viessmann 2 wire BUS.

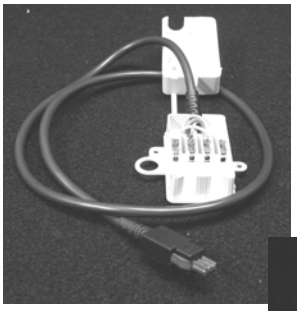
When the 141 Expansion Module is detected by the Vitodens, the scan codes will again change. The last digit of scan 2 indicates the presence of the 141 Expansion Module. The value displayed must be a 1 and not a 0. The second place digit in scan 2 indicates the number of participants on the 141 Vi-BUS. In other words, the second digit will show the number of controls that are communicating with one another. A Vitodens with a HK1 and a 300MV Control will show 3 as the second place digit.

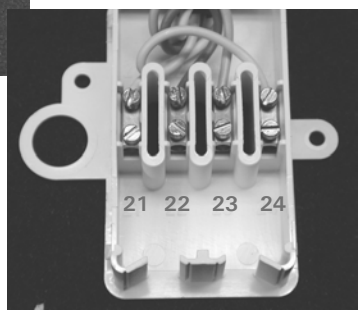
For the 300MV Control to communicate properly with the newly added mixing valve circuit, a few simple changes must occur.



Pictured above: Expansion board for 141 communication connected to VR2 taken from Vitodens inside of control.

1) The wire in terminal 2 of the 145 plug is moved to terminal 3.
2) The communication plug must be moved from the 145 socket to the 141 socket.
3) The first DIP switch must be put into the OFF position (all dip switches are now in the OFF position).
4) The 300MV Control is connected to the 141B of the HK1 mixing valve control.





Terminals shown inside of RIKO. Note 21 to 24 from left to right.

As mentioned earlier, the wire connection for the 141 Viessmann 2 wire BUS remains the same in the Vitodens. Vitodens terminal connections X5.3 and X5.4 are wired into a RIKO plug. The wires from X5.3 and X5.4 are connected to RIKO terminals 23 and 24 respectively. Once the RIKO plug is wired, then plug it into the HK1 control.

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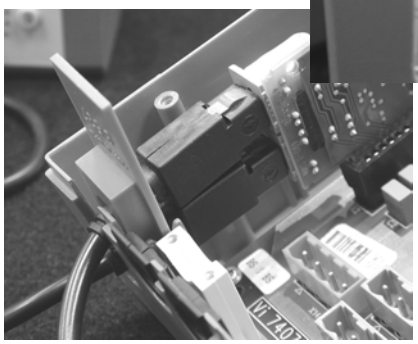
The RIKO wiring adapter is plugged into the 141A of the HK1 mixing valve control. In the case of a HK1, the 141A receptacle is closest to the motherboard.

Communication connections to the 300MV Control come out from the 141B receptacle in the HK1. Again, the wires are terminated into terminals 23 and 24 in the second RIKO plug adapter.

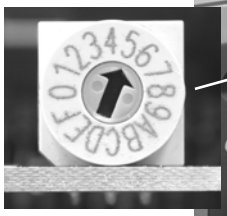


Pictured above: RIKO plugs inserted into communication board in HK1. Note 141A is bottom plug closest to motherboard. The 141B is above 141A.

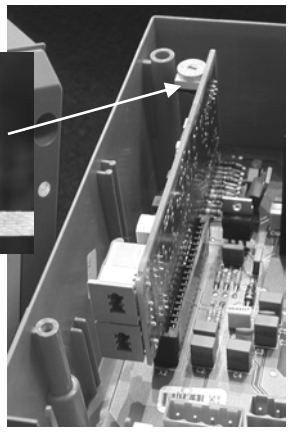
Ensure that communication wires are not crossed during these critical connection steps between the devices.

If during the start up of a Vitodens, with multiple mixing valves, a communication fault is encountered, check all the wiring. It is very important that the polarity is not reversed between the devices. Communication faults that may be displayed are *EO* or *Fault Viessmann 2-wire BUS*.

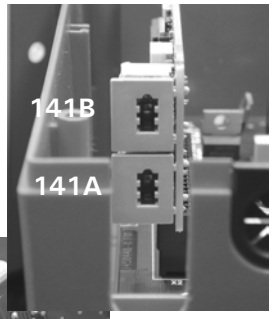
Common causes for communication errors are the position of rotary address selectors, improper DIP switch selection, incorrect system coding as well as improper wiring practices. Take a moment to double check all terminated connections or spliced wires.



Address Settings:
When multiple controls communicate together, they must each have a dedicated address. This is achieved by the adjustment of a rotary dial selector. This dial can be seen in all Dekamatik boiler controls as well as mixing valve controls.



The rotary dial selector for the HK1 is under the front panel which houses the Comfortrol display. By loosening the two bottom cover screws and two screws located on either side of the Comfortrol, this board may be accessed.



First, remove the bottom cover which houses the square power switch button. Then, pull the front section off of the HK1. Inside you will see the motherboard and the communication board. The communication board is plugged into a long socket on the left side of the motherboard. The rotary dial selector is mounted at the very top and has a factory setting position of 4. The newly added HK1 connected to the Vitodens must be set to position 5.

HK1 Coding:
The HK1 mixing valve control can be a stand alone unit with it's own outdoor sensor. The beauty with having it communicate on the 141 Viessmann 2 wire BUS is the elimination of multiple outdoor sensors.

When the HK1 has been installed and all the communication wiring checked, turn the power ON. A fault may appear in the screen of the Comfortrol with respect to the absence of the outdoor sensor. Access Coding 1 through the Installer Setup menu. Press the A button and continue forward through to the outdoor sensor option screen. You will be asked to select an outdoor sensor option. Rotate the dial until "no OTS" appears in the screen and press "D". Once the D button is pressed the word "Transferred" will appear and the HK1 will know to look on the 141 Viessmann 2-wire BUS for the outdoor temperature. Close the Comfortrol door and the current temperature should be displayed. It is possible to make this change within Coding Level 2. Address 57 can also be changed from its factory setting to program the control to look for the sensor on the BUS. Refer to manual for details.

Status Coding:
Like every Viessmann control, it is possible to view the scan statuses by accessing the *System Operating Status* menu option. Looking at scan 2 in the HK1, it is possible to verify the presence of the 141 Viessmann 2-wire BUS communication module.

The second place digit is an identifier of bus communications and the HK1's location on the BUS. The 2nd place digit is based on the value selected with the rotary selector dial. Duplications with respect to rotary dial selection settings are not allowed.

Operation
The operation of the HK1 is no different than it would be if it were a stand alone unit. It must be understood that all functions that govern the operation of the HK are controlled by its own Comfortrol and not that of the Vitodens. This includes Sun/Moon settings, relay tests, scanning sensors, coding changes or any other function that is specific to the HK unit.
The only true difference is the inability of a manual relay test on the 300MV Control. To compensate for this, make adjustments in the heating curve and/or slope to recalculate the set point temperature. The recalculation of set point up or down will cause the mixing valve to open or close depending on the actual temperature value.

With respect to boiler temperature calculations, the Vitodens knows it has to satisfy the greatest temperature set point. Having the mixing valves communicate as a whole, as opposed to stand alone units, the system is assured the Vitodens will meet set point demands.

It was previously mentioned that the 300MV Control rotation could be changed with a switch. In the case of

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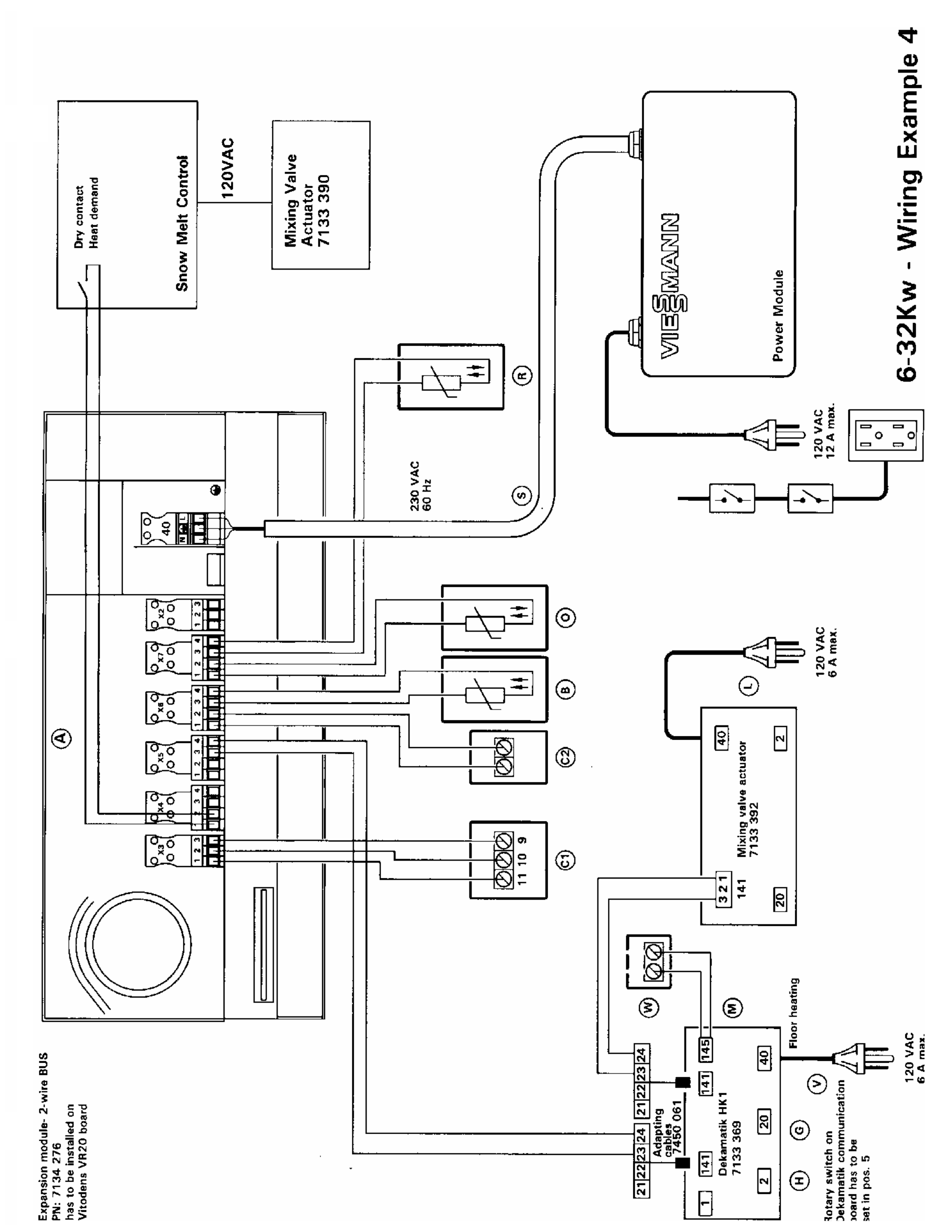
the HK1, the rotation can be changed with a coding adjustment instead of a mechanical switch. Address 008 has a factory default value of 000. This indicates that the supply is from the left, whereas, changing the value to 001 changes the supply to the right. Once the coding change is made, the valve will rotate in the opposite direction. Verify the correct direction with either a relay test or set point adjustment.

Schematic:
The drawing below shows the schematic of a Vitodens connected to a HK1 mixing valve control as well as a 300 mixing valve controller.

Until now, the issue of communication wiring has been the primary focus. Note on the schematic that the Vitodens and both of the mixing valve controls are also plugged into a standard wall receptacle. Depending on the proximity of all these devices, a double duplex receptacle could be installed or an individual receptacle for each unit.

Please also note that depending on local codes or requirements, a low water cut off for the Vitodens may need to be installed. This being the case, the same outlet that the Vitodens is plugged into, that is switched by the LWCO, may also supply power to either mixing valve control. This may affect future trouble shooting issues. **V**



Appendix A

The operation of a Vitodens boiler and/ or mixing valve, is based on satisfying a supply set point temperature. This calculated temperature compensates for the structures heat loss.

The heat loss is dependant on the R value of the structure. The loss is fundamentally controlled by the materials used for construction. It must be understood that heat is removed from a structure, whether a house or commercial building, based on the temperature differential between the outside and inside space.

To compensate for this loss, a system of supplying heat to the interior space is implemented. Obviously, our focal point is Hydronics and its related systems.

Physics dictates that heat moves from hot to cold. As heat is released into a cold room, the room temperature will be gradually increased. The transfer of heat from the hotter supply to the now warmer room starts to decrease. The decreasing heat transfer impacts the amount of heat taken from the supply water. In turn, the return water temperature to the boiler or mixing valve starts to increase.

The boiler or mixing valve control sees the increase in supply water temperature and starts to modulate the burner or mixing valve to maintain the set point. This cycle of heat transfer occurs 24 hours a day, 7 days a week, 365 days a year.

The terminal room temperature set point is dependant on the selection that has been made with WWSD, slope and shift settings. These settings are the primary factors how boiler and mixing valves work together.

If a remote Comfortrol, or RS sensor, is installed in the space, the operation of the boiler or mixing valve is now modified by the actual room temperature feedback. It is a natural assumption that the room temperature swings would be kept to a minimum, with this added feedback. However,

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there are numerous factors that need to be looked at first.

The nature of radiant floors or high mass systems dictates that everything that comes in contact with the floor, is heated to the floor temperature. This transfer of heat is known as *Conduction*. The physical property of conduction states that the transfer of kinetic energy, from one molecule to another, will occur. This is assuming that the two bodies are in contact with one another and a temperature differential exists between the bodies.

The heat capacity of concrete is almost 1700 times greater than air.

The heat capacity of water is more than 3400 times greater than air.

Given the same temperature rise in each material.

It must also be understood that different materials have their own thermal resistances. Thermal resistance is the ability of an object or material to resist the transfer of heat. However, given enough time, there becomes a point at which everything in the room reaches a thermal equilibrium (steady state). In other words, the solid oak table in the middle of the room will take longer to heat than the metal table, but there becomes a point at which they are the same temperature.

The opposite of this is also true. The same two pieces will radiate heat at different rates. The willingness of the oak table to give off its heat differs to that of the metal table. This is obviously dependant on the temperature differential between the two pieces, the surrounding air and the bodies they come in contact with.

Assume for a moment, a customer calls and asks if there is a room thermostat option for their new radiant system. They want to install it in the family room of their all single mixing valve radiant house. The suggestion that adding a RS room sensor is given and they would like to add it to their system. A few weeks go by and they again phone to complain they are getting swings of temperature.

Scenario:
When the room sensor detects the room temperature is above the calculated set point, the valve will be modulated closed. At this point, there is no heat being put into the house. Lets also assume the room is moderately influenced by solar gain through some adjacent windows or skylights in the next room.

The room temperature must drop below the set point before the mixing valve starts to open. For this to happen, the added solar gain energy must be used, the floor and all the furniture inside of the room, must be at a point where they cannot give off anymore heat. Maintaining room temperature will start to be difficult. The room has cooled sufficiently for the sensor to detect the drop in temperature.

At this point, the mixing valve starts to modulate open to allow hotter water to be supplied to the house and floor. Keep in mind, the room is still cooling down all the while heat is being allowed into the tubing of the floor. There will become a point at which the floor starts to raise the room temperature. However, the room temperature must increase enough for the room sensor to detect an increase enough to start modulating the valve closed.

...like taking a mouthful of water from a fire hose...

As was mentioned earlier, the floor will conduct heat to everything that it comes in contact with. Once the set point has been reached, the mixing valve will close and the whole process will start once again. Keep in mind that this is the only mixing valve in the house. What about the other rooms? How are they affected by geographical house positioning? Number of stories of the house? Shading of trees? Care to do any calculations on how the floor is going to respond based on water temperature, spacing of tubing, material of floor, thickness of the floor, floor coverings, furniture within the room, solar gain, internal gains.....

What's the answer?:
Arriving at an answer is to understand the house as a whole. Do not focus on "*that thing that makes heat, sitting in the corner*", but rather, from a system point of view.

Each stage of the system is designed for a specific purpose. The stages are intertwined to provide whole system control. The boiler provides heat to the mixing valves. The mixing valves supply heat to zone headers. The zone headers are controlled by thermostatic valves. The thermostatic valves are controlled by room sensors. Connecting the boiler directly to the zone headers is like taking a mouthful of water from a fire hose. Can the boiler supply just enough heat for the zone? Of course it can, but how does it impact the other systems within the *whole* house.

Proper room sensing is key to the operation of the *individual* zones. Select controls that provide the best performance. Instead of just sensing air temperature with an ON/OFF thermostat, choose the best combination of stat and zone valve. Select stats that pulse the actuator in response to the amount of deviation from set point temperatures. Allow the thermostatic valve to modulate the flow throughout the header into the flooring. Keep in mind, the less heat that is put into the zone, the more heat that is returned to the valve and the valve will respond as necessary. If there is another zone or area of the house that needs the heat, the mixing valve action will provide it.

When making selections for retro-fit or new installations, consider response time cast iron rads, fin tube base board, fan coils and not just high mass floors. Remember, do not expect a device to operate any other way than for which it was designed. **V**

Look forward to future informative issues of VITOTALK!