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| HVAC Controls | Electric Actuators | Actuated Valves |
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Setting the Stages

Electric Heater Stage Configuration

There are many ways to control an electric duct heater: modulating (0-10Vdc), pulse (24Vac or dry contact), On/Off (24Vac) or stages. In this document we will consider on/off or staged control.

Stages are a series of On/Off outputs (inputs to the heater) that increase the heater capacity with each step activated.

On/Off or staged heating can be achieved with TRIAC or Digital (Binary) outputs. Each stage requires its own output meaning that you require 4 TRIACs or Digital outputs to control a 4-stage heater. In addition to the physical output requirements, they must be configured to allow the controller to take action:

- Ramp
- Signal Type
- Activation Percentage
- Deactivation Percentage

The **Ramp** identifies the purpose of the output. Most of our controllers offer two distinct ramps (Heating Ramp 1 and Heating Ramp 2). When configuring stages, it is important to remain on the same ramp for all the outputs since each ramp has its own proportional and dead band. This means that if the first stage is configured on Heating Ramp 1, all the other stages should be configured on Heating Ramp 1. Note that Heating Ramp 2 is mostly used as reheat for dehumidification sequences.

The **Signal Type** defines the signal required to operate the electric heater. This configuration is only available when using TRIACs. When configuring digital (binary) outputs, the signal is automatically On/Off.

The **Activation Percentage** or referred to as "Close Position" in Neptronic controllers, defines the demand level at which the stage is activated. The Close Position must be seen from a contact point of view. There are many possible configurations, which will be demonstrated later. Note that the lowest configurable Close Position value is restricted to 15%.

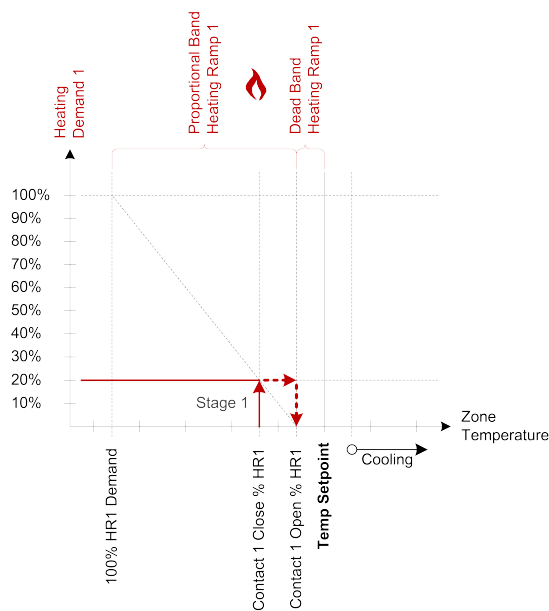
The **Deactivation Percentage** or referred to as "Open Position" in Neptronic controllers, defines the demand level at which the stage is deactivated.

As mentioned previously, stages can be configured differently and is a matter of preference. Below are examples of values that can be used to set-up stages. Note that Heating Ramp 1 was used in these examples but Heating Ramp 2 can be used as well.

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1 Stage Heating using TRIAC Outputs

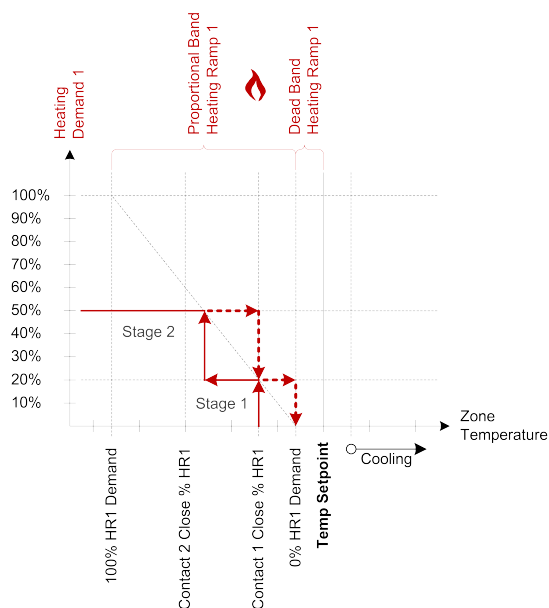
- TRIAC output ramp will be set to Heating Ramp 1 (HR1).
- TRIAC signal type will be set to On/Off.
- TRIAC Close & Open Position will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%

1 Stage Heating using Digital/Binary Outputs

- Digital/Binary output ramp will be set to Heating Ramp 1 (HR1).
- Digital/Binary Close & Open Position will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%



2 Stage Heating using TRIAC Outputs

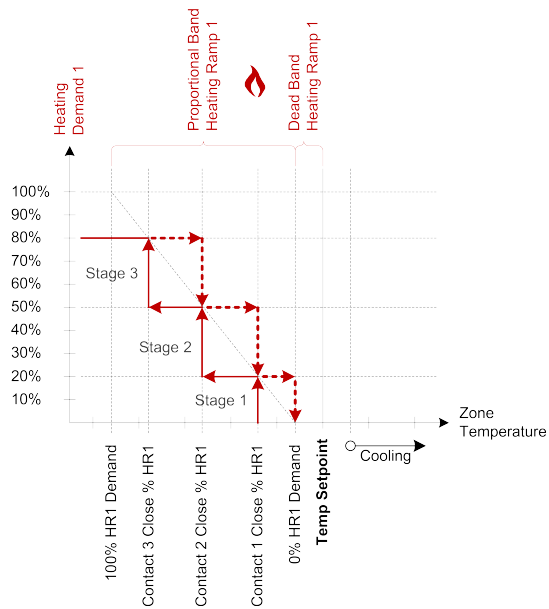
- TRIAC output ramps will be set to Heating Ramp 1 (HR1).
- TRIAC signal types will be set to On/Off.
- TRIAC Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	50%	20%

2 Stage Heating using Digital/Binary Outputs

- Digital/Binary outputs ramp will be set to Heating Ramp 1 (HR1).
- Digital/Binary Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	50%	20%



3 Stage Heating using TRIAC Outputs

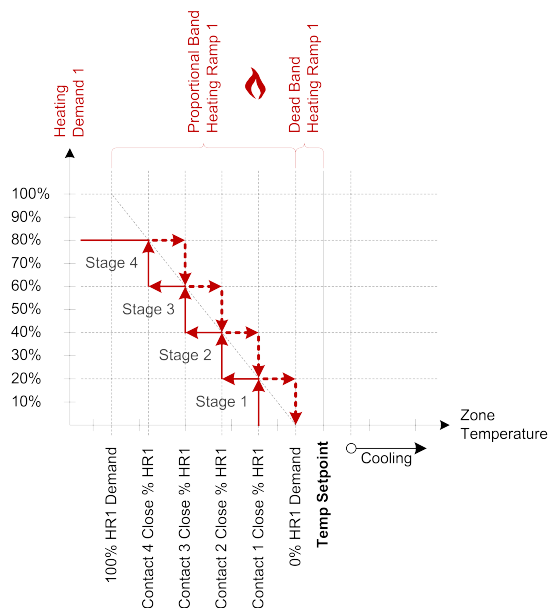
- TRIAC output ramps will be set to Heating Ramp 1 (HR1).
- TRIAC signal types will be set to On/Off.
- TRIAC Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	50%	20%
3rd Stage	80%	50%

3 Stage Heating using Digital/Binary Outputs

- Digital/Binary outputs ramp will be set to Heating Ramp 1 (HR1).
- Digital/Binary Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	50%	20%
3rd Stage	80%	50%



4 Stage Heating using TRIAC Outputs

- TRIAC output ramps will be set to Heating Ramp 1 (HR1).
- TRIAC signal types will be set to On/Off.
- TRIAC Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	40%	20%
3rd Stage	60%	40%
4th Stage	80%	60%

4 Stage Heating using Digital/Binary Outputs

- Digital/Binary outputs ramp will be set to Heating Ramp 1 (HR1).
- Digital/Binary Close & Open Positions will be set as follows;

Stage	Close %	Open %
1st Stage	20%	0%
2nd Stage	40%	20%
3rd Stage	60%	40%
4th Stage	80%	60%

The same principle can be applied to cooling by replacing the output ramps to Cooling Ramp 1 or 2. Just remember to keep the stages on the same ramp.