INTERMITTENT FAN POWERED BOXES
SUBZONED WITH THERMA-FUSER™ VAV DIFFUSERS

BACKGROUND

Intermittent fan powered boxes are also known as fan powered induction boxes, parallel fan powered boxes, primary bypass fan powered boxes, and powered induction units (PIU). They provide VAV to the conditioned space when cooling and constant volume when heating. Continuous fan powered boxes are different and subzoning them is covered in another chapter.

GOALS

The goals of applying Therma-Fuser™ diffusers in an intermittent fan powered box system may include:

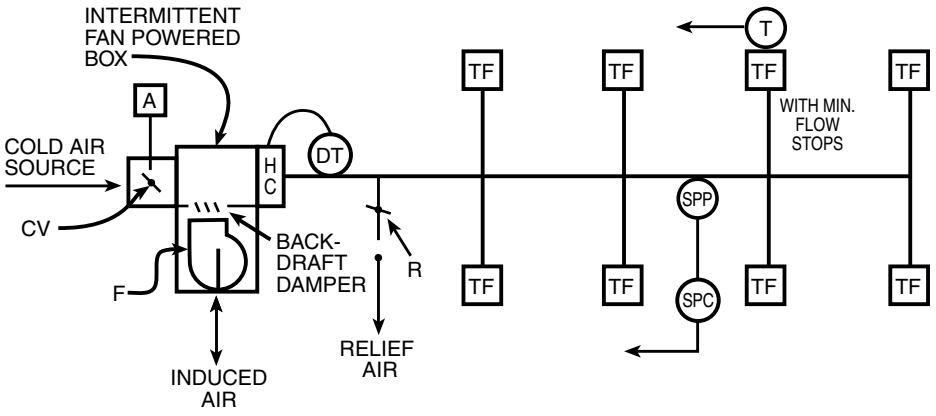
1) **Individual temperature control.** An intermittent fan powered box that serves more than one space may become a master zone which is subzoned with Therma-Fuser diffusers to provide individual room temperature selection and control.

2) **Vastly improved air distribution** is provided by variable aperture Therma-Fuser diffusers as contrasted to VAV supplied through fixed opening diffusers, especially at low air volume. Therma-Fuser diffusers allow modulation down to perhaps 10% maximum air volume with air distribution quality that fixed opening diffusers provide at 50% flow.

3) **Eliminate the problem of keeping air flow balanced** to all diffusers at all flow levels inherent to VAV systems which serve multiple outlets from a single terminal

4) Additional **energy savings** from not overcooling or over heating any of the rooms in the Therma-Fuser subzones.

(Continued)



LEGEND

HC:	**HEATING COIL. CONTROL VALVE (HOT WATER OR STEAM) OR ELECTRICAL CONTACTOR(S) ARE NOT SHOWN.**
CV:	**COLD AIR VALVE.**
A:	**ACTUATOR POSITIONING CV. MAY USE ACTUATOR IN TERMINAL.**
F:	**FAN.**
R:	**RELIEF AIR DAMPER AND ACTUATOR. SEE STATIC PRESSURE CONTROL FOR OTHER OPTIONS.**
TF:	**TYPE HC THERMA-FUSER DIFFUSER. OPTIONAL TF-HC-R (THERMA-FUSER WITH R-RING BY PASS). SEE STATIC PRESSURE CONTROL.**
T:	**ROOM THERMOSTAT. HEATING/COOLING WITH ADJUSTABLE DEADBAND. LOCATE IN MOST CRITICAL ROOM.**
DT:	**DISCHARGE THERMOSTAT TO CONTROL HEATED AIR. SET NO HIGHER THAN REQUIRED FOR HEATING NEED, BETWEEN 80°F / 26.5°C AND 120°F / 49°C.**
SP:	**STATIC PRESSURE CONTROLLER. MAY BE DIFFERENTIAL PRESSURE CONTROLLER EXISTING IN PRESSURE INDEPENDENT BOX. SET ABOUT 0.20"wg / 50Pa.**
SPP:	**STATIC PRESSURE PROBE. LOCATE ABOUT MIDWAY IN DUCT RUN.**

SEQUENCE OF OPERATION FOR SPECIFIC ROOM TEMPERATURES AT T

T	CV	FAN	HEAT	R
WHEN ROOM TEMP. IS **ABOVE COOLING SETPOINT**	CLOSES WITH INCREASED STATIC PRESSURE	OFF	OFF	CLOSED
WHEN ROOM TEMP. IS **BELOW COOLING SETPOINT**	CLOSED	ON	OFF	OPENS WITH INCREASED STATIC PRESSURE
WHEN ROOM TEMP. IS **BELOW HEATING SETPOINT**	CLOSED	ON	**ELECT. HEAT** ON WHEN DISCHARGE AIR TEMP. BELOW DT SETPOINT **H.W./STEAM VALVE** OPENS WHEN DISCHARGE AIR TEMP. BELOW DT SETPOINT	OPENS WITH INCREASED STATIC PRESSURE

acutherm™
The Individual Temperature Control People

INTERMITTENT FAN POWERED BOXES SUBZONED WITH THERMA-FUSER™ VAV DIFFUSERS—*continued*

METHOD OF UPGRADING

Each room will be equipped with one or more type HC Therma-Fuser diffusers. The intermittent fan powered box becomes the master zone which supplies heated or cool air to the Therma-Fuser subzones.

It is assumed that the existing system has an effective constant temperature cold air supply control at the cool air source and some form of static pressure control at the central fan.

Discharge thermostats control heated air supply to prevent excessive supply air temperature whether heating is steam, electrical or hot water. They also assure that heated supply air temperature is warm enough to change the Therma-Fuser diffuser to the heating mode.

SUPPLY AIR TEMPERATURE CONTROL

Note: BMS controls use sensors instead of thermostats. ***Control from BMS sensors located where thermostats are shown.***

Room thermostat, T, serves to select the mode: either cooling or heating. Heating coil, HC, is controlled by discharge thermostat, DT.

For room temperature **above the cooling set point of T**, cold air valve, CV, is modulated by static pressure controller, SP, the relief damper, R, is closed and both the fan, F, and heating coil, HC, are off.

As room temperatures drop **below the cooling setpoint of T**, cold air valve, CV, is closed, fan, F, is on, relief damper, R, is modulated by static pressure controller, SP, and the heating coil, HC, is off.

A continued temperature drop below the heating setpoint of T activates discharge thermostat, DT, which controls heating coil, HC. It is desirable for heated air to be supplied at a temperature (1) no higher than required to meet the heat loss of the space (lower temperatures mean less stratification), (2) high enough to accomplish TF changeover (80°F / 26.5°C or above), (3) not high enough to impair TF sensing of room temperature (less than 120°F / 49°C). We recommend that DT be set to accomplish these goals.

Use a Therma-Fuser diffuser with minimum flow stops in the room with the thermostat. The room thermostat can be located in the return air opening of the specific room to put it out of reach from continual readjustment.

STATIC PRESSURE CONTROL

The sequence shown has static pressure control when the fan, F, is on using relief damper, R. **Instances when R may not be required are:**

1) Turndown of the intermittent fan powered box master zone of 30% or less.
2) Fan, F, is not capable of generating sufficient static pressure to make the Therma-Fuser diffusers noisy regardless of turndown percentage.
3) Fan, F, has speed control which can be modulated to control static pressure when room temperature is below the cooling setpoint.
4) **Relief rings** are used on the Therma-Fuser units so that enough excess air is bypassed to the ceiling plenum to prevent the Therma-Fuser diffusers from becoming noisy. Relief rings will also bypass when cold air valve, CV, is open making the system less energy efficient when cooling.

When subzoning low pressure—**pressure dependent** intermittent fan powered boxes, **relief rings** may be used instead of a static pressure controller, SP, and static pressure probe, SPP. With room temperatures above the cooling setpoint of thermostat, T, cold air valve, CV, would be open (not modulating). The result is constant volume operation of the intermittent fan powered box when cooling as well as heating. This is an inexpensive upgrade but would provide less energy savings when cooling.

DDC CONTROLS

Program the software to carry out the sequence of operations described. Check with the controls contractor when in doubt about programming.

ELECTRIC CONTROLS

In addition to a new discharge thermostat, DT, and relief air damper, R, relays are required for electric control. Example wiring diagrams are shown. The first has separate controllers for the CV motors and relief air damper, R. The second has one controller for both.

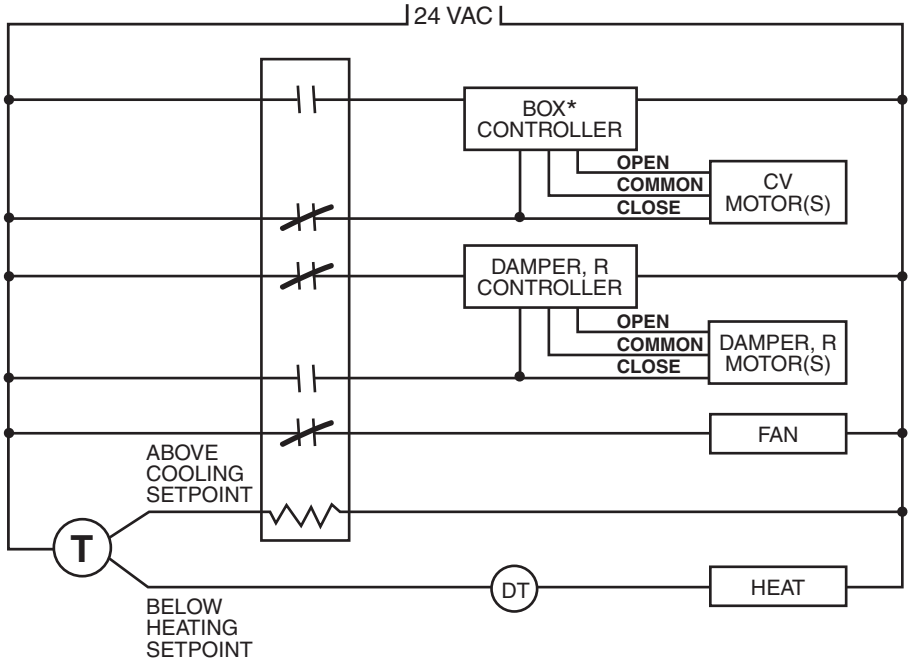
The Acutherm SMC can be used to control intermittent fan powered boxes used with DX equipment. See Acutherm Form 40.5.

PNEUMATIC CONTROLS

See the example of control connections for any additional controls required.

EXAMPLE ELECTRIC CONTROL WIRING

SEPARATE CONTROLLERS FOR VAV BOX* AND RELIEF AIR DAMPER, R

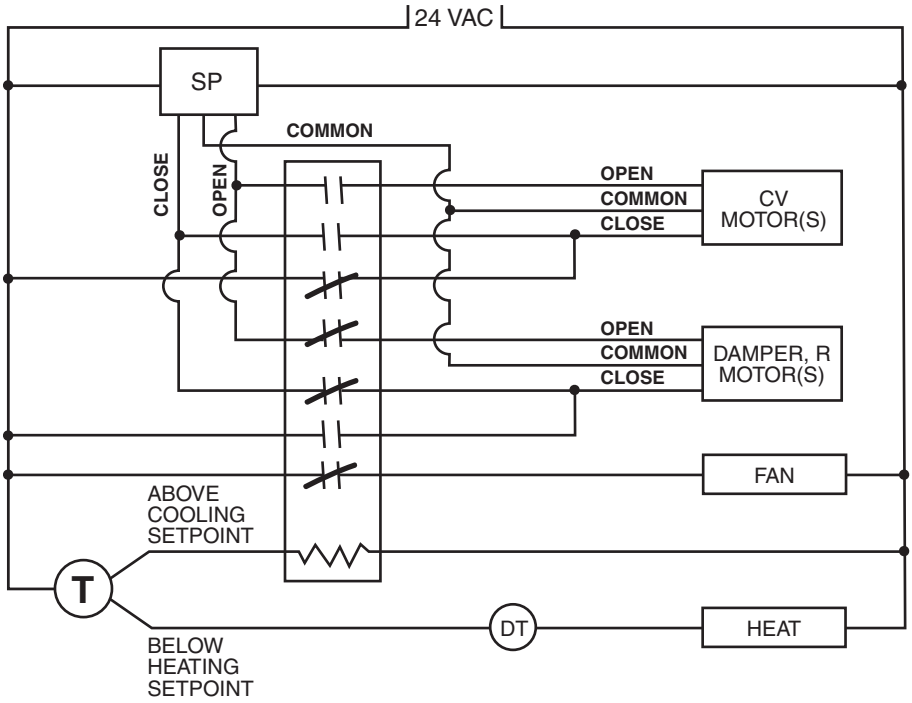


**See 6.11 for more on use of VAV box controller as a static pressure controller.*
Relief Air Damper, R, can be an Acutherm PIM.

ONE CONTROLLER (SP) FOR CV AND RELIEF AIR DAMPER, R

SP may be any of:

1) Controller on VAV box. See 6.11 for more on use of VAV box controller as a static pressure controller
2) Controller in Acutherm PIM.
3) Dwyer 1640 Null Switch.



NOTE: if seven-pole relay not available, use two relays with holding coils in parallel.

(Continued)

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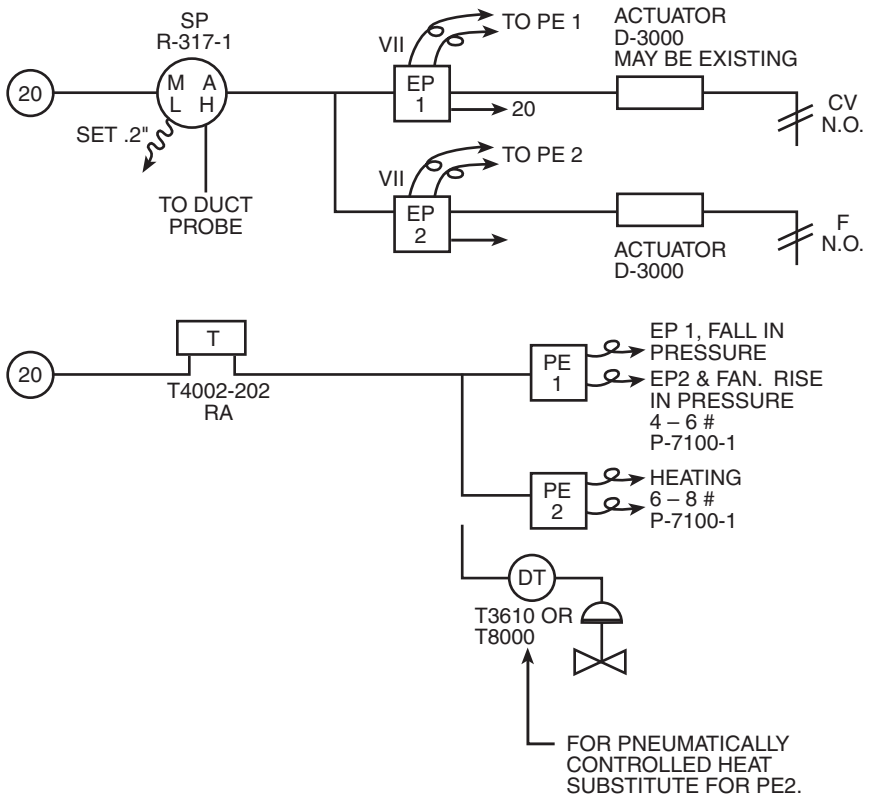
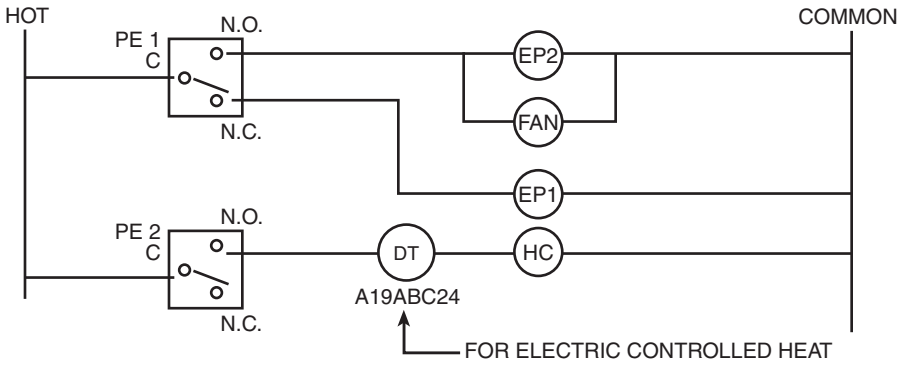
EXAMPLE PNEUMATIC CONTROL CONNECTIONS

Johnson part numbers are used. Modify as required to retain useable controls.

Pneumatic Connections



Electric Connections



NOTE: Existing fan powered box may contain useable PE switches and differential pressure controller to function as SP.

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