35K
Bypass Terminal Unit
for Variable Air Volume (VAV) Systems

Application Data

SAFETY CONSIDERATIONS

SAFETY NOTE

Air-handling equipment will provide safe and reliable service when operated within design specifications. The equipment should be operated and serviced only by authorized personnel who have a thorough knowledge of system operation, safety devices and emergency procedures.

Good judgement should be used in applying any manufacturer's instructions to avoid injury to personnel or damage to equipment and property.

⚠ WARNING

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected. Electrical shock and personal injury could result.

⚠ CAUTION

If it is necessary to remove and dispose of mercury contactors in electric heat section, follow all local, state, and federal laws regarding disposal of equipment containing hazardous materials.

GENERAL

The 35K bypass terminal is designed to maintain optimum occupant comfort by varying the amount of cold air supplied to a zone from a constant volume air handler. The 35K unit responds to a thermostat demand for cooling by varying the position of the bypass damper. The damper position determines the quantity of cold air entering the zone. Excess air is diverted into the ceiling plenum or back to the air handler return duct. The 35K unit allows a constant volume air handler to provide variable air volume to a zone.

The 35K unit is offered in 7 sizes covering an air delivery range up to 4400 cfm. The basic unit is a small diverting box with a single blade diverting damper. The unit's small size ensures an easy fit in all applications.

MAJOR SYSTEM COMPONENTS

Bypass Terminal Unit (35K) — The 35K unit casing is 20-gage galvanized steel. The 35K unit offers pneumatic and electric control options, with a damper actuator that responds directly to a thermostat output to control room temperature.

During reduced loads, the damper position changes to deflect supply air into the ceiling plenum or return air duct. In this way, the 35K unit allows a constant volume air handler to provide variable air volume to individual zones, increasing the control and comfort of those zones.

Savings result from the elimination of variable speed drives for the air-handling system. At reduced zone loads, cool primary air can be returned to the air handler through a plenum or return air duct without experiencing zone heat gains. The lower return-air temperature allows the air handler to operate more efficiently.

NOTE: The unit's maximum recommended inlet pressure is 0.6 in. wg static pressure.

All inlet collars are round to accomodate standard flex duct sizes. For proper operation, bypass and outlet connection are also round. Supply duct dimensions for 35 Series units are the same as for 45 Series fan-powered boxes, for easy interchangeability.

Standard casing insulation $^1/_2$ in. thick, 1 $^1/_2$ lb dual density fiberglass liner meeting UL 181 (Underwriters Laboratories) and NFPA-90A (National Fire Protection Association) requirements.

All units are equipped with a factory-installed airflow sensing device as a standard feature. The standard sensor is linear, multi-point, velocity averaging sensor with an amplified signal. Balancing taps are provided to allow for easy airflow verification. The probe offers a flow averaging capability and results in flow sensing capability equal to any competitive unit.

Factory-Mounted Controls — The 35K bypass terminal units are offered with a wide variety of factory-mounted controls that regulate the volume of air delivery from the unit and respond to cooling and heating load requirements of the conditioned space by opening and closing the bypass damper. See Fig. 1.

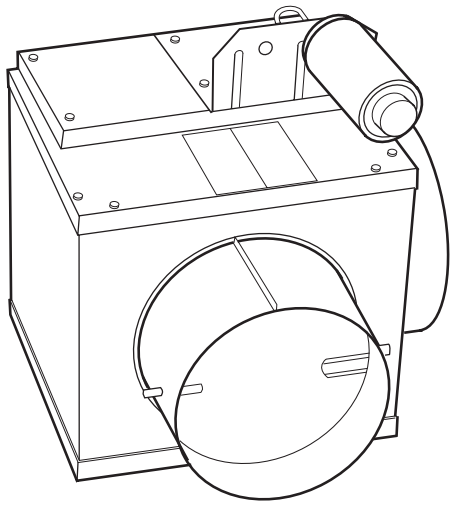

Fig. 1 — 35K Bypass Terminal Unit

Stand-alone controls will fulfill the thermal requirements of a given control space. These devices are available in both pneumatic and electronic arrangements. The 35K control offerings are identified as follows:

- 35KA: Analog electronic
- 35KP: Pneumatic
- 35KN: No controls or DDC (direct digital control) by others

Pneumatic control units utilize a standard linear damper actuator, which when combined with the 90-degree damper actuator, allows a simple switchover from normally open to normally closed applications without moving any components.

Units with electronic controls are available with an optional factory-supplied, mounted, and wired transformer, mounted inside the control enclosure.

CONTROLS

Each control approach offers a variety of operating functions and a control package number identifies combinations of control functions. The variety of function arrangements available, circuit diagrams, operating sequences and function descriptions will be described below according to each control offering.

Analog Electronic Controls (35KA)

DESCRIPTION AND SPECIFICATIONS — The analog electronic controls for the terminals are furnished with analog controls by Kreuter. Each analog 35K unit has pressure independent controls which include the following:

- sheet metal control enclosure
- flow probe
- thermostat
- damper actuator and analog controller

Each 35 Series unit is supplied with a linear averaging flow probe as a standard feature. This probe offers a flow averaging capability and results in flow sensing capability.

By combining a basic flow control with optional function devices and an integral electric actuator, the controller provides bypass damper control. The damper actuator responds to changes in the thermostat demand. As the room temperature increases, the room thermostat modulates the room damper open and the bypass damper is closed. As the room temperature decreases, the room thermostat modulates the room damper closed and the bypass damper is opened.

All analog electronic control arrangements include a sheet metal enclosure, flow probe, thermostat, and damper actuator and analog controller to match the control type as shown in Table 1.

Table 1 – 35KA Control Function Identification

CONTROL PACKAGE NUMBER	SEQUENCE DESCRIPTION AND IDENTIFICATION
3500	Electric Temperature Responsive
3501	Electric Temperature Responsive with Autochangeover

CONTROL PACKAGE OFFERINGS AND IDENTIFICATION — The electronic analog control system is pressure independent volume reset control that uses a Kreuter CSP-5001/5002 VAV controller-actuator. The system provides independently adjustable set points for minimum, maximum, and auxiliary airflow limits. The applied volume controller and inlet duct conditions limit the flow range of each size. Airflow is sensed by using a single or multi-point differential (velocity) pressure measuring station or pitot tube (such as an SSS-1000 series airflow sensor). Typically, the airflow range for each size is between 0 and 3,300 fpm through the inlet of the terminal unit with an accuracy of 3%.

The KMC CTE-5100 electronic room thermostat series is designed for use with the CSP-5001/5002 flow controller/actuator. The thermostat operates on a 16 vdc (14 to 20 vac) power supply from the controller and outputs a 0 to 10 vdc signals on the T terminals: T_1 in the cooling mode (direct acting) and T_2 in the heating mode (reverse acting). In general, T_1 and T_3 are used for the cooling mode, T_2 and T_4 for heating. Terminals T_3 and T_4 have fixed 0 to 10 vdc output signal. A single transformer which can be wired 120/208/277 v primary and a 24 v secondary may be used as an option.

Room temperature control is provided by the associated room thermostat which is selected according to the application. The room thermostat provides a fixed hysteresis of 2° F regardless of the minimum and maximum velocity limit set points. Adjustments for the minimum and maximum airflows are made at the thermostat.

NOTE: Transformers for cooling only and hot water reheat units must be specified at time of order.

Control packages for the 35KA units are completely wired at the factory, except for the wall thermostat which is furnished, not wired. The control packages correspond directly with the ordering procedure and price pages.

CONTROLLER COMPONENTS AND WIRING — The diagrams on various analog control sequences show the detail wiring of the controller and the control component list, together with the temperature/airflow diagram and the operating sequence. See Appendix A.

Pneumatic Controls (35KP)

DESCRIPTIONS AND SPECIFICATIONS — The 35KP units have pneumatic control of fan-powered terminals for both constant volume and variable volume distribution systems. Pneumatic controls can be furnished to provide a variety of functions. Each set of functions is assigned a control package number and its specified control sequence identification as shown in Table 2. All control packages are pressure independent (unless otherwise noted).

The damper actuator responds to changes in the thermostat demand. As the room temperature increases, the room thermostat modulates the room damper open and the bypass damper is closed. As the room temperature decreases, the room thermostat modulates the room damper closed and the bypass damper is opened.

All pneumatic control arrangements include a sheet metal enclosure, flow probe, and damper actuator and pneumatic controller. Thermostats are not included as standard.

Table 2 — 35KP Control Function Identification

CONTROL PACKAGE NUMBER	SEQUENCE DESCRIPTION AND IDENTIFICATION
1600	Pneumatic controller, DA-NC
1601	Pneumatic controller, RA-NO

LEGEND
DA — Direct-Acting Thermostat
RA — Reverse-Acting Thermostat
NO — Normally Open Damper Position
NC — Normally Closed Damper Position

CONTROLLER COMPONENTS AND WIRING — The diagrams on various pneumatic control sequences show the detail wiring of the controller and the control component list, together with the temperature/airflow diagram and the operating sequence. See Appendix B.

Field-Supplied Direct Digital Controls or No Controls (35KN)

DESCRIPTION AND SPECIFICATIONS — Control packages are field-supplied for factory mounting, unless otherwise noted. All DDC control arrangements include a standard linear

inlet flow sensor, optional transformer to 24 volts, and control enclosure.

All control arrangements include a standard linear inlet flow sensor.

CONTROL PACKAGE OFFERINGS AND IDENTIFICATION — Each set of functions is assigned a control package number and its specified control sequence identification as shown in Table 3.

Table 3 — 35KN Control Function Identification

CONTROL PACKAGE NUMBER	SEQUENCE DESCRIPTION AND IDENTIFICATION
0000	Terminal Only – No Control
XXXX	By Quote

APPLICATION DATA

Several factors should be considered when selecting a bypass damper terminal unit.

Airflow Range — Carrier bypass units are designed to operate with low-pressure constant volume systems. For best results, a manual balancing damper must be installed upstream of the unit set to provide the maximum zone airflow with the unit damper set 100% to the room. This unit is not a true VAV terminal, and failure to limit the flow upstream of the unit may lead to damper failure. In most cases, inlet duct maximum airflow of more than 1500 fpm should be avoided to prevent possible unit damage. As the unit is not pressure independent, there is no minimum airflow requirement. Design flows less than 400 fpm will likely result in poor room temperature control, however.

System Pressure — Control of duct pressures is the most effective means of ensuring low noise levels, accurate flow control, and minimum energy use. The use of various fan-tracking techniques can ensure optimum system efficiency and operation.

Acoustics — The primary determinant in the acoustics of a terminal is the inlet, or duct, static pressure. While velocity (flow rate) is also a factor, significant reductions in sound can be realized by reducing duct pressures in the branch duct supplying the unit.

Lined duct downstream of the unit is very effective in reducing discharge noise levels. Where no duct lining is employed between the unit and the room diffusers, a noisy system is possible. Reducing inlet pressure drop will help, provided the techniques used to reduce local duct pressure levels do not increase noise levels in the duct that will be carried into the space.

Radiated sound is rarely a problem with bypass terminals. Flexible duct at the inlet, however, can transmit airborne sound levels into the plenum space, where they add to the radiated sound component.

If both the diffuser and the terminal are selected at the same delivered sound power level, the discharge (airborne) sound levels should be combined, by octave band, with the sound power generated by the selected diffuser when predicting sound levels in the space. In many cases, diffusers generate higher frequency sound than the terminal, and the two power levels combine without raising the room NC (noise criteria) level. Each application of unit and diffuser must be examined individually to verify that the net NC does not increase. (Equal sound power levels, when added, increase the sound level by 3 dB.)

Acoustic performance data for 35K Series is based on tests conducted in accordance with ARI (Air Conditioning and Refrigeration Institute) Standard 880-98. Data is presented as sound power for the units indicated in the Product Data book.

Application sound levels are provided as NC levels. These are determined by applying factors provided in both ARI Standards 885-98, as indicated above. Lined duct, ceiling effect, and room attenuation are typical for many office spaces. These assumptions, for discharge (airborne) sound, also include a typical end reflection effect. Alternate effects can be examined by using the Air Terminal Builder program or ARI Standard 885, available at no charge from ARI's Web page (www.ari.org). See Carrier's HVAC Acoustic Application Guidelines, catalog no. 811-449.

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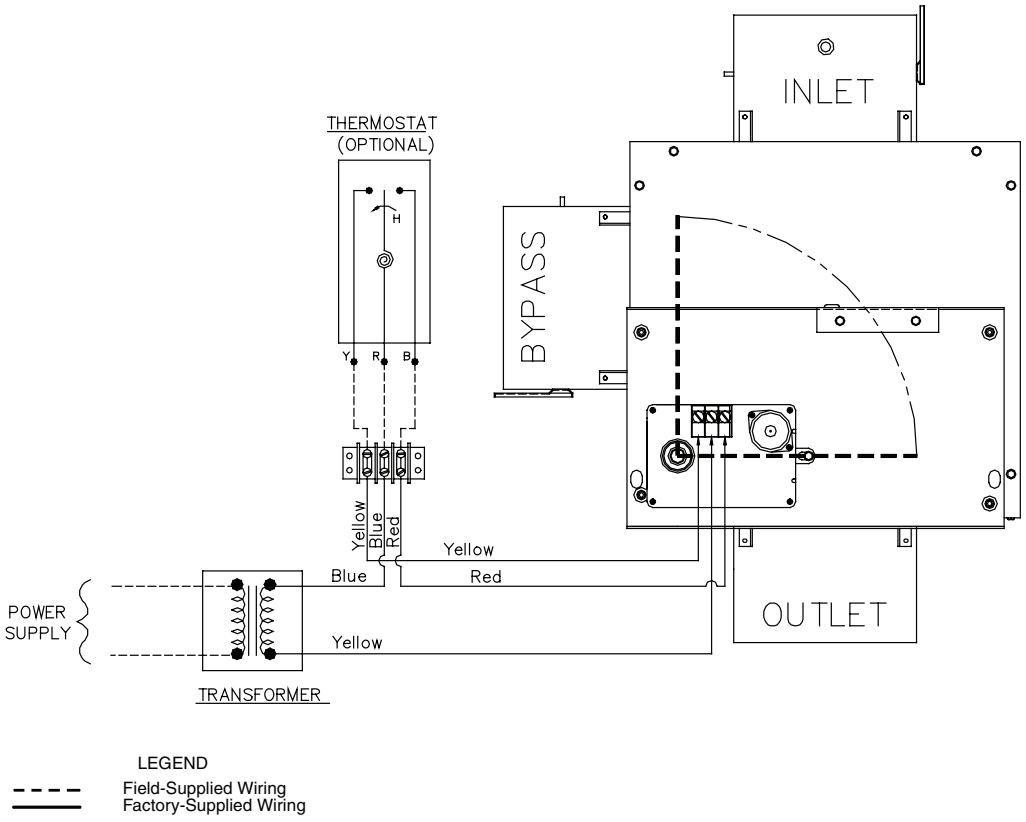
BYPASS TERMINAL UNIT WITH SINGLE DUCT ELECTRIC CONTROL

CARRIER CONTROL PACKAGE NO. 3500

Sequence of Operation
Thermostat Action: Single Pole, Double Throw

Standard Operation
The damper actuator responds to changes in the thermostat demand. As the room temperature increases, the room thermostat modulates the damper open to the room and closed to the bypass. As the room temperature decreases, the damper modulates closed to the room and open to the bypass.



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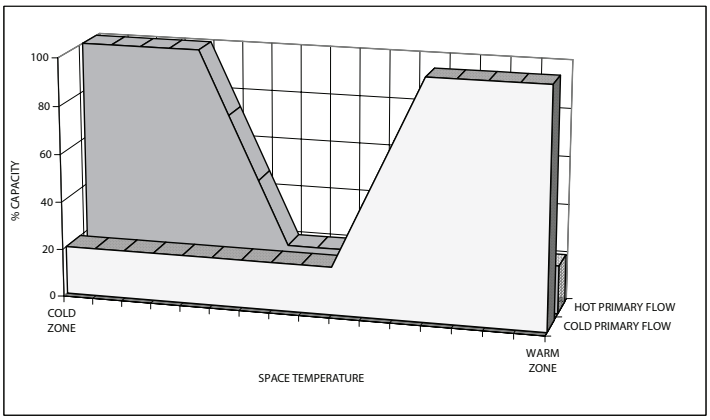


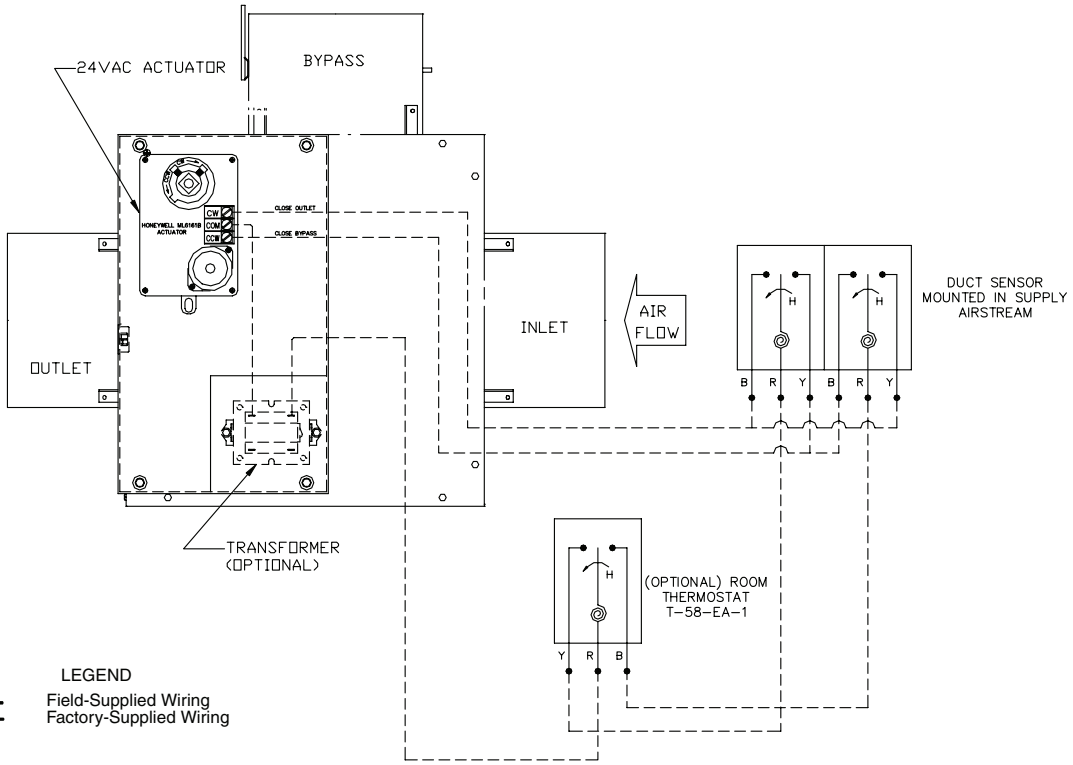
BYPASS TERMINAL UNIT WITH SINGLE DUCT ELECTRIC CONTROL AND TEMPERATURE RESPONSIVE CONTROL WITH AUTOMATIC CHANGEOVER

CARRIER CONTROL PACKAGE NO. 3501

User defined temperature set points are maintained at the room thermostat.

When cold primary air is supplied, the damper actuator responds to thermostat cooling demand and opens the damper to the maximum mechanical stop point regardless of central system pressure. The damper actuator responds to thermostat heating demand and closes the damper to the minimum mechanical stop point regardless of central system pressure.

When warm primary air is supplied, the ductwork thermostat switches the room thermostat to reverse acting. The damper actuator responds to the thermostat heating demand and opens the damper to the maximum mechanical stop point regardless of central system pressure. The damper actuator responds to the thermostat cooling demand and closes the damper to the minimum mechanical stop point regardless of central system pressure.



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BYPASS DAMPER TERMINAL UNIT WITH PNEUMATIC CONTROL

CARRIER CONTROL PACKAGE NO. 1600, 1601

Sequence of Operation

Thermostat Action: DA (Direct Action) for control type 1600 or RA (Reverse Action) for control type 1601

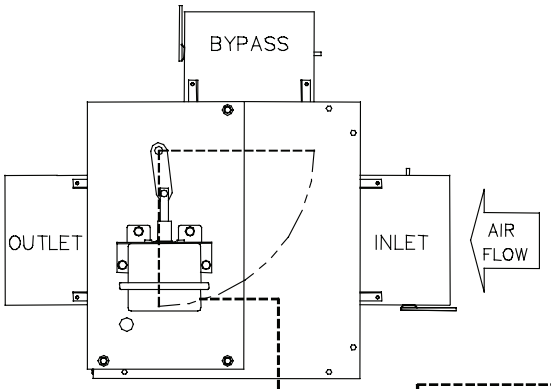
Damper Position: NA (Normally Closed) for control type 1600 or NO (Normally Open) for control type 1601

Air Consumption: 0.0 scfh (standard cubic feet per hour) at 20 psig

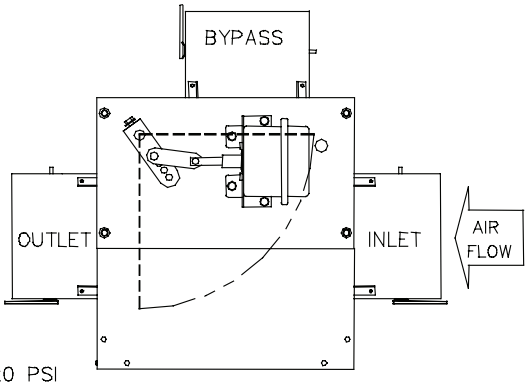
Standard Operation

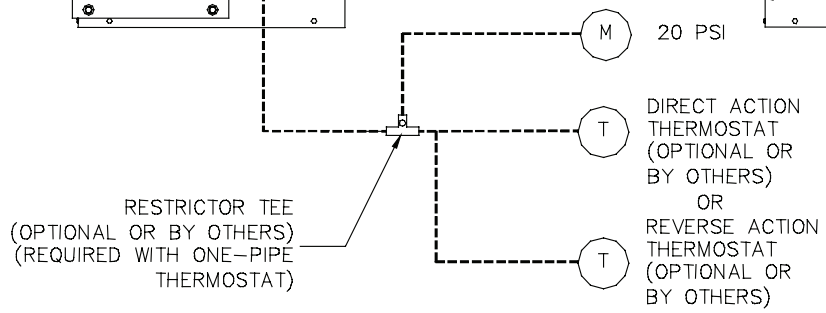
The damper actuator responds to changes in the thermostat demand. As the room temperature increases, the room thermostat modulates the damper open to the room and closed to the bypass. As the room temperature decreases, the damper modulates closed to the room and open to the bypass.

CONTROL TYPE 1600
(RIGHT HAND, DIRECT ACTING)



CONTROL TYPE 1601
(RIGHT HAND, REVERSE ACTING)





LEGEND

- - - - Field-Supplied Tubing
M — Main Air Supply (Metered)
T — Thermostat

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