

## CONTROL INFORMATION

### CONTROL SEQUENCE OF OPERATION

The standard KLPS sequence of operation has the induced airflow fan operating continuously, providing a constant volume of discharge air to the conditioned space.

### HEATING MODE

When the zone is at maximum heating demand, the primary air damper maintains a minimum flow and the fan runs constantly, inducing the maximum amount of warm ceiling plenum air. Electric or hot water heat, if supplied, operates at maximum capacity.

As the zone temperature rises, the optional heat, if supplied, cycles off. The fan continues to induce a maximum amount of ceiling plenum air. As the zone temperature rises above the thermostat setpoint, the KLPS unit enters the cooling mode.

### COOLING MODE

As the zone temperature rises above setpoint, the primary air damper begins to modulate toward the full open damper position. As the amount of conditioned primary air increases, the amount of induced ceiling plenum air decreases proportionally.

When the conditioned zone is maximum cooling demand, the primary air damper will maintain a constant maximum flow setting. With pressure independent controls, the damper will maintain the maximum flow setting regardless of system pressure fluctuations. The fan will discharge virtually 100% primary air if installed and balanced properly.

### NIGHT SETBACK

One of the most popular KLPS control arrangements is the night setback feature. With this control arrangement, the KLPS induced air fan will operate whenever central system pressure is sensed (day mode). When the central system is off (night mode), the KLPS induced air fan and optional heat will cycle on in response to thermostat demand.

### CONTROL OPTIONS

- **Pneumatic Controls:** Pressure independent control packages are available with or without hot water or electric heat, night shutdown and/or unoccupied heating. All control arrangements include an inlet flow sensor and fan speed controller.
- **Analog Controls:** Pressure independent control packages are available with or without hot water or electric heat, automatic or remote night shutdown and automatic night setback. All control arrangements include an inlet flow sensor, control enclosure, fan speed controller, transformer to 24 volts, and wall thermostat to match the control type.
- **Direct Digital Controls:** Smart Equipment control packages are provided and programmed by the factory for in-house mounting, piping, and wiring.
  - BACnet Compatible: 7201-7209
  - Standalone: 6201-6209

Other digital control packages can be supplied to the factory for mounting, piping, and wiring.

Contact your Krueger representative for a complete list of direct digital control arrangements.

- **No Control Unit:** Units are factory supplied without controls, assuming that the unit is being used for field mounting of direct digital control equipment. This arrangement includes an inlet flow sensor, control enclosure, fan speed controller, transformer to 24 volts, and fan relay.

NOTES: Visit Krueger's website at [www.krueger-hvac.com](http://www.krueger-hvac.com) or contact your local Krueger representative for a complete list of direct digital control arrangements.

To prevent the blower from spinning backwards, the simplest solution is to require that the building control system energize the series box fans prior to starting the central system air handler. Some DDC controls for series boxes have a start-up procedure that closes the damper, de-energizes the fan, (resets to zero on the pressure transducer while the damper is closed) and then returns control to the unit. Most manufacturers' Series Fan boxes are designed to maximize starting torque to overcome this backward rotation. If, however, the primary airflow is available for long enough, and the fan speed control is set at a low enough value, any series fan terminal can be expected to start and operate backward. This will not damage the unit, and it will deliver approximately 60% of designed airflow. Until the space load exceeds 60% of the design load, it is probable that no one will notice the unit is running backward. When the thermostat calls for more than 60% of the design load the excess primary will spill into the plenum and the likely result will be cold plenum air 'falling' from return grilles onto room occupants. No manufacturer offers a mechanical device to prevent backward rotation. Krueger can supply a special sequence that employs a pressure sensor installed in the high-pressure side of the inlet sensor to detect any airflow in the primary duct and energize the fan if the building's control system cannot be properly configured to avoid this problem.

**CONTROL INFORMATION (CONTINUED)**

The following list shows the standard control arrangements available with the KLPS product offering. Each control approach offers a variety of pressure independent operating functions; combinations of control functions are identified by the Krueger control package number.

**PNEUMATIC CONTROL ARRANGEMENTS**

- 1300 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat
- 1301 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1302 - Single Function Controller; DA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1303 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat
- 1304 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1305 - Single Function Controller; RA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1306 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat
- 1307 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1308 - Multi-function Controller; DA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1309 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat
- 1310 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1311 - Multi-function Controller; DA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1312 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat
- 1313 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat and with Night Shutdown
- 1314 - Multi-function Controller; RA-NC with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating
- 1315 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat
- 1316 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat and with Night Shutdown
- 1317 - Multi-function Controller; RA-NO with or without Hot Water or Electric Heat, with Night Shutdown and Unoccupied Heating

**Pneumatic Control Legend:**

DA - Direct Acting Thermostat

RA - Reverse Acting Thermostat

NO - Normally Open Damper Position

NC - Normally Closed Damper Position

Single Function Controller - Provides Single Function, DA-NO or RA-NC

Multi-function Controller - Capable of Providing DA-NO, DA-NC, RA-NC or RA-NO Functions

**ANALOG CONTROL ARRANGEMENTS**

- 2200 - Cooling Only
- 2201 - Cooling Only with Automatic Night Shutdown
- 2203 - Cooling Only with Automatic Night Setback
- 2204 - Cooling with On/Off Hot Water Heat
- 2205 - Cooling with On/Off Hot Water Heat and Automatic Night Shutdown
- 2207 - Cooling with On/Off Hot Water Heat and Automatic Night Setback
- 2208 - Cooling with Proportional Hot Water Heat
- 2209 - Cooling with Proportional Hot Water Heat and Automatic Night Shutdown
- 2211 - Cooling with Proportional Hot Water Heat and Automatic Night Setback
- 2212 - Cooling with Up to Two Stages of Electric Heat
- 2213 - Cooling with Up to Two Stages of Electric Heat and Automatic Night Shutdown
- 2215 - Cooling with Up to Two Stages of Electric Heat and Automatic Night Setback
- 2217 - Cooling/heating with Automatic Changeover
- 2218 - Cooling with Proportional Electric Heat

**DIRECT DIGITAL CONTROL ARRANGEMENTS**

Visit Krueger's website at [www.krueger-hvac.com](http://www.krueger-hvac.com) or contact your Krueger representative for a complete list of factory mounted direct digital control arrangements.