AG-Lynergy-03
December 6, 2021

Lynergy™ Comfort Control SCR Electric Heater Application Guide

Titus™
Redefine your comfort zone.™ | www.titus-hvac.com

605 Shiloh Road
Plano, Texas 75074
972.212.4800

Contents Page

General

This document provides application highlights covering the Lynergy™ Comfort Control SCR Electric Heater. (USPN 7,177534)

Additional information may be found at the Titus website, www.titus-hvac.com.

Introduction

The zone reheat in an HVAC system needs to address concerns about comfort, indoor air quality, energy and acoustics. Several ASHRAE Standards are used to cover all of these areas of design.

The ASHRAE Fundamentals Handbook states that discharging air at a temperature more than 15°F above the room (90°F in a 75°F room) will likely result in significant unwanted air temperature stratification.

ASHRAE Standard 62 (Indoor Air Quality) has been modified to require increased outside air when heating from the ceiling (Table 6.2, Addenda N. Using the ASHRAE 129 test procedure for Air Change Effectiveness, mixing effectiveness values as low as 20% (or lower) have been observed, when the supply to room differential exceeds 15°F. In most cases, it only requires 85°F air to handle a typical winter design perimeter load at 1 cfm/Sq.Ft. air supply rate (the airflow rate recommended for both good ventilation mixing and comfort).

Standard staged electric heat energizes each stage of heat as the zone temperature calls for more heat. In a three-stage heater, the increase happens in 33% heater output increments. If an additional 33% heater output provides too much heating, then the heater will de-energize that stage. The result is over- and under-heating of the zone.

A proportional SCR heater eliminates the over- and under-heating of the zone by providing only as much heater output needed to satisfy the zone.

In addition to providing the exact amount of heater output required, the Titus Lynergy™ heater has an optional discharge temperature sensor. This allows the Lynergy™ controller to limit the maximum discharge temperature of the electric heater allowing you to meet the requirements of the ASHRAE standards.

During the time a standard staged electric heater is over-heating the zone, it is using more energy than needed to satisfy the zone. For example, if the zone requires 50% of the heater capacity, a three-stage heater would have to output 66% of its capacity until the thermostat responds to the temperature in the over-heated zone and de-energizes the second stage of heat.

Standard staged electric heat typically uses magnetic contactors to energize the stages of heat. Due to acoustic requirements in many building designs, engineers often specify mercury contactors for silent operation. Mercury contactors significantly increase the cost of the heater.

There are also growing environmental concerns about the use of mercury in buildings. Many building components contain mercury and, in the component's application, pose little risk to the environment, but the potential for a spill is always present. For this reason, some local codes require registration of mercury devices, and careful controlled disposal. Because of this, many engineers are limiting the use of mercury contactors.

The solid-state relays, used in the Lynergy™ heater, address the acoustic concern of using magnetic contactors and the environmental concern of mercury contactors.

Description

The Lynergy™ Comfort Control SCR electric heater is an electronic, time proportional electric heater, which utilizes silent, rapid responding solid-state relays. The solid-state relays are controlled by
the Lynergy™ Comfort Controller.

The Lynergy™ Comfort Controller accepts one of several input signal types to provide superior control and flexibility.

The order code determines the input signal jumper position the Lynergy™ heater will be set to when shipped. The electric heater order code for the Lynergy™ heater is in the format LXY, where X represents the same supply voltages used on the standard electric heaters and Y represents the inputs signal code. The table below shows the voltage options.

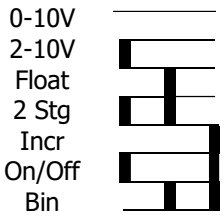
X Code	Voltage
2	208V, single phase
3	240V, single phase
4	277V, single phase
6	208V, three phase
9	480V, three phase

The table below shows the signal type options.

Y Code	Signal Type
1	PWM heat
2	2 stage heat
3	0-10V / 0-20mA
4	2-10V /4-20mA
5	Incremental T-stat
6	Binary
7	3 point floating

For example, code L91 is a 480V, three-phase heater with PWM heater control.

The Lynergy™ heater provides flexibility in input signal by simply putting a jumper between contacts on the controller board. The figure below shows the various jumper positions on the Lynergy™ control board.



Discharge Temperature Sensor

If the optional discharge temperature sensor is used, the heater is set to modulate heat to a set discharge temperature. The sensor can be mounted up to 20 feet from the unit discharge. User defined maximum temperature and controller defined temperature desired are maintained independent of heater kW or incoming air temperature.

The maximum discharge temperature produced by the heater is set by rotary dial on the Lynergy™ control board. When the unit receives a signal to start heating, the board will take an initial temperature reading and modulate heat from that point to the maximum temperature. For example, if a thermostat requires only a 10% increase in heating of air that was initially 60°F, and has a maximum temperature setting of 90°F, the Lynergy™ controller will modulate the heater's output temperature to 63°F (the additional 3 degrees coming from (90°-60°)*10%). This option allows an increase of heater energy into occupancy by increasing discharge airflow while keeping an optimal discharge temperature.

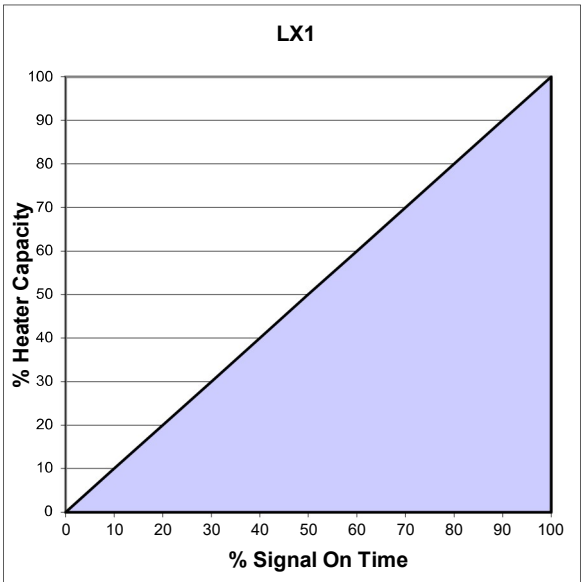
Lynergy™ Code LX1

Proportional electric heat controlled by single 24Vac output.

LX1 provides proportional electric heat from 0-100% for use with controllers that can supply a pulsed 24V signal.

When a 24Vac signal is sent, the heater control board immediately turns the heater on to 100%. Heater output can be proportionally modulated by decreasing length of pulse within a constant time period. For example, if every 5 seconds the heater

is turned on for only 3 seconds, the unit provides 60% (3s/5s * 100%) of the heater's kW rating.

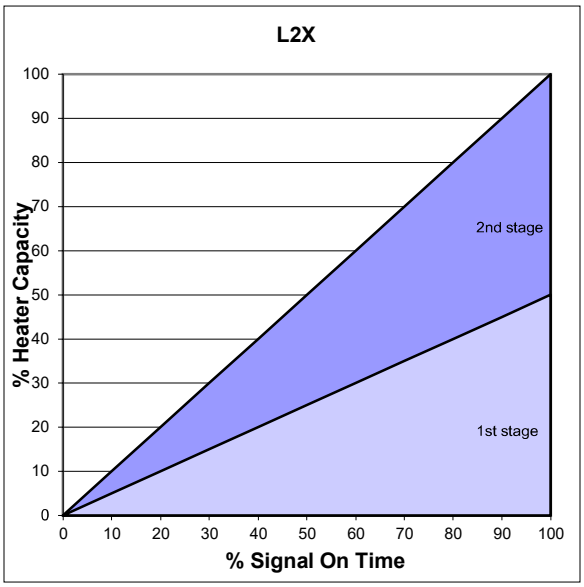


Lynergy™ Code LX2

Proportional electric heat controlled by two 24Vac outputs.

LX2 provides proportional electric heat from 0 to 100% for those controllers that have two 24Vac outputs available for supplemental heat control that cannot be programmed to provide "open/close" signals.

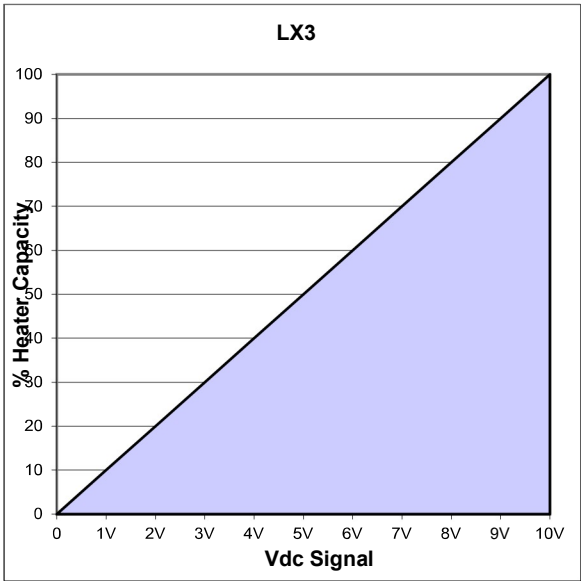
One output is used for controlling heat from 0 to 50%. The second output is for controlling heat from 0 to100%. Proportional heat is available by decreasing the length of pulse within a constant time period. For example, if every 5 seconds only Input 2 (Dec) is turned on for only 3 seconds, the unit provides 60% (3s/5s * 100%) of the heater's kW rating. Applications using two 24Vac signals can have more accurate control of the lower heater outputs. By modulation of Input 1 (Inc), the turn down ratio is greater, increasing the accuracy of low heat output. For example, if every 5 seconds Input 1 is turned on for only 3 seconds, the unit provides 30% (3s/5s * 50%) of the heater's kW rating. This can also be used for dual staging electric heat to 50% and 100% capacity.



Lynergy™ Code LX3

Proportional electric heat controlled by analog 0-10 Vdc or 0-20 mA output.

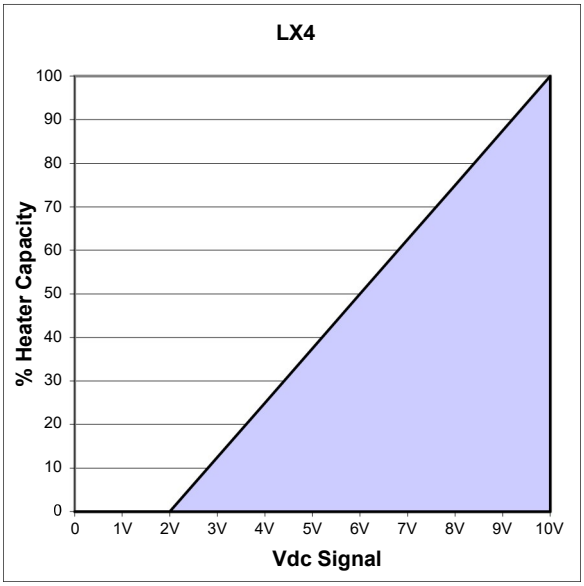
LX3 provides proportional electric heat from 0 to 100% for those controllers that have 0-10 Vdc (0-20 mA) available for supplemental heat control. Heater output is directly proportional to Vdc signal. For example, 2 Vdc (4 mA) provides 20% (2s/10s * 100%) of the heater's kW rating.



Lynergy™ Code LX4

Proportional electric heat controlled by analog 2-10 Vdc or 4-20mA output.

LX4 provides proportional electric heat from 0 to 100% for those controllers that have 2-10 Vdc (4-20 mA) available for supplemental heat control. Heater output is directly proportional to Vdc signal over 2Vdc. For example, 4Vdc (6mA) provides 25% (2dcV/ 8dcVs * 100%) of the heater's kW rating. For inputs below 2Vdc (4mA), the heater will stay off.

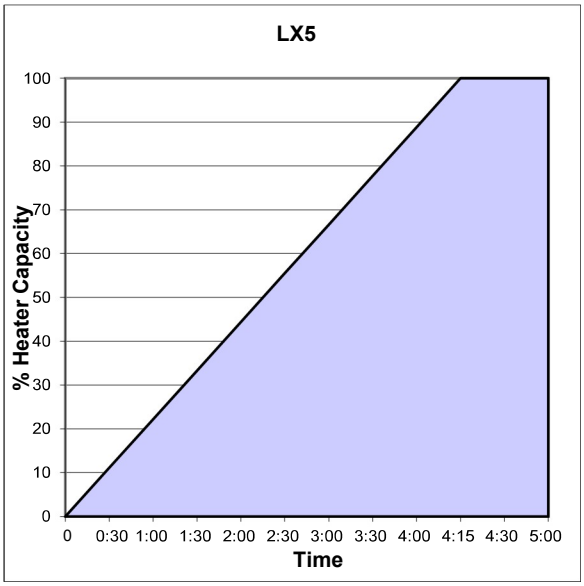


Lynergy™ Code LX5

Proportional electric heat controlled by single 24Vac output with gradual increase and decrease of heater output.

LX5 provides electric heat from 0 to 100% for those controllers that only have one 24Vac output available for supplemental heat control. This application does not provide proportional heat with pulsed input, but is appropriate for those controls with only one definite purpose 24Vac that cannot pulse rapidly.

The application mimics the use of hot water reheat controlled by a Normally Closed valve and provides gradual heating cycling without occupant awareness. When 24Vac signal is sent, the heater control board begins increasing heater output to 100% over a 4 minute 15 second interval. When desired room temperature has been met and the 24Vac signal is removed, the heater output will begin to decrease at the same rate. If input is given again while heater is decreasing, the heater output will again begin to climb from the current capacity.



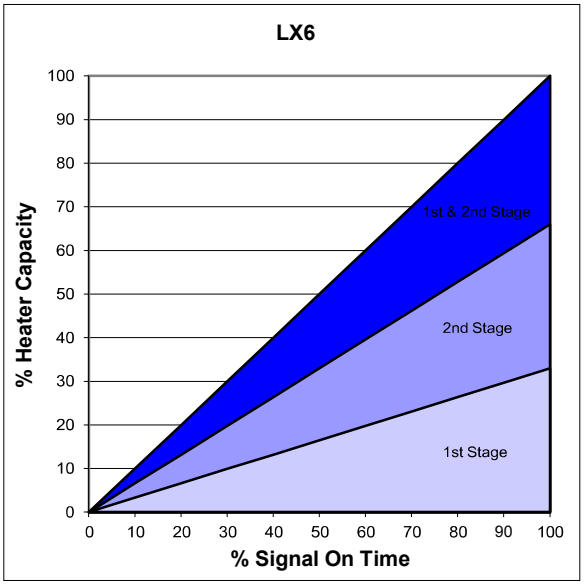
Lynergy™ Code LX6

Proportional electric heat controlled by two binary acting 24Vac outputs.

LX6 provides proportional electric heat from 0 to 100% for those controllers that have two 24Vac outputs available for supplemental heat control that can be operated in a binary fashion (A on/B off, A off/B on, and A on/B on), but not programmed to provide "open/close" signals. One output is used for controlling heat from 0 to 33%, the second output is for controlling heat from 0 to 67%, and both together provide 100% heat. Proportional heat is available by decreasing length of pulse within a constant time period.

For example, if every 5 seconds both inputs (Inc & Dec) are turned on for only 3 seconds, the unit provides 60% (3s/5s * 100%) of the heater's kW rating. Applications using two 24Vac signals can have more accurate control of the lower heater outputs. By modulation of Input 1 (Inc), the turn down ratio is greater, increasing accuracy of low heat output. If every 5 seconds Input 1 is turned on for only 3 seconds, the unit provides 20% (3s/5s * 33%) of the heater's kW rating, and if every 5 seconds Input 2 is turned on for only 3 seconds, the unit provides 40% (3s/5s * 67%) of

heater capacity. This can also be used for staging electric heat to 33%, 67% and 100% capacity.

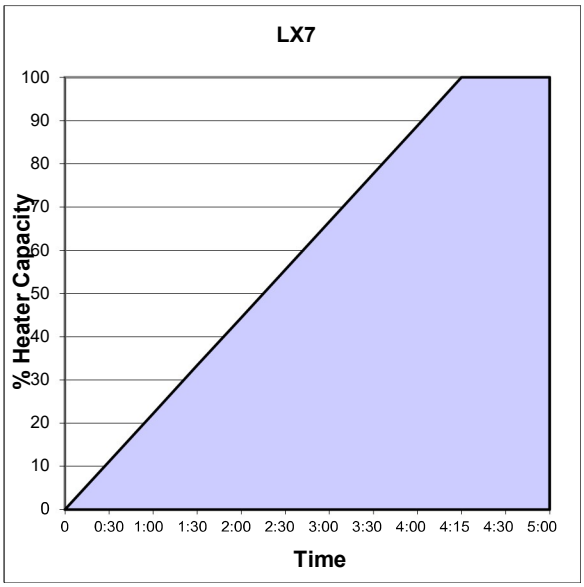


Lynergy™ Code LX7

Proportional electric heat controlled by two 24Vac outputs with floating control.

LX7 provides proportional electric heat from 0 to 100% for those controllers that have two 24Vac outputs available for supplemental heat control. This application mimics the use of hot water reheat controlled by a Three Point modulating valve and provides gradual heating cycling without occupant awareness.

When 24Vac “open” signal is sent, the heater control board begins increasing heater output from 0 to 100% over a 4 minute 15 second interval. When desired room temperature has been met and the 24Vac signal is removed, or the 24Vac “close” signal is sent at the same time, the heater output will stay constant. When the 24 Vac “close” signal is sent alone, the heater will decrease at the same rate. If the 24 Vac “open” signal is again sent alone, the heater will again start increasing from current capacity.



Suggested Specification

Electric Reheat Coils

1. Proportional electric coils shall be supplied and installed on the terminal by the terminal manufacturer. Coils shall be ETL listed. Coils shall be housed in an attenuator section integral with the terminal with element grid recessed from unit discharge a minimum of 5 inches to prevent damage to elements during shipping and installation. Elements shall be 80/20 nickel chrome, supported by ceramic isolators a maximum of 3.5 inches apart, staggered for maximum thermal transfer and element life, and balanced to ensure equal output per step. The integral control panel shall be housed in a NEMA 1 enclosure with hinged access door for access to all controls and safety devices.

2. (For Single Duct terminals) Electric coils shall contain a primary automatic reset thermal cutout, a secondary manual reset thermal cutout, differential pressure airflow switch for proof of flow, and line terminal block. Unit shall include an optional integral door interlock type disconnect switch that will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

2. (For Fan Powered Terminals) Electric coils shall contain a primary automatic reset thermal

cutout, a secondary replaceable heat limiter per element, differential pressure airflow switch for proof of flow, and line terminal block. Coil shall include an integral door interlock type disconnect switch, which will not allow the access door to be opened while power is on. Non-interlocking type disconnects are not acceptable. All individual components shall be UL listed or recognized.

3. Heaters shall be equipped with a Lynergy™ Comfort Controller to control heater coil firing. The control panel shall include an interface to control heater coil firing in proportion to the ATC signal. The ATC signal shall connect to low voltage universal signal interface circuitry supplied and installed by the terminal manufacturer. The universal interface shall allow at least the following seven interface options without additional interface circuitry. ATC equipment providers with 0-20mA or 4-20mA signals shall supply and install a suitable dropping resistor to convert the current signal to a 0-10Vdc signal or 2-10Vdc signals:

- PWM heat
- 2 stage heat
- 0-10V / 0-20mA
- 2-10V /4-20mA
- Incremental T-stat
- Binary
- 3 point floating

4. A downstream air temperature limit and control shall be automatically invoked by adding a downstream air temperature sensor. When invoked, the downstream air from the heater shall not exceed an adjustable maximum temperature set point. When the ATC's call for heat is less than 100%, the heater shall control the downstream air temperature to a point in proportion to the span between the heater's probable entering air temperature and the maximum air temperature set point.

Abbreviations

The following table lists abbreviations used within this document.

Abbrev.	Term
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
Vac	Volts Alternating Current
Vdc	Volts Direct Current
DDC	Direct Digital Control
ETL	Electrical Testing Laboratories
NEMA	National Electrical Manufacturers Association
PWM	Pulse Width Modulated
mA	Milliamps