How to implement electrical heating controls

Introduction

Electrical heating controls can be used to control the hours and temperature range over which electrical heating systems operate. They can also be used to only switch a heating system on when the area is occupied. Whilst the latest Building Regulations set minimum standards for the control of both new and replacement electrical heating systems, many existing electrical heating systems will also benefit from the improvements in energy efficiency offered by upgrading heating controls.

Sites with both regular and irregular occupancy patterns using electrical heating are likely to benefit. In typical applications, energy savings of between about 8 and 30 % can be made with payback times of between 3-5 five years.

The technology

Electrical heating controls consist of the following main types:

- time controllers
- temperature controllers (thermostats)
- occupancy controllers (presence sensors)

Time controllers

Time controllers can either be separate from or integrated into the electric heater. They range from simple 24 hour timers, to 7 day timers, to more sophisticated units that allow extended holiday periods to be set when the building is unoccupied. Tamper-proof controls will ensure that the heating is not left on inappropriately. Run timers are also available which allow the heating to be switched on, on-demand, for a pre-specified period only.

Typical heating time controller

Temperature controllers

Temperature controllers can also be either separate from or integrated into the electric heater. Different types of temperature controllers are required for different systems, with warm air systems using room thermostats (see picture), while radiant heating systems are controlled with black bulb thermostats (as described in more detail in the "How to implement radiant heating guide") positioned in the line of sight of the heater. Tamper-proof temperature controls should be fitted wherever possible, to ensure that areas are not left with inappropriately high set points, causing over heating and wasting money. Set back timers can be included in temperature controllers. These timers allow different temperatures to be used for different time periods (e.g. day time and night time settings). They also allow the temperature to be manually increased during one time period, but ensure that it will automatically be re-set for the next time period.

Typical heating temperature controller

Occupancy sensors

Occupancy sensors are supplied separately from the heating unit and can be used to detect the presence/absence of people in the area, and so to switch the heating on or off appropriately. The occupancy sensor can be based on a Passive Infra Red (PIR), ultrasonic or microwave technologies, or a combination of these. Further details on the use of occupancy sensors are provided in the "How to implement automatic lighting controls guide" downloadable from the lighting pages of the Carbon Trust website. A key point to note is that PIR sensors should not be used within 2m of the heat source.

Application

The following table summarises the range of applications in which electric heating controls may be used:

Occupancy type	Controller type		
	Time	**Temperature**	**Occupancy**
Regular pattern of occupancy of the space* e.g. offices	Specified to cover period over which space is regularly occupied, ensuring the heating is off outside normal hours. e.g. 7 day timer for offices	Specified to meet the requirements of the anticipated activities in the area at the time e.g. 20°C for office activities, 12°C for frost protection over night.	Unlikely to be required.
Irregularly or infrequently occupied spaces used for specific activities e.g. work benches, meeting rooms.	Run timers most appropriate.	Specified to meet requirements of the anticipated activities e.g. 17°C for strenuous activities. Set back timers appropriate.	Could be used to ensure heating only supplied when space occupied. An alternative option to run timers.
Irregularly occupied by general public e.g. waiting room	Specified to switch on at a low level for the period over which space is open to the public. Set to ensure the heating is off outside these hours. e.g. 7 day timer	Specified to meet requirements of the anticipated activities e.g. 17°C may be sufficient for spaces where outdoor clothing is worn. Set back timers appropriate.	Likely to be appropriate. Typically heating is on at a low level, and set point increased only when the space is occupied.

* Heating systems using alternative fuel sources should be considered if there is significant, regular use made of electric heating systems (due to the higher p/kWh cost and CO_2 emissions factors of electricity).

Specification checklist

The following table lists the key parameters that you should define through discussions with your supplier when carrying out a project to implement controls for electric heaters.

Item No.	Parameter	Comments
1	Type of electric heating system	e.g. warm air heating, radiant heating
2	Number of heaters	
3	Independent heaters or operated as a system	Independent heaters can be controlled individually, but more sophisticated controls are appropriate where the multiple heaters are operated as one system.
4	Control inputs available on the heater	Ring main for electric heating system available to be switched. Local power switching only e.g. where heater is plugged in.
5	Power of the heater/heating system	Measured in kW
6	Physical space available and connection options	For locating and connecting appropriate controllers.
7	Usual type of occupancy pattern	Regular/infrequently occupied. Occupied as a public space.
8	Controller types required	Time/Temperature/Occupancy. Temperature sensor appropriate to heating system type. Time controller with appropriate increments to cover typical usage e.g. 7 day if premises not occupied at the weekend.

Commissioning procedures

The optimum values for control settings will depend upon individual applications, but as a general rule the following should be observed:

- There should be a delay time to switch off, for occupancy sensor controlled systems, which should not be less than ten minutes to avoid excessive switching.
- The temperature set point should be as low as practicable to provide reasonable comfort.

In addition, during commissioning the appropriate staff should be trained in the operation of the heating system controls.

Hard wired controls will need to be electrically tested and a Minor Electrical Installation Work Certificate (reference IMN2) issued by a competent electrician.

Common problems

A very simple problem which occurs frequently is that temperature sensors are covered or the air flow to them is otherwise obstructed, often leading to over heating of a space. Ensure that sufficient space is left around them for their effective operation.

Tampering with heating controllers often leads to heating being left on inappropriately for long periods, or the set points being increased above that required, causing excessive energy use. Tamper proof controllers should be used in all public areas although having a policy as to who can adjust the heating settings may suffice in smaller, non-open access areas.

Finding a supplier

Manufacturers of electric heating controls can be found by carrying out a web search, or by contacting a local electrical or heating wholesaler. Ask for references to ascertain whether the product has performed successfully in other, similar situations.

Electrical heating controls should always be fitted by an NICEIC approved electrical contractor.

If you do not already know a suitable contractor try contacting a recognised Trade Association for details of their membership, for example:

- The Heating and Ventilating Contractors Association (HVCA) – telephone number 020 7313 4900 – www.hvca.org.uk

The business case

As a rule of thumb; an occupancy detector, time controller or temperature sensor would each typically cost around £200 (plus VAT) to install using a contractor.

For example, take a room heated using 2kW of electric heating which is left on continuously for six months of the year, using about 2,190 kWh of electricity. A timer could be installed to switch the heating off for eight hours overnight, saving 730 kWh per year. This would lead to financial savings of about £58 per year (based on electricity costing 7.9p/kWh, including CCL), leading to a payback period of about 3.5 years on the investment.

If a room thermostat is also installed, reducing the room temperature by 1°C on average, then typically 8% of energy used by the heating would be saved. This would amount to saving a further 117kWh per year with about £9 per year saving in electricity costs. The combined installation of timer and thermostat would have a payback period of just under six years.

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