

Sustainable comfort

How to use this energy-saving
relocatable classroom

READY

*Every
child,
every
opportunity*



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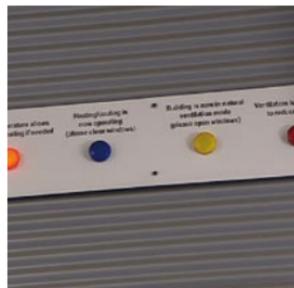
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Introduction

In its commitment to energy reduction and minimising greenhouse gas emissions in Victorian government school buildings, the Department of Education and Early Childhood Development (DEECD) has introduced energy-saving relocatable classrooms designed to reduce energy consumption and improve comfort.

These enhanced relocatable classrooms have the potential to save considerable amounts of energy. That potential can only be realised if classroom users (teachers and students) are aware of how best to use these classrooms.

DEECD has produced this booklet, a 15-minute DVD and classroom posters to help teachers and students take full advantage of these new relocatable classrooms.



1. Energy-saving features



1.1 Low-energy lighting

The classroom's low-energy lighting turns off automatically if no one is using the room. The classrooms have monitors that measure light levels, and some of the lights automatically switch off if they're not needed. These two measures help reduce energy consumption.



1.2 Double-glazed windows

Double-glazed windows help to keep the heat inside during winter and outside during summer by slowing down the transfer of heat. Two layers of glass with air between them help the room maintain a comfortable temperature and reduces the need to use energy-consuming heating and cooling.



1.3 Insulation

Insulation in the roof, walls and underneath the floor helps keep the heat inside the classroom during winter and outside in summer. Just like double-glazing, this works by slowing down the transfer of heat and reduces the need to turn on the heating and cooling.

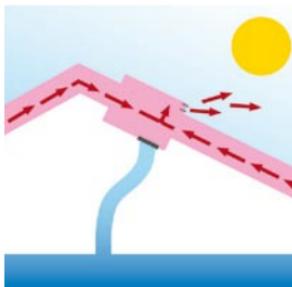
1.4 Ceiling fans

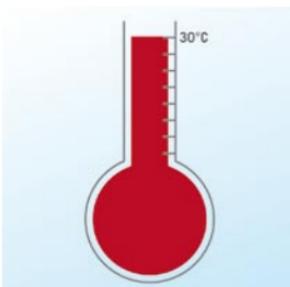
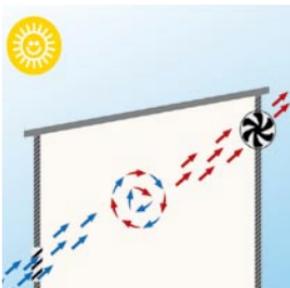
Ceiling fans make the classroom more comfortable in summer by moving the air to create a cooling breeze. In winter, ceiling fans can still help to regulate the temperature. Because hot air rises, fans can be used to push the warm air back down to floor level. Fans use much less energy than turning on the heating or cooling unit.



1.5 Smart solar-powered unit

Every classroom has a smart solar-powered unit on the roof. In summer, the unit removes the hot air that is trapped between the ceiling and steel roof so that the heat doesn't radiate into the classroom – thereby reducing the need for cooling. In winter, the unit redirects this hot air into the classroom to assist with heating – thereby reducing the need for heating. Making use of solar energy means less electricity is used.





1.6 Ventilation system

Each classroom has an automatic ventilation system that helps regulate temperature and air quality. The ventilation system has louvres and an extraction fan that operate automatically to bring in fresh air and take hot air away. Whenever the outdoor temperature is pleasant, the ventilation system makes the most of the natural outdoor conditions by bringing fresh outside air into the classroom. This is known as natural ventilation mode.

On a warm day, this reduces the need to use the cooling system.

On summer nights, the ventilation system takes hot air out of the classroom so, by the next morning, the classroom is filled with cool, fresh air.

When carbon dioxide levels are high, the ventilation system automatically operates and removes stale air from the classroom. Good air quality helps us to concentrate and makes better learning environments.

2. Activating the room

The first thing you need to do when you enter the room is to ‘activate’ the room.

The room is activated by pressing the green activation button located near the front door. This will:

- turn on the lights
- enable the ceiling fans
- enable the heating/cooling system.

The room will automatically ‘deactivate’ 15 minutes after everyone leaves, sensors automatically detecting there has been no motion in the room for that time. The deactivation process will:

- turn off the lights
- turn off the ceiling fans
- turn off the heating system
- switch the cooling system to ‘Hot day standby mode’ (see page 19).



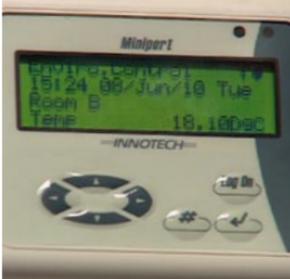
3. The building control system



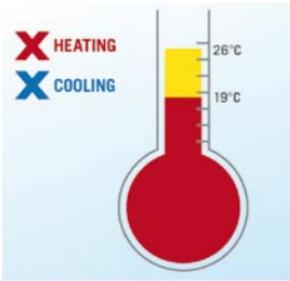
The new classrooms have a building control system that thinks. It monitors:

- indoor and outdoor temperature
- indoor air quality
- light levels
- whether the room is occupied.

By monitoring the temperature inside and out, the control system determines whether the heating and cooling system can be used.

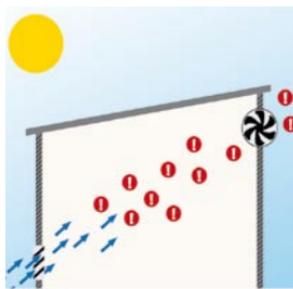


If both the indoor and outdoor temperatures are below 19°C, the heating system can be used. If the indoor temperature is above 27°C and the outdoor temperature is above 26°C, the cooling system can be used.



An indoor temperature between 19°C and 26°C is considered an ideal comfort range for learning that doesn't require heating or cooling. That will mean you won't be able to use the heating or cooling system when the temperature is in this range.

The building control system also monitors the indoor air quality. If there's too much carbon dioxide, the ventilation system automatically turns on to bring fresh outdoor air into the room.

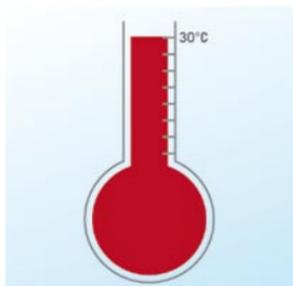


Light levels are also monitored and some of the lights will automatically turn off if there is enough natural light in the room.

If the room has been unoccupied for more than 15 minutes the control system will automatically turn off the heating or cooling, ceiling fans and lighting, reducing unnecessary energy consumption.



The building control system continues to monitor the room temperature on hot school days even when the room is not in use. The system keeps the room below 30°C so it's not too hot when students return and requires less cooling to be comfortable.



4. Lighting



4.1 Classroom lighting

When the classroom is first activated, the central row of lights will turn on. The front and rear rows of lights will only come on if the indoor light levels are too low. If you're not happy with the automatic light levels, it is possible to override the system by changing the light control switch in the office from 'Auto' to 'On' or 'Off'. This mode will operate for two hours and then change back to 'Auto'. The lights will turn off after 15 minutes if there is no motion detected in the room.



4.2 Office lighting

The office lights will come on automatically if there are low light levels in Room A and turn off after 15 minutes if there is no motion detected in the office. There is no override switch or separate switch for the office lights.



4.3 Security lighting

The external security lights will come on at night if either room is activated. They will also come on at night if both rooms are 'inactive' and there are low light levels. 'Night' means:

- 4pm – 7am in winter (Apr–Sept)
- 7pm – 7am in summer (Oct–Mar).

5. Ceiling fans

The ceiling fans must be operated manually and are your first option when trying to heat or cool the classroom because they consume less energy than the heating and cooling system. The room must first be activated (by pressing the green activation button located near the front door) for the fans to operate. Ceiling fans are turned on by the switch outside the office.

5.1 Summer/winter setting

The ceiling fans have a summer and a winter setting. The setting is altered using a switch on each fan. Follow your school's OH&S procedure to do this safely.

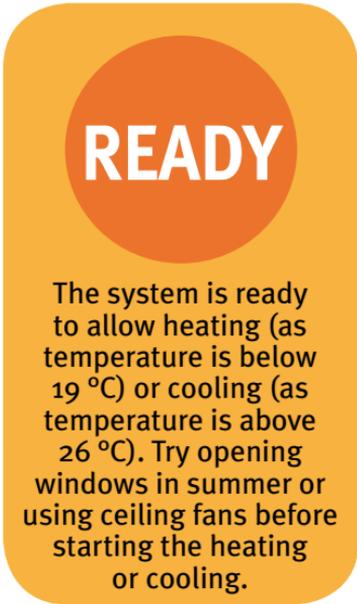
The summer setting circulates air throughout the room, creating a cooling breeze for teachers and students. The winter setting pushes down warm air from the ceiling to where it can be felt by teachers and students, hence reducing the need to use the heating system.



6. Indicator panel

The coloured lights on the indicator panel provide an instant overview of conditions in the room.

Remember that opening windows is the most efficient and energy-saving way to maintain good air quality and a comfortable temperature.

An orange rounded rectangle containing a white circle with the word "READY" in white capital letters.

READY

The system is ready to allow heating (as temperature is below 19 °C) or cooling (as temperature is above 26 °C). Try opening windows in summer or using ceiling fans before starting the heating or cooling.



The heating or cooling is on. Close all windows. Ceiling fans help with heating and cooling – make sure the winter/summer fan setting is correct.



The ventilation system is working to bring in fresh air. This is called natural ventilation mode.
Open windows.



The ventilation system is working automatically to reduce CO₂ levels.
Open windows (unless the heating or cooling is on).

7. Automatic and manual operations

These clever classrooms have been designed to be energy-efficient and easy to use. Many features are automatic. Everything you'll need to do to make the room as comfortable as possible is available at the touch of a button. The building control system will even tell you when you need to take action – just by looking at the indicator panel.

This page explains what the classroom does automatically and what needs to be controlled by teachers.

7.1 Automatic functions

Light levels are monitored and the front and rear rows of lights are only switched on when needed.

The classroom monitors motion in the room and automatically switches off heating, cooling, lighting and ceiling fans if there is no motion detected for 15 minutes.

The ventilation system operates automatically in response to indoor and outdoor temperature and carbon dioxide levels in the room.

Heating can be turned on when the indoor and outdoor temperatures are both below 19°C. The heating will automatically turn off when the indoor temperature is 20°C or the outdoor temperature is above 18°C.

Cooling can be turned on when the indoor temperature is above 27°C and the outdoor temperature is above 26°C. The cooling will automatically turn off when the indoor temperature is 24.5°C or the outdoor temperature is below 26°C.

The heating and cooling system does not turn on automatically. If conditions for operating heating/cooling are met (indicated by the orange light) heating/cooling can be turned on manually by using the blue button on the control panel. Heating and cooling will automatically turn off when conditions are met or when no motion is detected in the room for 15 minutes.

The building control system continues to monitor the room temperature on hot school days, even when the room is not in use. The room is kept below 30°C so it's not too hot when students return and requires less energy to cool the room to a comfortable temperature.

External security lights come on automatically depending on light levels and whether the room is occupied.

7.2 Manual functions

Although many features of these new relocatable classrooms are automated, there are a number of things you must do manually.

These are:

- pressing the green activation button to activate the room when you first enter
- turning on the ceiling fans
- changing the ceiling fans to summer or winter setting
- turning on the heating
- turning on the cooling
- opening and closing the windows
- overriding the automatic lighting setting.

8. Heating the room

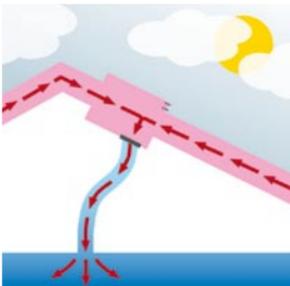


Heating the classroom is easy and can be done by following three simple steps.

However, to save energy, see if the room can be made comfortable without turning on the heating system. Try turning on the ceiling fans, making sure they are switched to the winter setting. This will push hot air down from the ceiling to floor level where it can be felt.



The solar unit will also introduce warm air into the room automatically in winter when the roof-space temperature exceeds the classroom temperature.



Step 1

If you need to turn on the heating system, the first step is to ensure the green activation button located near the front door is on.



Step 2

Next, check that the orange light is on, showing that the indoor and outdoor temperatures are both below 19°C. The heating will only operate if this light is on. There is no way to override the system.



Step 3

Finally, turn on the heating by pressing the blue button on the control panel in the office. The blue button will illuminate and the heating will start soon after.



Ceiling fans can be used when the heating is on to push warm air down from the ceiling. Check that the fans have all been switched to the winter setting.

9. Cooling the room



Cooling the classroom can be done by following three simple steps.

However, to save energy, see if the room can be made comfortable without turning on the cooling system. Try opening windows and turning on the ceiling fans, making sure they are switched to the summer setting.



Step 1

If you need to turn on the cooling system, the first step is to check that the green activation button located near the front door is on.



Step 2

Next, check that the orange light is on, showing that the indoor temperature is above 27°C and the outdoor temperature is above 26°C. The cooling will only operate if this light is on. There is no way to override the system.

Step 3

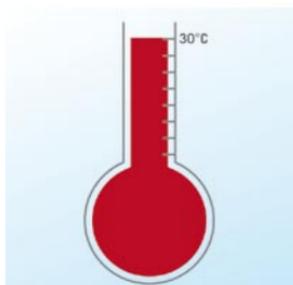
Finally, press the blue button on the control panel to activate the cooling system. The blue button will illuminate and soon after the cooling will start. Ceiling fans can remain on when cooling

is operating but the windows must be closed.

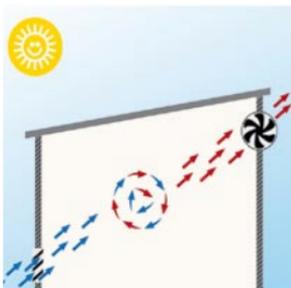
9.1 Hot day standby mode

The building control system continues to monitor the room temperature on hot school days even when the room is not in use. The room is kept below 30°C so it's not too hot when students return and requires less cooling to be comfortable.

If motion is not detected for more than 15 minutes, the room will deactivate and, if this occurs on a hot school day, the cooling system will operate in 'hot day standby mode' to keep the room at or below 30°C.

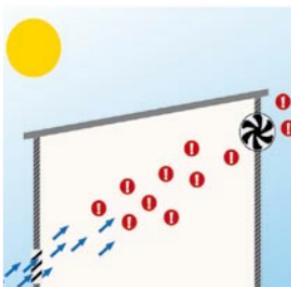


10. Indoor air quality



10.1 Natural ventilation

The new relocatable classrooms have a ventilation system that is automatically turned on in response to temperature or high levels of carbon dioxide. The ventilation system brings outdoor air into the room through louvres under the window and takes warm, stale air out of the room through high extraction fans. This creates cross-ventilation.



The ventilation system will come on if the indoor temperature is over 22°C and warmer than the outdoor temperature. This is ‘natural ventilation mode’. The yellow light indicates that natural ventilation mode is operating.



10.2 Carbon dioxide extraction

To help prevent carbon dioxide building up, the ventilation system comes on for one minute each hour so fresh air is brought into the classroom. When high levels of carbon dioxide are detected, the red light will come on indicating that the ventilation system is operating. If the heating or cooling is on, the ventilation system won't operate unless it is needed to reduce carbon dioxide levels.

Table 10.1: How ventilation works with heating, cooling and carbon dioxide levels

Condition	Heating/cooling off	Heating/cooling on
High carbon dioxide levels	Ventilation ON continuously	Ventilation ON continuously
Classroom warm ^a and normal carbon dioxide levels	Ventilation ON	Ventilation OFF
Classroom cool ^b and normal carbon dioxide levels	Ventilation OFF	Ventilation OFF

a. Classroom warm means the indoor temperature is warmer than 22°C and warmer than the outdoor temperature

b. Classroom cool means the indoor temperature is cooler than 22°C or the room temperature is cooler than the outdoor temperature

Note: When ventilation is not operating (i.e. has not been triggered by temperature or high carbon dioxide levels) ventilation will come on for one minute every hour.

10.3 Night purging

On summer nights, the ventilation system takes hot air out of the classroom so, by the next morning, it is filled with cool, fresh air. Night purging will operate when the indoor temperature is warmer than 22°C and warmer than the outdoor temperature.

It will continue to operate until the indoor temperature falls to 20°C or the room becomes occupied.

11. Reading the Information Display

Next to the control panel is the Information Display that shows the status of equipment that the building control system is monitoring.

The Normal mode for the Information Display is to show the status of the following attributes, cycling through each continuously:

- indoor and outdoor temperature
- light levels
- carbon dioxide levels
- whether the room is occupied
- whether heating or cooling is operating.

By using the navigation keys in the circular layout under the screen, you can view Fault mode and other modes of the Information Display.

Figure 11.1: Information Display – Normal mode

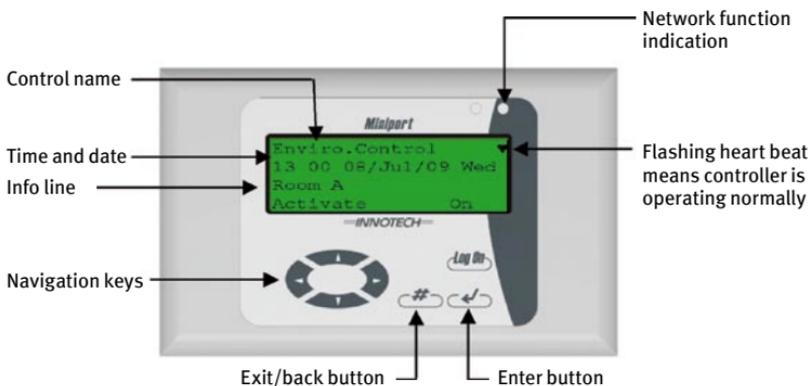
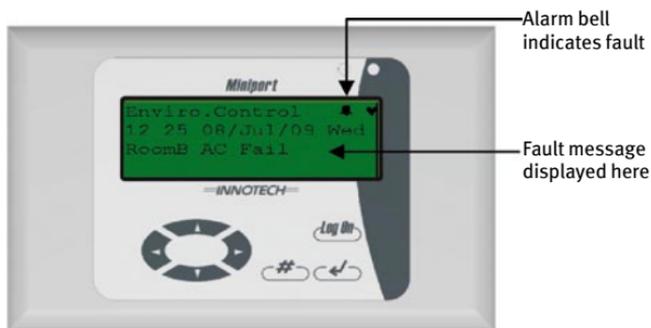


Figure 11.2: Information Display – Fault mode



12. Frequently asked questions

How do I heat the room?

1. Ensure that the green activation button located near the front door is on.
2. Check that the orange light is on, showing that the indoor and outdoor temperatures are both below 19°C. The heating will only operate if this light is not on. There is no way to override the system.
3. Turn on the heating by pressing the blue button on the control panel in the office. The blue button will illuminate and the heating will start soon after.

How do I cool the room?

1. Ensure that the green activation button located near the front door is on.
2. Check that the orange light is on, showing that the indoor temperature is above 27°C and the outdoor temperature is above 26°C. The cooling will only operate if this light is on. There is no way to override the system.
3. Turn on the cooling by pressing the blue button on the control panel in the office. The blue button will illuminate and the cooling will start soon after.

How can I override the system to turn on heating or cooling when the orange light is not on?

You cannot do this. The system has been designed so that:

- heating cannot be turned on unless both the indoor and outdoor temperatures are below 19°C
- cooling cannot be turned on unless the indoor temperature is above 27°C and the outdoor temperature is above 26°C.

How do I turn on the lights?

Lights will automatically turn on when you press the green activation button located near the front door.

How do I turn off the lights?

You can turn off the lights by using the override switch on the control panel in the office.

The room lights will automatically turn off if no motion is detected in the room for 15 minutes.

When should the windows be opened?

Windows should be open whenever it is comfortable to have them open. It is an ideal temperature for windows to be open when the indoor temperature is over 22°C and warmer than the outdoor temperature.

What does the orange light mean?

The orange light means that the room is either cold enough to turn on the heating or hot enough to turn on the cooling system. Heating or cooling can only be turned on when the orange light is on. To turn on heating or cooling, you need to press the blue button on the control panel in the office.

What does the blue light mean?

The blue light shows that the heating and cooling system is on. Make sure all the windows are closed so cool or warm air doesn't escape outside.

What does the yellow light mean?

The yellow light means that the ventilation system is operating to bring in fresh air. This happens when the indoor temperature is warmer than 22°C and warmer than outside. These conditions are perfect for opening windows.

What does the red light mean?

The red light means that carbon dioxide levels in the room are high and so the ventilation system is operating automatically to bring outdoor air into the room. Unless the heating or cooling system is on, open windows to speed up this process.

How can I check if the room is working properly?

See page 22 for information about using the Information Display.

13. Reporting faults

1. If you detect a fault in the system, first refer to the Information Display located in the office.
2. If you can't resolve it yourself, the next step is to contact the building facilities manager at your school.
3. If the situation still hasn't been rectified, please email DEECD at relocatable.school.buildings@edumail.vic.gov.au

The following faults should be reported as soon as possible:

- louvres do not open when the classroom is warmer than 22°C and warmer than outside
- red light stays on for more than two hours
- red light is on first thing in the morning
- heating or cooling will not operate when the orange light is on
- Information Display indicates a fault such as 'AC Fault'.

Acknowledgements

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