RAYCON ENGINEERS PTY LTD

Attic Mounted Whole House Fans

Owner's Manual

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Attic Mounted Whole House Fan 3.1

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Introduction

Congratulations on purchasing your Raycon Whole House Fan.

Sitting on my deck in Brisbane in summer, the temperature most evenings is pleasant. But go inside and the house is hot from the heat of the day. Our answer has been to turn on the air conditioning. This seemed horribly wasteful to me.

I looked for about two years for a simple exhaust fan that would bring in that cool night air, was not too noisy and would cost a fraction of my air conditioning to run.

The result is the fan you have purchased. Your Whole House Fan has been designed to move a large volume of air, 9,000 cubic meters per hour using the least amount of power, only 375 Watts (94% less than my air conditioner). Your unit is easy to install. The components are the best I could find to ensure your Raycon Whole House Fan will keep your home naturally cool for many years to come.

I hope you love your Raycon Whole House Fan as much as I do.

Mark Edwards
Director of Raycon Engineers Pty Ltd.

Figure 1. Installed prototype at my house in Chapel Hill.

How to use your Whole House Fan

How to turn the fan on and off

Use the dial speed controller to turn your Whole House Fan on and off.

Turning the dial speed controller to its minimum setting turns off the fan. The electronic speed controller on the motor reduces the fan to its minimum speed and powers it off.

To turn the fan on simply turn the controller dial to your desired speed. The electronic motor controller will power up the fan and bring it to the speed you have selected. The controller is programmed to bring the fan up to speed in a period of 15 seconds.

This soft start and slow ramp up in speed reduces the loads on your unit to increase its life.

Speed controller operation

Use the dial speed controller to adjust the speed of your Whole House Fan.

Use the high speed setting to rapidly remove hot air from your house or during daytime.

Use a lower speed setting at night for whisper quiet operation and a more comfortable sleeping environment.

Typical usage scenarios

Since installing my own fan I have been documenting the ways I have used it in my own home and how effective they were.

1. **Night time no breeze 50% humidity.**
   In this case, it was the end of a hot day in the mid 30's. By evening, the outside air temperature was dropping but still about 27C. I had the doors and windows open and the breeze had cooled the house to 28.5C.
   The outside breeze then stopped and the air was still. Time for the Whole House Fan.
   I closed all of our windows other than bedroom windows and turned on the Whole House Fan. It was at about 75% speed.
   This made for very comfortable sleeping conditions. The outside temperature dropped to 23C by morning.
   We needed blankets to sleep that night as the temperature in the house fell to 24C by morning.

2. **Daytime 35C maximum no breeze until afternoon.**
   By morning, the Whole House Fan had reduced the temperature to 24C in the house. Outside temp was 23C at dawn.
   I closed all of the windows in the house but left the windows in my office

open.
I turned the Whole House Fan speed up to 100% and ran it all day.
This pulled a comfortably strong breeze in my office windows and through the house keeping the heat from building up at the high point in our upstairs area.
By midafternoon, the internal temperature in the house peaked at 31.5C while outside was 35C.
During the day I checked the attic temperature which would normally be about 40C or higher and it was the same as inside the house. It was noticeably cooler upstairs than normally on a hot day. I guess this was a combination of the cooler ceiling temperature and the increased air movement.
After 2pm the sea breeze started and I opened the doors and windows to let the house cool down in the afternoon.
By early evening, the house temperature was 27.5C and outside was 26C.

3. **Night time no breeze 88% humidity.**
In this case, it was the end of a hot and very humid day with 33C maximum.
By evening, the outside air temperature was dropping but still about 27C.
There was little to no breeze. I had the doors and windows open and the Whole House Fan on maximum had cooled the house to 28C.
On a night like this we would definitely have used air conditioning as it was so humid.
I closed all of our windows other than bedroom windows and turned the Whole House Fan down to about 75% speed for sleeping.
Even though it was 28C in the house it was comfortable enough to sleep easily with the breeze coming in through the windows driven by the Whole House Fan.
By about 4am I woke up cold. It was still 88% humidity but the house was cold. I had to reduce the breeze in our bedroom as it was too cold to sleep comfortably even with a light blanket. The outside temperature dropped to 23C by morning.
Others we spoke to that day said they had AC on all night. Not us.

4. **Removing barbeque smoke or other odours.**
On several occasions I have burnt pizza bases in our pizza oven producing quite a lot of smoke. This has set off our smoke alarm. Turning on the Whole House Fan to maximum and opening a nearby kitchen door helps to quickly clear the smoke out of the house. Unlike just opening windows where the smell would linger for hours sometimes, all traces of the smoke smell are gone within a few minutes.

5. **Drying out damp floors.**
If you have just had your floors mopped, use your Whole House Fan on high speed to dry them out.

6. **Arriving home at night to a hot house.**
Getting home at10pm one night on a day when the temp had hit 38C and the house had been closed up the whole day. The internal temperature was 34C

upstairs.
I turned on the Whole House Fan and opened windows only in the three occupied bedrooms and watched how quickly it reduced the temperature. Within a few minutes, the cool breeze from outside made the bedrooms all comfortable enough to sleep.
The internal temperature dropped by about 1 ½ degrees C per hour. This is faster than our ducted air conditioning would be able to.
By 6am the following morning the temperature in the bedrooms was down to 22C. The minimum that morning was 21C.
This was a 12 degree reduction in 8 hours.
The cost of running our Whole House Fan for the 8 hours was 77c. The equivalent cost for our air-conditioning which would not have been able to do as good a job would have been at least $12.28.

These are just some of my own experiences. I would love to hear how you have used your fan.

Installation

Positioning your Whole House Fan

Before beginning your installation you need to decide on the location of:

1. **Ceiling duct.** This duct requires a 500mm square hole in the ceiling. The covering grill which fits into this hole is 545mm square. The location should be central to your floor plan. If you have more than a single story it should be in the upper floor ceiling. Ideally, a corridor or stairwell ceiling. Position the duct to avoid obstacles in your attic space.

2. **Wall control.** You will need to choose a location for your dial speed controller. Ideally it should be close to your ceiling duct to reduce the wiring requirements and to allow you to hear your Whole House Fan when you are adjusting your settings.

3. **Damper unit.** The damper unit will sit directly above the ceiling duct. It should be clear of any major structural elements in your roof. You require at least 700mm clear space above the ceiling duct to install the unit.

4. **Fan unit.** The fan unit needs to be within 3 meters of the damper unit and hangs from a convenient roof timber. It needs to be positioned with a minimum of 1m of clear space from the exit grill to allow for free flow of air from the unit.

5. **Eave vents.** Extra eave vents may be required to allow the air sucked out of your home to exit easily from your roof space. Look for easily accessible eaves (the vents are installed from outside the attic into the eaves).

Installing the Ceiling Duct

Your inlet grill is installed in a hole cut through the ceiling plaster and framed with timber above this hole to support the damper unit.

You will need:

1. Framing timber to match the size of your joists.
2. Tape measure, Drill, Pencil, Timber saw, Plaster saw, Liquid Nails and caulking gun.
3. Timber screws long enough to fix your framing to the existing joists.

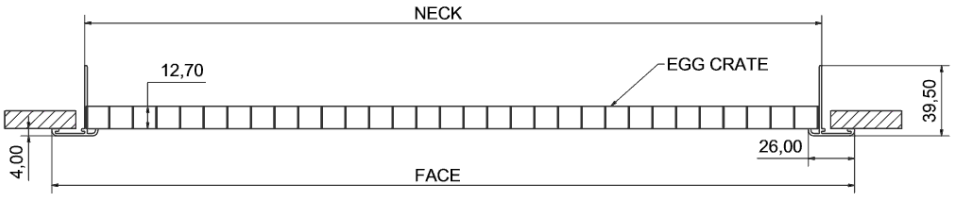


Figure 2. How the inlet grill fits through the ceiling hole. Your nominal neck size is 500mm and the face is 545mm.

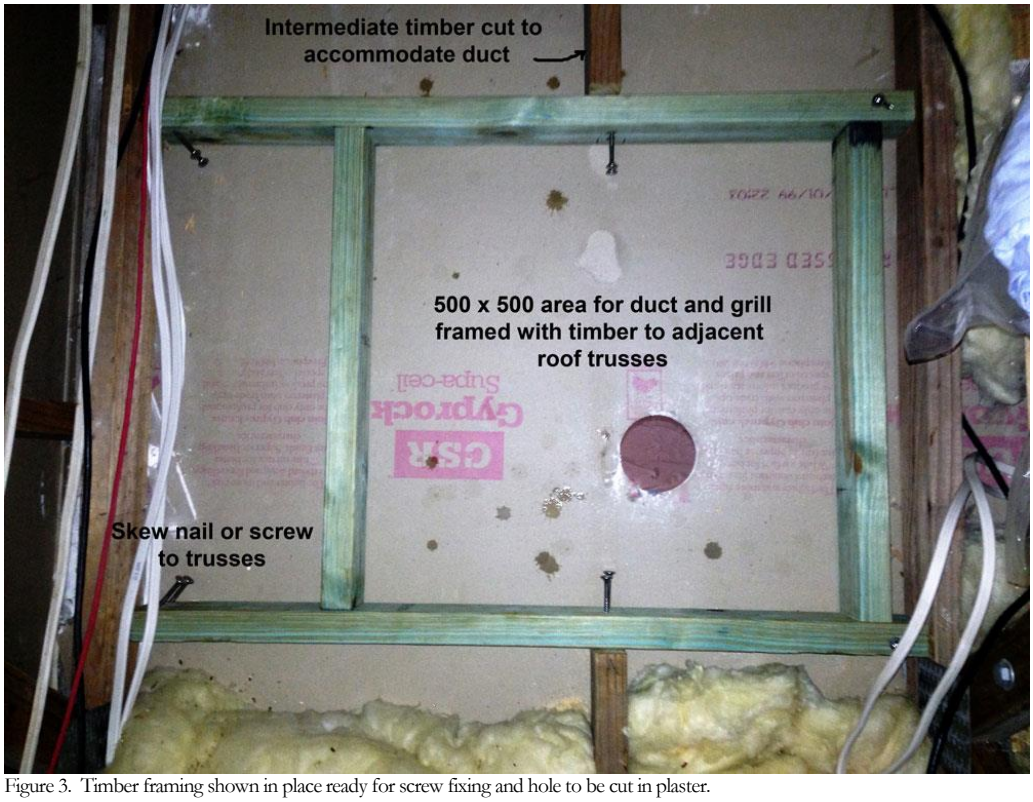


Figure 3. Timber framing shown in place ready for screw fixing and hole to be cut in plaster.

On the ceiling at your chosen location, mark out the position of your ceiling inlet hole to suit the neck measurement of your inlet grill. Drill a small hole to confirm the location is suitable on inspection from the attic. If so, drill small holes at each corner and confirm the location.

Measure your required framing timber.

Measure the size of your duct grill neck size.

If you have a large enough ceiling access you can build the framing outside and carry it into the Attic space. In this case you can use the inlet grill as a template to size your timber framing. Cut any timber crossing your intended opening to allow for the framing as shown in Figure 3. You can then cut the hole using your framing timbers as a guide.

Alternately, cut the ceiling hole and use this to pass up the framing timber.

Installing the Damper Unit

The damper unit sits on top of your timber framing. It is only light <2kg so your aim is just to seal the gap between the duct and the timber framing.

You will need:

1. Single sheet of marine ply suitably sized to cover the 500mm square hole and the immediately surrounding timber. For most installations, a single 1200mm x 610mm wide 9mm thick marine ply sheet should be adequate.

2. Jig Saw.

3. Liquid Nails or similar.

Measure the size of sheeting you will need to seal the hole in the ceiling. Cut this to size.

Draw the 500mm square hole on the sheet.

Place the damper inside the drawn square with the spine of the damper pointing toward the fan.

Figure 4. Orientation of damper spine.

Lift the blades of the damper unit so you can see the ply underneath.

With a Nikko pen, draw a circle inside the duct on the ply sheet. The duct will sit on a narrow lip of ply once this circle is cut out.

Cut the circular hole in the ply.

Bring the damper and ply sheet into the attic and put them in place for a final check.

If you need to use the ceiling hole to get the fan unit, mesh guard and flexible ducting into the attic do this now.

Run a bead of Liquid Nails around the top of the timber framing and sit the ply sheet on it.

Place the damper unit on the ply ensuring the orientation of the damper is correct (refer Figure 4).

Seal around the bottom edge of the damper with Liquid Nails to seal it against the marine ply sheet.

Check the damper blades move freely.

Figure 5. Damper in position.

Fan Unit Installation

The fan unit should be near the top of the attic space at the high point of a nearby truss. This reduces the noise level from the fan and reduces structure borne vibration.

The fan unit hanger is bolted to the fan case angle as shown below with the supplied nut, bolt, washer and split washer. The hanger can be bent and twisted as required to hold the fan in the right position and orientation. The hanger can then be screw fixed (two timber screws are recommended) through a suitable timber truss member.

Ensure the motor shaft and fan blades point toward the damper unit.

Figure 6. Hanger bracket installation.

The unit is now ready for electrical installation.

Flexible duct installation

Slide the flexible duct over the damper unit. Run duct tape around the join to fix it in place.

Pull the flexible duct up to the fan unit and slide it over the end of the duct. Once again secure the duct with tape.

Unlike a HVAC system, this ducting is in vacuum rather than under pressure so it will tend to pull in to the ducting and a strapped seal in not required.

Ensure the flexible duct makes a gentle 90 degree bend up to the fan unit and is not kinked or distorted. Ensure it is not rubbing on anything. If necessary, add a light support to the duct to maintain a smooth curve.

Inlet grill Installation

Push the ceiling duct into the hole from underneath and screw in place using the 4 supplied 8g x 15mm galvanised button head screws as shown in Figure 7.

Figure 7. Screw fixing of inlet grill

Finally, seal any gaps between the framing timber and the plasterboard with Liquid Nails to prevent air leaking in from the attic.

Figure 8. Inlet grill in position.

Electrical Installation

Electrical installation of the 240V wiring to the motor of your Whole House Fan must be performed by a licensed electrician. You can install the speed controller wiring to the wall mounted dial controller yourself as it is low voltage.

Speed controller wiring

Connect the variable resistor terminals for the wall mount speed controller to the matching remote input connections for the speed controller in the isolator.

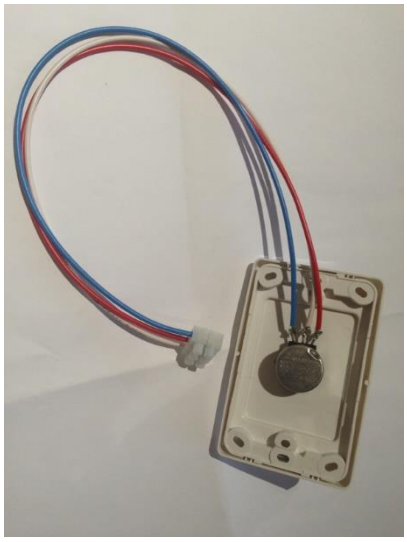


Figure 9. Rear of variable resistor showing terminals.

Inside the isolator on the fan case, the speed control wires are the matching red, white and blue in the terminal block. This is low voltage wiring and does not require an electrician to install.

Figure 10. Isolator wiring.

Fan power wiring

The wiring to the fan isolator must be carried out by a licensed electrician.

The 240V connection simply requires a line, neutral and earth connection to be made inside the isolator.

Figure 11. Motor controller programming.

The motor controller has been programmed to ramp up its speed over a period of 15 seconds or more. Unlike a normal induction motor, the EC motor in this Whole House Fan does not have high current draw at startup.

It is quite comfortable on a 10A circuit with other devices.

Prior to turning on the isolator, turn the wall mount speed controller to the minimum setting. This will ensure that when the isolator is turned on the fan will not immediately start.

When the isolator is switched to ON, the LED indicator will light up even though the fan should not spin if the speed controller has been turned to minimum.

The speed controller will initialise and show 0 speed and 0 demand.

Turn on the speed controller to start up the fan and test that it runs.

The speed controller will report the current speed and percentage demand as it ramps up to the selected set speed.

Operation data

Speed and Airflow Testing

This is not required, however if you are interested in measuring the installed performance of your unit the following procedure may help.

Run the unit at full speed. Use a portable anemometer to measure the air speed at the fan exit and the inlet grill.

Air velocity around the motor case should be approximately 15m/s.

Air velocity at the face of the ceiling grill should be 9m/s for the 500mm grill.
Air velocity at eave vents should be 4m/s or less if possible.

Performance data

Performance data from previous installations for reference is shown in the table below.

Note this data uses the Origin Energy Tariff 11 rate of 25.586c per kWh in effect since 1 July 2016.

Exchanges per hour is the number of times all the air in a 250 square metre home with 2.5m ceilings will be completely exchanged.

Speed	RPM	Power (W)	$/hour	M3/hour	Exchanges per hour
100%	1250	375	$0.10	8,167	13
75%	940	280	$0.07	6120	10
50%	625	187	$0.05	4084	7
25%	313	93	$0.02	2042	3

Noise level data

The noise from a Whole House Fan is just the noise of air rushing through the duct and out of your house.

It has been described as a dull rumble. Some customers have said they love the sound of it as it is like white noise.

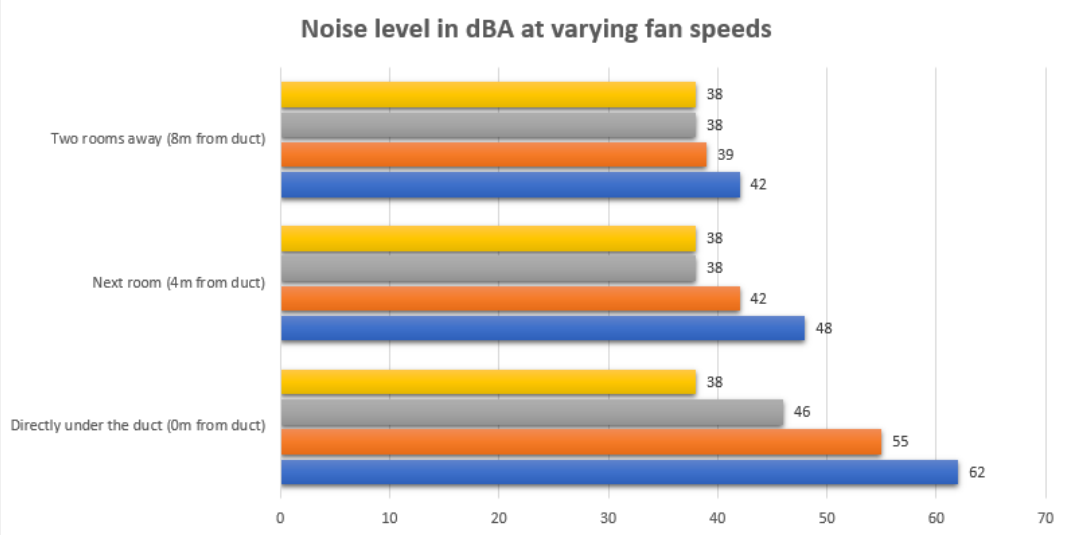
Even people who comment about hearing the fan running say within a day or two they no longer notice it.

To meaure the noise of the Whole House Fan prototype I have installed, I measured the sound level at 3 different points in the house at varying fan speeds. The results are shown below.

As you can see from the chart of noise measurements below, the reason the noise is hardly noticeable is because it is very low.

To compare, our bathroom exhaust fan is 57dBA when standing directly underneath it. It is also a far more annoying sound as it is higher frequency.

So how quiet are these measurements? Noise levels in a quiet suburb are about 50dBA and the noise level in a library is 40dBA.



	Directly under the duct (0m from duct)	Next room (4m from duct)	Two rooms away (8m from duct)
0%	38	38	38
50%	46	38	38
80%	55	42	39
100%	62	48	42

Figure 12. Noise level measurements.