Rickard Design Guide, System Limitation, & Component Description

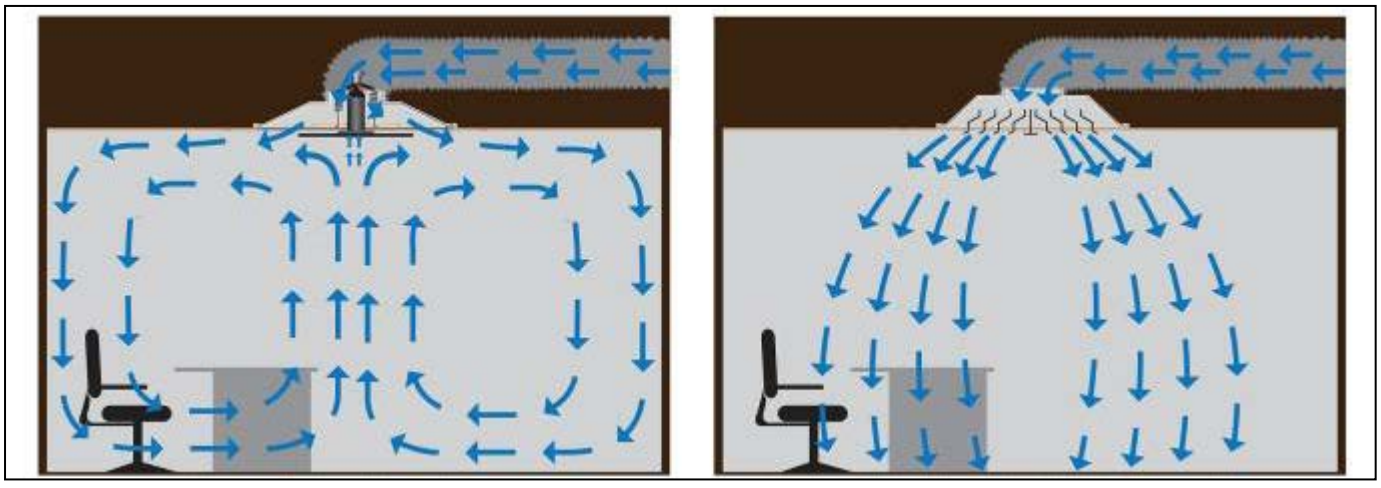
Introduction

The following guide aims to assist in the understanding and design of Rickard VAV electronic systems through the explanation of components and their limitations, system architecture, and worked examples. Specific duct design and airflow requirements are not covered but key requirements will be briefly touched on. Please also refer to drawings W201 and W202 for system examples to complement this guide.

The Rickard electronic products allow room temperature to be controlled by varying the supply air volume in accordance with demand. Volume control is achieved by opening and closing a disc or shutter within a diffuser so as to vary the aperture through which the air passes. This is the variable geometry concept which maintains constant air movement in the room.

The position of the control disc or shutters is varied by means of an electronic actuator which drives the control disc in response to a signal received from a temperature controller. The diffuser will control room temperature on a proportional/integral basis. Maximum & minimum supply air volumes may be adjusted to suit the particular design conditions.

The combination of an automatically adjusting opening in the diffuser responding to temperature, and a varying supply air velocity responding to duct pressure, ensures that the diffuser is always distributing and mixing an optimal velocity of air that eliminates vertical dumping.



Rickard VAV diffusers allow thorough air mixing regardless of supply air velocity.

Standard fixed grille diffusers rely on a constant supply velocity to mix air efficiently and prevent dumping at low air flows.

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System Description

The variable geometry diffusers are suitable for operation in conjunction with Rickard standard, modular (MLM) & BMS compatible (Mini BMS) controls as well as those supplied by others. The Rickard control range is able to provide you with a number of options including onboard or remote mounted temperature sensing, automatic cooling/heating change-over, air flow sensing/monitoring, and more.

The Master/Slave arrangement of diffusers allows contractors and building owners to easily modify the system to respond to changes, expansion, and new operating requirements because any diffuser can easily have its setting changed or ancillaries swapped/added for further customisation at any stage.

The use of 'plug and play' interconnecting cabling fitted with RJ type connectors at each end eliminates any potential “human error” which so easily occurs when using the conventional soldered plugs or screw terminals. Power and control signals share the same cable which is daisy chained between diffusers to again simplifying install. All plugs and sockets are keyed to eliminate the possibility of incorrect connection. Sockets are identified and any plug may be inserted into any socket in a particular group of diffusers. Each electrical component also has a unique ID which means it can be easily identified on the PC software when connected.

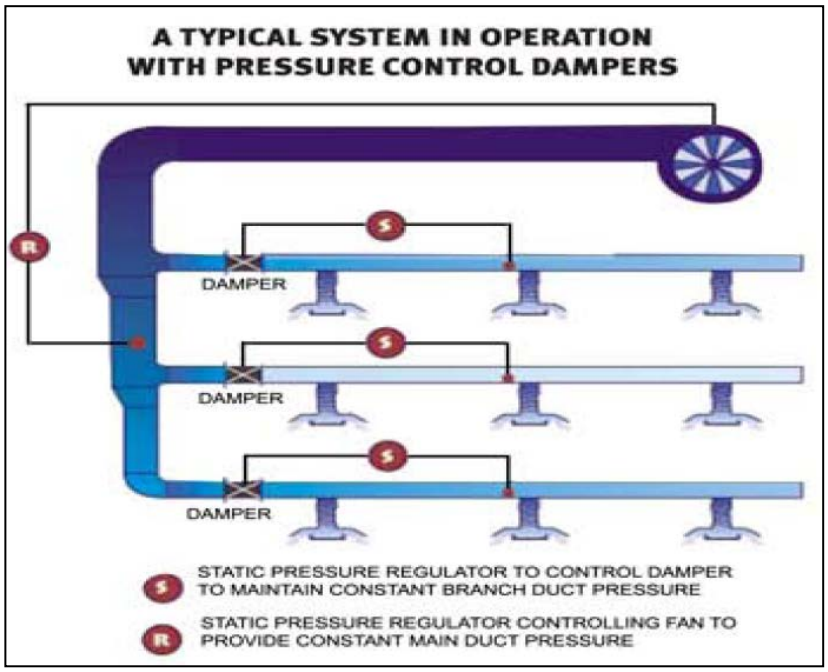
There is no need to balance the airflow to every variable geometry diffuser. These diffusers are essentially self balancing. The aim of the commissioner and duct designer is to ensure that the diffuser most likely to be starved from air, typically at the end of the run, has enough air at maximum load conditions (i.e. all diffusers in that run are fully open).

Consideration and Control of Duct Pressure

As the Rickard products vary their opening size, duct pressure will be affected as a result (i.e. openings are closed - duct pressure will rise, openings are open - duct pressure will fall). The control of duct static pressure within the design limits of the terminal units is an essential requirement of variable volume systems. Such control is easily achieved by any or a combination of the following methods, depending on the size & configuration of the air distribution system:

1. Control of supply air duct fan output by means of static pressure sensor operating in conjunction with the fan (EC style speed control) or by-pass damper configuration.

2. Dividing the air distribution system into the most conveniently selected low pressure supply duct zones, supplied with low/medium pressure main ducts or risers, by the fitting of branch duct dampers operating in conjunction with branch supply duct static pressure regulators.

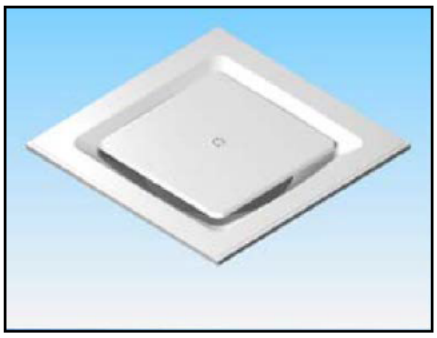


Components

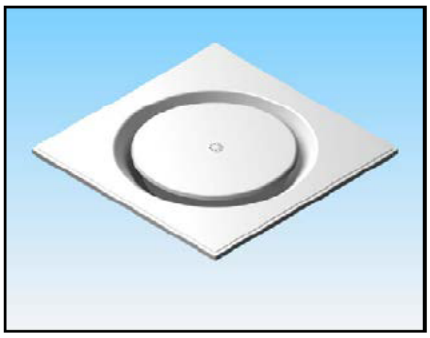
The following section will help to identify components and describe their functions for a better system understanding.

NOTE: ONLY A SMALL SUPPLY OF SELECTED MODELS AND COMPONENTS ARE CURRENTLY HELD IN STOCK. PLEASE CHECK STOCK LEVELS BEFORE PLACING ORDERS. ALL LARGE PROJECT ORDERS OR ORDERS OF MODELS NOT STOCKED WILL BE PLACED DIRECTLY WITH RICKARD WITH LEAD TIMES OF 12 WEEKS.

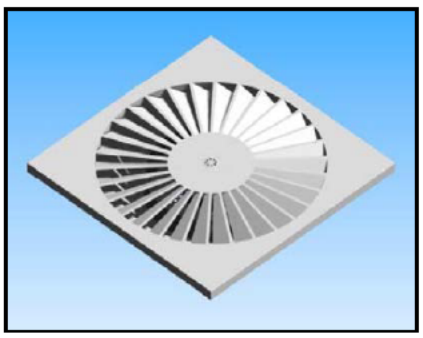
Ceiling Diffusers



VSD - Square Trim



VCD - Circular Trim

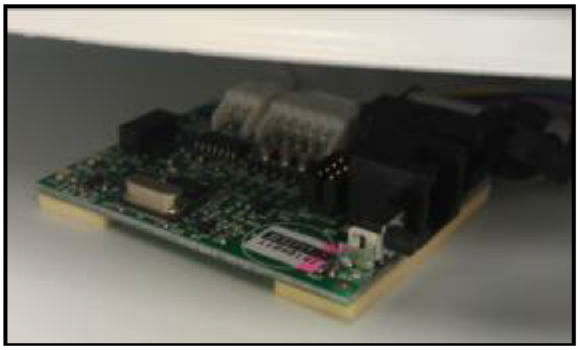


VSW - Swirl

The ceiling range of diffusers all operate using a control disc driven by a 12V DC electronic actuator. They have a small sensor installed in the centre of trim that can be used to measure the room temperature if an On Board Controller is installed. The diffusers are built as slaves but can become masters by installing an On Board Controller or Wall Stat. They are available in a number of spigot and tile sizes on request. A Interface board is mounted on the rear of the which is used to connect the power/control cable, Wall Stat, and Supply Air Change Over Sensor. The diffuser is supplied with a 6m long control/power cable as standard known as a Slave cable.



Interface Board



Trim Mounted Control Board



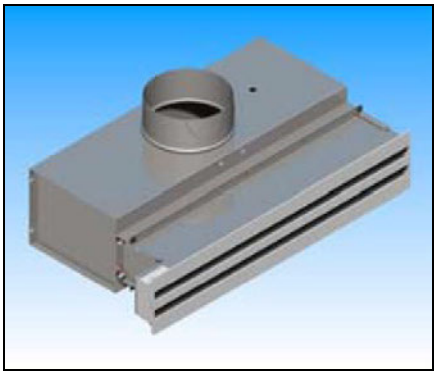
Trim Plate Sensor

The trim mounted control board is located on the back of the trim under the control disc. This is where the On Board Master Controller is plugged into. The diffusers are fitted with a number of ID tags; a small sticker on the trim mounted control board, one under the control disc on the support, and one sticker tag attached with a rubber band to the trim mounted control board (that can be removed and stuck to a floor plan to record the location of the diffuser to ease installation). Each board is also fitted with a small ping button which can be pushed to ID the diffuser when connected to the software. On the board is a RJ style socket that allows the connection of a Wall Stat which has been converted to a Setup Module.

Wall/Bulkhead & Linear Diffusers



WDB - Wall/Bulkhead



VLN - Linear Slot Ceiling

The WDB and VLN diffusers operate the same as the ceiling diffusers but use a series of alloy vanes to vary the airflow. Both are fitted with a Interface board which is in a closed panel on the side of the diffuser that allows the Slave cables (6m cable supplied), Wall stat, and Change Over Sensor to be connected. These models are not offered with an onboard temperature sensor as they can be affected by back end cooling/heating so therefore must be fitted with a Wall stat to become a master if required. (Back end cooling/heating is when an on board sensor's accuracy is at risk from being affected due to the cold or hot air supply. This is not a problem with the ceiling diffusers as the sensor is clear of the supply airflow and contains a venturi system that draws in the mixed air from the room).

Unlike the WDB (which is fixed), the VLN can have its airflow pattern adjusted manually from below. The airflow can be varied from two-way blow to one-way blow in either direction or just straight down.

Power Supply



Power Supply

Each power supply is fitted with a single phase plug and lead and converts the 240V input into a 12V DC output for the diffusers. It comes fitted with two termination resistors that are to be removed from the slaving ports and fitted to each end of the diffuser run in order to complete the series.

The power supply has a single RJ style port that is used to connect it to a USB module or a Master Communications Unit. During installation and connection of diffusers ensure the ID numbers of the diffusers are noted to aid addressing and programming later.

Each diffuser is supplied with a slave cable and interface board that allows it to be daisy chained from one to another. One power supply provides power for a maximum of 15 diffusers, 8 connected to one port and 7 connected to the other. The maximum total slave cable length per port is 60m. Standard slave cable length is 6m, 8m is available as an extra, and both lengths can be joined together but this reduces the amount of diffusers supported per port by one each time this is done. A power supply should not be used to power diffusers on different floors because of the restrictions in cable length.

Master Communication Unit



Master Communication Unit

The Master Communication Unit (MCU) allows up to 4 power supplies to be attached in order to set up, adjust, and monitor a possible network of up to 60 diffusers via the MLM software which is supplied. The MCU is connected to the Power Supplies via RJ style cable that is currently available in 20m lengths but can be supplied in 40m, 60, and 80m lengths. The maximum cable length must not exceed 100m.

The MCU is fitted with status lights, an RJ socket and a USB socket for computer connection. No cables are supplied for connection to computer but this is simply done by using a network cross-over cable for direct connection, or a standard network cable via a hub if connected to a network. Each unit has a default IP address which is used to connect to the software. This can then be changed once connection has been made. More in depth details are available in the software instructions.



MCU Cable

The MCU unit is available in a number of formats as it can also be connected to multiple Building Management Systems (BMS) software as follows:

Rickard using TCP/IP
BacNet using TCP/IP
BacNet using MS/TP
LON with twisted pair network

PC Set up Software and USB Module

The PC Set up kit contains the USB module and Software needed to set up and program smaller networks of diffusers where a MCU is not used.



Software and USB Module

The USB module can be connected directly to the RJ style socket on the power supply that powers a network of up to 15 diffusers by the supplied 3m cable. A supplied 1.5m USB cable then plugs into the computer. Software is supplied with the package to allow connection and each USB module has a serial number that is used to ID the module via the software.

Once the diffuser network is set up and programmed the USB module can be removed and used on another network. If another network is not required the USB module can remain connected to the computer and used for adjustment and monitoring. Please refer to the software guide for complete instructions on the program's features and functions.

Master Controllers - Wall Stat and Analogue On Board Controllers

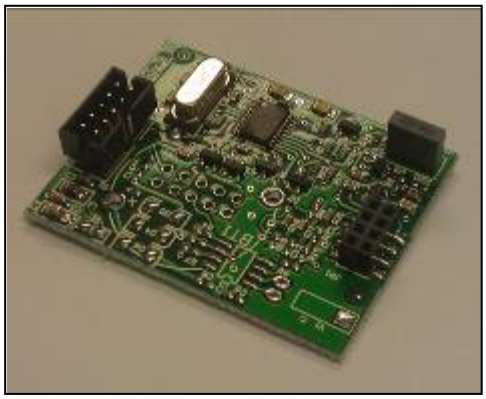
All diffusers come as slave diffusers and become masters when either a Wall Stat or On Board Controller (or both) is installed. These devices give the diffuser the ability to sense temperature, store a set point, and more. More detail into Master and Slave diffusers can be found later in this guide.



Wall Stat and Cable

If a Wall stat is installed the temperature will be measured at the Wall Stat (Environment), if an On Board Controller is installed the temperature will be measured at the Diffuser (Mixed Air), and if both are installed the user can select which location to use.

The Wall stat provides a user with the ability to adjust a set point, monitor the room temperature, and change other settings if activated. The Wall Stat is supplied with an 8m cable. Please refer the Wall Stat Guide for user instructions, and the Extended Wall Stat Guide for use of more complex features.


On Board Controller

The On Board Controller (referred to as Analogue in the PC software program) is designed to make a diffuser a Master in a 'set and forget' fashion. It is programmed on installation and then is not adjustable by a user unless they have access to the networked Software via a USB module or MCU. The On Board Controller simply plugs into the board on the back of the diffuser trim. The On Board Controller is only for use with ceiling mounted diffusers.

Change Over Sensors

The Change Over Sensor is required to be fitted to all Master diffusers. As all Slave diffusers receive control signals from their Master they are not required to be fitted with a sensor. The sensor allows the diffuser to monitor if the air handling system is supplying warm or cold air to the diffuser and in turn changes the mode and direction that the actuator operates.

The sensor is simply plugged into the interface board on the back of the diffuser. The sensor on the end of the cable is then inserted into the centre of the connecting duct via a small hole approximately 30cm from the diffuser.



Change Over Sensor

System Design and Terminology

The Rickard diffuser network can be thought of as a simple tree style network. All diffusers are connected in daisy chain style via slave cables that carry both power and control signals. System limitations have been covered previously during the component descriptions and example diagrams are provided at the end of this document to assist design. The following is a brief summary of limitations in regard to physical dimensions:

Diffusers
Standard supplied Slave cable length is 6m. 8m lengths can be purchased as an extra. Slave cables can be joined to create a maximum of 16m.

Power Supply
A maximum of 15 diffusers supported, 8 & 7 daisy chained per port. Termination resistors are to be fitted at the end of each run. Maximum cable length per port is 60m.

Master Communication Module
Maximum of 4 Power Supplies attached, hence maximum of 60 diffusers per network. Multiple MCU units available to support a variety of BMS software. Maximum cable length to each power supply of 100m.

Wall Stats
Cable length of 8m provided.

Masters and Slaves

The Rickard system is designed around the use of Master and Slave diffusers. All diffusers are setup to be Slave diffusers from the factory and are converted to Master diffusers as required by the addition of a Wall Stat, On Board Controller, or both. These devices give the diffuser the ability to sense temperature at the Wall Stat or diffuser and create a set point for that diffuser.

As the name suggests, Slave diffusers are 'slaved' to a Master diffuser and will copy the actions of the Master diffuser. For example a small room may require two diffusers, but only one diffuser needs to do the measuring. Therefore one of the two options above will be fitted to one diffuser for control purposes while the other is simply slaved to it using the Rickard Software.

Each diffuser has it's own ID so it is important that this is recorded on the building plans during installation so that location is known to aid in programming. As previously mentioned each diffuser has a ping button that will allow the diffuser to be identified on the software if required. Once running, the software will show the diffuser with master controls attached automatically.

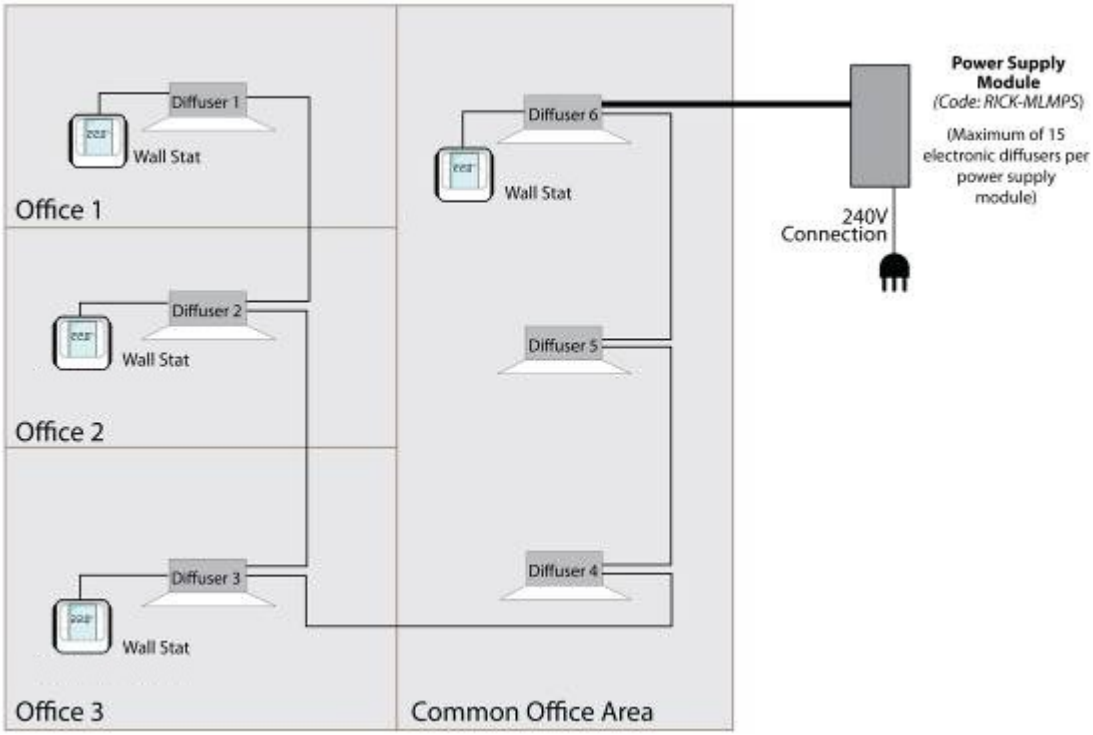
Because any diffuser can become a Master, if at any stage an office is restructured, walls moved, or a Wall stat relocated, the Master component can simply be moved from one diffuser to the next and reprogrammed using the software. This means infinite adjustability and customisation can be done without the diffusers, power supplies, and slave cabling being moved.

Channels, Loops, and Zones

When one or more diffusers are slaved to a Master Diffuser, a group of diffusers are created that act in the same way. The number of these groups and number of diffusers in these groups are determined by the building design.

The following diagram is an example of a typical small office layout. Here it can be seen that there are 4 rooms that will require individual climates. Each room has been given a Wall Stat to create a Master diffuser. As the common office area is a larger room it requires 3 diffusers, 2 of which have been slaved off the master diffuser in that room so that they copy its movements.

These newly created groups of diffusers are known as Loops. As there can be up to 15 diffusers per Power Supply there can be up to 15 Loops per Power Supply. Smaller installations or installations that do not use a MCU will be set up using Loops.



In a larger installation where the diffuser network contains over 15 diffusers and uses multiple Power Supplies connected via a MCU, slightly different terminology is used.

As there can be up to 4 Power Supplies per MCU, the diffusers on these power supplies (when connected to the MCU) are given a Channel number between 1 and 4. Each Channel can have up to 15 diffusers as limited by the Power Supply. Because diffusers on different Channels can now be grouped these are known as Zones. There are 60 possible zones.

On the PC software the diffuser icon will display the individual Channel number, Loop number, and Zone number (if available) of each diffuser as it is set up.

In summary, if a diffuser network contains 15 or less diffusers, is not linked via an MCU and is hence set up using a USB module, the Loop Concept is used. If the network has multiple Power Supplies, is linked and set up using a MCU, the Zone Concept is used.

Loop/Zone Rules

There are a few rules that must be followed when installing a diffuser network. When the PC software is first run, all Master Diffusers will automatically be given a Loop/Zone number and all Wall Stats and On Board Controllers are paired with the diffuser they are installed on. All Slave diffusers will also appear but will not yet be assigned to a Loop/Zone. The next step is to assign the Slaves to their respective Loop/Zones and adjust to required settings.

Each Loop/Zone can only contain 1 active Master diffuser or an error message will be displayed due to more than one measurement and set point being available. The software will allow you to put more than one Master diffuser on the same Loop/Zone but the Wall Stat or On Board Controller on the diffuser that is to become a Slave must be disabled. If a Wall Stat and On Board Controller is installed on a single diffuser there must only be one set point and measurement point enabled. The ability to adjust these settings without doing any physical changes means that changes to the buildings layout can be easily made.

As previously mentioned each Diffuser has an individual ID (serial) number that appears on the software. This number should be recorded against a location during installation to assist in system set up. When creating Zones/Loops it is not necessary for the Slave diffusers to be in series with it's Master. Any diffuser can be slaved to another in a network of up to 60 diffusers as long as they are operating on the same air supply system. This needs to be the case because if a Master is being supplied with warm air it will be in heating mode and its slaves will mimic it even if they are on a different system being supplied with cool air.

Design for Growth

When designing a diffuser network it is often a good idea to consider the possibility of expansion and areas of the network that this may affect. For example 30 diffusers are required in an office. This could be covered by two Power Supplies but if there is a chance that the office may be renovated there is no more room on the Power Supplies to simply add on another diffuser. Therefore it may be worth considering setting up the original system using 3 Power Supplies so there is room for changes or growth in the system. (This will allow for an addition 5 diffusers per Power Supply).

While the addition of further components down the track is easily done, it is more cost effective to plan for it during the original install as this will minimise the physical labour of installing multiple new components and also simplify and reduce the amount of programming required.

Design Examples

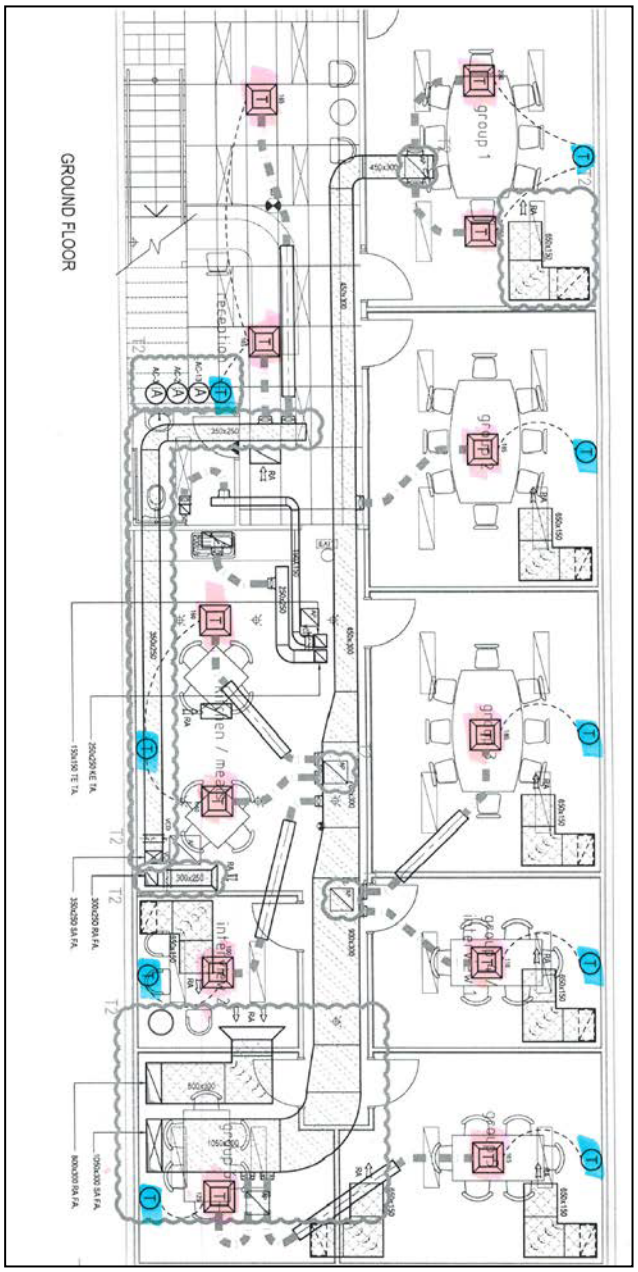
The following is a worked example for a simple two level office installation. Looking at the system a few assumptions can be immediately made and a list of questions created. Please also refer to drawings W201 and W202 for system examples to complement this guide.

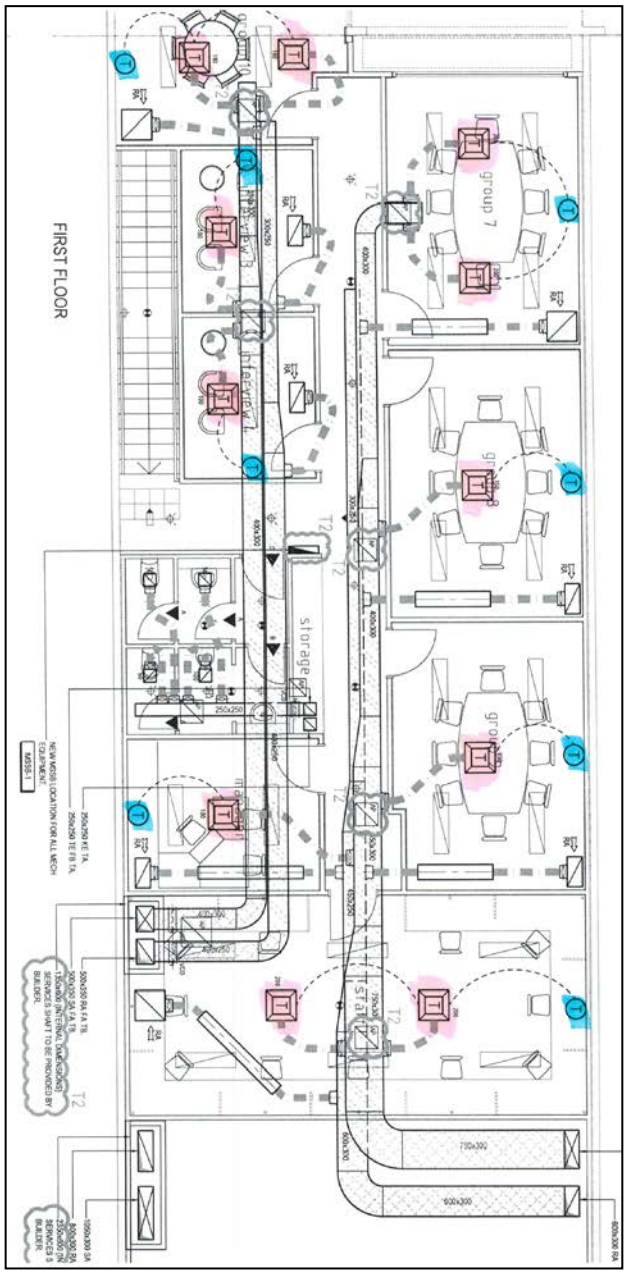
Assumptions

- The ground floor contains 12 diffusers with 9 Wall Stats and the first floor contains 11 diffusers with 8 Wall stats. Hence 17 Master diffusers total.
- As there are 17 Master diffusers 17 Change Over Sensors are required
- A Power Supply is required on each floor.

Questions

- Does the client want the ability to sense temperature at the diffuser (On Board Controller)?
- Does the client want the ability to monitor the network as a whole from a single station?
- Does the client want the system to be compatible with a specific BMS software network?





Option 1 - Simple, Install and Leave

- Two independent diffuser networks
- USB module used for install & setup. From then on all wall stat controls to be used to adjust settings
- Temperature measured at wall stat (environment temp) and set at wall stat

Parts Required

- 2x Power Supplies (One for each floor - can power 15 diffusers each)
- 23x Electronic Diffusers (Come with 6m slave cable - ensure each diffuser is within 6m of another or 8m cable will need to be ordered separately)
- 17x Wall Stats
- 17x Change Over Sensors (Used to switch modes from heating to cooling)
- 1x PC Set up (Includes USB module, software etc. This will be used to set up and program each level and then disconnected. It could be reconnected at a later stage if the system requires adjustments that cannot be made by a wall stat)

Option 2 - Simple, Install and Leave - With On Board Controllers

- Two independent diffuser networks
- USB module used for install & setup. From then on all wall stat controls to be used to adjust settings
- Temperature measured at **EITHER** wall stat (environment) **OR** at diffuser with on board controller. Wall stat will set temp

Parts Required

- 2x Power Supplies (One for each floor - can power 15 diffusers each)
- 23x Electronic Diffusers (Come with 6m slave cable - ensure each diffuser is within 6m of another or 8m cable will need to be ordered separately)
- 17x Wall Stats
- 17x Change Over Sensors (Used to switch modes from heating to cooling)
- **17x On Board Controllers**
- 1x PC Set up (Includes USB module, software etc. This will be used to set up and program each level and then disconnected. It could be reconnected at a later stage if the system requires adjustments that cannot be made by a wall stat)

Option 3 - Advanced, Install and Monitor

- Complete Network, able to be monitored and adjusted from a single computer AND independently at wall stats.
- MCU Control Box used for install and set up. If left connected to a computer the system can be monitored and adjusted from a single computer. (or if connected via a hub, any computer on the network with the software installed).
- If both wall stat and on board controller installed, Temperature measured at **EITHER** wall stat (environment temp) **OR** at diffuser with on board controller. Wall stat will set temp

Parts Required

- 2x Power Supplies (One for each floor - can power 15 diffusers each)
- 23x Electronic Diffusers (Come with 6m slave cable - ensure each diffuser is within 6m of another or 8m cable will need to be ordered separately)
- 17x Wall Stats
- 17x Change Over Sensors (Used to switch modes from heating to cooling)
- *17x On Board Controllers (If temperature measuring at diffuser is wanted)*
- 1x MCU Control Unit (Requires a cross over cable to link directly to a computer or network cable via a hub - both not included)
- 2x MCU Cables (To link to power supplies)

Option 4 - Advanced, Install and Monitor - With BMS Connectivity

-Same as option 3 only the MCU device is specifically ordered to suit the BMS system being used in the building. This means the diffuser network can communicate with other devices on the BMS along with being controlled and monitored by building services and maintenance.

GOODS AND WARRANTY

1. When supplying goods to a consumer, the following mandated statement applies:
   "Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure."

2. The benefits of this warranty are in addition to any rights and remedies imposed by Australian State and Federal legislation that cannot be excluded. Nothing in this warranty is to be interpreted as excluding, restricting or modifying any State or Federal legislation applicable to the supply of goods and services which cannot be excluded, restricted or modified.

3. Subject to the conditions and limitation below, the Company warrants products of its manufacture to be free of defects in workmanship and/or materials at the time of delivery to the Buyer.

4. Any part, assembly or portion thereof found to be defective within one year from the date of commissioning or eighteen (18) months from date of shipment from our factory, whichever is the sooner, unless expressly stated otherwise in the Company's Publications or Literature, will be repaired or exchanged F.O.B factory.

5. The Company reserves the right to replace defective parts of the goods with parts and components of similar quality, grade and composition where an identical component is not available.

6. Goods presented for repair may be replaced by refurbished goods of the same type rather than being repaired. Refurbished parts may be used to repair the goods.

7. Goods or parts that have been returned for repair (except where the repair is as a result of the Company's failure to comply with the statutory guarantees in the ACL) or warranty assessment are deemed to have been abandoned by the Buyer if not collected within 30 days after the Company has notified the Buyer in writing of the warranty assessment outcome or the completed repair.

8. The Company reserves the right to dispose or otherwise deal with an abandoned product or part at its discretion.

9. This warranty does not apply if:
   (i) the goods have not been paid for by the Buyer as per the credit terms provided; or
   (ii) the goods have not been installed in accordance with AS NZS 3000/2000 Australian/New Zealand Wiring rules; or
   (iii) the goods have been misused or neglected.

10. The Company assumes no responsibility under this warranty for the labour costs involved in the removal of defective parts, installation of new parts or service charges related thereto.

11. If a fault covered by this warranty occurs, the Buyer must first contact the Company at the contact address listed below.

12. Any warranty claim must be accompanied by:
    (i) proof of purchase;
    (ii) written details of the alleged defect; and
    (iii) appropriate documentation (such as installation and maintenance records etc).

13. The Company shall have the option of requiring the return of the defective part (transportation prepaid by the Buyer) to establish the claim.

14. The Company makes no warranties or representations other than set out in this clause 7.

15. The repair or exchange of the goods or part of the goods, is the absolute limit of the Company's liability under this express warranty.

FANTECH
Intelligent Ventilation

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