Automated Ceiling Registers, LLC

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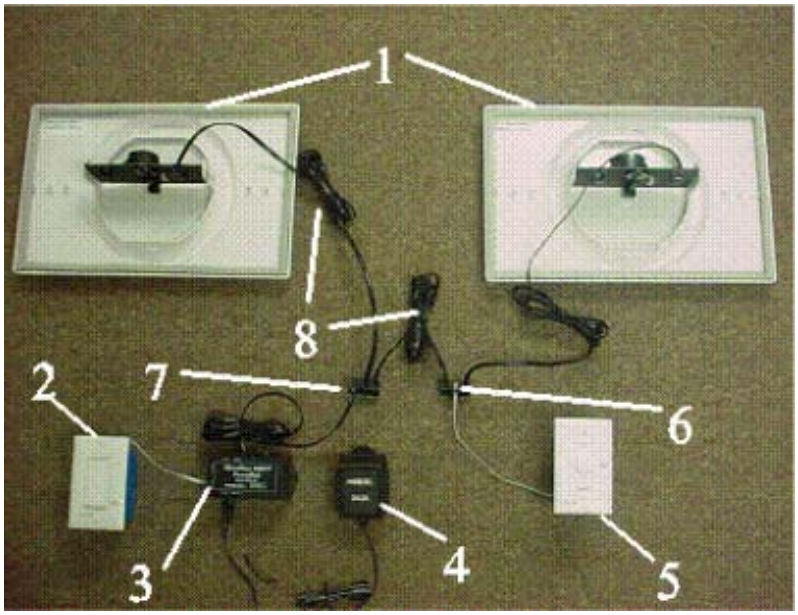
MICROFLOW 2000™ PLANNING GUIDE

Figure 1. ACR Ceiling Register

The planning process begins with the selection of rooms and associated register boxes that will receive ACR ceiling registers (Figure 1). Manual registers (Model 100M) are mounted to the register box in the same manner as standard conventional registers using the screws provided. For installing automated registers (Model 100A), a floor plan sketch of the structure with all ceiling register locations marked is a handy planning guide (See Attachment C).

MicroFlow 2000™ system components are shown in Figure 2 as they are typically connected in an installed system. Numbered system components are:

Figure 2. MicroFlow 2000™ System Components



1–Automated registers
2–Master control switch
3–PowerHub™ (controller)
4–Plug-in 24 volt transformer
5–Local control switch
6–Local switch T connector
7–Register cable T connector
8–Interconnect modular cables
(Shorter versions shown for clarity)

For installation, the transformer 4 is plugged into a convenience outlet and connected to the power jack on the PowerHub™ 3. Twenty five foot register cables 8 are plugged together to sequentially connect all registers 1 to the PowerHub™ 3. At each register location, a modular T connector 7 is used to provide serial input and output connections plus a local 7' drop connection to the associated register 1. Master control switch 2 is plugged into the switch jack (S1) on the PowerHub™ 3 through a supplied 35' silver modular cable. For those registers where additional local control is desired, local switch T connector 6 is inserted in the associated register drop line and a 17.5' silver modular cable connected from the T connector 6 to the Local control switch 5. Local switches provide local override control for one or more registers connected downstream from the local switch T connector 6.

Some airflow strategies that can be easily implemented are:

1. To shut off rarely used rooms such as guest bedrooms, formal dining rooms, living rooms, game rooms and/or unused bathrooms. This simple configuration will increase airflow to the rest of the house, producing added comfort and reduced heating and cooling costs.

2. To connect registers in one zone complementary (opposite) to those in another zone. As registers in one zone close, those in the complementary zone open proportionally. This can be achieved with a single wall switch.

3. To connect registers in a "day" zone complementary to those in a "night" zone with automatic changeover. Full day/night zoning of a complete residence has shown in tests to reduce heating and cooling costs by an average of about 25% with 50% or more savings during peak energy demand periods.

4. To close registers in unoccupied areas, e.g. bedrooms to provide increased airflow and comfort level for "entertainment" areas being occupied by homeowner's guests.

5. To connect registers in one zone complementary to those in another zone as a means for dynamically balancing airflow between the two zones.

6. To provide two levels of control, e.g. master control and local control of any register or zone of registers. This function is provided by the Model LS kit

7. To provide controlled introduction of outside air into the air conditioning return plenum for improving indoor air quality in homes. Contact ACR for more information regarding whole house ventilation possibilities with the MicroFlow 2000™ system.

Figure 3. Transformer and PowerHub

In planning the installation, a central, convenient location should be selected for mounting the PowerHub™ and plug-in transformer as shown in Figure 3. Any "out of sight" location with a power outlet is acceptable, e.g. attic, garage, basement, closet, etc. If the PowerHub™ is not within 25' of the nearest automated register, additional 25' cables and T connectors can be used to extend this line or longer cables are available from ACR. If the PowerHub™ and transformer are located in a visible area of the home, the register and switch modular cables should be routed inside the wall and into the attic in the same manner as conventional telephone cables.

It is recommended that no more than 50% of all registers in a structure be allowed to close at any given time in order to maintain adequate airflow across the evaporator cooling coils or heat exchanger. Also, when full house day/night zoning is used, an auxiliary thermostat is needed in the complementary zone. See Appendix A-1 for technical information and wiring details. Also, contact ACR at 800-451-6539 for additional information.

Multiple registers are connected in a daisy-chain fashion around the attic. One cable run can be used to serially connect up to 15 registers to the PowerHub™. At each register location, a T connector as shown in Figure 2 (item 7) is used between 25 foot register cables to provide a "drop" cable for connection to the register board. For large installations with more than 15 automated registers, use two different daisy-chained cables connected to the PowerHub™ register (R) ports as detailed below.

Each PowerHub™ has two register cable connectors which are labeled R1 (and/or R2) depending on which model PowerHub™ is used. The numbers 1 and 2 refer to the independent zone numbers. Each zone is controlled by a correspondingly labeled switch port (S1 or S2). Dual connectors (both R and S) for each zone are supplied for convenience in making switch and register cable connections. Like numbered connectors are internally connected together pin to pin.

White decorator master switches are supplied as the standard color in all models. Ivory decorator switches or standard toggle switches are also available as an option. Switch cables are 35 feet long for added mounting flexibility and silver in color to distinguish them from the black register cables. Contact ACR if longer switch cables are needed.

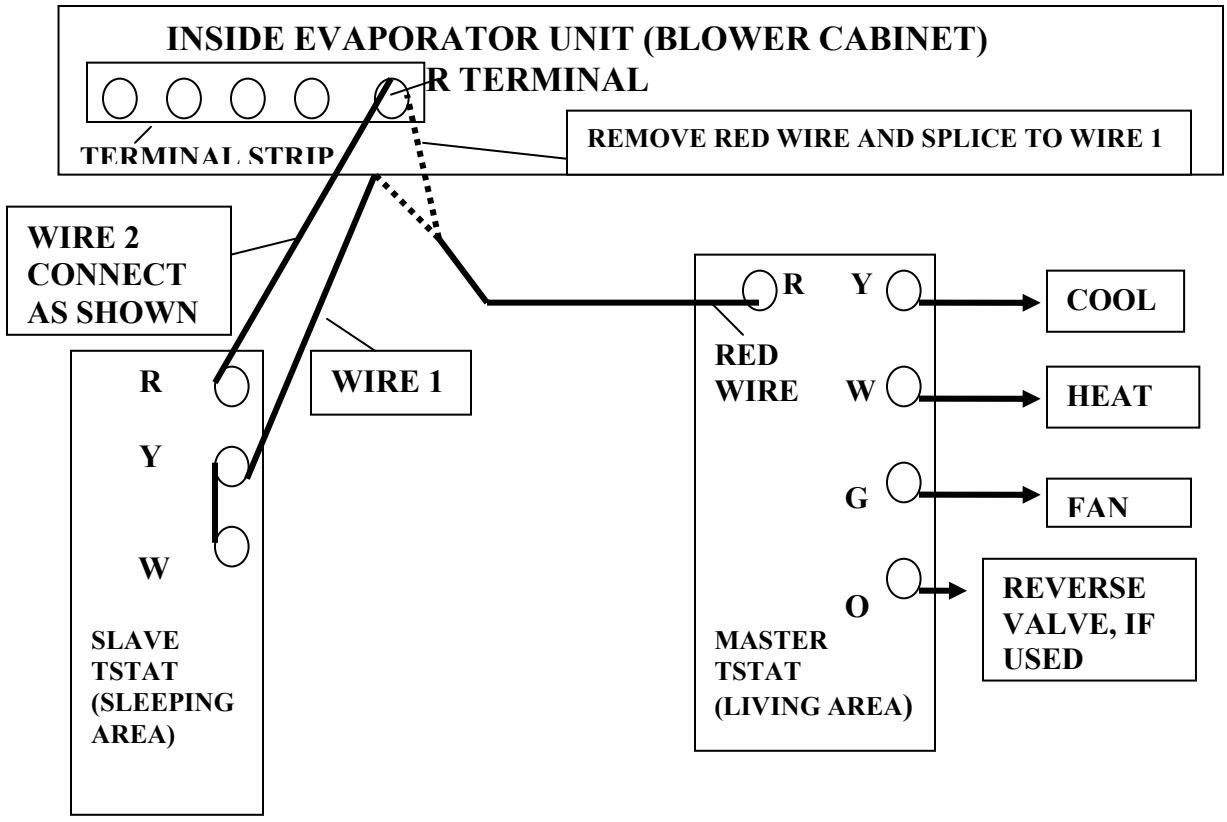
WARNINGS - Use only the supplied cables. Do not use standard telephone cables; they will cause system control problems. If these cables are being installed first in a new home under construction, cover each exposed modular jack connector with a small plastic bag and rubber band to prevent paint, texture or other foreign objects from coating the gold plated contacts during construction. Failure to follow this procedure will cause reliability problems with the cable connections.

APPENDIX A: Special Considerations:

1. Thermostats

Use of automated registers within a zone where the master thermostat is located can cause overheating or overcooling of a complementary zone when airflow is curtailed or cut off to the master thermostat zone, e.g. when day/night zoning is used. This situation is avoided by installing a secondary 2-wire thermostat in the complementary zone. The secondary thermostat is connected in "series" with the master thermostat as shown in Figure 4. The "series" connection allows the thermostat located in the zone receiving the higher volume of conditioned air to become the "controlling" thermostat since the other thermostat is now starved for air and is continuously calling (closed contacts). Each thermostat is simply set to the desired set point temperature when its zone is "active" (open registers) and the heat/cool switch of both set to the same position. The secondary thermostat should be wired internally as shown with the "Y" and "W" terminals tied together for proper operation in both HEAT and COOL positions. The master thermostat can be a conventional mechanical or electronic set-back (programmable) type as long as it doesn't require 2-wire 24 volt ac power to operate, e.g. is battery operated. The
secondary thermostat can be an inexpensive mechanical heat/cool model.

Figure 4. Two wire connection for secondary thermostat.



2. Heat Pump System

The MicroFlow 2000™ system is particularly well suited to Heat Pump installations since the BTU heating capacity for a given size home in many climates is insufficient while that same BTU cooling capacity is completely adequate. By reducing the total area to be heated during winter at any given time, a more comfortable environment can be maintained in occupied areas without resorting to more expensive supplemental heat. For maximum energy efficiency, an outdoor thermostat should be installed on any heat pump system to prevent the system from applying supplemental heat until the outside temperature drops to the point where heat pump efficiency is below that of the supplementary heat source. Without an outdoor thermostat, indoor heat pump thermostats typically call for supplemental heat when room temperature drops two or three degrees below the set point temperature. The assumption is that the heat pump alone is inadequate to maintain room temperature and supplemental heat is required. Indeed, the act of manually raising the set point temperature a couple of degrees will automatically turn on supplemental heat regardless of outside temperature unless an outdoor thermostat is installed. Day/Night zoning, by its very nature, will likely cause room temperature to drop well below the set point temperature in the same manner as programmable thermostats. Supplementary heat will automatically be enabled during the recovery period unless an outside thermostat is used. It should be emphasized that the MicroFlow 2000™ system will work fine with heat pump systems without an outdoor thermostat. The only issue is that of minimizing energy costs during winter months. Installation of an outdoor thermostat to a heat pump system is better left to a professional HVAC technician. For additional information on this subject, contact ACR**.**

3. Automated control

Control of MicroFlow 2000™ registers is accomplished by any automated system capable of opening and closing a simple electrical switch, e.g. relay contact or "open collector" transistor switch. Inexpensive Home Automation products which utilize both wireless RF (radio) and existing house wiring for control are readily available. Contact ACR for additional details.

4. Restricting airflow

Closing a significant percentage of registers will cause duct air pressure to rise. Modern blower motors are designed to deliver a relatively constant volume of air (cubic feet per minute) over a fairly wide range of external (duct) pressure. Limiting the percentage of registers allowed to be closed at any particular time to 50% of the total will have minimal impact on airflow across the evaporator coils and should not be detrimental to compressor operation unless there are on-going problems such as low coolant or blocked inlet filters. Closing half of the available registers will nearly double the airflow from registers which are open. MicroFlow 2000™ registers are aerodynamically designed to easily handle these larger volumes of airflow.

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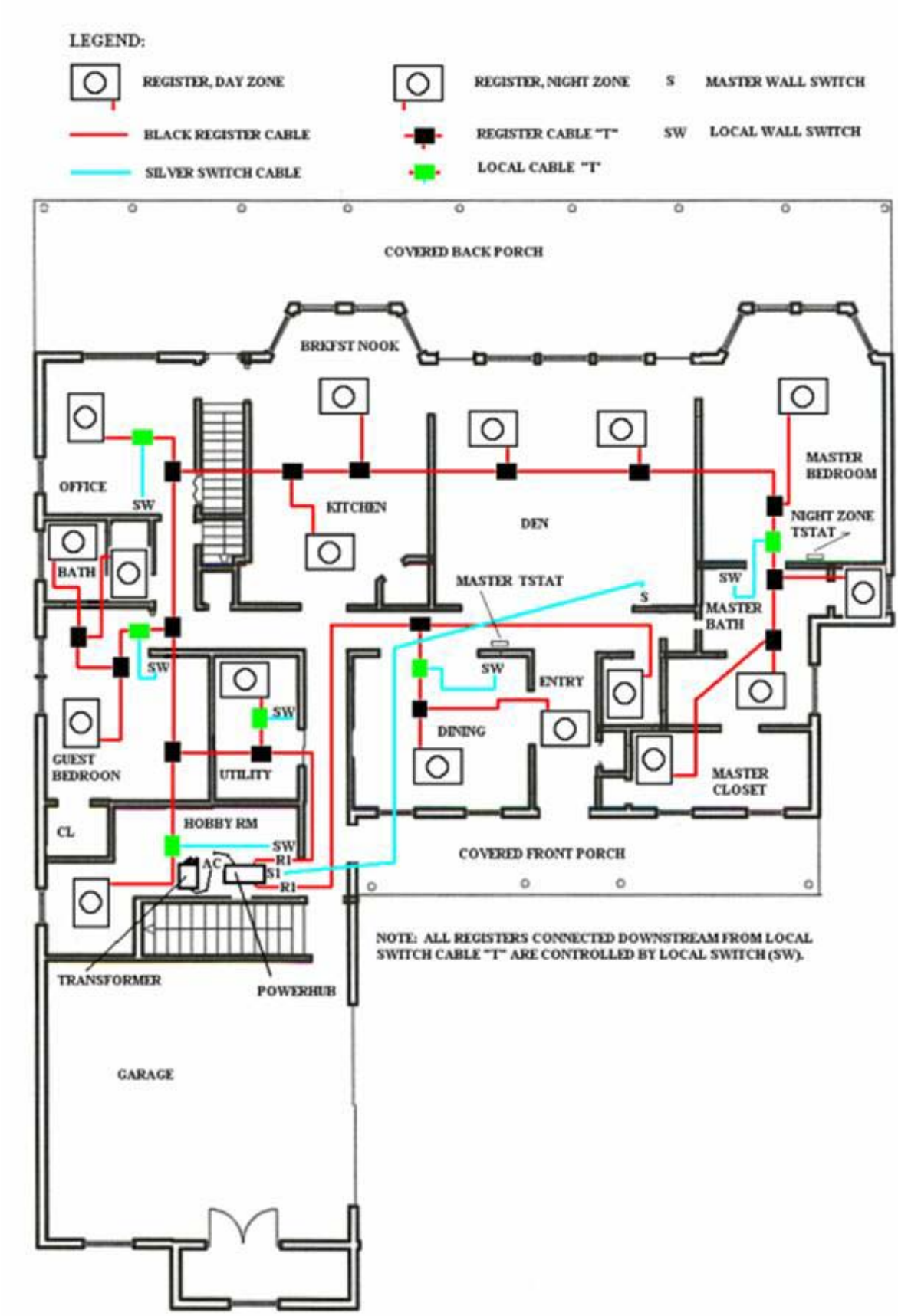

ATTACHMENT C INSTALLATION EXAMPLE FOR MICROFLOW 2000 SYSTEM