OMNIZONE

MODULATING ZONE CONTROL SYSTEMS FOR VAV APPLICATION OF AIR CONDITIONING UNITS

November 1988

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All specifications subject to change without notice.

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OMNIZONE MAKES AIR CONDITIONING UNITS MORE VERSATILE AND CONSERVES ENERGY

Constant volume air conditioning units have limitations. Omnizone overcomes many of them, converting any air conditioning unit to a complete VAV system with modulating zone control.

The following components open the way to using larger size A/C units more effectively in many new applications — office complexes, storerooms with offices and fitting rooms, sales showrooms, classrooms, medical buildings, fabricating shops and other facilities that have zones with varying demands.

① The modulating damper with room thermostat matches available airflow to zone need

The heart of the Omnizone system is the OMC modulating damper. The OMC matches cooling or heating airflow to zone needs.

OMC units have fast-response, elliptical dampers. Each OMC solid state control center receives the following information:

1. Zone temperature from an electronic space thermostat.
2. Supply air temperature, from an electronic sensor in duct, to provide automatic summer/winter changeover.
3. Damper position data from a potentiometer mounted on the damper shaft.

The OMC automatically modifies the damper position to supply the exact amount of heated or cooled air required for its zone and available from the system.

Other systems:

OMRX — zone temperature control for zone requiring supplemental or reheat capability. An electronic switch energizes the supplemental heater (by others) to prevent zones from overcooling.

② Bypass damper diverts and returns unneeded air

The Omnizone OBP is a bypass damper with a velocity sensor that allows excess air to flow from the supply to the return side of the air supply unit. Its unique elliptical shape permits close control of the amount of air bypassed.

③ Leaving air temperature sensor provides heating and cooling capacity control

The Omnizone LAT is a leaving air temperature sensor with a built-in timer to provide heating and cooling capacity control for single or two-stage compressor systems. When supply air temperature goes above or below set points, this control turns off the heater or compressor for approximately seven minutes.

④ The discriminator can sense temperatures in up to ten locations

The Omnizone DSC is an electronic two-stage cooling, two-stage heating discriminating controller that senses building temperatures in up to ten different locations, operating the system to respond to loads in any of the sensor locations.

PARTIAL LIST OF USERS

TRW
Digital Equipment Corp.
Hughs Aircraft Co.
Jet Propulsion Laboratories
American Telephone & Telegraph Company

Buffums Department Stores
Army Corps of Engineers
National Semiconductor Corp.
Fashion Island, San Francisco
Bank of America
Texas Instruments

Hewlett Packard Co.
Long Beach Mall
Town Hall, Houston
Cardiac Care Systems
Palm Coast, Fla.
ITT Cannon Camera Co.

Aerojet General Corp.
Rockwell International
Minnesota States Attorney Office
Peoria High School, Phoenix
Capital Building, South Carolina

Zone Thermostat with DSC Sensor

See Installation Instructions (pp. 19-28) for specific information.

OMNIZONE

OMC ZONE DAMPER

OMC ZONE DAMPERS are used in cooling/heating systems to provide modulating zone control. Each unit is made up of spiral duct and an elliptical damper. The damper travels through 45 degrees between the full open and full closed positions. The limited travel and elliptical shape give the damper the ability to closely track the zone airflow requirements.

The solid state control center in each Omnizone unit receives temperature information from the electronic room thermostat. The control center receives damper position information from a potentiometer mounted on the damper shaft. Using this information, the control center modulates the damper position to exactly supply the amount of air required to match the zone load.

The OMC has a built in automatic summer/winter changeover sensor and LED to show heat mode. The control center in the OMC constantly monitors room temperature and duct temperature. When the duct temperature is 3 degrees cooler than the room temperature the damper operates in the cooling mode. If the duct temperature is 7 degrees warmer than the room temperature the damper operates in the heating mode. In this way the damper reverses operation as the main system switches from cooling to heating and back.

OMC with snap out PC board

FEATURES

AUTOMATIC HEAT/COOL
built in changeover

LOW PRESSURE
up to 2200 CFM @ .1″ W.C.

SNAP OUT P.C. BOARD
easy service

LED TO INDICATE HEAT MODE

ELECTRONIC THERMOSTAT
very accurate

MAX.-MIN. CFM STOPS
field adjustable

24 VOLT SYSTEM
only 12 V.A. per damper

FAST ACTING DAMPER
2½ min. full open-full closed

ELLIPTICAL DAMPER
true modulation

STRONG
spiral pipe construction

DIMENSIONAL DATA

SIZE	D	L	W
6	6″	18″	10″
8	8″	18″	12″
10	10″	18″	14″
12	12″	24″	16″
16	16″	24″	20″

SELECTING AN OMNIZONE DAMPER

1. To add one Omnizone damper in an existing system select damper to add one Omnizone damper, select to match existing duct size: e.g., for a 10″ existing duct, select a 10″ damper.
2. For new systems or where required load is known: Determine CFM from heat gain or loss calculations. Then select Omnizone unit to fit duct size required for zone. A second method is to select the Omnizone based on CFM and velocity. CFM is determined from load calculations. Recommended velocities are:

   Main duct 1000-1500 FPM Branch ducts 700-1000 FPM
3. For Omnizone dampers within three feet of outlet (grille or register), velocities above 700 FPM are not recommended.
4. Flexible sound attenuating ducts are recommended where Omnizone dampers at velocities above 1000 FPM are installed within 10′ of an outlet.
5. Zone dampers should be preceded by 2-4 diameters of straight duct if possible.
6. Two or more dampers may be used for a single zone and be controlled by a single zone thermostat. Refer to page 18 for master/slave wiring.
7. If more than 40% of a system's airflow is to be dampered, then *all* of the airflow must be dampered.
8. If any zones are to have supplemental heat, those zones should be controlled by type OMRX dampers. See page 5 for specifications and page 17 for wiring.

CAPACITIES

		RECOMMENDED			
PRESSURE DROP ▶	.015	.035	.07	.1	.2
VELOCITY FPM ▶	700	1000	1500	1800	2500
SIZE ▼	CFM	CFM	CFM	CFM	CFM
6″	125	175	250	315	437
8″	220	315	470	567	787
10″	380	550	820	990	1375
12″	500	700	1060	1260	1750
16″	800	1250	1850	2250	3125

OMNIZONE

OMRX ZONE DAMPER
with supplemental Heat Control

The **OMRX ZONE DAMPER** is designed to operate as a cooling, heating, automatic changeover damper with two stages of supplemental heat control capability.

Each OMRX is furnished with controls to turn on two stages of supplemental heat on demand from the Omnizone room thermostat.

The OMRX can also be used in heating/cooling systems and with heat pumps. The OMRX has a heating/cooling changeover like the OMC. The damper modulates to maintain room temperature. Radiant ceiling panels, electric baseboard or strip heat will turn on only when room temperature falls three degrees below thermostat set point.

The solid state control center in each Omnizone unit receives temperature information from its' electronic room thermostat. The control center receives damper position information from a potentiometer mounted on the damper shaft. Using this information the control center modulates the damper to exactly satisfy the room air requirements.

If the air conditioning unit is in the cooling mode, the damper will modulate between 100% open and its minimum position to satisfy room cooling demand. If the A.C. unit is in the heating mode, the damper will modulate to satisfy the heating demand. When room temperature drops three degrees below set point, one stage of supplemental heat is turned on. A drop of one more degree will turn on the second stage of heat. *This is true regardless of the mode of the air conditioning unit.*

An electric or hot water auxiliary heat coil can be selected for installation downstream of the OMRX unit. The reheater should be large enough to raise leaving air temperature above desired room temperature. The heating unit must be protected with a sail switch or pressure switch to prevent burnout or other problems due to fan failure. A minimum air damper position is required and will have a modest impact on temperature control during cooling. The installation must be made in accordance with all applicable codes.

FEATURES

THERMOSTATIC
two stage supplemental heat control

SNAP OUT P.C. BOARD
easy service

ELECTRONIC THERMOSTAT
very accurate

ELLIPTICAL DAMPER
true modulation

LOW PRESSURE
up to 2200 CFM @ .1" W.C.

24 VOLT SYSTEM
requires 12 V.A. for damper and 24 V.A. per stage of heating

FOR CAPACITY AND DIMENSIONAL DATA SEE PAGES 3 AND 4.

OMNIZONE T 200 DELUXE DIGITAL THERMOSTAT

The **OMNIZONE THERMOSTAT** is made up of two elements. An electronic temperature sensor and a set point device. The temperature sensor is an integrated circuit designed to measure room temperature. The sensor puts out a voltage that is linear with temperature. As the room temperature goes up or down the sensor voltage goes up or down proportionately. The sensor output varies .01 volt per degree centigrade, starting at 273 degrees below zero centigrade.

For example 77°F = 25°C. The sensor will put out (273 + 25) × .01 or 2.98 volts.

The set point device is designed so that its setting will put out a voltage similar to that of the sensor. When the set point is 77 degrees the output will be 2.98 volts. When we manually change the set point to 68 degrees it will put out 2.93 volts.

The printed circuit board at the damper compares the voltages that it receives from the thermostat. In cooling mode, when the sensor voltage is higher than the setpoint, the damper modulates open. When the sensor voltage is lower than the setpoint the damper modulates closed. The amount of damper travel is limited by a feedback potentiometer on the damper shaft.

The Omnizone deluxe thermostat is furnished with an easy-to-read digital set point switch. This switch displays the room set point. The digital setpoint switch is installed in a handsome aluminum-faced enclosure. Space is provided within this enclosure for discriminator sensors if desired. Field calibration to match any thermometer is very simple.

If the thermostat is in a peak load critical zone the DSC sensor can be conveniently mounted in the deluxe thermostat. For best operation a thermostat in a peak load critical zone should be set within a few degrees of the DSC set point.

OMNIZONE DELUXE THERMOSTAT

*DSC SENSOR

DELUXE THERMOSTAT WITH DSC SENSOR* INSTALLED

T 300 COMBINATION THERMOSTAT

The **OMNIZONE T 300** combines the functions of a zone damper thermostat and a peak load sensor. The T 300 is made up of three elements. Two electronic temperature sensors and a temperature set point device. The temperature sensors are integrated circuits that convert temperature to voltage. These sensors deliver a voltage that is linear with temperature. As the room temperature goes up or down, the sensor voltage increases or decreases proportionately.

One sensor is used to measure room temperature and control the zone damper. The other measures room temperature for the discriminating thermostat (DSC). The DSC operates the air conditioning unit.

The set point device is designed so that its settings will deliver a voltage similar to that of the sensor. As the set point is varied, the output voltage goes up and down.

The printed circuit board at the damper compares the voltage that is received from the room sensor with that of the set point device. In the cooling mode when the sensor voltage is higher than the set point, the damper modulates towards open. When the sensor voltage is lower than the set point, the damper modulates toward the closed position. The amount of damper travel is limited by a potentiometer on the damper shaft.

The DSC sensor section of the thermostat is electrically independent of all other components of the combination thermostat. It is powered by the DSC panel.

All of the sensors need not be connected to the DSC. Connect only those sensors that are installed in peak load or critical zones. The perimeter requires more sensors to monitor solar load around the building. Interior sensors generally need not be duplicated. See the DSC sheets for further sensor information.

The **LAT CAPACITY CONTROL** is a simple on-off device located in the leaving air stream of the A/C unit. During a low-load cooling cycle, the LAT reduces compressor capacity to prevent coil freeze-up. In heating operation, the LAT will cycle the gas valves to protect the heater from overheating.

SINGLE STAGE OPERATION:

The LAT sensor measures leaving air temperature from the A/C unit. When the duct temperature drops below the LAT cooling set point (approximately 50°), the compressor is turned off. When the duct air temperature raises above the cooling set point, the LAT starts its timer. At the end of the timing cycle (5-7 minutes), the compressor is restarted. This type of operation continues until the system control is satisfied or until the load increases.

During the heating cycle, the heater is turned off when duct temperature exceeds the LAT heating set point (approximately 130°). When residual heat in the exchanger has been dissipated and the duct temperature drops below the set point, the timer starts. At the end of the timing cycle (5-7 minutes), the heater is restarted.

TWO STAGE OPERATION:

The LAT can be used to operate the second stage of a two stage cooling and heating system. The second stage cooling and second stage heating wires are broken through the "W" and "W" and "Y" "Y" terminals on the LAT. When the supply duct temperature drops below the LAT cooling set point (approximately 50°), the second stage compressor will be turned off. If first stage compressor operation is adequate to satisfy the load, the air temperature will remain below the set point and the LAT timing mechanism will not start. When the load increases and duct temperature goes above the set point, and the timing cycle is completed, the 2nd stage compressor is allowed to start.

Two stage heating operation is similar. Second stage heat will not operate as long as first stage can handle the load.

If desired, two LAT controls may be used to provide capacity control for both stages of cooling and both stages of heating.

HEAT PUMP:

The LAT is also available for heat pump applications. The factory settings are approximately 50° cooling and 108° heating. Install the LAT where it will monitor the AC coil temperature only. The LAT must not be affected by electric heatstrips. On a two stage heat pump the LAT provides a time delay between the first and second stage compressor operation.

Other shut off temperatures may be easily set in the field.

BYPASS DAMPER (OBP)

The **OBP BYPASS DAMPER** is used to provide constant air delivery through an air conditioning unit in a system with Omnizone modulating dampers. As building load is satisfied, the zones in the system start to modulate closed. This reduces building air requirements. The sensor drives the bypass damper partially open to allow the excess air to flow from the supply to the return side of the air conditioning unit. In this way excessive static pressure does not build up in the duct system. This prevents the generation of noise at the diffusers and erratic control in the zones.

Each OBP is made up of a spiral duct and a unique elliptical damper. The damper is made in the form of an ellipse and only travels through 45 degrees from the full open to full closed position. This limited travel and special shape gives the damper the ability to closely control the amount of air bypassed from the supply to the return side of the air conditioning unit. The solid state control center of the OBP unit is operated by the Omnizone electronic velocity sensor. The velocity sensor is installed as shown, where it measures the total CFM flowing through the unit.

VELOCITY SENSOR

OBP DAMPER

FEATURES

ELECTRONIC VELOCITY SENSOR
- will operate up to 3 OBP's

LOW PRESSURE DROP
- up to 3000 CFM @ .2" W.C.

STRONG
- spiral pipe construction

SOLID STATE CONTROL
- accurate modulation

ELLIPTICAL DAMPER
- accurate control

FAST ACTING DAMPER
- 2½ min. full open to closed

2 LED SETPOINT INDICATORS
- for easy adjustment

24 VOLT SYSTEM
- requires only 12 V.A. per bypass damper

DIMENSIONAL DATA

SIZE	D	L	W
6	6″	18″	10″
8	8″	18″	12″
10	10″	18″	14″
12	12″	24″	16″
16	16″	24″	20″

SELECTING THE OBP

The bypass is selected at 2500 FPM for 50% of air conditioning unit fan capacity. For larger systems up to three OBP's can be operated from one velocity sensor.

Example: Select a bypass for a 7½ ton air conditioning unit. 3000 CFM is the nominal rating formost 7½ ton units. Select an OBP which will handle 1500 CFM at a relatively high pressure drop. The bypass velocity should be as close to 2500 FPM as possible. This is done for two reasons. One, there is a large differential pressure available between the supply and return ducts. Two, regulation is better at higher pressure drop across the OBP. In this case we would refer to the capacity table and select a 12″ OBP. The 10″ was not chosen because its velocity would be excessive. The 16″ could be used but its pressure drop would be less than .07″ W.C. Therefore, we recommend the 12″ OBP for the 7½ ton unit.

CAPACITIES

			RECOMMENDED
PRESSURE DROP ▶	.07″	.1″	.2
VELOCITY FPM ▶	1500	1800	2500
SIZE	CFM ▼	CFM ▼	CFM ▼
6″	250	315	437
8″	470	567	787
10″	820	990	1375
12″	1060	1260	1750
16″	1850	2250	3125

OMNIZONE DISCRIMINATING THERMOSTAT (DSC)

The **OMNIZONE DSC** is an electronic two-stage cooling, two-stage heating discriminating thermostat. It may be used to control split systems as well as package units; cooling only, gas/electric or heat pump systems.

The DSC is unique because it can sense building temperature in up to ten different locations. The DSC constantly monitors its sensors and will operate an air conditioning unit to satisfy the peak load from any of the sensors.

The DSC is a cooling priority device so all cooling calls must be satisfied before heating calls can be serviced. The temperature sensing integrated circuits are designed to allow greater current flow to the warmest sensor. The additional current flow slightly adds to the sensor temperature. This forces the system to cooling priority. When all of the cooling calls are satisfied, this addition of current to the warmest sensor must be overcome by the heating sensors. This is done by averaging the heating sensors against the strong cooling sensor. When the temperature difference between sensors is great enough, heat will be turned on. As the peak load shifts from one zone to another the DSC will keep the unit operating until the new load is satisfied.

EXAMPLE:
If the DSC is set at 75 degrees it will operate the unit in the cooling mode when any DSC sensor is above 75 degrees. If the temperature at any sensor rises to 76 degrees, second stage cooling will turn on. When all sensors are below 75 degrees the package unit will operate in the ventilating mode. When the temperature at any of the sensors drops to 70 degrees*, first stage heating will turn on. If the temperature at any sensor drops below 69 degrees, second stage heating will turn on. In this way, the unit will automatically operate to satisfy any peak building temperature demand from the sensors.

The DSC is designed to work with Omnizone modulating dampers. The DSC operates the package unit to satisfy demand from the DSC sensors. The Omnizone modulating dampers vary air delivery to zones under their control.

*Standard 5 degree dead band may be field modified to 3 degrees by substituting a 270 ohm resistor in place of existing 390 ohm resistor.

FEATURES

DIGITAL SET POINT
LED, SYSTEM STATUS SIGNAL LIGHTS
SOLID STATE ELECTRONIC CONTROL
SENSES TEMPERATURE IN UP TO
TEN LOCATIONS (2 TO 6 RECOMMENDED)
TWO-STAGE COOLING, TWO-STAGE HEATING
AUTOMATIC COOL/HEAT CHANGEOVER
INTEGRAL SYSTEM ON/OFF SWITCH

DSC TEMPERATURE SENSOR, ONE MOUNTED IN EACH PEAK LOAD ZONE.

NOTE: THIS SENSOR IS INCLUDED AS A PART OF THE T300 THERMOSTAT.
DO NOT DUPLICATE SENSORS.

Standard thermostats use mercury switches or bimetal contacts to turn on stages of heating and cooling. The DSC uses solid state devices to turn on its stages. Therefore, the DSC should be able to operate any air conditioning unit that does not require special switching.

Sensors should monitor exterior loads so they can compensate for solar changes. Sensors should normally not be installed in interior zones where they might call for long cooling periods during the heating season. Interior zones should be handled by a separate unit where possible.

DSC sensors mounted in rooms with high internal heat gains, like a computer room, require special treatment. Provide reheat to any zones connected to a unit controlled by a sensor in a high internal heat gain area.

DSC sensors are contained in T300 thermostats or can be mounted in the T200 deluxe thermostats of any zone to be monitored. They can also be installed in the return duct from a zone. When the sensor is mounted in the return duct, it should be close to the return grill. Sensors should not be more than 500 feet away from the DSC. If AC unit is more than 100 feet from DSC, use #16g. wire.

For complete wiring diagram, see pages 17 and 18.

‡Fan switch will operate blower even when system switch is "off." (To obtain "fan only" in mild weather.)

*If more than four sensors, wire additional sensors in parallel

If A/C Unit Has Honeywell W973 Controller:

a. A Honeywell T7067B thermostat with T7047C averaging zone sensors may be used in place of the Omnizone DSC. The T7067B will provide ramp voltage signals to the A/C unit for economizer (if used) and each stage of heating or cooling

or

b. An optional Omnizone interface board (IFB) may be used with standard DSC discriminating thermostate and peak load zone sensors. The IFB will provide fixed DCV signals to activate two stages of heating or cooling. If A/C unit is equipped with economizer, please contact Omnizone regional office or factory.

AUTOMOBILE DEALERSHIP

PROBLEM:
In auto sales facilities, offices and closing rooms might overheat and overcool.

SOLUTION:
Master-submaster (partial zoning) cooling/heating system.
1. Set up duct system to supply air to master zone (showroom area).
2. Take branch ducts to each subzone. For example: Offices or closing rooms.
3. Install Omnizone OMC dampers on each branch duct.
4. Install Omnizone thermostat in each subzone to control Omnizone damper.
5. Install air conditioning unit thermostat in showroom area.

OPERATION:
With air conditioning unit on, air will be supplied to all diffusers. As offices and closing rooms start to satisfy, the Omnizone units will modulate to match exact room load. Excess air not required in these subzones will be shunted to the showroom area. When the thermostat in the showroom area is satisfied, it will shut the refrigeration system down or step out one compressor on two compressor systems.

With the air conditioning unit thermostat selector switch set on heat, warm air will be supplied to the duct system. The Omnizone damper automatic changeover on each unit will reverse its thermostat operation. As warm air enters each subzone, the zone thermostat will modulate its damper to exactly match load conditions. Excess warm air will be shunted to the showroom to be controlled by air conditioning unit thermostat.

Note: Master-submaster (partially zoned) systems can only be used where less than 40% of system air is controlled by zone dampers. The master zone must be the most demanding zone. If more than 40% of the system's air is to be dampered, then <u>all</u> air must be dampered.

PROBLEM:

Medical building with many zones, waiting room with wide range of occupancy, nurses station with small zone interior load, many small examining rooms and Doctor's corner office with large glass area.

SOLUTION:

1. Select and install air conditioning/heating unit to match block load.
2. Select and install bypass unit (50% of fan CFM). See bypass instructions.
3. Select convenient location for Discriminator. Select sensor locations as required to monitor major loads. We would recommend two sensors. One in the waiting room because of large west glass load and highly variable pop load. Another sensor should be located in the Doctor's office because of its south-east glass load.
4. Install duct system to supply proper air quantity to each zone.
5. Install Omnizone OMC Dampers in duct system to control air delivery to each zone.
6. Install Omnizone Thermostats in each zone.

OPERATION:

With the Discriminator (DSC) set for 75 degrees the system will operate as follows. When the temperature at any zone sensor (indicated by an "S") is above the set point, the air conditioning unit will operate in the cooling mode. Cooling will continue to operate until all zone sensors are below 75 degrees. While cooling is being supplied, each zone thermostat can control its own damper to maintain the temperature required in that zone. When all sensors are at or below 75 degrees, the DSC will operate the system to provide ventilation. When there are no calls for cooling and temperature at one of the sensors falls to 70 degrees, the DSC will turn on heating. Heating will operate until all sensors are at or above 70 degrees or a critical zone is again calling for cooling. During heating operation all zone thermostats will change to the heat mode. Any zone requiring heat can be wide open. Zones with less demand will modulate to maintain the desired zone temperature.

As the zone dampers modulate, fan capacity is controlled by the OBP. Compressor capacity is controlled by the LAT. In this way a variety of zone requirements can be satisfied by one air conditioning unit.

OMNIZONE

EAST/WEST EXPOSURE (DIVERSITY)

PROBLEM:

Long building with east/west exposure. This is a difficult building to do with constant volume units because one thermostat cannot furnish adequate control.

The long narrow building with east/west exposure poses a difficult control problem because of the high solar demand shifting from east to west.

The usual approach to this type of building is to put individual package units on the east and west side of the building. However, designing the system this way will substantially increase its size and cost. The west side package unit or units will have to be sized for the peak west load of the building and the east units for the peak east load.

Designing the building with an OMNIZONE system takes advantage of diversity. The Omnizone system will follow the sun and shift air to the side of the building with the maximum load.

SOLUTION:

1. Select air conditioning units to match block load of building.
2. Design duct system to supply proper air quantity to each zone.
3. Select Omnizone modulating dampers for each zone.
4. Select thermostat locations for each Omnizone modulating damper.
5. Select Omnizone OBP (bypass damper) for 50% of unit CFM.
6. Select locations for discriminator sensors to monitor major east/west loads.

OPERATION:

With the DSC (discriminator) set for 74 degrees and sensors installed on the east and west sides of the building, the DSC will first satisfy a demand for cooling from any sensor with a temperature higher than 74 degrees. The Omnizone dampers will reduce air delivery to zones with lower demand for cooling. As the load shifts from east to west, the DSC sensors will operate the package unit and the Omnizone dampers will modulate airflow to maintain required room temperatures. As the zone dampers modulate, the OBP (bypass) will provide constant air volume through the unit.

Using this system of control, taking advantage of shifting sun load, the building A/C system can be sized around its block load rather than the sum of the peak loads.

OUTLINE FOR DESIGNING OMNIZONE VAV SYSTEM

I STANDARD HVAC DESIGN PROCEDURE

1. Calculate heat gain & loss
2. Select unit
3. Size & locate diffusers & grilles
4. Identify zones
5. Design air distribution system
6. Layout & size supply & return duct system

II OMNIZONE SELECTION IF 100% SYSTEM AIR IS DAMPERED

1. Size and locate OMC and/or OMRX damper boxes
2. Size main duct dampers @ 1000 to 1500 FPM or use ductulator
3. Size branch duct dampers @ 700 to 1000 FPM or use ductulator
4. Select location for each zone damper thermostat
5. Size OBP for 50% of system air @ 2500 FPM
6. Locate OBP & velocity sensor
7. Locate LAT in supply duct
8. Identify peak load critical zones (those that get warmer or cooler first) & locate DSC sensors in these zones
9. Review typical wiring diagrams

OR

IF LESS THAN 40% SYSTEM AIR IS DAMPERED

1. Select master zone & locate unit thermostat
2. Locate OMC and/or OMRX damper boxes
3. Size submaster zone damper boxes @ 700-1000 FPM
4. Select location for each zone thermostat
5. No OBP, LAT or DSC is required

III WIRING & POWER REQUIREMENTS

WIRING: Size wire according to NEC: 18g minimum
Solid wire is preferred. Stranded is ok, but terminators are required.

1. Damper to stat	4w-18g
2. OBP to velocity sensor	4w-18g
3. LAT to unit	4w-18g
4. DSC to sensors	3w each-18g
5. DSC to unit	5-7w-18g

POWER:

1. Damper -	24V-12VA each - common transformer is ok*
2. OBP -	24V-12VA each only when fan on
3. LAT -	24V-12VA uninterrupted
4. DSC -	24V from unit control transformer; check to insure adequate capacity

*For OMRX dampers, or for several dampers on one transformer, increase transformer capacity. Increase wire size to 14-16g as required.

DSC-GE & LAT WIRING FOR SINGLE STAGE GAS ELECTRIC UNIT WITH NIGHT SET BACK

DSC-GE & LAT-GE WIRING FOR TWO STAGE GAS ELECTRIC UNIT

UP TO TEN SENSORS MAY BE CONNECTED IN PARALLEL

If A/C unit is equipped with Honeywell W973 controller, see NOTE p. 12.

WIRING OF ISOLATION RELAY (by others) For A/C Unit with Electric Heat*

(W_1) energizes blower (G) without feedback to (Y_1)

*May also be used for hot water or steam heating with intermittent fan operation

OMRX WIRING

MOTOR FACTORY WIRED

CAPACITY OF TERMINALS 3 AND 4 IS 1 AMP EACH

DSC-H & LAT-H WIRING FOR SINGLE STAGE HEAT PUMP

DSC-H & LAT-H WIRING FOR TWO STAGE HEAT PUMP

If A/C unit is equipped with Honeywell W973 controller, see bottom of p. 12.

SLAVING ONE OR MORE DAMPERS FROM ONE THERMOSTAT OR VELOCITY SENSOR

IF MORE THAN 3 SLAVES ARE REQUIRED, A RELAY SHOULD BE USED TO POWER TERMINAL #1 AND #2 OF SLAVE BOARDS.

INSTALLATION INSTRUCTIONS

WARNING Do not carry or handle unit by damper. Gears will strip. Do not manually move or adjust damper position. Gears will strip.

Do not turn on power to damper until check, test and start directions are read. Follow start up instructions.

SHEET METAL Install unit so that damper shaft is either horizontal or vertical with control box on top (see below).

NOTE: Install OMC or OMRX so that the temperature sensor will be upstream from damper.

SEE PAGE 17 FOR OMRX WIRING

WIRING Locate thermostat where it can sense normal zone load. Do not locate thermostat on outside walls or near a source of heat or cold. Air from register must not blow on thermostat. Connect four wires from thermostat to Omnizone damper, color to color, as shown on diagram. Be sure that each zone damper is connected to the thermostat in the zone it controls. After thermostat is wired, connect the 24 volt transformer to the "Y" "Y" connections as shown in diagram.

NOTE: Thermostats must be calibrated (see instructions on page 22). After startup check damper operation. When the duct temperature is higher than room temperature the red LED on the damper printed circuit board will turn on. The damper will run open on a thermostat call for warmer and closed on a call for cooler.

When the duct temperature is lower than room temperature, the LED will turn off, the damper will open on a thermostat call for cooler, and close on a call for warmer.

A.C. VOLTAGE CHECKS TO BE MADE AT DAMPER

NOTE: Do thermostat check, test and start (page 21-22) before proceeding with this section.

*For OMRX, add at least 12 VA for each contactor coil.

MECHANICAL CHECKOUT TO BE MADE AT DAMPER

CHECK, TEST, START AND SERVICE

Use these flow charts and a digital voltmeter to service Omnizone Phase II OMC or OMRX units and T 200 or T 300 thermostats.

The voltage range of 5% allows for meter differences. When *none* of the voltages agree with chart, check meter.

Most operating problems involve field wiring. Check for proper wiring before changing components. Do not recalibrate thermostats without checking wiring. Be sure that thermostats are connected to the right dampers.

D.C. VOLTAGE CHECKS TO BE MADE AT THERMOSTAT

CALIBRATING THE T 200 AND T 300 THERMOSTAT

The thermostat and damper do not generate hot or cold air. The thermostat can only maintain room temperature when a source of heating or cooling is provided by the air conditioning system.

The zone thermostat can be recalibrated by following these simple instructions. (Thermostat is out of calibration if it will not cause damper to reverse when thumbwheel is turned 1 or 2 degrees above and below zone temperature)

1. With an accurate thermometer measure temperature at the thermostat.
2. Set the temperature dial at the room temperature measured at the thermostat.
3. Set digital voltmeter to the 200 millivolt range. Place voltmeter *positive* probe on the "G" terminal and the *negative* probe on the "W" terminal of the thermostat.
4. Rotate calibration potentiometer until meter reads +15 to +20 millivolts.
5. Set temperature dial one or two degrees *above* room temperature. After 5 to 10 seconds, check the white lobe opposite the motor to see if damper is moving.
6. Set temperature dial one or two degrees *below* room temperature and check for reversed motor operation.

T200

T300

BYPASS DAMPER:

Install the bypass damper between the supply and return duct as shown. Branch takeoffs must not be made *upstream* of the OBP takeoff. The OBP can dump into a plenum ceiling, but it is advisable to have the outlet as near as possible to the return inlet. If an economizer is used, be certain the return air damper does not close off the bypass air. A 15% minimum return air position is usually sufficient.

VELOCITY SENSOR:

The preferred installation of the velocity sensor is in the air conditioning unit upstream or downstream of the cooling coil and near the center of the coil. To avoid turbulence, the velocity sensor should be on the opposite side of the coil from the blower. The velocity sensor may also be installed in the supply duct (2" diameter hole required) near the duct center line and at least two feet away from the air handling unit. The velocity sensor should not be installed in the corner of an elbow or a dead spot where it will not sense air movement.

WIRING:

Connect velocity sensor to control panel, color to color, as shown in diagram. Install and wire 24 volt transformer in blower circuit so that it will only operate when the fan is on. When breaking the power to the OBP, *both* wires must be broken. Do not connect any other dampers to the OBP transformer. If two or more OBP's are wired to one velocity sensor, see page 18 for slave wiring.

OBP WIRING DIAGRAM

SIDE VIEW OF MODULE

START-UP:

1. Turn on system blower.

2. Set all zone thermostats so that all dampers are open and full air volume is being supplied to each zone. Allow air system to run for 5 minutes.

3. Check the position of the white plastic damper lobe on side of OBP module. The damper should be in the fully closed position. There are two indicator lights on the OBP printed circuit board. Turning the set point lever counter-clockwise will open the damper and turn on the green light. Turning it clockwise will close the damper and turn on the red light.
   a) Turn the lever clockwise to be sure that the damper is fully closed. Only the red "closed" light should be lit.
   b) Move the lever slowly counter-clockwise until the red light turns off and the green "open" light just comes on.
   c) Move the lever very slowly clockwise and stop when both lights are off. (OK if both lights just go off or just go on.)
   d) Observe the motor operation through the window on the end of the motor. If the motor is running stop it by slightly adjusting the lever. If the motor is not running, adjust the lever to barely start it then bring it to a stop. Be sure damper remains closed. The OBP is now ready to operate.

4. Measurably reducing the air velocity, with the zone dampers, will cause the OBP to partially open. The OBP will only open enough to compensate for the change in air velocity in the air handling unit.

5. If it is necessary to verify velocity sensor operation: with fan running, remove velocity sensor from airstream. If damper does not open, replace sensor and/or circuit board.

6. Two or more OBP dampers may be operated in parallel from one velocity sensor. See wiring on page 18.

START-UP:

1. When power is first turned on, the LAT will run through a time delay cycle (approximately 5-7 mins.). This will happen every time power is interrupted. Because of this operating characteristic, the LAT must have an uninterrupted 24V power source.

2. All LATs designated LAT7F (manufactured after May, 1986) will have four status lights and four temperature test points. The red lights indicate heating relay and cooling relay operation. The green lights indicate temperature within operating range. The test points are explained in the calibration section below.

3. When the LAT is powered on startup, all four lights should be on. After the time delay period (5-7 minutes), the red lights will turn off indicating that the relays are in the normal operating mode. In this mode the relays will allow the compressor and heater to respond to heating and cooling calls from the control center. Under normal operating conditions, the green lights will be on and the red lights will be off.

4. If discharge duct temperature drops below 50 degrees, the green cooling temperature light will go off. Simultaneously the red cooling light will turn on, indicating that the relay has opened the "Y" "Y" terminals to turn off the compressor. When the duct returns to a temperature above 50 degrees, a reset occurs. The green cooling light turns on, and the delay timer starts counting. The "Y" "Y" terminals will remain open, and the red heating relay light will remain on for 5 to 7 minutes until the timer completes its cycle.

5. When the temperature goes above the heating setpoint (130 degrees for gas and 108 degrees for heat pump), the green heating temperature light will go off. Simultaneously, the red heating relay light will go on, indicating that the relay has opened the "W" "W" terminals turning off the heat. When the duct returns to a temperature below the heating setpoint, a reset occurs. The green heating temperature light will turn on showing that the temperature is again in the proper range. At the same time, the delay timer starts counting. The "W" "W" terminals will remain open, and the red heating relay light will remain on for 5 to 7 minutes until the delay timer completes its cycle.

The operation of the status lights is shown in the following table for various conditions:

	COOL		HEAT	
DUCT TEMP.	RELAY (R)	TEMP (G)	RELAY (R)	TEMP (G)
NORMAL	OFF	ON	OFF	ON
BELOW 50	ON	OFF	OFF	ON
COOL RESET	ON	ON	OFF	ON
ABOVE 130	OFF	ON	ON	OFF
HEAT RESET	OFF	ON	ON	ON

CALIBRATION:

The factory setting on the LAT7F may be checked or changed using an accurate digital voltmeter which can read to three decimal places. The readings are taken on the test points numbered 1 through 4 on the printed circuit board.

Connecting a meter between terminal #2 and terminal #3 will show the *supply duct temperature* as a voltage. *Cooling* set point voltage can be read between terminals #2 and #1. *Heating* setpoint voltage can be read between #2 and #4. Table 1 shows factory setpoint voltages.

To change the heating or cooling setpoint, rotate the screw on the heating or cooling potentiometer. Verify the setting with a digital voltmeter (which can read to three decimal places) attached to the proper test points. (See Table 2 on opposite page)

OMNIZONE LEAVING AIR TEMPERATURE CONTROL (LAT)

TABLE 1

	Setpoint °F	Read Terminals	DC Voltage
Cooling	50	#2 & #1	2.832
Heating: gas electric	130	#2 & #4	3.276
Heating: heat pump	108	#2 & #4	3.152
Discharge Duct Temperature	—	#2 & #3	per table #2

TABLE 2

TEMPERATURE TO DC VOLTAGE CONVERSION

°F	DC Volts	°F	DC Volts	°F	DC Volts
40	2.775	74	2.964	108	3.153
41	2.781	75	2.970	109	3.159
42	2.787	76	2.975	110	3.164
43	2.792	77	2.981	111	3.170
44	2.798	78	2.987	112	3.175
45	2.803	79	2.992	113	3.181
46	2.809	80	2.998	114	3.187
47	2.814	81	3.003	115	3.192
48	2.820	82	3.009	116	3.198
49	2.825	83	3.014	117	3.203
50	2.831	84	3.020	118	3.209
51	2.837	85	3.025	119	3.214
52	2.842	86	3.031	120	3.220
53	2.848	87	3.037	121	3.225
54	2.853	88	3.042	122	3.231
55	2.859	89	3.048	123	3.237
56	2.864	90	3.053	124	3.242
57	2.870	91	3.059	125	3.248
58	2.875	92	3.064	126	3.253
59	2.881	93	3.070	127	3.259
60	2.887	94	3.075	128	3.264
61	2.892	95	3.081	129	3.270
62	2.898	96	3.087	130	3.275
63	2.903	97	3.092	131	3.281
64	2.909	98	3.098	132	3.287
65	2.914	99	3.103	133	3.292
66	2.920	100	3.109	134	3.298
67	2.925	101	3.114	135	3.303
68	2.931	102	3.120	136	3.309
69	2.937	103	3.125	137	3.314
70	2.942	104	3.131	138	3.320
71	2.948	105	3.137	139	3.325
72	2.953	106	3.142	140	3.331
73	2.959	107	3.148		

DSC CHECK, TEST, START AND SERVICE

DSC CALIBRATION

NOTE: Before calibrating remove all Y, W and G wires from DSC. Do not remove R and C wires.

1. Read temperature at all DSC sensors connected to DSC.
2. Set digital switch 1° above highest temperature read at any DSC sensor.
3. Rotate calibration potentiometer to turn on first stage cooling light. Back potentiometer off until first stage cooling light just turns off.
4. Set digital switch to read temperature at sensor. First stage cooling light should turn on.
5. Check heat turn-on by raising set point five degrees. First stage heat light should turn on.
6. Check with A.C. voltmeter between C and Y/1. When first stage cooling light is on, 24 volts should be available between C and Y/1.
7. When light is off, six to eight volts may show up depending on the sensitivity of the meter.
8. Connect load wires and check out operation of air conditioning unit.

*If more than 4 sensors, wire additional sensors in parallel.

Furnish and install an Omnizone Variable Air Volume System, including the following components:

1. **MOTORIZED ZONE DAMPERS** (One or more per zone)

   Model OMC dampers shall be used, except in zones having supplementary heat where model OMRX dampers shall be used. Each damper shall consist of a round duct fitted with an elliptical damper to assure linear air flow; a solid-state control center, two 24 volt modulating motors and one drive assembly; a potentiometer to signal actual damper position; and a heating/cooling changeover sensor.

2. **ZONE THERMOSTATS** (One per zone)

   An electronic thermostat, furnished by the damper manufacturer, shall be installed in each zone. The thermostat shall contain a setpoint device and an electronic sensor which produces a voltage signal directly proportional to room temperature. Thermostats located in peak-load zones shall also contain a sensor to be connected to the discriminating master thermostat.

3. **BYPASS DAMPER** (One or more per unit)

   A model OBP bypass damper shall be installed at each air handling unit to allow excess air to flow from the supply to the return side of the unit as building load decreases and zone dampers begin to modulate closed. The bypass damper shall be controlled by a velocity sensor, mounted in the unit or supply duct, and shall maintain a constant airflow through the unit regardless of the volume of air being delivered to the building. (Note: A bypass is not required on VAV units equipped with blower inlet vanes or a variable speed drive.)

4. **LEAVING AIR TEMPERATURE CONTROL** (One per A/C unit)

   A model LAT leaving air temperature control shall be installed in the supply air duct to reduce the cooling or heating capacity of the A/C unit as building load decreases. As zone dampers begin to close and excess air is recirculated through the unit, the supply air temperature will increase or decrease according to the system mode. If the supply temperature drops below 50 degrees F, the LAT shall shut off one stage of cooling. If the temperature goes above 130 degrees F (108 degrees for heat pumps), the LAT shall shut off one stage of heating. In both cases, there shall be a 5-7 minute time delay to prevent short cycling of the compressor or heater. When using a strip heater the LAT shall be installed downstream of the inside coil and upstream of the strip heater, where it will not be affected by auxillary strip heat. Overheat and/or low air protection for the strip heater shall be as recommended by the strip heater manufacturer.

5. **DISCRIMINATING THERMOSTAT** (One per A/C unit)

   A model DSC, two stage heating/cooling automatic changeover thermostat with mode status lights, on/off switch and fan switch shall be installed to operate each A/C unit. This thermostat shall provide automatic heating/cooling changeover by monitoring the actual space temperature in peak-load critical zones as measured by DSC sensors located in these zones and mounted in the thermostat (see plans for location). Cooling requirements shall be satisfied first. Once all cooling calls are satisfied, the unit shall operate in the ventilating mode until there is a call for heat. The unit shall then operate in the heating mode until all heating calls are satisfied or a critical zone again calls for cooling. The dead band shall be 5 degrees F (standard) or 3 degrees F (optional). The DSC shall be powered from the A/C unit control transformer which shall be wired to provide no less than 23.5 VAC at the DSC.

6. **TRANSFORMERS AND WIRING**

   All 24 volt transformers shall be properly sized and furnished by the installing contractor. Individual or common transformers may be used for all zone dampers and the LAT. The bypass damper shall be operated from its own transformer, connected to the load side of the blower motor starter. Transformers and wire shall be sized to provide no less than 22.5 VAC at each component, except DSC.

SEQUENCE OF OPERATION

On system startup, each zone thermostat shall cause its zone damper to modulate the flow of conditioned air to match the air supply requirements of that zone. The changeover sensor in each damper shall measure the air temperature in the duct to determine if the damper control should operate in the cooling or heating mode.

Additionally, in any zone with supplementary heat, if the room temperature drops 3 degrees F below the thermostat setpoint, the OMRX control center shall provide 24 VAC to turn on the first stage of the zone heater, regardless of the system mode. If the room temperature drops 4 degrees below setpoint, the OMRX shall provide 24 VAC to turn on the 2nd stage of supplementary heat if available.

As building load is reduced and zone dampers begin to close, the bypass damper shall modulate open, maintaining a constant volume of air through the unit.

If the bypass opens to the point that supply air from the unit drops below 50 degrees F on cooling or goes above 130 degrees on heating (108 degrees on a heat pump), the leaving air temperature control shall shut off the appropriate compressor or heater. A built-in timer shall prevent short cycling.

The discriminating thermostat, acting on temperature information received from peak-load sensors, shall operate the A/C unit to satisfy cooling, then heating, requirements as the load shifts from one area of the building to another.

START-UP SUPERVISION

Check, Test and Startup supervision and owner instruction shall be provided by a trained technician of the air conditioning and VAV control equipment supplier.

OMNIZONE

SUBMITTAL DATA

Project _____

Location _____

Mech. Eng. _____

Contractor _____

P.O. _____

BILL OF MATERIALS

QTY.	SIZE	TYPE	TAG

DIMENSIONAL DATA			CAPACITIES—CFM					
(SIZE) D	L	W	PRESS. DROP ▶ VEL(FPM)▶	.15" 700	.035" 1000	.07" 1500	.1" 1800	.2" 2500
6"	18"	10"	6"	125	175	250	315	437
8"	18"	12"	8"	220	315	470	567	787
10"	18"	14"	10"	380	550	820	990	1375
12"	24"	16"	12"	500	700	1060	1260	1750
16"	24"	20"	16"	800	1250	1850	2250	3125

☐ **OMC:** The OMC is a cooling/heating damper with automatic summer/winter changeover. When supply air temperature is below room temperature, an internally mounted duct temperature sensor tells the Omnizone thermostat to operate the damper in the cooling mode. When supply air temperature is above room temperature the thermostat reverses and operates the damper in the heating mode.

☐ **OMRX:** The OMRX is identical to the OMC damper with two stages of supplemental heat control capability.

☐ **OBP:** The OBP is used as a bypass on small and mid-range systems to control the air delivery where inlet vanes are impractical. The OBP is controlled by an Omnizone velocity sensor installed in the unit or supply air duct.

☐ **THERMOSTAT:**
The Omnizone thermostat is designed around a rugged integrated circuit on a silicon chip. The Thermostat will exactly modulate the damper to deliver air to its zone to match the load.

☐ **LAT:** The Omnizone LAT is a leaving air temperature sensor with a built-in timer to provide heating and cooling capacity control for single or two-stage compressor systems. If leaving air temperatures go above or below set points, this control turns off the heater or compressor for five to seven minutes.

☐ **DSC:** The Omnizone DSC is an electronic two-stage cooling, two-stage heating thermostat that senses building temperatures in up to ten different locations, operating the system to respond to loads in any of the sensor locations.

OMNIZONE 5731 McFadden Avenue
Huntington Beach, CA 92649 (714) 898-9538