Excellence Without Compromise

EWC® CONTROLS INC.

TECHNICAL BULLETIN

TB-206 Model NCM 300 Zone Control System

LEAVE THIS BULLETIN ON THE JOB SITE FOR FUTURE REFERENCE

The NCM 300 panel provides intelligent control of Heat Pump or Conventional forced air zoning systems at a maximum of three zones using motorized dampers and practically any off-the-shelf heat/cool thermostat. With features like automatic changeover, one zone setback feature, field selectable timers and supply air sensing capability, the NCM 300 provides a high level of performance in a non-expandable zone control panel. Perfect for new construction and retro-fit applications.

Zone Capacity

Controls two or three air zones with most 24vac Power Open/Closed or Spring Assisted motorized dampers.

Compatible HVAC Systems

Will control heat pumps with O or B type reversing valves and electric auxiliary heat. Will also control 1 or 2 stage gas or oil fired furnaces, with single stage electric air conditioning.

Compatible Thermostats

Regardless of the application, use standard 24vac, 4/5 wire heat/cool mechanical or electronic thermostats in all zones! Mercury, Battery, and Power robbing types that draw less than 20 ma of current can also be used. *Compatible with a select type of heat pump thermostat in zone 1 only.*

Automatic Heat/Cool Changeover

The NCM300 panel features automatic changeover from any thermostat allowing for individual zone comfort from the HVAC system.

Status LED

The STATUS LED blinks slowly during normal operation to indicate the micro processor is operating properly.

System LEDs

A total of 9 LED's indicate the system status and mode of operation.

Damper LEDs

LEDs labeled Zone 1 thru Zone 3 indicate which dampers are energized to open.

Operating Power

Operates on 24VAC power supplied from a separate transformer. A single 40VA transformer can power all three zones, with a total of four dampers. 8va draw per damper.

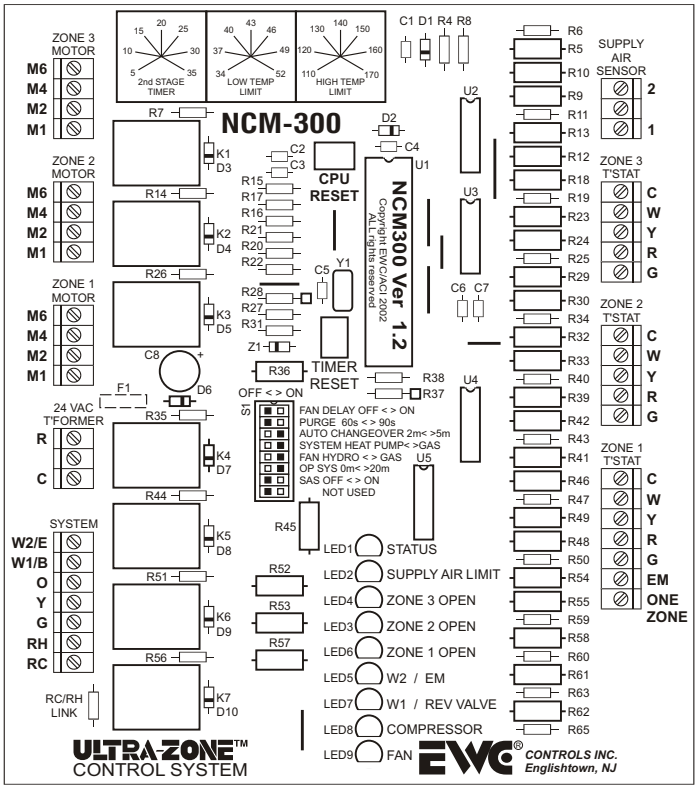


Figure 1. NCM300 panel

Thermal Breaker

The NCM300 has a thermal circuit breaker in place of a fuse, and protects the panel from shorts in the thermostat and damper field wiring. It does not protect against shorts in the HVAC system wiring.

CAUTION: When the circuit breaker is tripped it will get quite hot. To reset the breaker, locate and repair the short, remove the 24vac power for 30 seconds and then restore it.

Watch Dog Circuit

The panel has a built-in circuit that monitors the computers performance and resets the panel if an error occurs in operation or due to power failures.

Indoor Fan Control

Any zone can activate the indoor fan and only the dampers in zones calling for continuous fan operation will open. Continuous fan operation will only occur when there are no heating or cooling calls.

EWC Controls Inc. 385 Highway 33 Englishtown, NJ 07726 800-446-3110 FAX 732-446-5362 E-Mail- info@ewccontrols.com

Built-In Timer Settings

The panel has built-in timers that insure reliable operation.

*Short Cycle Timer	2 minutes, fixed.
*Minimum Run Timer	2 minutes, fixed.
*Changeover Timer	2 or 5 minutes
*Opposing System Service Timer	20 minutes, fixed.
*Second Stage Heating Timer	5 to 35 minutes, adjustable.

Minimum Run Timer

When a call is activated the panel will run the system in that mode for a minimum of 2 minutes.

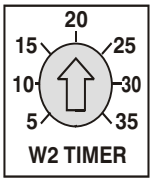
Short Cycle Timer

When the system is satisfied, the panel will not resume the same call for a minimum of 2 minutes.

Changeover Timer

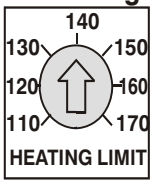
A built-in timer prevents the system from rapidly switching between heating and cooling. At the end of a call, an adjustable 2 or 5 minute timer is started and the panel will not switch to the opposing system until the timer has expired.

Stage Two Heating Timer

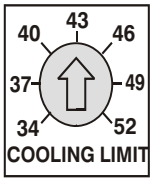


The W2 TIMER sets the total amount of time delay before second stage heating is energized. 1st stage heat will stay energized when 2nd stage heat activates.

Heating and Cooling Limit Settings



The Heating Limit potentiometer sets the supply air temperature at which the heating is cycled off and the fan continues to run, until the supply air temperature has dropped below the heating limit set point.



The Cooling Limit potentiometer sets the supply air temperature at which the cooling is cycled off and the fan continues to run, until the supply air temperature has risen above the cooling limit set point.

Timer Reset BUTTON

Momentarily pressing the TIMER RESET button clears the built-in timers controlling the minimum run timer, short cycle timer, W2 timer, and the changeover timer. This enables you to test the installation faster. Caution should be observed when using this button.

CPU Reset BUTTON

Momentarily pressing the CPU RESET button resets the computer.

Selecting the Options Using the DIP Switches

7 DIP switches allow you to select the features that will allow the panel to operate your HVAC system.

FAN DELAY OFF < > ON

DIP switch 1 allows the NCM300 to operate the fan during the 60/90 second purge mode. Works in heat and cool mode. Set the switch to OFF to allow the system to operate it's own fan purge.

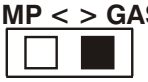
PURGE 60s < > 90s

DIP switch 2 selects a purge time of 60 seconds or 90 seconds. The damper(s) on the last zone(s) calling will be held open for 60 or 90 seconds.

AUTO 2m < > 5m CHANGEOVER

Select between 2 or 5 minutes of change over time delay. The panel will not switch to the opposing system until the timer has expired.

SYSTEM TYPE HEATPUMP < > GAS



Select the type of HVAC system the panel is controlling. Heat Pump or Gas/Oil/Hydronic heat with A/C.

FAN HYDRO < > GAS

Select the GAS position when setting up for gas or heat pump applications. Select HYDRO when setting up for straight electric or hydronic heating applications.

OP SYS 0m < > 20m

Select 20 minutes of time delay for opposing system calls or, 0 minutes and the panel will work on majority rules only.

SAS OFF < > ON

Select ON if you are using a Supply Air Sensor with the NCM300. Select OFF if you have not installed a sensor.

NOTE: DIP SWITCH #8 HAS NO FUNCTION AND IS NOT USED!

INSTALLATION INSTRUCTIONS

WARNING: THESE PANELS ARE DESIGNED FOR USE WITH 24VAC. DO NOT USE OTHER VOLTAGES! USE CAUTION TO AVOID ELECTRIC SHOCK OR EQUIPMENT DAMAGE. ALL WIRING SHOULD BE DONE TO LOCAL AND NATIONAL CODES AND ORDINANCES. USE 18 AWG SOLID COPPER, COLOR-CODED, MULTI-CONDUCTOR THERMOSTAT CABLE.

The NCM300 zone control panel requires standard 1 stage heat/cool thermostats in all zones, regardless of the application. **2nd stage heat output is controlled by an adjustable timer on the panel. The NCM300 will work with a select type of heat pump thermostat in Zone 1 only. Easy thermostat wiring diagrams are shown below.**

Thermostat Wiring

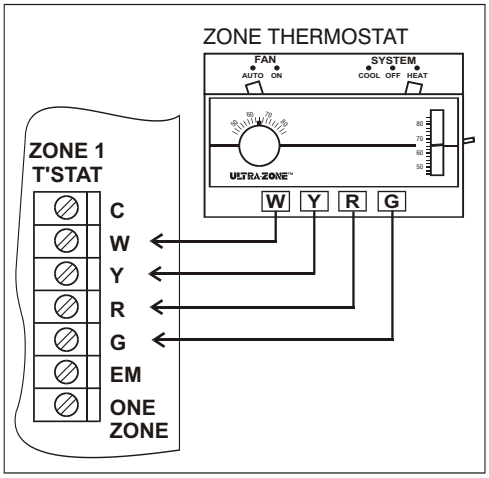


Figure 2a. Typical heat/cool thermostat wiring in zone 1, 2, or 3.

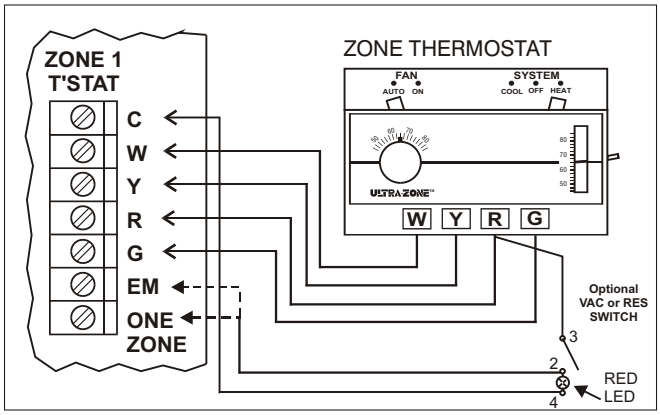


Figure 2b. Typical heat/cool or heat pump application wiring in zone 1, with separate *Vacation* or *Emergency Heat* switch. Part #VAC or RES.

Zone 1 will also accept heat pump style thermostats with a constant 24vac output during emergency mode, and separable W1 and Y terminals. These thermostats can be field configured & programmed to conventional heat / cool operation.

A White Rodgers Model 1F94-371 programmable is compatible with the NCM300. A Honeywell T-8011 programmable or T-8411 non-programmable is also compatible. These versatile thermostats can be set up in Conventional mode, and still allow use of the Heat pump features. (i.e. Emergency Mode)

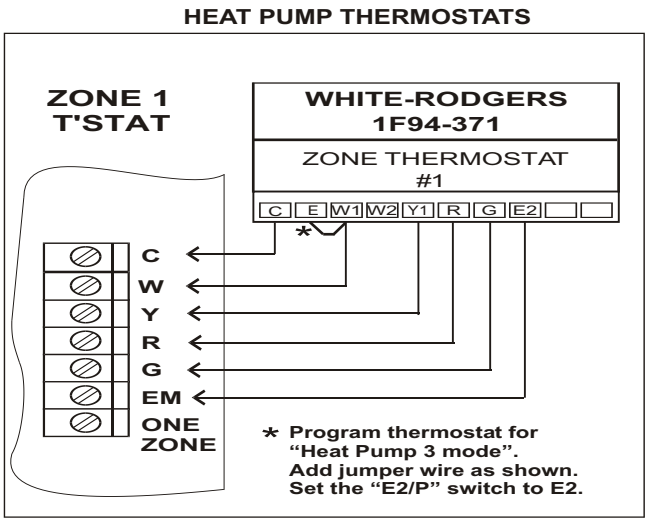


Figure 2c. **Zone 1 will accept heat pump style thermostats with a constant *24vac output during Emergency Mode,* and/or separable *W1* and *Y* terminals. Use a programmable White Rodgers 1F94-371 or Honeywell Model T8011 programmable or T8411 non programmable. Other compatible Models include the White Rodgers 1F93-380, 1F95-377, and the CTC Model# 43403.**

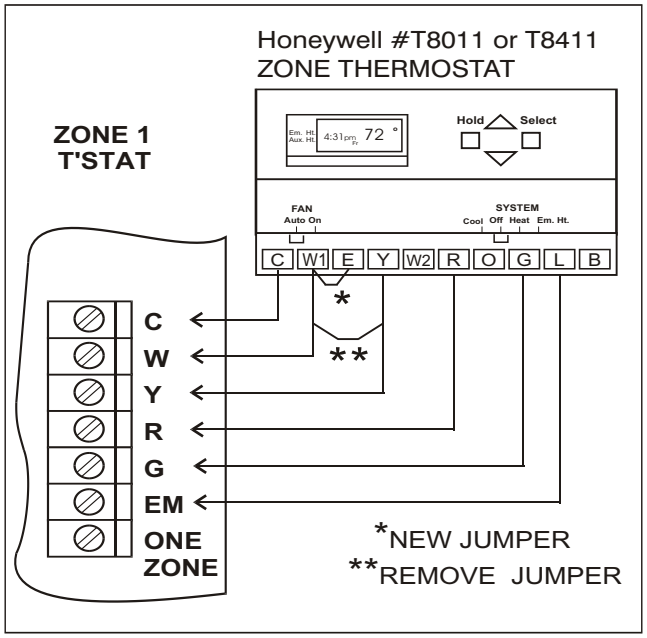


Figure 2d. Wiring for heat pump thermostat in zone 1. NOTE: Constant **L** output in the Emergency heat mode. Remove the factory jumper between **W1** and **Y** terminals and install a new jumper between **W1** and **E** terminals.

System Wiring

The NCM300 panel was designed to be easy to understand and wire up. We have provided several typical diagrams to review. Your actual field wiring may vary.

Single Transformer Gas/Electric Systems

Typical gas/electric system wiring using a single transformer is shown below. ***Note the jumper (link) between RC and RH. There is no need to install your own jumper.***

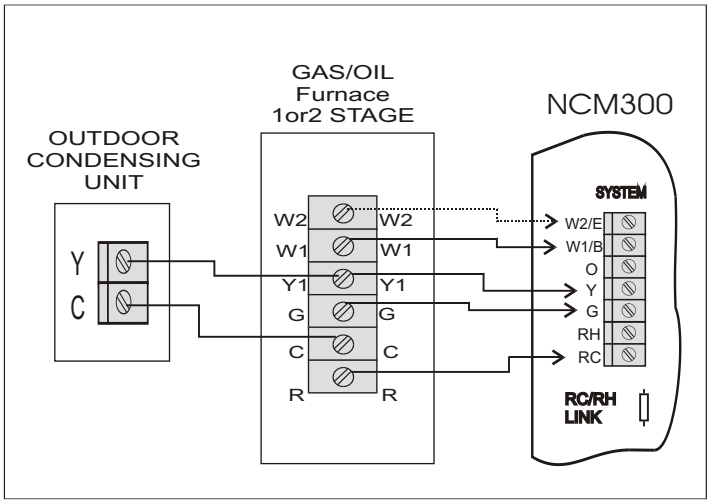


Figure 3a.

Two Transformer Systems

**** Note: Your Air Handler may include a W terminal. That means it may have it's own isolation circuit. If you can confirm this, simply connect the W1/B terminal to the W terminal on the air handler. Do not cut the Rc / Rh jumper. Wire up your Oil Burner, Circulator relay, or Hydronic Zone valve to the isolation contacts or wires provided in the air handler. (Follow dashed lines) The fan is controlled via time delay relay inside the air handler.***

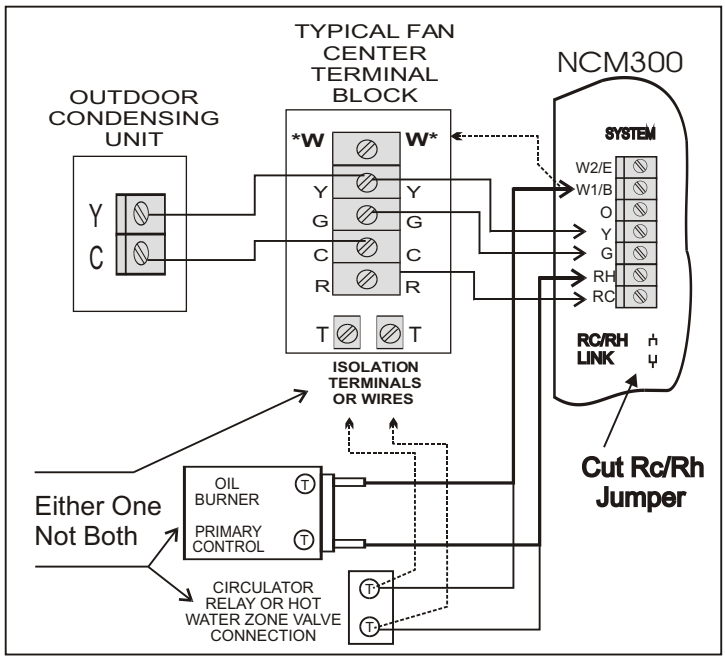


Figure 3b.

Heat Pump with O Type Reversing Valve

Typical heat pump system wiring with electric resistance backup heat. Wire up the reversing valve to either O or W1/B, depending on your type of system. Applies to air cooled or geothermal / ground source systems.

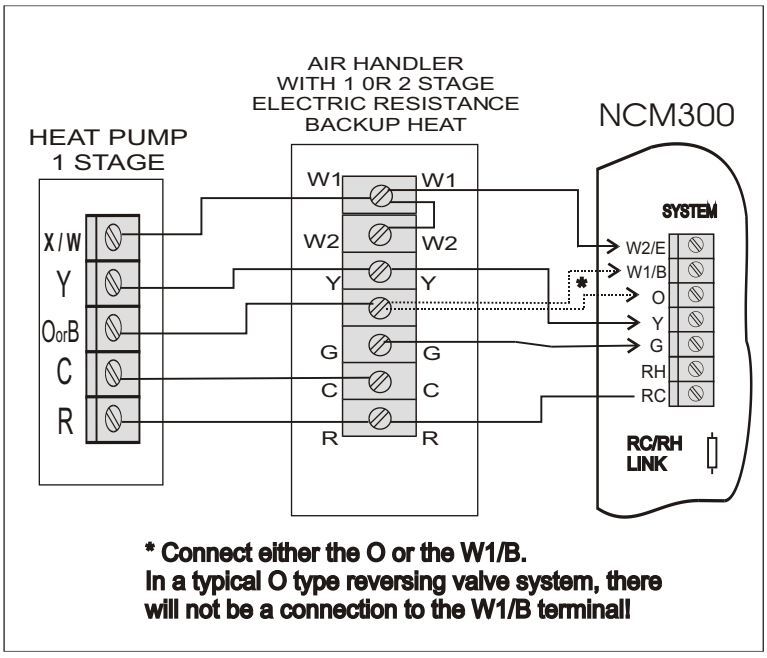


Figure 3c. Conventional Heat Pump System

Simple Fossil Fuel Application

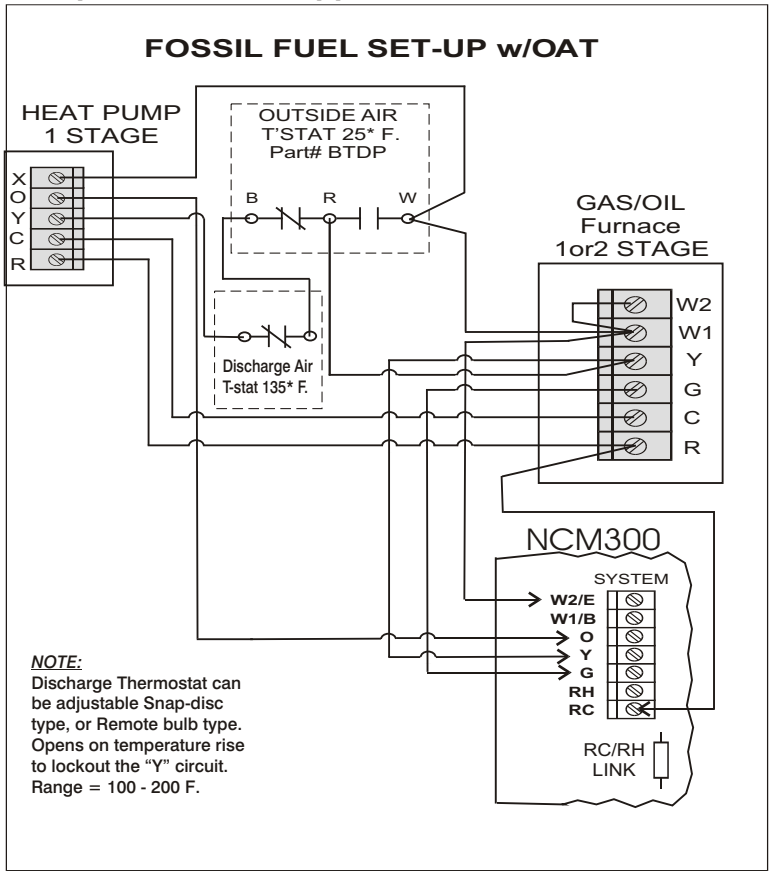


Figure 3d. Single stage heat pump and 1or 2 stage furnace.

DAMPER WIRING

Note: All zone dampers default to the "OPEN" position after a purge delay has occurred. Dampers also default "OPEN" during changeover & short cycle delays, and when all zone demands are satisfied, and no signals are detected from the thermostats.

REFERENCE THESE DIAGRAMS PRIOR TO INSTALLATION AND POWER WIRING. DOING SO WILL SAVE TIME AND LABOR LATER ON.

ZONE MODULE DAMPER MOTOR TERMINAL BLOCK DESIGNATION & FUNCTION

Terminal M6 24vac to Close a damper(s)
Terminal M4 24vac to Open a damper(s)
Terminal M2 Constant 24vac HOT
Terminal M1 Common 24vac

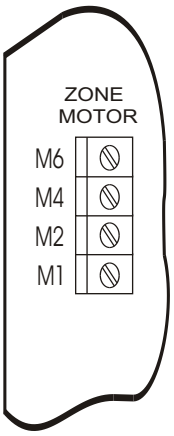
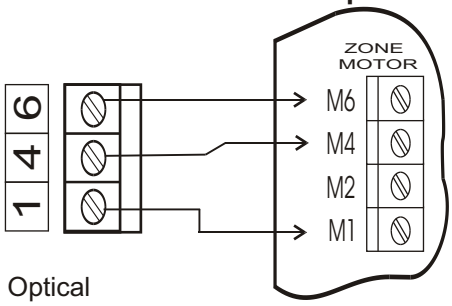


Figure 4a

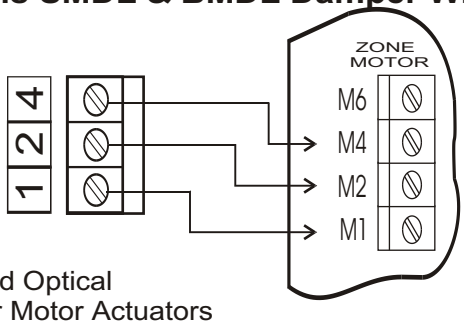
All Models MA-ND & MA-URD Damper Wiring



Patented Optical
Damper Motor Actuators

Figure 4b

All Models SMDL & BMDL Damper Wiring



Patented Optical
Damper Motor Actuators

Figure 4c

2 Wire Spring Return Motor Wiring

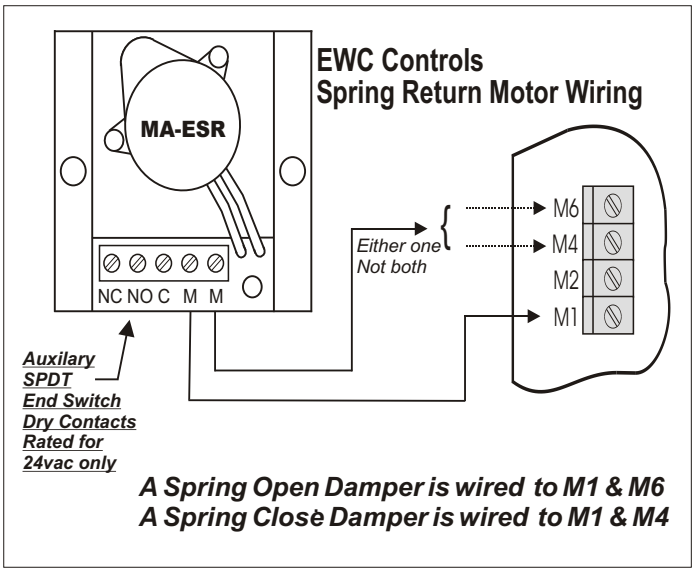


Figure 5

Multiple MA-ND & MA-URD Damper Wiring on a Single Zone

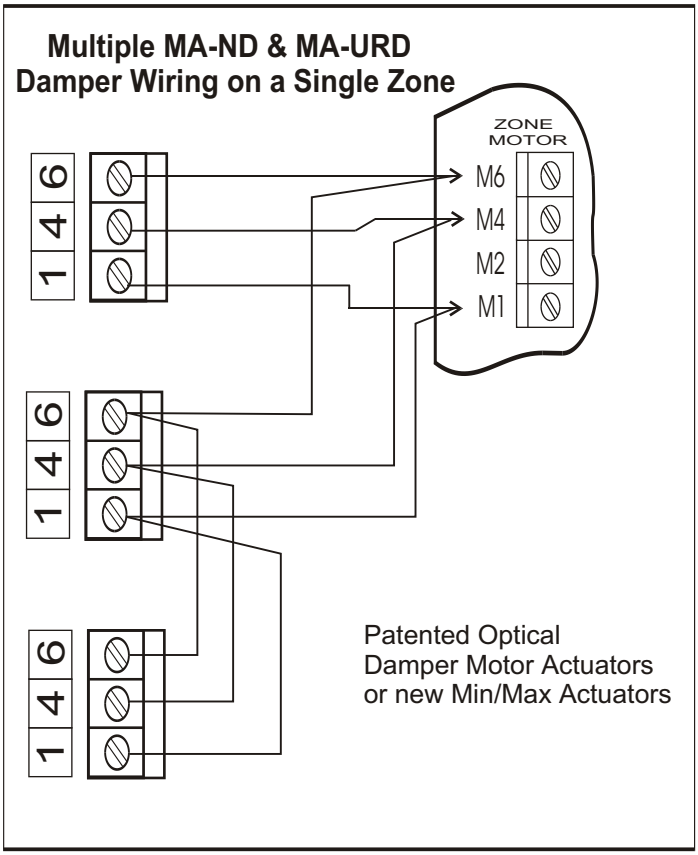


Figure 6

On all these dampers and most older style dampers, including competitor's dampers, always wire up number to number. Contact EWC Controls Technical Support when you are on the job site for assistance with damper wiring.

Do not overload your transformer!

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SERVICE GUIDE

Some Helpful Guidelines

All voltage measurements on the panel should be made with the ground lead of your meter on terminal **C** of the 24VAC input terminals.

All VAC measurements at the HVAC system terminals (W1/B, O, Y, W2/E & G) should be made with the meter ground lead on the system's **C** terminal at the HVAC system.

Using the LED Indicators

The STATUS LED should blink at 1second on / 1 second off, to indicate the microprocessor is operating properly.

The SUPPLY AIR LIMIT LED will illuminate if the panel senses a discharge temperature in excess of the high or low limit set points. The LED will blink rapidly if the sensor is open or shorted. The panel will function normally but with no supply air temperature control, until the open or short is repaired.

The ZONE damper LED's will illuminate to indicate which dampers should be open.

The W1/REV VALVE LED indicates that the panel is in the 1st stage heating mode.

The W2/EM LED indicates 2nd stage heat or Emergency heat has been energized.

The COMPRESSOR LED indicates the compressor is energized.

The FAN LED indicates the fan is energized.

Dampers Not Responding Properly

If the Zone LED indicators are illuminated but the dampers appear to be malfunctioning, check the damper field wiring.

If the ZONE LED's are not responding properly, check the calls on each zone thermostat. If the calls indicate a damper should be energized and is not, press the TIMER RESET button to reset the timers. If the problem persists, see Table 2 for service help.

Check 24VAC Power

Measure 24VAC at all damper M1 and M2 terminals and all T-stat **R** and **C** terminals. See Table 1 if any of these voltages are incorrect.

HVAC System Not Responding Properly

If the HVAC LED indicators are responding properly, but the system appears to be malfunctioning, check that the HVAC system is wired correctly and that the DIP switches have been properly set.

If the HVAC LEDs are not responding properly, check the calls on each zone thermostat. If the calls indicate that the HVAC system should be activated and is not, press the TMR RESET switch to reset the timers. Also check that the DIP switches have been properly set. If the problem persists, see Table 3 for trouble shooting help.

Table 1. Detecting 24VAC Shorts

Detecting 24VAC Short

The STATUS LED will be **off**, you will measure 24VAC at the transformer terminals **R & C**, but not at any damper **M1&M2** terminals, or any zone thermostat **R & C** terminals. **CAUTION:** The thermal fuse will be very hot.

Isolating 24VAC Shorts Panel or Wiring

Remove the power to the panel and allow the thermal poly fuse to cool down.

Remove the wire at each zone thermostat **R** terminal and test if the short still persists by restoring power to the zone panel and testing as described above. If the short disappears, check the zone thermostat wiring and the thermostat itself. This applies if the thermostat requires the 24 volt (**C**)common, or the **R** wire could be shorted to ground.

If the short still persists disconnect all the wires at each damper terminal (M1, M2, M4 & M6). Restore power and test as described above. If the short clears, check the damper wiring and the dampers for shorts with a continuity tester. If the short still persists, call the technical support hot-line.

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Table 2. Detecting Damper Problems

Damper LED On But Damper Not Responding

Check the damper wiring to insure it is correctly wired. Be sure the wires are secured in the terminals. Test the damper motor to insure it is properly operating. If the problem still persists, contact technical support.

NCM300 Damper LED Not Responding

Check that the STATUS LED is blinking. If it is not, the panel may have been placed in the Contractor Test inadvertently by holding the TMR RESET switch for 15 seconds. Press the CPU RESET switch to cancel the Contractor Test.

Press the TMR RESET switch to clear any timers that may be keeping the call off and the damper from not responding.

Check the voltage at each zone thermostat terminal W, Y and G terminals to insure the damper should be activated.

If the problem still persists, call the technical support hot-line.

Testing Damper Motors

For a RDN/SMDL/BMDL damper, connect 24VAC common to terminal 1, and 24VAC to terminals 2 and 4. The damper should open. Remove 24VAC from terminal 4 and the damper should close.

For a BMD/SMD/ND/URD damper, connect 24VAC common to terminal 1, and 24VAC to terminal 4 and the damper should open. Remove 24VAC from terminal 4 and apply 24VAC to terminal 6 and the damper should close.

For a power close spring open damper, connect 24VAC to the two motor terminals, and the damper should CLOSE. Remove the 24VAC and the damper should OPEN. For a power open damper, the action will be reversed.

Table 3. Detecting Heating, Cooling and Fan Problems

W1/B, O, Y, W2/E & G LEDS On But System Not Responding

Check the HVAC wiring to insure it is correctly wired. Be sure the wires are secured in the terminals. Check that there is 24VAC at the RC and RH terminals. Use the HVAC system common (C) for the ground lead of your meter. Check that RH and RC are connected if the system uses a single transformer.

For a gas/electric system test the HVAC by shorting terminals R and W1/B together to activate the heater, RC to Y to activate the compressor and RC to G to activate the fan. If the HVAC system has responded properly, call EWC technical support.

For a heat pump system test the heating by shorting terminals R to Y, W1/B and G. For a cooling test short R to Y, O and G.

LEDs and System Not Responding

Check that the STATUS LED is blinking to insure the computer is operating properly, press the SYSTEM RESET switch if it is not.

Press the TMR RESET switch to clear the timers that may be preventing the call. The panel could be in minimum run time, short cycle delay, changeover delay or opposite system timing mode.

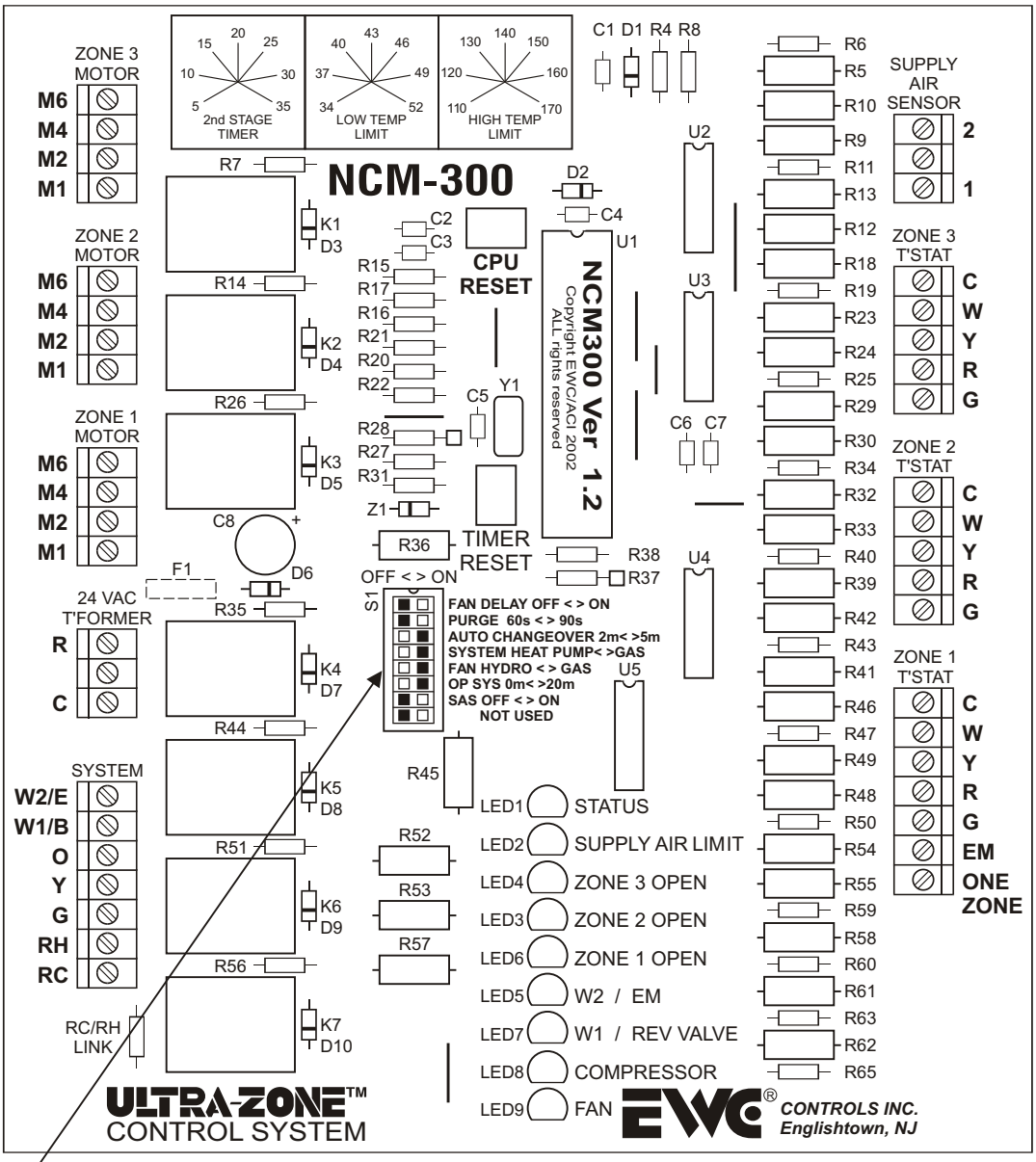
If the system still does not respond, measure the voltage at each zone thermostat terminal W, Y, EM & G to insure they are correct and a call is in order.

Measuring Thermostat Voltages

Heat/Cool thermostats will apply 24VAC to the W1 terminal during a heating call. During a cooling call, 24VAC is applied to both Y and G.

During a continuous fan call, 24VAC is applied to the G terminal.

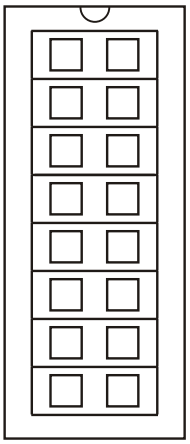
Be sure the RC and RH terminals at the thermostats are jumped together if your specific installation requires it.



Blow-up view of NCM-300 showing Factory Dip Switch settings.

OFF < > ON

S1

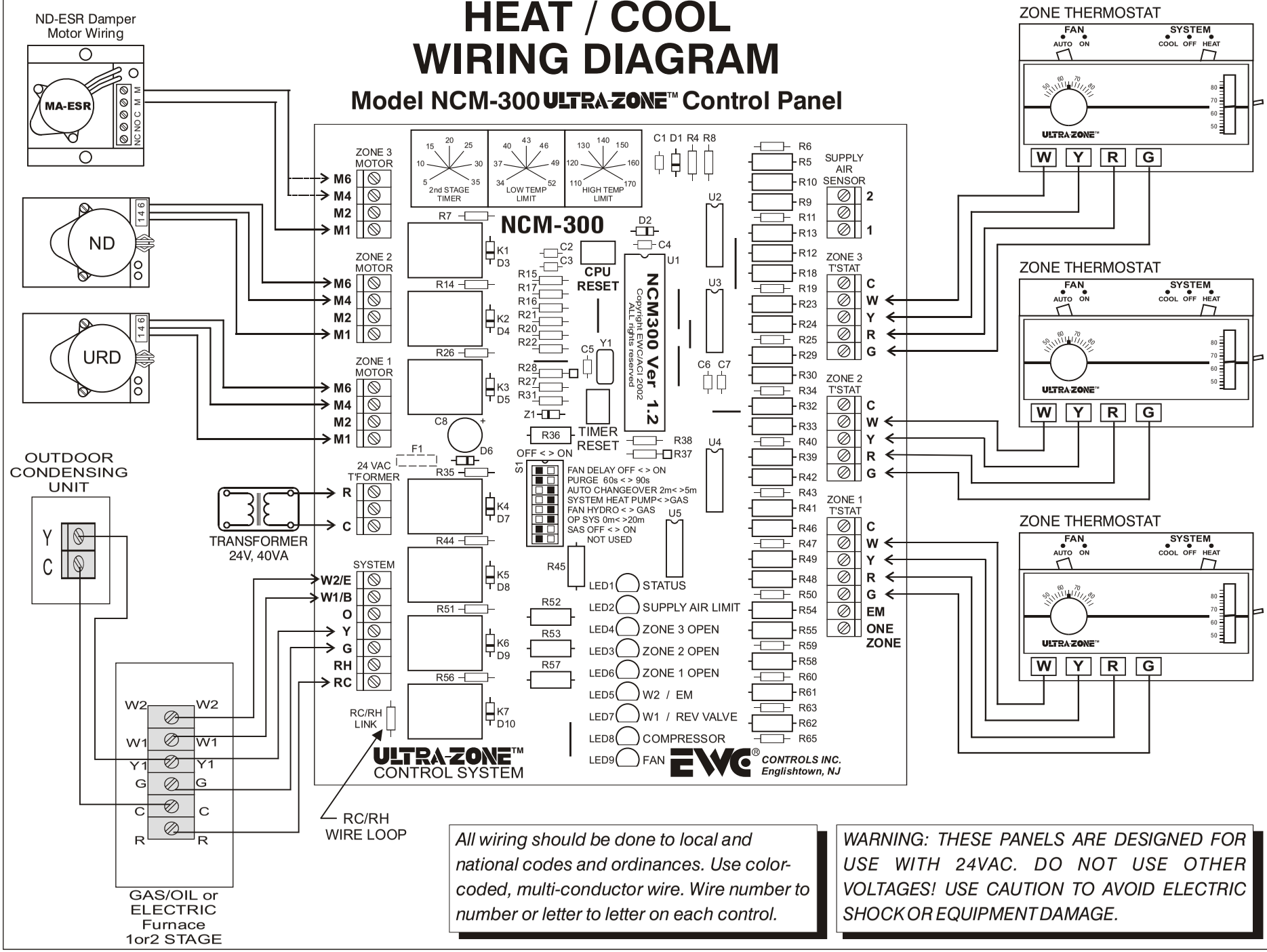


FAN DELAY OFF < > ON
PURGE 60s < > 90s
AUTO CHANGEOVER 2m< >5m
SYSTEM HEAT PUMP< >GAS
FAN ELEC < > GAS
OP SYS 0m< >20m
SAS OFF < > ON
NOT USED

RECORD YOUR OWN DIP SWITCH SETTINGS HERE →

HEAT / COOL WIRING DIAGRAM

Model NCM-300 ULTRA-ZONE™ Control Panel



All wiring should be done to local and national codes and ordinances. Use color-coded, multi-conductor wire. Wire number to number or letter to letter on each control.

WARNING: THESE PANELS ARE DESIGNED FOR USE WITH 24VAC. DO NOT USE OTHER VOLTAGES! USE CAUTION TO AVOID ELECTRIC SHOCK OR EQUIPMENT DAMAGE.

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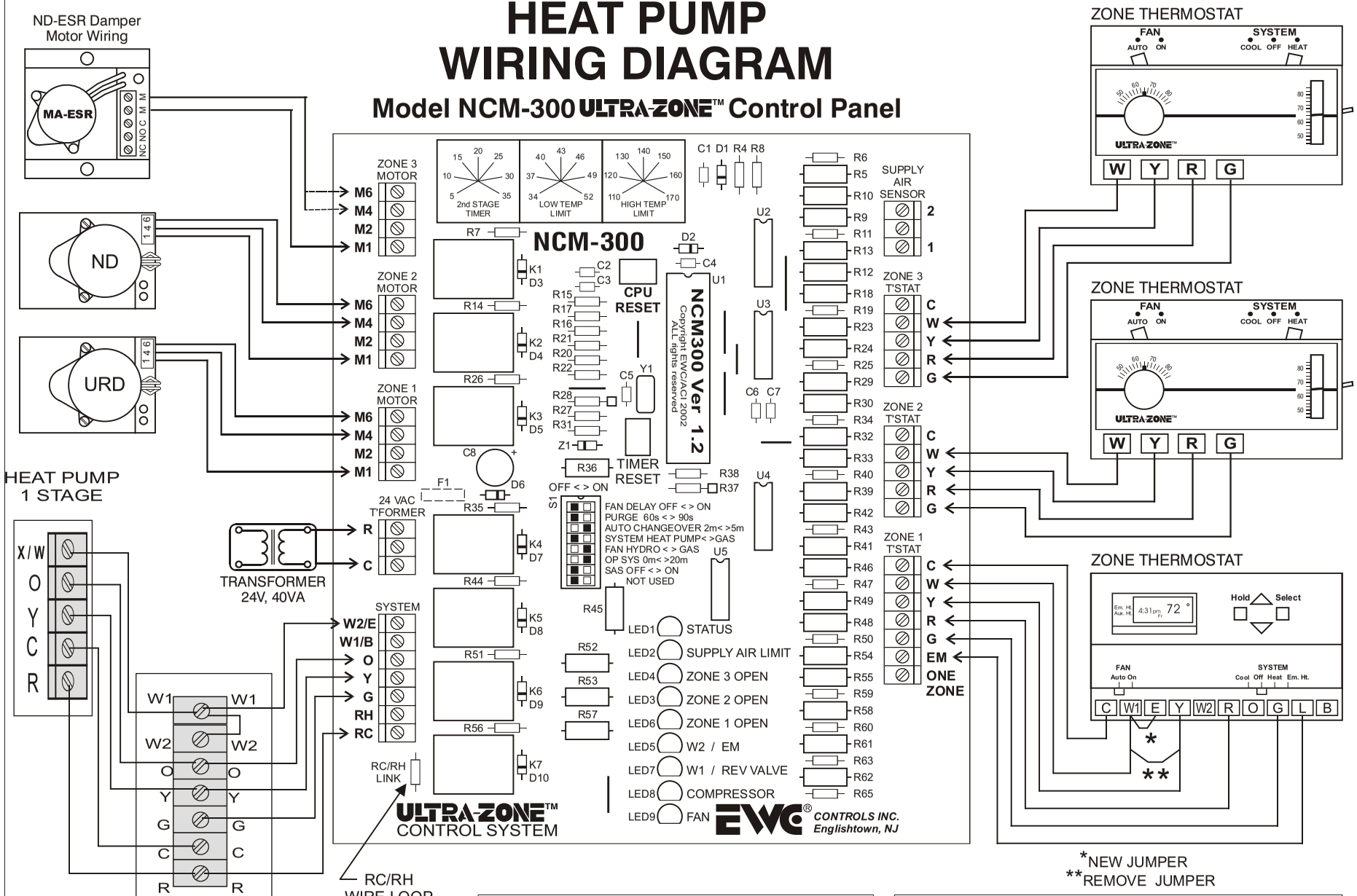
HEAT PUMP WIRING DIAGRAM

Model NCM-300 ULTRA-ZONE™ Control Panel



All wiring should be done to local and national codes and ordinances. Use color-coded, multi-conductor wire. Wire number to number or letter to letter on each control.

WARNING: THESE PANELS ARE DESIGNED FOR USE WITH 24VAC. DO NOT USE OTHER VOLTAGES! USE CAUTION TO AVOID ELECTRIC SHOCK OR EQUIPMENT DAMAGE.

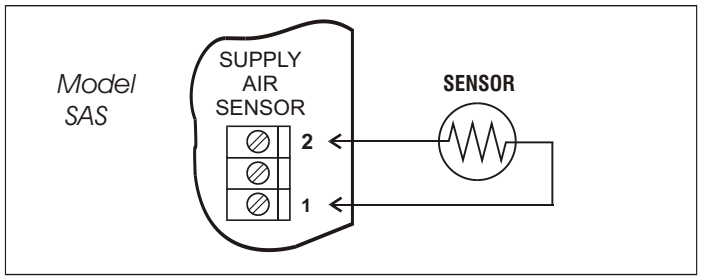
P/N 090375A0206 REV B

SUPPLY AIR SENSOR OPERATIONS AND ONE ZONE FEATURE CONTROL

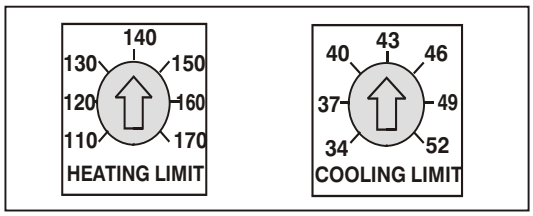
A *Supply Air Sensor* can be used to limit supply air temperatures and prevent over heating of the equipment during the heating cycle or coil freeze-up during cooling cycles. Wire the sensor as shown below and set dip switch #7 to the *ON* position. (See Page 2)

The Supply air sensor installs into the supply air plenum or downstream of the evaporator coil or heat exchanger and monitors the discharge air temperature in heating and cooling modes. The actual temperature is relayed backed to the microprocessor. When the temperature exceeds or falls below the HEAT or COOL limit set points, the microprocessor will de-energize all HEAT or COOL outputs for a minimum of 3 minutes. It also energizes the FAN, if it is not already running, to help dissipate the heat or warm up the evaporator coil.

There is no differential built in to the sensor! Once the supply air temperature rises or falls to a safe value and, the 3 minute time delay has expired, the microprocessor will restore the HEAT or COOL outputs. The FAN will de-energize or stay running, depending on the mode and the application.



Supply air temperature sensor.

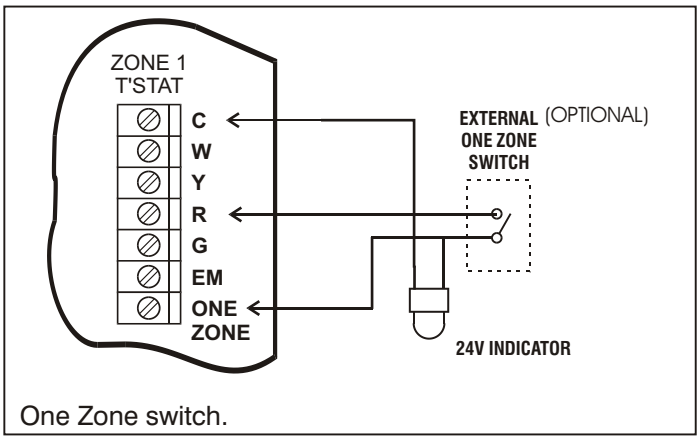


Adjustable Heating & Cooling limit potentiometers

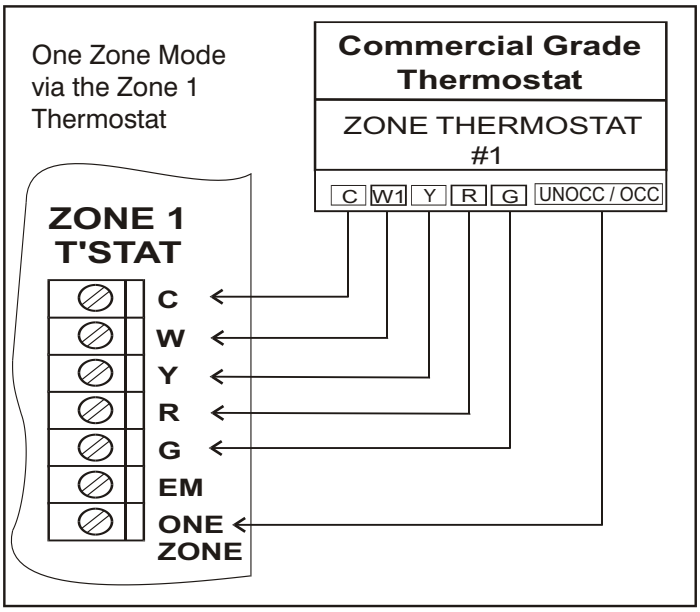
The *One Zone* feature allows the homeowner to control all the zones from a single thermostat by using an optional switch connected to the One Zone terminals shown below. A homeowner can switch to One Zone control when they leave for vacation or as a night setback mode, and the Zone 1 thermostat will control all zones. All zone dampers will respond to the Zone 1thermostat.

One Zone can also be used in commercial applications with a programmable thermostat in Zone 1 and non-programmable thermostats in all other zones, thus satisfying the requirements of California Title 24.

Substantial energy savings and equipment protection can be obtained with proper use of the One Zone feature and the supply air sensor.



One Zone switch.



Excellence Without Compromise

EWC® CONTROLS INC.

AUTOMATIC CONTRACTOR TEST

The NCM300 has a built-in automatic sequencer that the contractor can initiate to test each zone damper, the HVAC system outputs and the LED indicators.

Step 1. **To start the contractor test, hold the timer Reset switch for 15 seconds and release. The Status LED blinks rapidly to indicate Contractor Test Mode.**
The panel checks whether **Gas**/**Electric** or **Heat Pump** type system was selected on dip switch #4.

Step 2. The panel energizes the fan (G) on, and opens the zone 1 damper. After 60 seconds the Zone 2 damper opens. After 60 seconds the Zone 3 damper opens.

Step 3. After 60 seconds HEATING (W1/B)energizes. COMPRESSOR (Y) energizes also if Heat Pump mode was selected.

Step 4. After 120 seconds HEATING (W2)energizes.

Step 5. After 60 seconds HEATING (W1/B),(W2) and/or (Y) de-energize. FAN (G) continues to run.

Step 6. After 120 seconds COOLING (O) energizes and COMPRESSOR (Y) energizes.

Step 7. After 120 seconds COMPRESSOR (Y) de-energizes.

Step 8. After 60 seconds FAN (G) de-energizes.

End of Contractor Test. The NCM300 resumes normal operation after step 8.

NOTE: Pressing the CPU Reset button at any time during the test, terminates the Contractor mode test and returns the NCM300 to normal operation.

NOTES: