Excellence Without Compromise

EWC® CONTROLS INC.

TECHNICAL BULLETIN

TB-201C Models BM-2000/4000/6000/8000

The BM2000 panel provides intelligent control of forced air zoning systems with up to eight zones using motorized dampers and practically any off-the-shelf heat/cool thermostat can be used. With such features as automatic changeover, opposite system service, short cycle timers and changeover timers the BM2000 provides the highest level of performance at the lowest cost.

Zone Capacity Controls two zones using motorized dampers and may be expanded to four, six or eight zones using one, two or three EX-2 Expansion Panels.

Compatible HVAC Systems Controls single stage gas or oil fired furnaces and electric air conditioning.

Compatible Thermostats Compatible with any heat/cool mechanical or electronic thermostat that operates on 24VAC, battery power or power robbing types that draw less than 25 ma of current.

Automatic Heat/Cool Changeover The BM2000 panel will automatically detect which zones are calling for heating and cooling and service the system with the greater number of calls. When the same number of zones simultaneously call for heating and cooling, the panel will service heating calls first.

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

System LEDs Bright LEDs labeled G, W and Y indicate the functions that are energized

Damper LEDs LEDs labeled Zone 1 thru Zone 8 indicate which dampers should be open.

Operating Power Operates on 24VAC power supplied from a separate transformer. A single 40VA transformer can power four zones, each with a single damper.

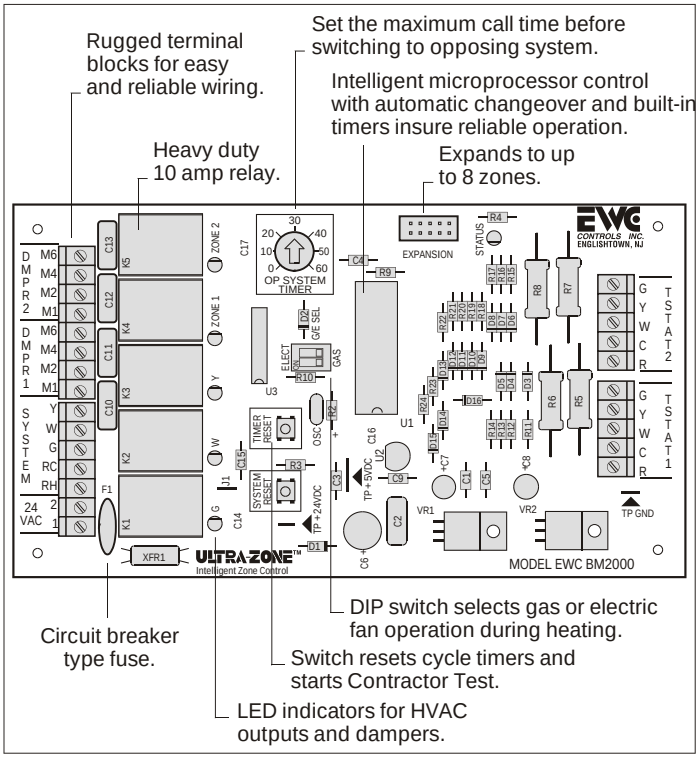

Figure 1. BM2000 panel showing features.

Thermal Breaker The BM2000 has a thermal circuit breaker in place of a fuse and protects the panel from shorts in the thermostat and damper wiring. It does not protect against shorts in the system wiring.

When the circuit breaker is tripped it will get quite hot. To reset the breaker, remove the 24VAC power for approximately 30 seconds. The figure above shows the location of the device.(F1)

Brown-Out Protection Brown-out detection circuit prevents microcomputer lockup when brown-outs occur.

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.*

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Indoor Fan Control During Heating

A pair of DIP switches select whether or not the indoor fan is activated by the panel during heating calls. The indoor fan is always activated during cooling calls.

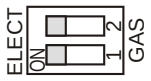
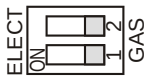
	Both switches in the ON position activate the fan during a heating or cooling call.
	Both switches in the off position activate the fan only during a cooling call.
Both switches must always be in the same position.	

Figure 2. DIP switch select fan control.

Built-In Timer Settings

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

Short Cycle Timer	2 minutes, fixed
Minimum Call Timer	2 minutes, fixed
Changeover Timer	5 minutes, fixed
Opposing System Service Timer	0 to 60 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.

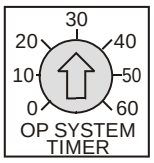
Short Cycle Timer

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, a five-minute timer is started and the panel will not switch to the opposing system until the timer has expired.

Opposite System Timer



The OP SYSTEM TIMER sets the maximum call time before the system switches to service zones calling for the opposing system, even though there may be more calls for the active system. Setting the timer to 0 turns the opposing system feature off and the panel will service zones based on whether there are more zones calling for heating or cooling.

Timer Reset BUTTON

Momentarily pressing the TIMER RESET button clears the built-in timers controlling the minimum call time, off time and changeover time. This enables you to test the installation faster.

System Reset BUTTON

Momentarily pressing the SYSTEM RESET button resets the computer.

INSTALLATION INSTRUCTIONS

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.

Thermostat Wiring

Practically any heat/cool thermostat can be used with the BM2000 panel. A typical thermostat installation is shown below.

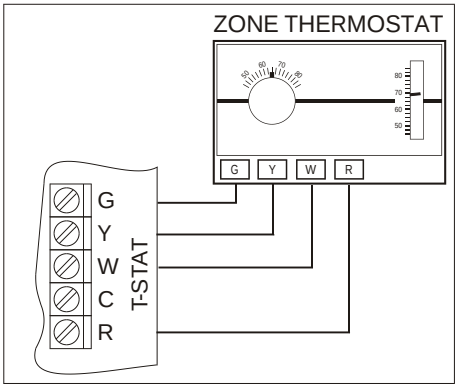


Figure 3a. Typical thermostat wiring.

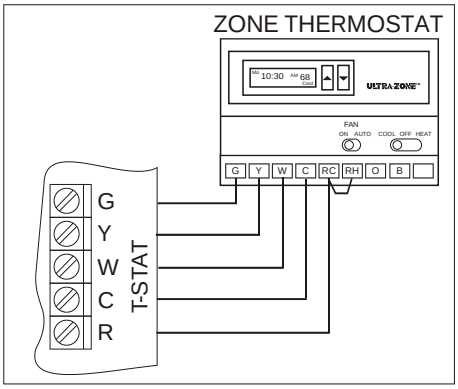


Figure 3b. Wiring for thermostats with RC and RH terminals.

HVAC System Wiring

On the BM2000 panel, the fan (G) and the compressor (Y) are powered by the RC terminal and the heating (W) is powered by the RH terminal.

Single Transformer Systems

Typical gas/electric system wiring using a single transformer is shown below. Be sure to add a jumper wire between RC and RH as shown.

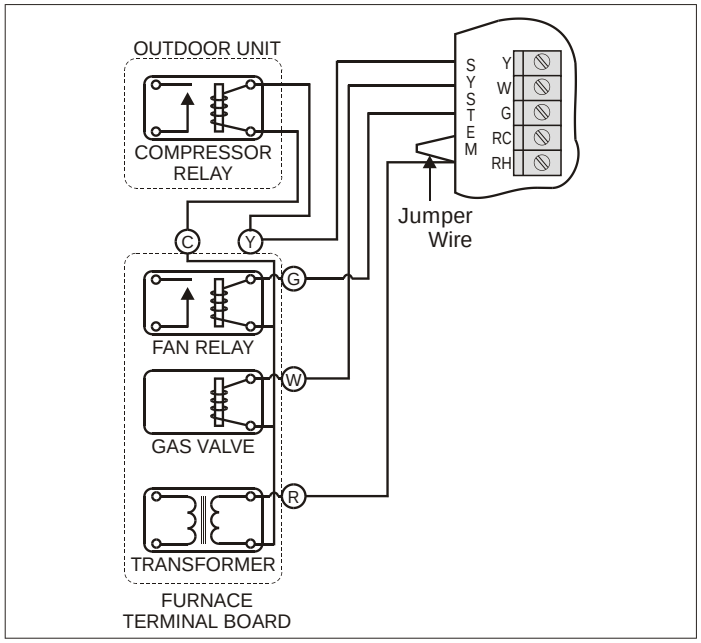


Figure 4a. Single transformer gas/electric system.

Round Damper Wiring

The damper motor terminals (M1, M2, M4 and M6) will accommodate practically any 24VAC motorized damper. Damper motor selection should be limited to motors with less than .5 amp current draw.

Terminal M1	Common
Terminal M2	24 VAC constant
Terminal M4	24 VAC to open a damper
Terminal M6	24 VAC to close a damper

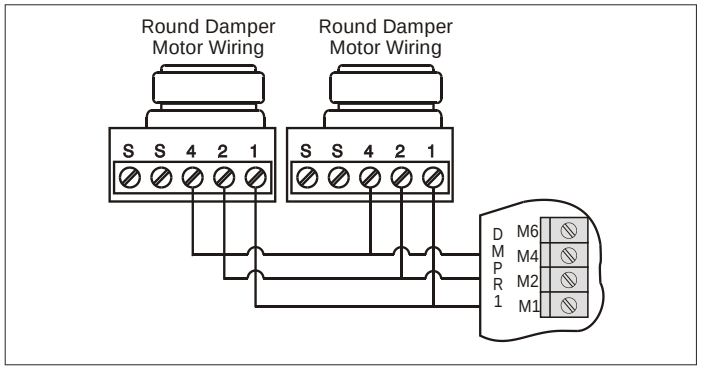


Figure 5. A zone controlling two round dampers.

Two Transformer Systems

Wiring diagram for a typical oil burner or hot water coil heating with electric cooling. No jumper wire is required between RC and RH.

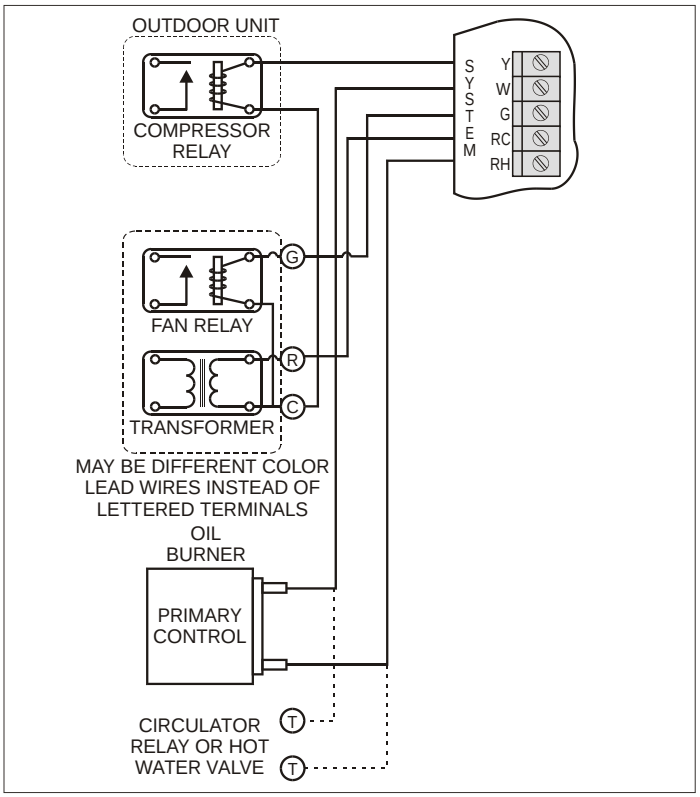


Figure 4b. Two-transformer oil burner with electric cooling.

Rectangular Damper Wiring

A single rectangular damper motor is wired to the M1, M4 and M6 terminals as shown in figure 6a.

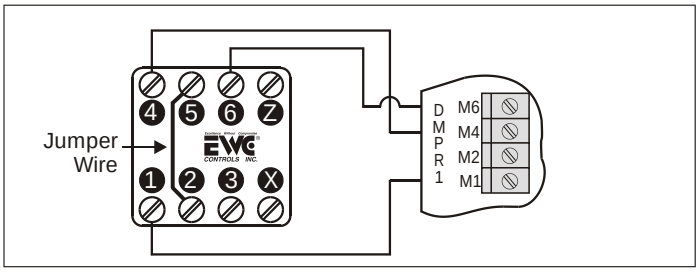


Figure 6a. A zone controlling one rectangular damper.

Wiring Two Rectangular Dampers

Wiring two rectangular damper motors controlled by one zone is shown in figure 6b.

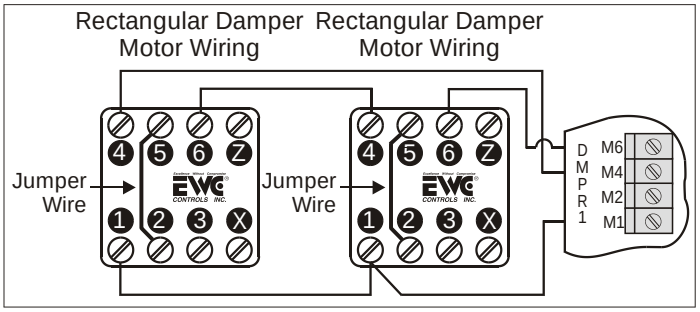


Figure 6b. A zone controlling two rectangular dampers.

Controlling 3 or More Dampers From One Zone

A relay can be added to the system to control more than two dampers per zone. Figure 7a shows a relay used to control four dampers using the "R4" relay which has four sets of contacts (4-pole) with both normally open and normally closed contacts. If more than four dampers are required on a single zone, a second R4 relay can be added and the coils wired in parallel.

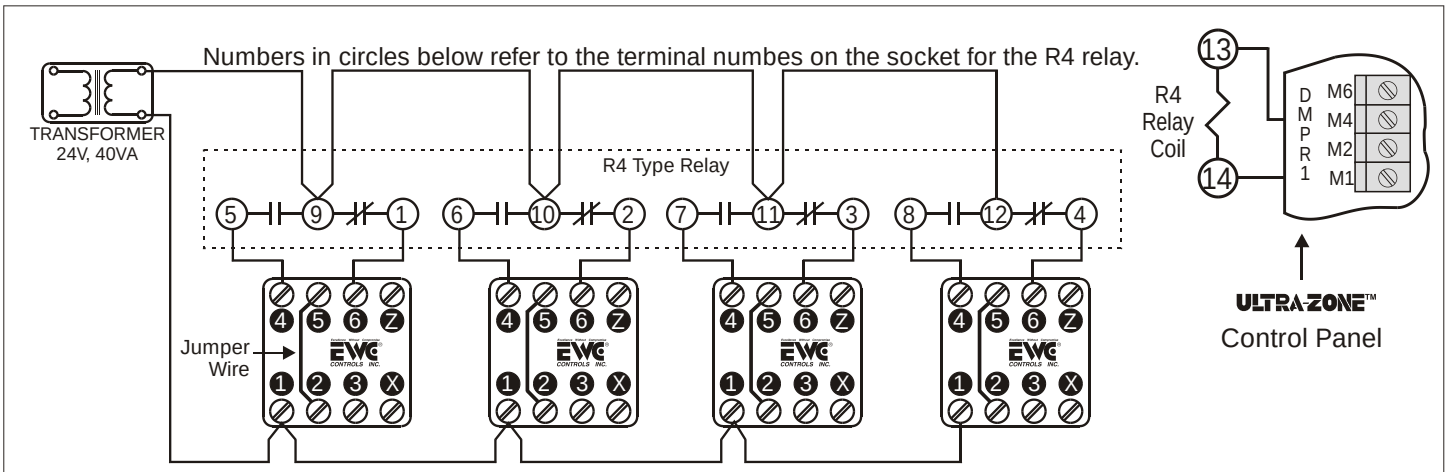


Figure 7. A zone controlling four rectangular dampers using the R4 relay.

Spring Return Motor Wiring

Figure 8 shows how to wire a spring return damper. A power close style damper is wired M1 & M6. Power open style damper is wired to M1 & M4.

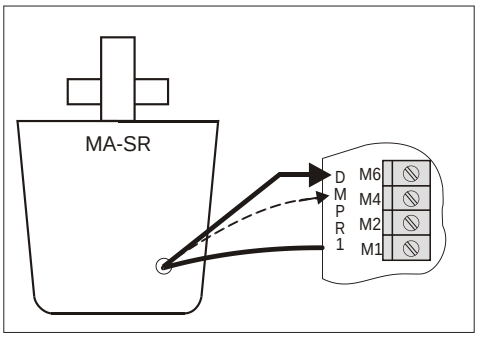


Figure 8.

24VAC Power Wiring

A single 24VAC, 40VA transformer can power the BM2000 panel and one EX-2 expansion panel with one damper on each zone. It is important that the 24VAC terminals 1 and 2 be wired the same as shown in figure 9. Reversing the terminal wiring can damage the panel.

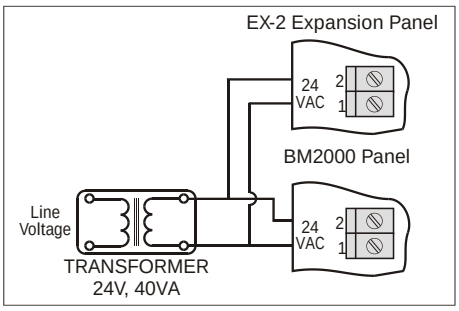


Figure 9. 24VAC power wiring.

Automatic Contractor Test

The BM2000 has a built-in automatic test that the contractor can initiate to test each zone damper, the indoor fan, the furnace, the air conditioning system and the LED indicators. The test is started by holding the TIMER RESET switch for 15 seconds. The test will start by turning the STATUS LED on continuously, turning the indoor fan on and opening the Zone 1 damper.

Step 1.	Status LED is on (not blinking), indoor fan is on and Zone 1 damper is open.
Step 2.	After 30 seconds, the Zone 2 damper opens. For 2 zone systems press the TIMER RESET switch to advance to the heating test [step 9].
Step 3.	After 30 seconds, the Zone 3 damper opens.
Step 4.	After 30 seconds, the Zone 4 damper opens. For 4 zone systems press the TIMER RESET switch to advance to the heating test [step 9].
Step 5.	After 30 seconds, the Zone 5 damper opens.
Step 6.	After 30 seconds, the Zone 6 damper opens. For 6 zone systems press the TIMER RESET switch to advance to the heating test [step 9].
Step 7.	After 30 seconds, the Zone 7 damper opens.
Step 8.	After 30 seconds, the Zone 8 damper opens.
Step 9.	After 30 seconds, the heating system is activated.
Step 10.	After 2 minutes, the heating system is turned Off and the fan remains On.
Step 11.	After 2 minutes, the cooling system is turned On.
Step 12.	After 2 minutes, the cooling system is turned Off and the panel returns to normal operation.

Setting the Expansion Panel DIP Switches

Each expansion panel has a 5-position DIP switch that must be set as shown in figure 10 to insure the panel operates properly.

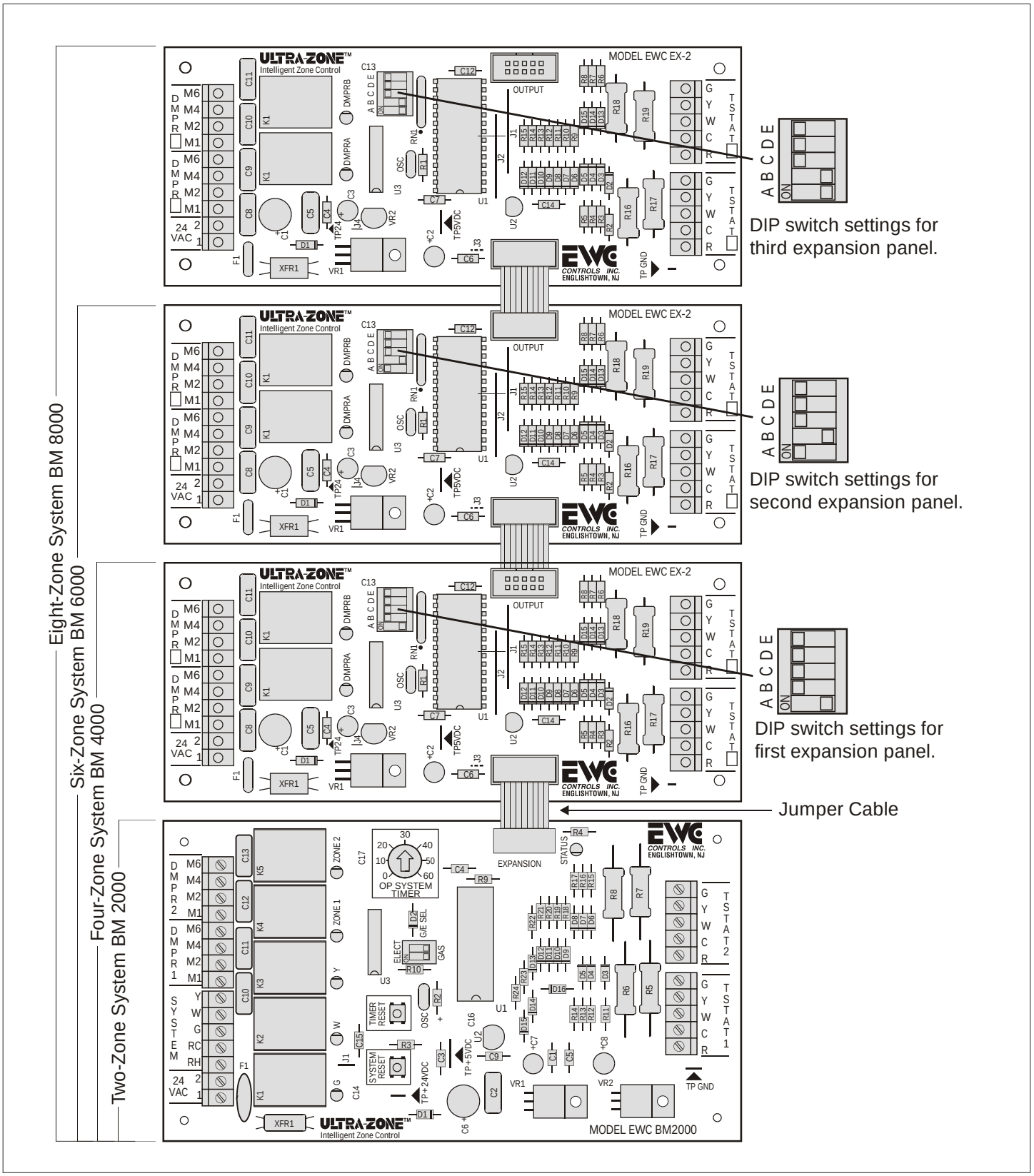


Figure 10. Proper connection and DIP switch settings for an eight-zone system.

SERVICE GUIDE

Some Helpful Guidelines

All VDC measurements on the panel and VAC measurements at the damper terminals and thermostat terminals should be made with the ground lead of your meter on terminal 1 of the 24VAC input terminals.

All VAC measurements at the HVAC system terminals (W, Y & G) should be made with the meter ground lead on the system's C terminal at the HVAC system.

Caution! The thermal fuse (F1) gets very hot when a short occurs in the 24VAC wiring or the panel. Always use caution when checking the fuse.

When measuring 24VAC, the voltage can vary from 22 to 28VAC.

Using the LED Indicators

The STATUS indicator should blink on and off every second to indicate the microcomputer is operating properly.

The W, Y and G LEDs indicate that the panel is trying to activate the HVAC system.

The ZONE 1 and ZONE 2 LED indicate that the panel is trying to activate the dampers.

Check 24VAC Power

You should measure 24VAC at all damper M2 terminals and all thermostat R terminals.

You should measure +5VDC at the 5V test point (see figure 11 for location) and +24VDC at the 24V test point.

See Table 1 if any of these voltages are incorrect.

Dampers Not Responding Properly

If the ZONE 1 and ZONE 2 LED indicators are illuminated but the dampers appear to be malfunctioning, check that the dampers are wired correctly.

If the ZONE 1 and ZONE 2 LEDs are not responding properly, check the calls on each zone thermostat. If the calls indicate a damper should be activated and is not, press the TMR RESET switch to reset the timers.

If the problem persists, see Table 2 for service help.

HVAC System Not Responding Properly

If the W, Y and G LED indicators are responding properly, but the system appears to be malfunctioning, check that the HVAC system is wired correctly.

If the W, Y and G LEDs are not responding properly, check the calls on each zone thermostat. If the calls indicate an HVAC call should be activated and is not, press the TMR RESET switch to reset the timers.

Table 1. Detecting 24VAC Shorts and Loss of +5VDC or +24VDC

Detecting 24VAC Short	The STATUS LED will be off, you will measure 24VAC at the transformer terminal 2, but not at any damper M2 terminal or any zone thermostat R terminal. The thermal fuse will be very hot.
Isolating 24VAC Shorts BM2000 or EX-2 Panels	Remove the power to the panel and all expansion panels and allow the fuse to cool. Disconnect the jumper cable between the panel and the first expansion panel. Re-power the panel. If the short persists, the problem is in the BM2000 or its wiring.
Isolating 24VAC Shorts Panel or Wiring	Remove the wire at each zone thermostat R terminal and test if the short still persists. If the short disappears, check the zone thermostat wiring and the thermostat itself.
	If the short still persists disconnect all the wires at each damper (M1, M2, M4 & M6). If the short clears, check the damper wiring and the damper.
	If the short still persists, the panel or expansion panel is defective.
Detecting Loss of +24VDC or +5VDC	The +5VDC and +24VDC can be measured at the test points shown in figure 11 on page 8. If either voltage is not correct, disconnect the jumper cable connecting the panel and the first expansion panel.
	If the voltage problem clears, check that the 24VAC power is wired to the correct terminals (terminal 1 to 1 and terminal 2 to 2 as shown in figure 9). If the problem still persists, the panel is defective.

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, replace the damper.
BM2000 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 SYSTEM 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 the panel is defective.
EX-2 Damper LED & Damper Not Responding	If the damper is on an expansion panel, check the DIP switch settings on each expansion panel to insure they are properly set. Check the > > > 24VAC power to insure the expansion panel is powered and check that the jumper cables are installed properly. Check the voltage at each zone thermostat terminal W, Y and G terminals to insure the damper should be activated.
Testing a Damper Motor	For a round damper, conect 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 rectangular 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. Be sure there is a jumper between terminals 5 and 2. For a power close spring return damper, connect 24VAC to the two wires, 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

W, Y & G LED 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. You can test the HVAC by shorting terminals R and W 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, the panel is defective.
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 call time, minimum off time, > > > changeover delay or opposite system timing. If the system still does not respond, measure the voltage at each zone thermostat terminal W, Y & G to insure they are correct and a call is in order.
Measuring Thermostat Voltages	Heat/Cool thermostats will apply 24VAC to the W 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 jumpered together.
Damper Defaults	*All dampers will stroke to the OPEN position when all thermostats are satisfied and the BM2000 panel is idle.*

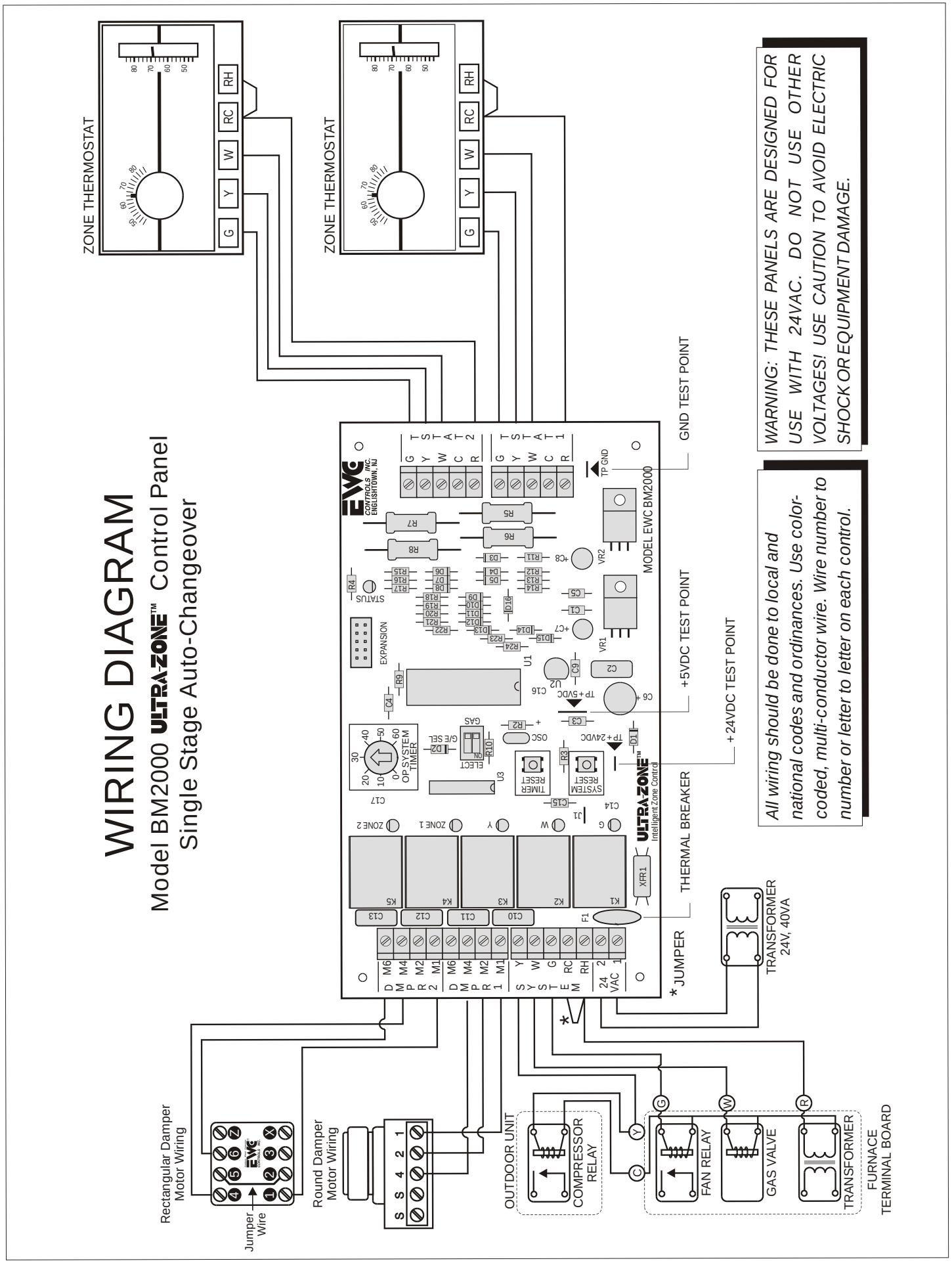


Figure 11. BM2000 wiring diagram.