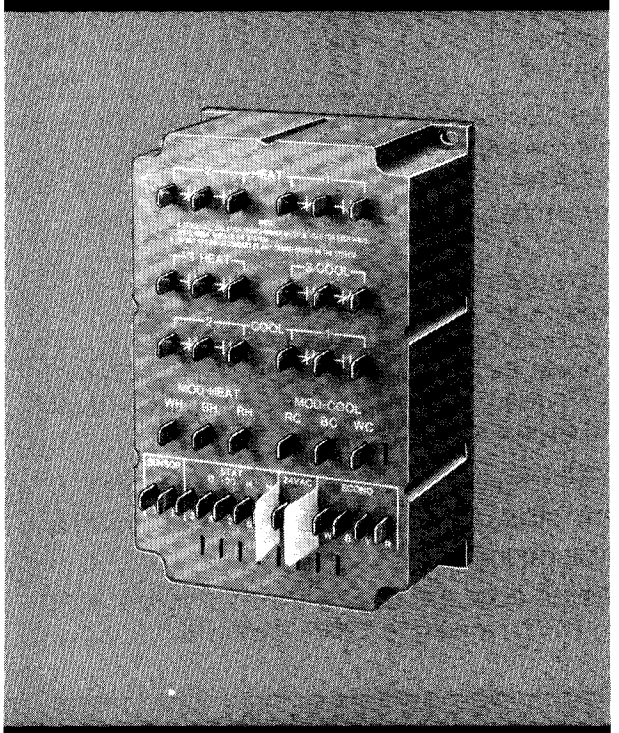
Honeywell

LOGIC PANEL



W973A,B,D-H,J

THE W973 SOLID STATE ENERGY MANAGEMENT SYSTEM CONTROLS HEATING, COOLING, AND ECONOMIZER OPERATION IN COMMERCIAL AIR CONDITIONING EQUIPMENT.

- ☐ Panels can be used with staged gas, oil, or electric heat; modulating gas, hot water, or steam heat; and direct expansion or modulating chilled water cooling.
- ☐ Integrated economizer provided as the first stage of cooling in all models.
- ☐ Positive modulating low limit starts to close economizer motor to minimum position if discharge air temperature drops below factory-set temperature of 62 F [17 C]. Motor will be at minimum position when discharge temperature is 50 F [10 C].
- ☐ W973 balances system output against space load demand to maintain stable room temperature with minimum temperature swing.
- ☐ Load reactive time delays provided by T7067 ensure stable system performance.
- ☐ System recycles to all stages off on power interruption. When power is restored, system sequences stages back on with a time delay between stages.
- ☐ Compact to fit easily in air conditioning equipment control panel.
- ☐ Quarter in. male quick-connect terminals provided for wiring connections.
- ☐ Pilot duty spdt relays control on-off heating and cooling stages.
- ☐ Modulating dc current signal controls economizer and valve motors.
- ☐ T7067 solid state dual set point thermostat located in the controlled space provides heating and cooling input signals.
- ☐ Up to 6 W973 panels can be controlled from one thermostat.
- ☐ C7046A secondary sensor located in discharge air duct provides anticipation and a positive economizer modulating low limit signal.
- ☐ W974 Heating Setback-Cooling Setup/Shutdown Module can be added to reduce equipment operation and energy consumption when the building is unoccupied.
- ☐ W975 Satellite Sequencers can be added to expand the staging capacity to 10 stages of heat and 10 stages of cooling.
- ☐ System meets ASHRAE 90-75 guidelines.
- ☐ System meets U.S. Department of Defense guidelines.
- ☐ W973 is Underwriters Laboratories Inc. component recognized.

Form Number 60-2428—2

G.P.
REV. 7-80

SPECIFICATIONS

IMPORTANT

THE SPECIFICATIONS GIVEN IN THIS PUBLICATION DO NOT INCLUDE NORMAL MANUFACTURING TOLERANCES. THEREFORE, THIS UNIT MAY NOT MATCH THE LISTED SPECIFICATIONS EXACTLY. ALSO, THIS PRODUCT IS TESTED AND CALIBRATED UNDER CLOSELY CONTROLLED CONDITIONS, AND SOME MINOR DIFFERENCES IN PERFORMANCE CAN BE EXPECTED IF THOSE CONDITIONS ARE CHANGED.

MODELS: W973 Logic Panel–See Table 1.

TABLE 1–W973 LOGIC PANEL MODELS

MODEL	MODULATING ECON. WITH MOD. LOW LIMIT	MODULATING HEATING OUTPUT	MODULATING COOLING OUTPUT	HEATING STAGES[a]	COOLING STAGES[a]
W973A[b]	Yes	No	No	2	2
W973B	Yes	Yes	Yes	3	3
W973D	Yes	No	No	2	4
W973E	Yes	No	No	0	4
W973F	Yes	No	No	4	2
W973G	Yes	No	No	6	2
W973H	Yes	No	No	5	3
W973J[c]	Yes	No	No	4	4

[a]W975 Satellite Sequencer can be used to increase number of on-off stages to 10 heat or 10 cool, maximum. See list of additional system components on page 6.

[b]W973A1041 provides 4 F [2.2 C] economizer offset. Special scaleplate included.

[c]W973J1009 provides load control and heat reclaim.

ELECTRICAL RATINGS:

Voltage and Frequency–24 Vac, 50/60 Hz.

Maximum Power Consumption–8 VA.

Contact Ratings (spdt pilot duty relays)–see Table 2.

VA ratings valid for either N.O. or N.C. contacts (not both) on each relay.

SWITCHING: (on-off stages): Pilot duty spdt relays.

INPUT SIGNAL (from T7067 thermostat): 1 to 16 Vdc.

STAGE DIFFERENTIALS: See Fig. 1.

HEATING-COOLING DEADBAND: 3 F to 30 F [1.7 C to 17 C], provided by T7067 Thermostat.

TABLE 2–W973 RELAY CONTACT RATINGS

CONTACT	VOLTAGE (Vac)	INRUSH (VA)	RUNNING (VA)
Normally Open	24	240	60
Normally Closed	24	75	30
Normally Open	120/240	750	75
Normally Closed	120/240	240	40

(continued on page 3)

ORDERING INFORMATION

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR TRADELINE WHOLESALER OR YOUR DISTRIBUTOR, REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING NUMBER, OR SPECIFY–

1. **Order number.**
2. **Accessories, if desired.**
3. **Order additional system components and system accessories separately.**

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. **YOUR LOCAL HONEYWELL RESIDENTIAL SALES OFFICE (CHECK WHITE PAGES OF YOUR PHONE DIRECTORY).**
2. **RESIDENTIAL GROUP CUSTOMER SERVICE**
   HONEYWELL INC., 1885 DOUGLAS DRIVE NORTH
   MINNEAPOLIS, MINNESOTA 55422 (612) 542-7500

   (IN CANADA–HONEYWELL CONTROLS LIMITED, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO)
   INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

ADDENDUM TO FORM NO. 60-2428-2

W973J1033 FOR SUPERMARKET HEAT RECLAIM APPLICATIONS

Application

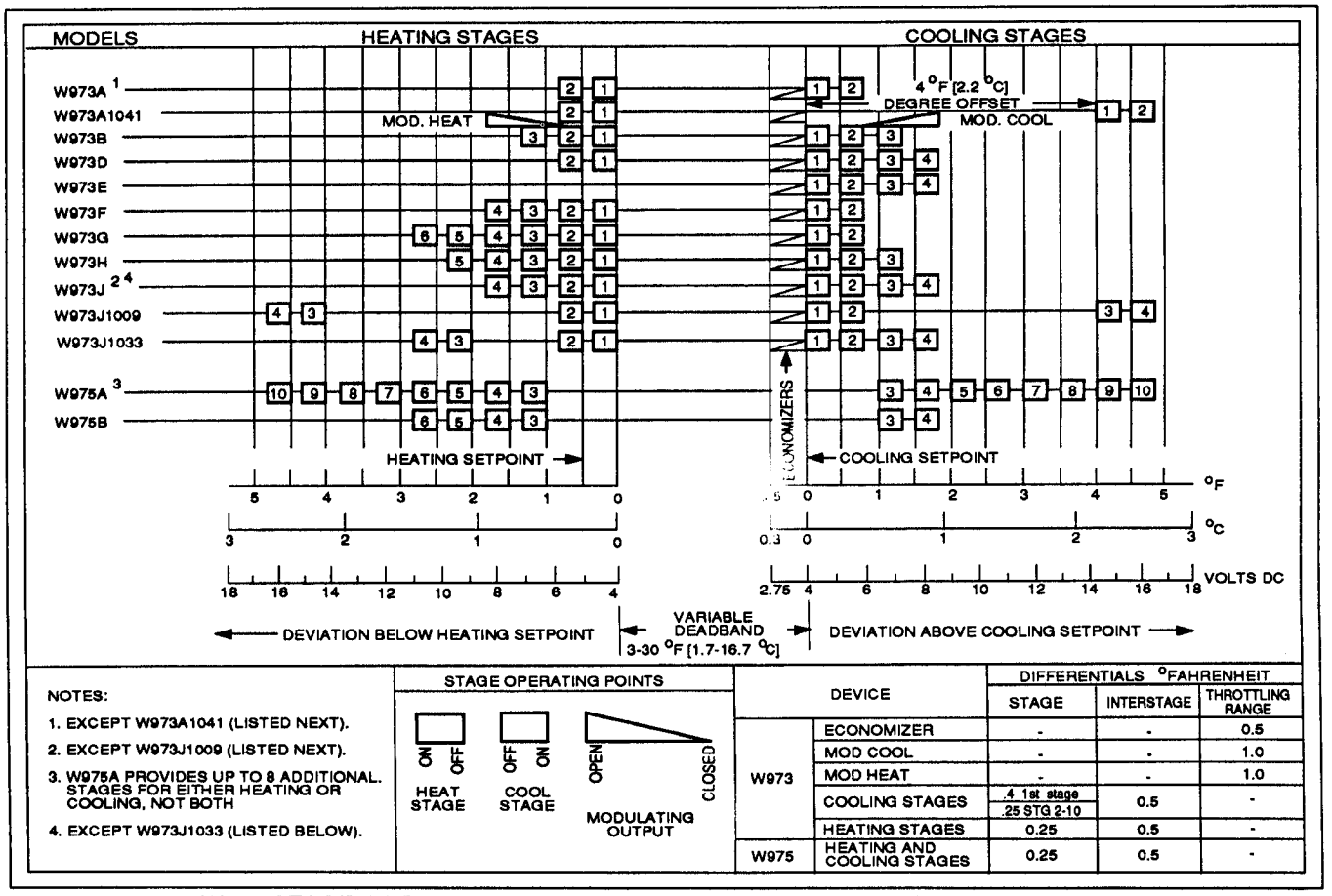
The W973J1033 incorporates a modified heating sequence allowing supermarkets to reclaim heat from compressor racks, ice cream cases, coffin freezers, and other heat generating sources common to supermarkets. This sequence allows space temperature to drift further from setpoint before the W973J1033 energizes stages of gas or electric heat to supplement the reclaimed heat. This delay makes optimal use of the available reclaimed heat and minimizes the need for other more expensive sources of heat.

The W973J1033 can also be applied elsewhere. Specifically, applications where generated heat can be channelled through a heat exchanger and then used as an alternative to gas or electric heat in areas served by a rooftop unit. An example would be a combination office/manufacturing building where heat emitted by machinery can be used as space heat source.

Stage Operating Points

The figure below shows modified stage operating points and switching differentials for heating stages 3 and 4 on the W973J1033. These two stages would energize supplemental gas or electric heat only when reclaimed heat from stages 1 and 2 could not satisfy demand.

This version of the W973J complies with all other specifications for the W973J family. For information regarding installation, wiring, adjustment, checkout and accessories, please consult the W973 specification sheet (form number 60-2428-2).



NOTES:

1. EXCEPT W973A1041 (LISTED NEXT).
2. EXCEPT W973J1009 (LISTED NEXT).
3. W975A PROVIDES UP TO 8 ADDITIONAL STAGES FOR EITHER HEATING OR COOLING, NOT BOTH
4. EXCEPT W973J1033 (LISTED BELOW).

STAGE OPERATING POINTS

DEVICE		DIFFERENTIALS °FAHRENHEIT		
		STAGE	INTERSTAGE	THROTTLING RANGE
W973	ECONOMIZER	-	-	0.5
	MOD COOL	-	-	1.0
	MOD HEAT	-	-	1.0
	COOLING STAGES	.4 1st stage .25 STG 2-10	0.5	-
	HEATING STAGES	0.25	0.5	-
W975	HEATING AND COOLING STAGES	0.25	0.5	-

W973 STAGE OPERATING POINTS, DIFFERENTIALS, AND THROTTLING RANGES.

DBF/SLB
3/89

Form Number 63-4195

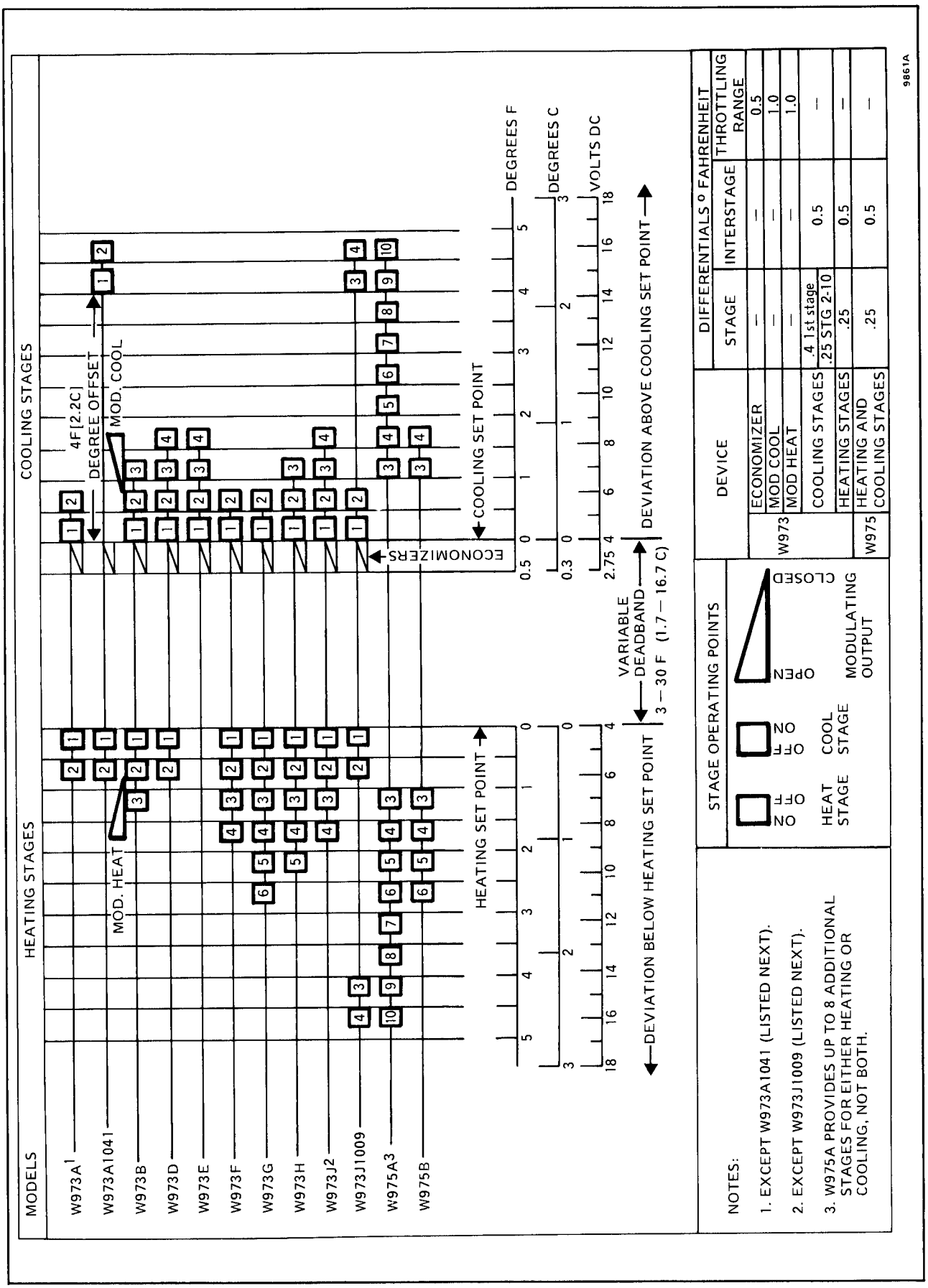


FIG. 1–W973 STAGE OPERATING POINTS, DIFFERENTIALS, AND THROTTLING RANGES.

ECONOMIZER MODULATING LOW LIMIT: Overrides thermostat to modulate economizer motor to minimum position when discharge air temperature falls below 62 F [17 C]. Economizer motor will be at minimum position when discharge air temperature is 50 F [10 C]. Modulating Range–12 F [7 C], from 50 to 62 F [10 to 17 C].

DISCHARGE SENSOR AUTHORITY: 25:1. (Ratio means that a 25 F [12.5 C] rise in discharge temperature is equivalent to a 1 F [0.5 C] rise in space temperature.)

AMBIENT TEMPERATURE RANGE:

Operating–Minus 40 F to plus 150 F [minus 40 C to plus 65 C].

Shipping–Minus 30 F to plus 150 F [minus 34 C to plus 66 C].

MOUNTING: Mounts with four No. 8 screws (not provided) through mounting holes in the base.

DIMENSIONS: See Fig. 2.

UNDERWRITERS LABORATORIES INC. COMPONENT RECOGNIZED: File No. SA481, Guide No. SDFY2.

ACCESSORY:

191444B Metal Cover–general purpose rated. Overall dimensions of W973 with metal cover are 6-5/8 in. [168.3 mm] long by 4-5/16 in. [109.5 mm] wide by 4-13/16 in. [122.2 mm] high. Allow 4-3/4 in. [121 mm] clearance above cover for removal.

ADDITIONAL SYSTEM COMPONENTS:

ELECTRONIC SPACE THERMOSTAT (required)–senses room temperature and sends heating or cooling signal to the W973 Logic Panel.

T7067A Dual Set Point Thermostat–includes integral sensor.

T7067B Dual Set Point Transmitter–no sensor included; designed for use with T7047C1025 or T7022A1010 remote sensor.

THERMOSTAT SUBBASE–provides manual switching for T7067 Thermostat or Transmitter.

Q667A–provides COOL-AUTO-HEAT-OFF system switching.

Q667B–provides COOL-AUTO-HEAT-OFF system switching and AUTO-ON fan switching.

C7046A DISCHARGE SENSOR (required)–senses discharge air temperature and sends a signal to the W973 Logic Panel which is modified by the signal from the space thermostat. The signal from the discharge sensor also acts as a positive modulating low limit for the economizer. If the discharge air temperature drops below 62 F [17 C], the economizer starts to modulate towards the minimum position. At 50 F [10 C], the economizer will be at the minimum position.

W975 SATELLITE SEQUENCER–provides spdt pilot duty relay outputs for additional heating or cooling stages.

W975A–eight additional stages for heating or cooling. Panel provides stages 3 through 10 of heating or cooling.

W975B–two additional stages of cooling and four additional stages of heating. Panel provides stages 3 and 4 of cooling and 3 through 6 of heating.

W974 SETBACK MODULE–provides a selectable amount of heating setback and cooling shutdown or a selectable amount of cooling setup. Separate time clock initiates unoccupied cycle.

W974A–provides setback of heating and cooling shutdown, drives the outdoor air damper closed, and interrupts continuous fan operation during unoccupied periods.

W974B–provides setback of heating, cooling setup or shutdown, and automatic intermittent fan operation during unoccupied periods. The outdoor air damper goes closed at the beginning of the unoccupied cycle; if cooling setup is selected, the economizer operates as the first stage of cooling.

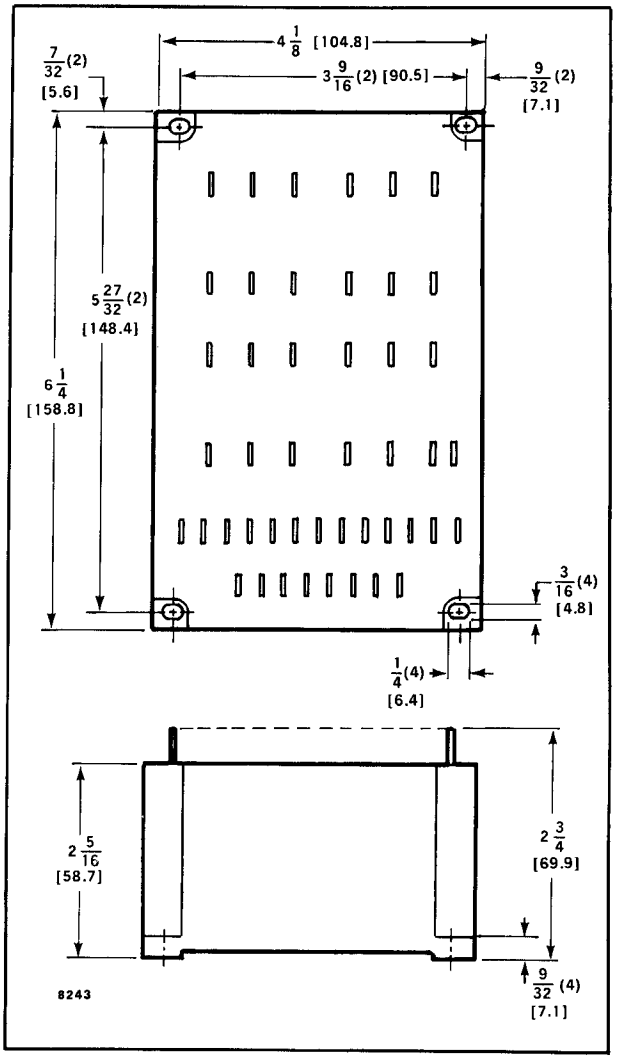


FIG. 2–MOUNTING DIMENSIONS FOR W973 IN IN. [mm IN BRACKETS].

NONSPRING-RETURN MOTORS–with solid state balance relay. Provide proportioning control of economizer dampers, and water, steam, or butterfly gas valves in response to a signal from the W973. Adapt for reversed operation by reversing B and W leads to motor.

M954–150 lb.-in. [17 N·m], 90 or 160 degree stroke (fixed or field adjustable depending on model). 24 Vac, 60 Hz power supply.

M734D,E, M744A–35 or 150 lb.-in. [4.0 to 17 N·m], 90 or 160 degree fixed stroke, depending on model. 24 Vac, 50/60 Hz power supply. A 4074EAC Resistor Kit must be used with these motors.

SPRING-RETURN MOTORS–with solid state balance relay. Provide proportioning control of outdoor and return air dampers, and water, steam, or butterfly gas valves in response to a signal from the W973. Spring-return on power loss. Adapt for reversed electrical operation by reversing B and W leads to motor..

M955–50 lb.-in. [5.7 N·m] motor, 90 to 160 degree adjustable stroke, 24 Vac, 60 Hz power supply.

M745–50 lb.-in. [5.7 N·m], 90 or 160 degree stroke. 24 Vac, 50/60 Hz power supply. A 4074EAC Resistor Kit must be used with this motor.

SYSTEM ACCESSORIES:

Transformers–

AT20–20 VA.

AT72–40 VA.

130810–40 VA cover transformer for M954/M955.

AT88–75 VA.

IMPORTANT

Each M744, M745, M954, M955 must have its own transformer for isolation. The transformer used to power the W973 can be used to power load relays on W974 and W975 panels, and M734 motors, providing the VA rating of the transformer is not exceeded. Never ground the secondary of any transformer used to power any system component.

Q209A MINIMUM POSITION POTENTIOMETER–mounts directly on M734, M744, M745, M954 and M955; provides minimum open position of economizer motor.

Q209B MOTOR COVER AND MINIMUM POSITION POTENTIOMETER–use with M974 to provide minimum open position of economizer motor.

Q605 DAMPER LINKAGE–connects motor to damper. INCLUDES MOTOR CRANK ARM.

Q618A VALVE LINKAGE–used to connect Modutrol motor to modulating steam or water valves.

S963A REMOTE MINIMUM POSITION POTENTIOMETER–provides remote manual control of minimum open position of economizer motor.

S963D THERMOSTAT SIMULATOR–simulates signal from thermostat to allow checkout of control system from W973 location.

MODULATING STEAM OR WATER VALVES–use with Super Modutrol motor and Q618 Linkage to provide modulating control of steam or water with the W973B Logic Panel.

–V5011, 2-way valve.

–V5013, 3-way valve.

–V5051, 2-way cage valve.

–V5047, 2-way double seated valve.

COMPRESSOR AMBIENT LOCKOUT THERMOSTAT–optional for direct expansion cooling system; prevents compressor operation when outside air temperature falls below set point.

–T675A Temperature Controller.

–L6018C Temperature Controller.

ECONOMIZER CHANGEOVER CONTROLLER–holds economizer at minimum position whenever outdoor air temperature or enthalpy is above controller set point.

–H205A1038 or H205A1046 Enthalpy Controller.

–T675A Temperature Controller.

–L6018C Temperature Controller.

MORNING WARMUP THERMOSTAT–holds outdoor air damper full closed after night setback until return air temperature exceeds selected set point.

–T675A Temperature Controller.

–L6018C Temperature Controller.

HEATING LIMIT THERMOSTAT–monitors heating medium temperature; shuts down system if temperature exceeds set point.

–T675A Temperature Controller.

S43 SAIL SWITCH–optional airflow sensor used to insure blower is running.

S6005 TIMER–initiates unoccupied cycle when used with W974 module.

4074EAC Resistor Kit required for multiple motor applications using M734, M744, or M745. Order separately.

4074EAU Resistor Kit required for multiple motor applications using M954, M955. Kit included with M954, M955 motors.

INSTALLATION

WHEN INSTALLING THIS PRODUCT . . .

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.

2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.

3. Installer must be a trained, experienced service technician.

4. After installation is complete, check out product operation as provided in these instructions.

CAUTION

1. Installer must be a trained, experienced service technician.
2. Disconnect power supply before connecting wiring to prevent electrical shock and equipment damage.
3. Accidental shorting of terminal one on W973, W974, W975, or T7067 to the transformer secondary will cause component failures.
4. When the W973 is installed in a system having multiple compressors piped as independent refrigeration circuits, the W973 must start all compressors before energizing any cylinder unloader to increase compressor capacity. Hot bypass compressor protection is recommended on each compressor, if the compressor is to operate in low ambient with a high percentage of outdoor air.
5. Conduct a thorough checkout before leaving installation.

IMPORTANT

Each M744, M745, M954, M955 must have its own transformer for isolation. The transformer used to power the W973 can be used to power load relays on W974 and W975 panels, and M734 motors, providing the VA rating of the transformer is not exceeded. Never ground the secondary of any transformer used to power any system component.

LOCATION AND MOUNTING

The W973 can be mounted in any position on a flat wall or panel where it is not exposed to the weather. It is mounted with 4 screws through the mounting holes in the base. The holes are sized for No. 8 screws (not provided).

If the optional metal cover (Part No. 191444B) is used, allow at least 4-3/4 in. [120.7 mm] clearance above the wiring terminals to facilitate removing the cover for checkout or service.

Mount other control system components according to instructions packed with the individual units.

WIRING

Disconnect power supply before connecting wiring to avoid electrical shock or equipment damage. All wiring must comply with local codes and ordinances.

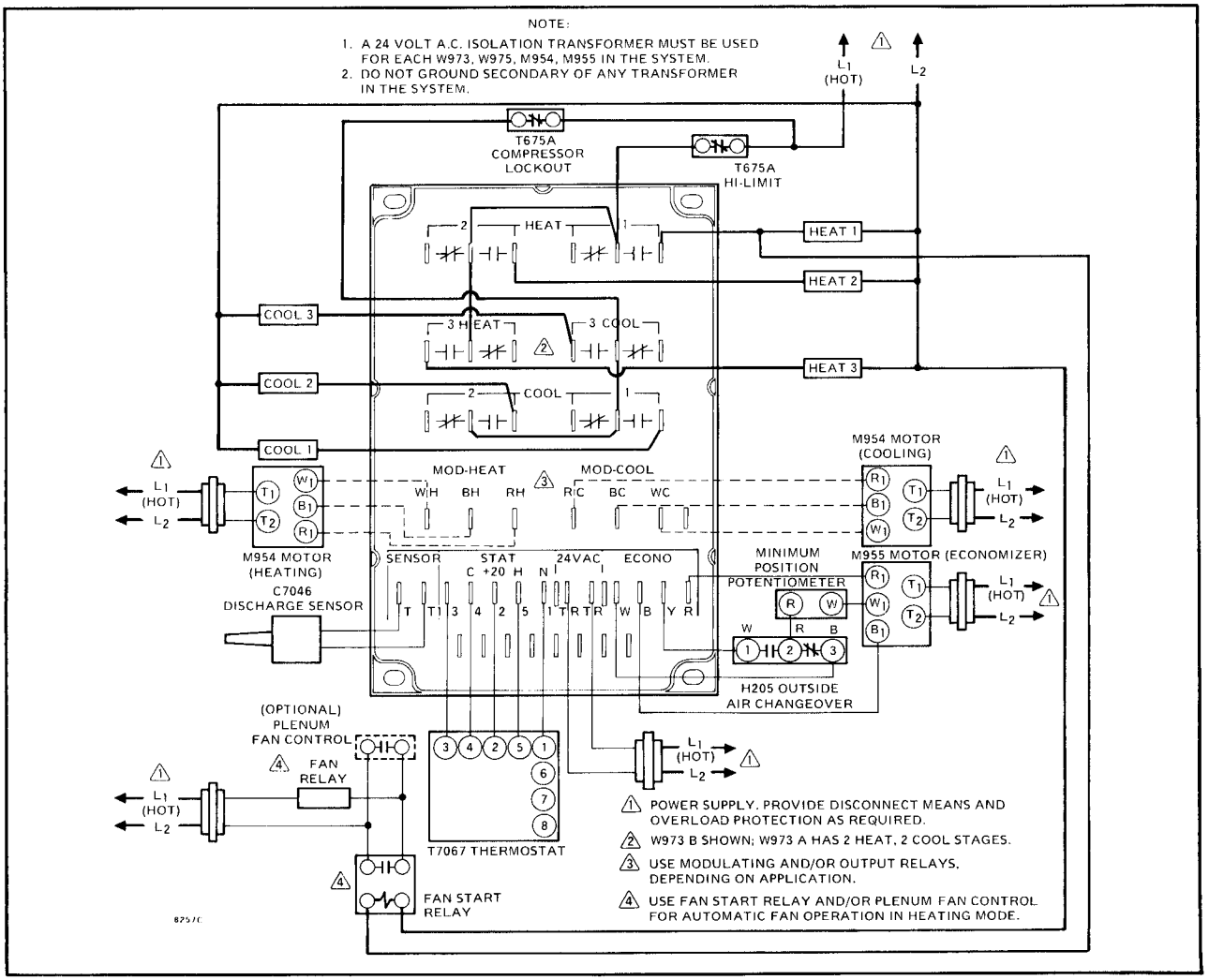


FIG. 3–WIRING CONNECTIONS FOR W973A,B LOGIC PANEL.

Connections to the W973 in an HVAC system with mod-heat, mod-cool, heat/cool stages, and economizer are shown in Fig. 3. Connections to the W973 panel in flame safeguard systems are shown in Figs. 4 and 5.

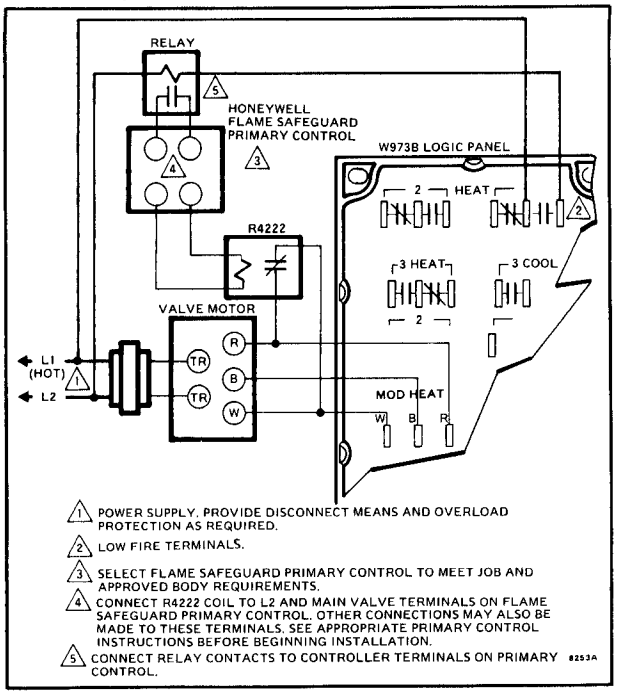


FIG. 4–WIRING CONNECTIONS FOR W973B WHEN USED WITH A HONEYWELL FLAME SAFEGUARD PRIMARY CONTROL.

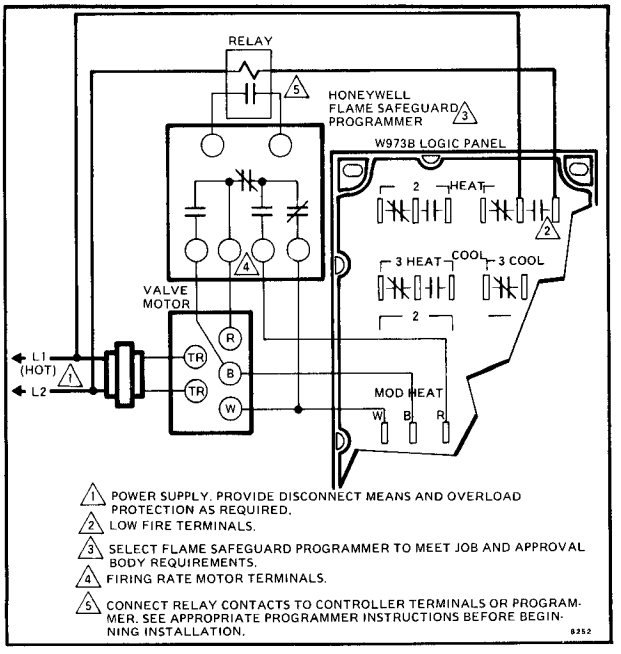


FIG. 5–WIRING CONNECTIONS FOR W973B WHEN USED WITH A HONEYWELL FLAME SAFEGUARD PROGRAMMER.

CONNECTING MOTORS FOR UNISON OPERATION

Up to 3 Modutrol motors, or economizers–with solid state balance relays–can be connected to operate in unison. Wire the motors and add resistors as shown in Figs. 6,7. Wire economizers as shown in Fig. 8.

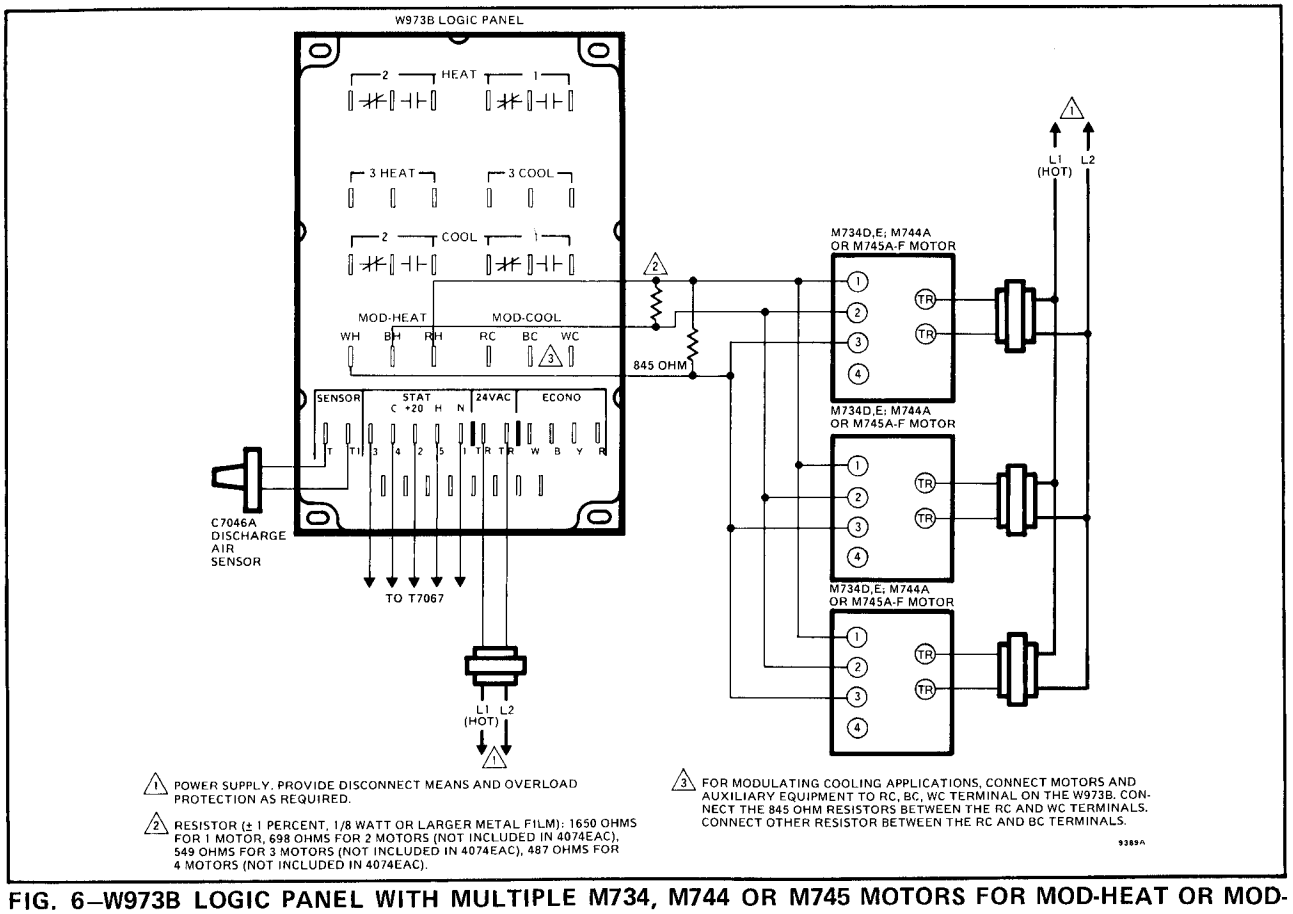


FIG. 6–W973B LOGIC PANEL WITH MULTIPLE M734, M744 OR M745 MOTORS FOR MOD-HEAT OR MOD-COOL.

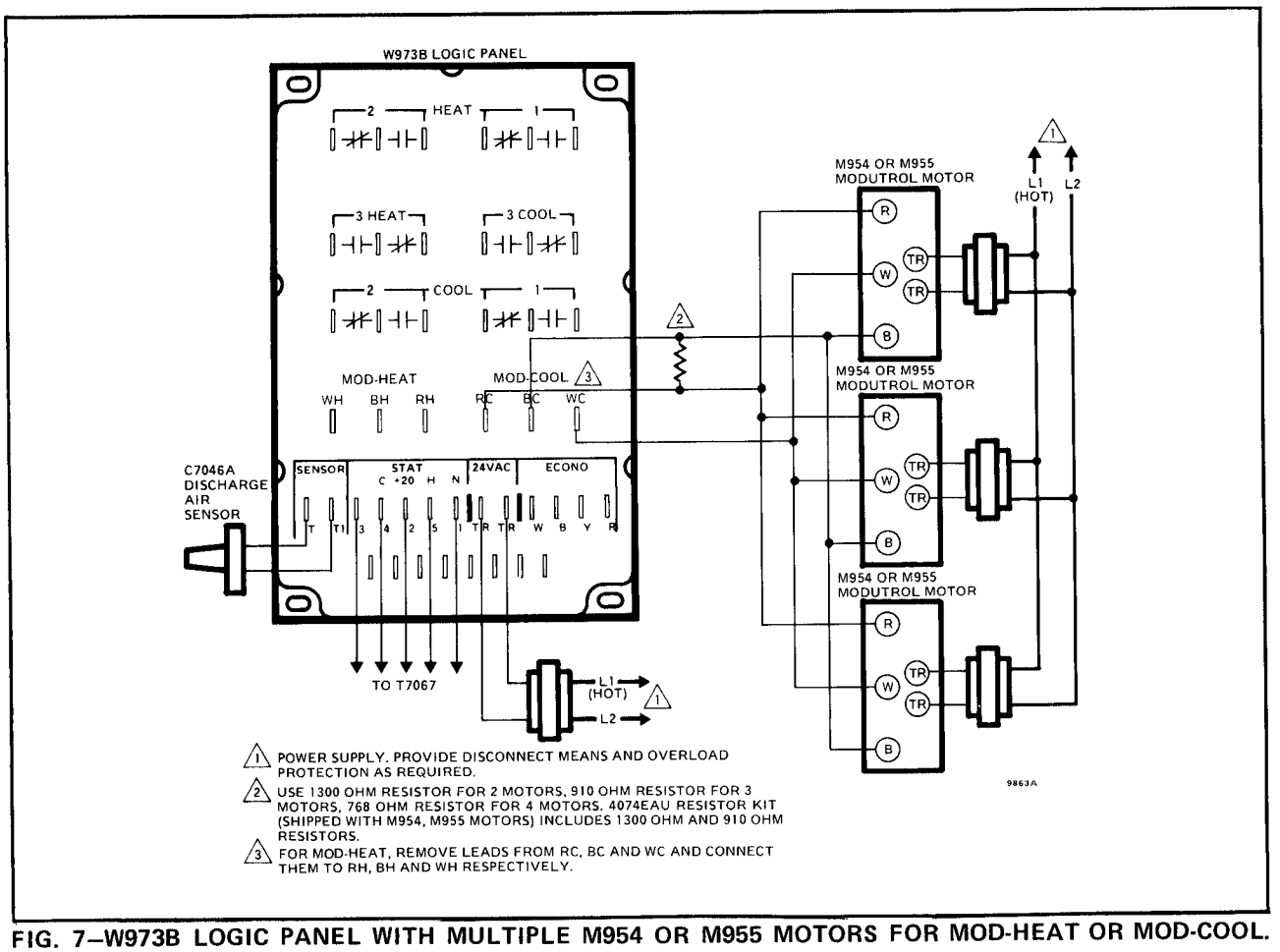


FIG. 7–W973B LOGIC PANEL WITH MULTIPLE M954 OR M955 MOTORS FOR MOD-HEAT OR MOD-COOL.

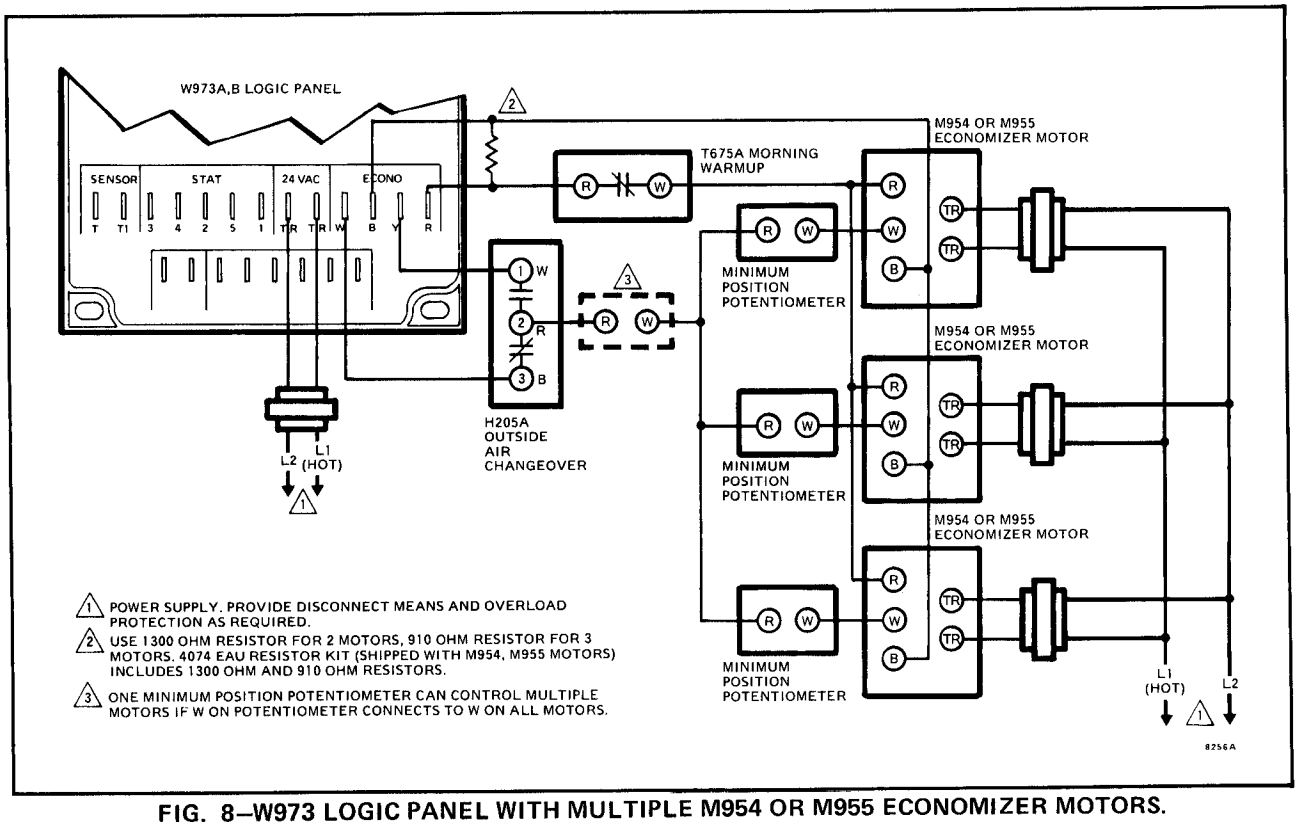


FIG. 8–W973 LOGIC PANEL WITH MULTIPLE M954 OR M955 ECONOMIZER MOTORS.

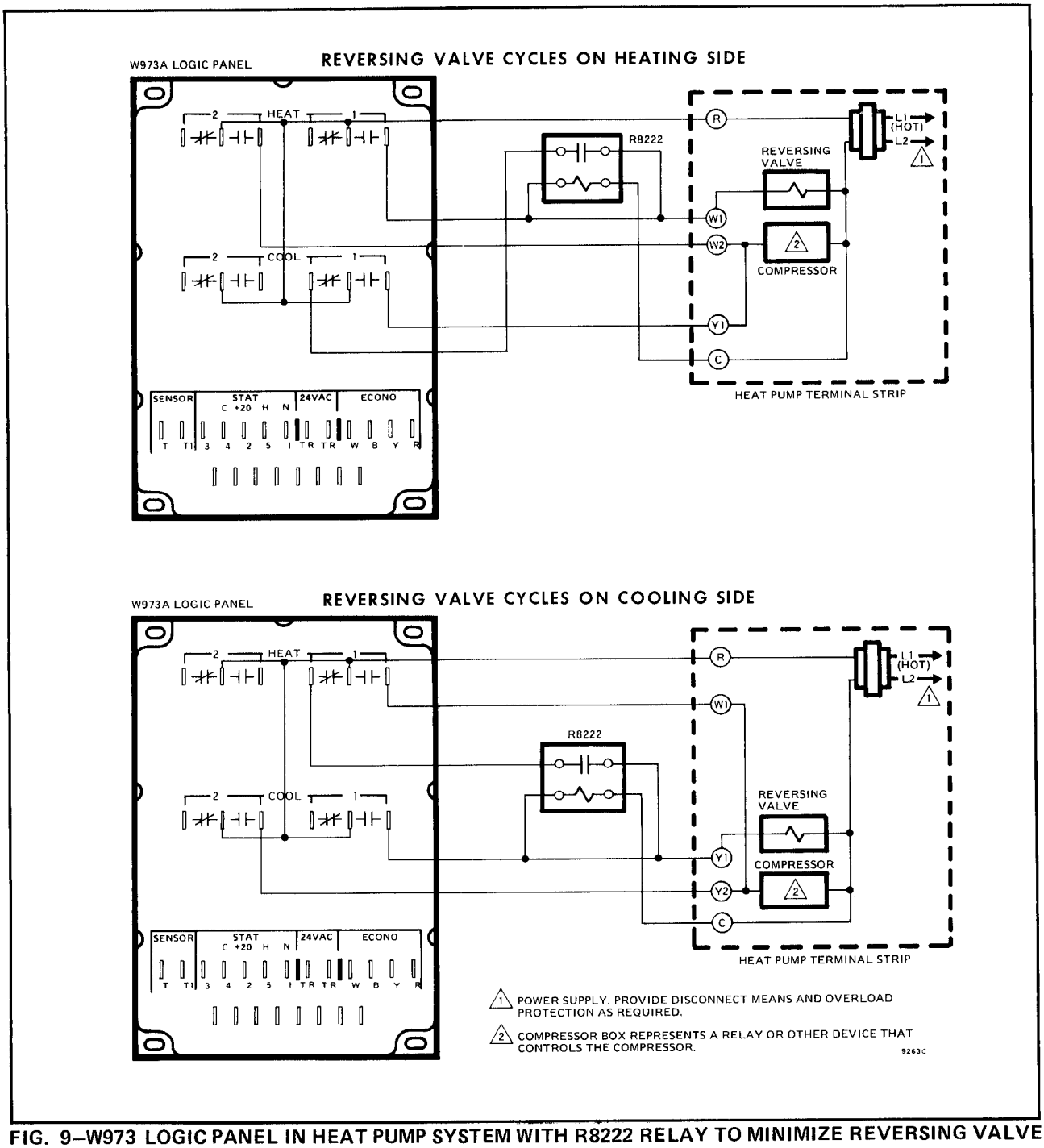


FIG. 9–W973 LOGIC PANEL IN HEAT PUMP SYSTEM WITH R8222 RELAY TO MINIMIZE REVERSING VALVE CYCLING.

HEAT PUMP APPLICATION

A heat pump consists basically of an indoor coil, an outdoor coil, a reversing valve, and a compressor. The unit is similar to a direct expansion cooling unit except that, depending on the position of the reversing valve, it provides either space heating or cooling. The W973 can be used to control a heat pump when wired as shown in Fig. 9. Note that the stage 1 contacts control the reversing valve. In some heat pumps, the reversing valve is energized on heating. In that case, use the stage 1 heating contacts to control the reversing valve and stage 2 heating contacts to control the compressor on heating.

In order to prevent excessive reversing valve cycling, an R8222 relay can be connected, as shown in Fig. 9, to keep the valve energized (for heat or cool) rather than allowing it to cycle with the compressor. Separate circuits are shown for heat pumps with the reversing valve on the heating and cooling side.

In heat pump systems using stages of auxiliary heat, connections to the W973 are made as shown in Fig. 10.

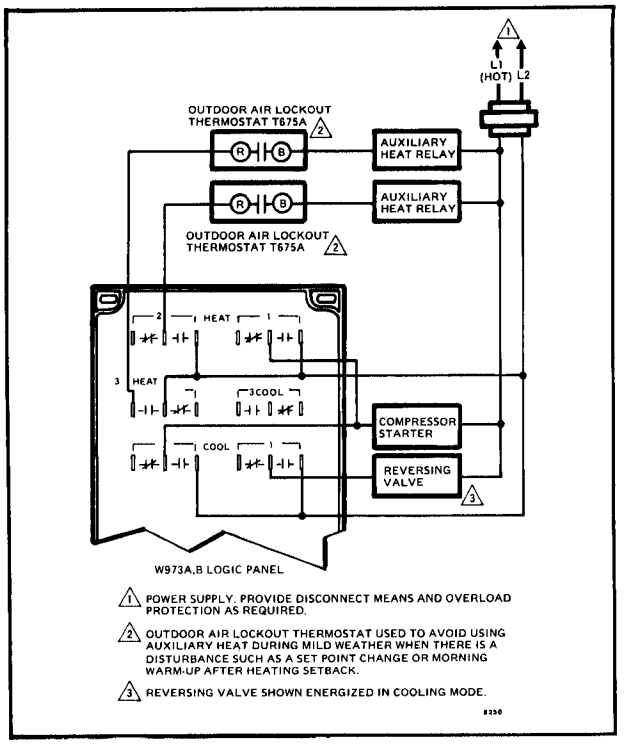


FIG. 10–W973B IN HEAT PUMP SYSTEM WITH 2 STAGES OF AUXILIARY HEAT.

NIGHT SETBACK CONNECTIONS

The W974A Setback Module provides setback of heating and cooling shutdown, drives the outdoor air damper closed, and interrupts continuous fan operation during unoccupied periods.

The W974B Setback/Setup Module provides setback of heating, cooling setup or shutdown, and automatic intermittent fan operation during unoccupied periods. The outdoor air damper goes closed at the beginning of the unoccupied cycle. If cooling setup is provided, the economizer operates as the first stage of cooling.

With both models, a separate time clock is used to initiate the unoccupied cycle. A T675A morning warm-up thermostat can be added to hold the outdoor air damper closed after heating setback until return air temperature exceeds the selected set point. For further information, see W974 specification sheet.

CONNECTING ADDITIONAL STAGES

Control of additional stages of on-off cooling or heating can be provided by adding a W975 Satellite Sequencer to the W973 system. Use W975A for 8 additional heating or cooling stages.

W975B provides 4 heating and 2 cooling stages. The satellite sequencers are wired into the system as shown in the W975 specification sheet.

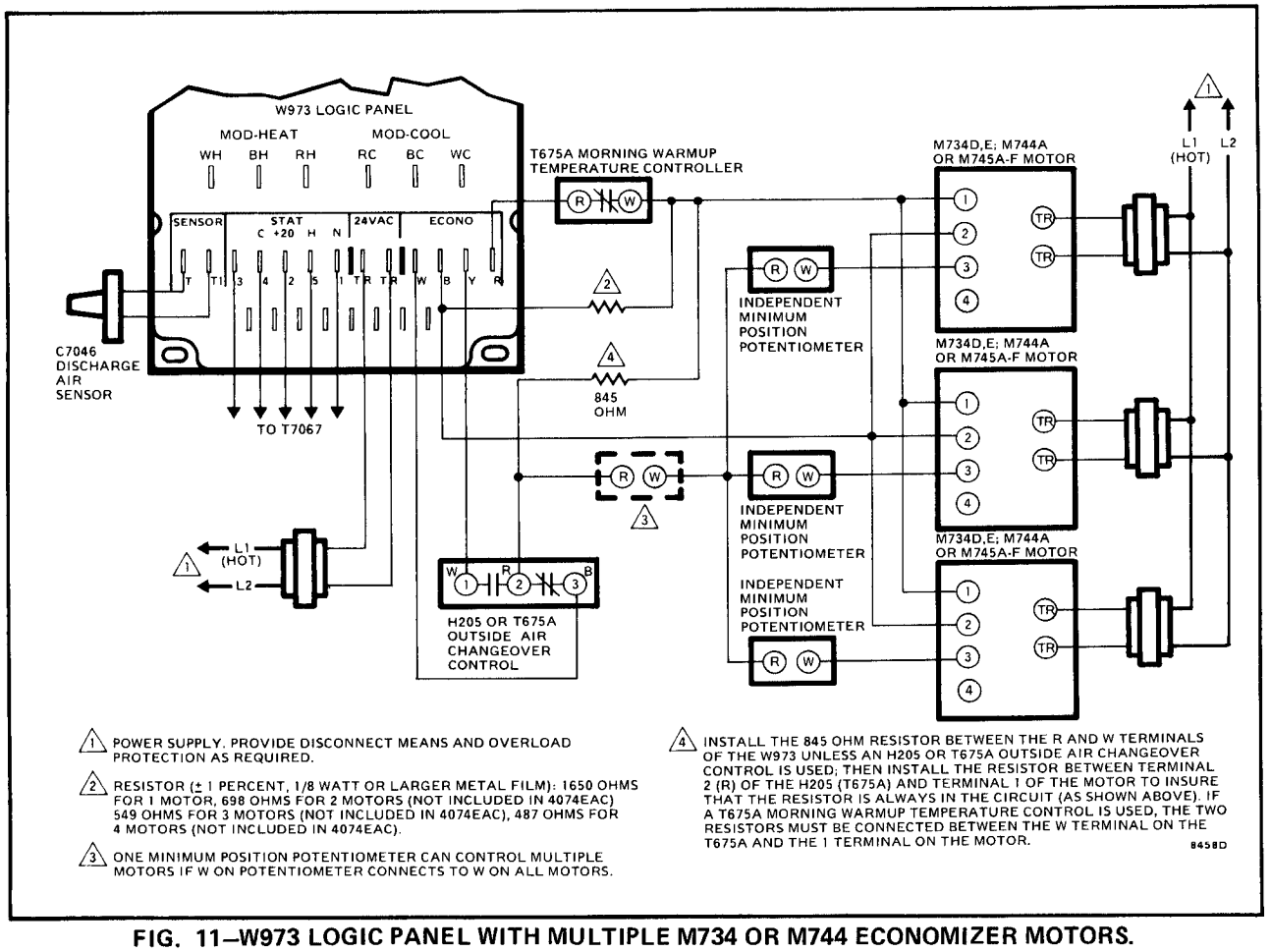


FIG. 11–W973 LOGIC PANEL WITH MULTIPLE M734 OR M744 ECONOMIZER MOTORS.

W973A1041 LOGIC PANEL WITH OFFSET ECONOMIZER

A modified W973A Logic Panel, W973A1041, is available with an economizer offset for applications where guidelines recommend a high cooling set point. The W973A1041 panel drives the economizer full open 4 degrees F [2.2 C] below the guideline set point (Fig. 1). This offset enables the economizer to hold temperatures 4 F [2.2 C] below set point whenever outdoor air temperature is suitable. At set point (4 degrees above full open economizer), cooling stages will begin to sequence on. A special scaleplate (Part No. 194538A) is included with the W973 for use on the T7067 thermostat to insure proper temperature calibration for the W973A1041 system.

Up to 8 additional stages of heating or cooling can be added to the W973A1041 using the W975A Satellite Sequencer. However, when adding cooling stages, do not overlap the 2 offset cooling stages in the W973A1041 (see Fig. 1).

W973J1009 LOGIC PANEL FOR LOAD CONTROL AND HEAT RECLAIM

In applications where load control or heat reclaim are included, a modified version of the W973J Logic Panel, W973J1009, is available in which the last 2 stages are offset from the first 2 stages by approximately 4 F [2.2 C] for both heating and cooling (see W973J1009 in chart, Fig. 1). For load control wiring, see Fig. 12.

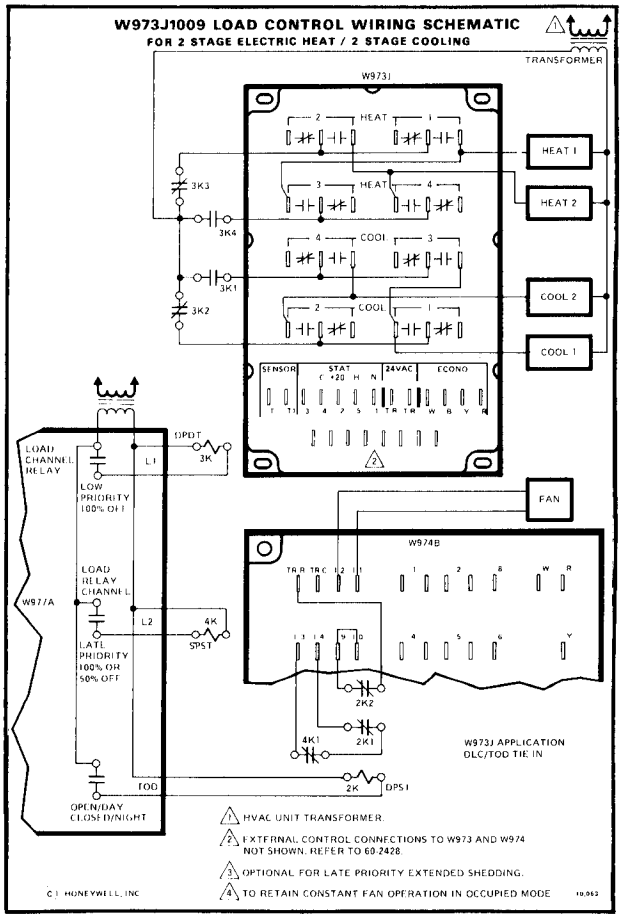


FIG. 12–W973J1009 LOAD CONTROL WIRING.

In load control applications, this panel enables the demand limit controller to switch control from stages 1 and 2 to stages 3 and 4 in a 2-heat, 2-cool system (Fig. 12), The result of peak demand is to move the control point 4 degrees higher for cooling and 4 degrees lower for heating.

In heat reclaim applications, heating stages 1 and 2 are used for heat reclaim equipment, while stages 3 and 4 are used for conventional heating. Stage 3 will operate 4 degrees below stage 1; stage 4 will operate 4 degrees below stage 2. For example, with the T7067 heating set point at 69 F [21 C], heat reclaim 1 and 2 will be activated within approximately 1 F [0.6 C], or by 68 F [20 C]. However, the first mechanical heat stage would not come on until the space temperature dropped to 65 F [18.3 C].

This unit is particularly useful in supermarket and restaurant applications where mandatory set point guidelines are imposed.

When a W975A sequencer is used to add cooling stages, do not overlap the 2 cooling stages in the W973J1009 panel (see Fig. 1).

MULTIPLE W973 SYSTEMS

USING W973 TO CONTROL MULTIPLE HVAC UNITS

In some applications more than one HVAC unit is used to condition the air in a single, unpartitioned space. Up to six W973 and W975 panels, in any combination, can be controlled from one T7067 thermostat. A separate W973 is used for each unit.

In multiple W973 systems, a master W973 provides the power input to the T7067 thermostat. A C7046 discharge sensor is used with each W973 to provide a positive modulating low limit for each system.

All W973 panels in the system receive the same signals from the thermostat, and all systems operate in unison. However, since independent economizer changeover controllers are used, some variation in economizer operation may occur when air temperature is near the changeover point.

SYSTEM OPERATION

The W973 Logic Panel controls the economizer motor and stages of heating and cooling equipment or valve motors in response to a signal from a dual set point thermostat located in the controlled space or a dual set point transmitter with a remote sensor located in the controlled space.

To maintain stable space temperatures, the W973 Logic Panel balances the space thermostat demand signal against the system output. System output is measured by a temperature sensor located in the discharge air duct. The combined demand and output signals determine the economizer position and the number of heating or cooling stages energized, or the positions of the valve motors. The discharge sensor also provides a positive modulating low limit signal to the W973. This signal modulates the economizer closed if discharge air gets too cold to help avoid damage to the cooling coils due to freezeup.

Heating setback, cooling setup or lockout, and additional staging capability are provided by separate, optional solid state panels. These panels can be included

in the initial installation, or they can be added at any time thereafter. The W974B provides heating setback and cooling setup/shutdown. The W975 provides additional stages of heating or cooling.

On a power failure, all stages go off, and spring-return motors, if used, return to the normal (de-energized) position. When power is restored, the required stages sequence on with a time delay between stages.

HEATING

When the space temperature drops below the thermostat heating set point, the thermostat responds to the combined space and discharge sensor input, and sends a modulating voltage signal to the W973. The discharge sensor is mounted in the discharge air duct to provide anticipation for the system. The W973 responds to the modulating voltage signal by turning on the minimum number of on-off heating stages which will satisfy the thermostat demand, or opening the proportioning valve motor to the required position.

The W975A,B satellite sequencers are used to extend the number of stages. Note that heating stage 3 of the W973B, and heating stage 3 of the W975 pull in at the same signal voltage. Use either the W973 or W975B, not both, to control stage 3 operation. Refer to Fig. 1 for sequence of operation of stages.

When the W973B is used in a modulating gas system, a call for heat first fires the burner at the low fire position through the heat stage 1 pilot duty relay contacts in the W973. As additional heat is required, the valve motor is modulated by the W973.

As the space temperature approaches the thermostat's heating temperature set point, the stages cycle off, last first, and/or the valve motors modulate closed.

During heating, the economizer is limited to the minimum position to provide minimum outdoor air for ventilation. The outside air dampers must be properly selected and adjusted to avoid heating excessive quantities of outside air.

COOLING

When the space temperature rises above the thermostat's cooling set point, the thermostat sends a modulating voltage signal to W973. The C7046A Discharge Sensor, mounted in the discharge air duct, provides anticipation for the system. The W973 responds to the combined thermostat-discharge sensor signal by activating the minimum amount of cooling to satisfy the thermostat demand. The economizer operates as the first stage of cooling if outdoor air temperature or enthalpy is below the changeover set point. On a call for cooling, the W973 modulates the outdoor air damper open. If outdoor air temperature or enthalpy is above the changeover set point, the economizer remains at the minimum position.

If the economizer cannot satisfy the space demand or cooling, mechanical cooling stages are energized as needed, or the chilled water valve is opened to the required position.

The W975A,B satellite sequencers are used to extend the number of stages. Note that cooling stage 3 of the W973B and cooling stage 3 of W975 pull in simultaneously. Refer to Fig. 1 for sequence of operation.

As the space temperature approaches the thermostat's cooling set point, the stages cycle off, last stage first, or the valve motor modulates closed. After all stages of mechanical cooling are off, or the chilled water valve is closed, the W973 signals the economizer motor to modulate to minimum position.

If at any time during the cooling cycle the discharge air temperature drops to 62 F [17 C], the economizer motor starts to modulate closed. The economizer motor will be at minimum position when discharge air temperature is 50 F [10 C].

HEATING SETBACK/COOLING SETUP

The W974 Setback Module provides heating setback and shutdown or setup on cooling. A time clock is used to put the system into the unoccupied mode. The time clock contacts are closed during occupied operation and open during setback.

See W974 specification sheet for application information and wiring diagrams.

HEATING MODE

1. The control point is reduced 5, 8, 12, or 15 F [2.8, 4.4, 6.7, or 8.3 C], depending on setting.
2. The economizer motor drives to the closed position for maximum energy savings.
3. The system fan starts when first stage heat is energized.
4. When the system returns to the occupied cycle, the economizer remains closed until space temperature approaches the heating set point if the T675A Morning Warmup Thermostat is connected as shown in Fig. 8 or 11.

COOLING MODE

W974A

All cooling is shut down. Outdoor air damper is held in closed position.

W974B

1. Control point is increased 5, 8, or 12 F [2.8, 4.4, or 6.7 C] or locked out.
2. Economizer drives to closed position.
3. *Outdoor temperature or enthalpy below changeover point*: On call for cooling fan starts when economizer starts to open.
4. *Outdoor temperature or enthalpy above changeover point*: On call for cooling economizer remains closed. Fan starts when first stage cooling is energized.

TIME DELAYS

The time delay circuit in the T7067 thermostat is a load reactive type of time delay to ensure stable system performance. It is not a substitute for minimum off timers used to protect the compressors against short cycling on limit action. The time delay length varies exponentially with space temperature deviation from thermostat set point. That is, the delay between turn on of successive stages is long when space temperature is close to set point. This ensures that the thermostat does not overreact and turn on too many stages. As the deviation between space temperature and thermostat set point increases, the time delay between turn on of successive stages becomes shorter so that the system can react to changes in load.

ADJUSTMENTS AND CHECKOUT

SYSTEM CHECKOUT

IMPORTANT

If system operation is not as described below, see Component Checkout section.

A system checkout should be performed after installation or whenever a detailed check is appropriate.

1. Successful completion of the following checkout procedure verifies that the W973 system is operating properly.

2. Make sure power is on to the W973 system and controlled equipment, and time clock, if used, is in occupied mode. Make sure compressor ambient lockout, morning warmup, and any limit control contacts are closed.

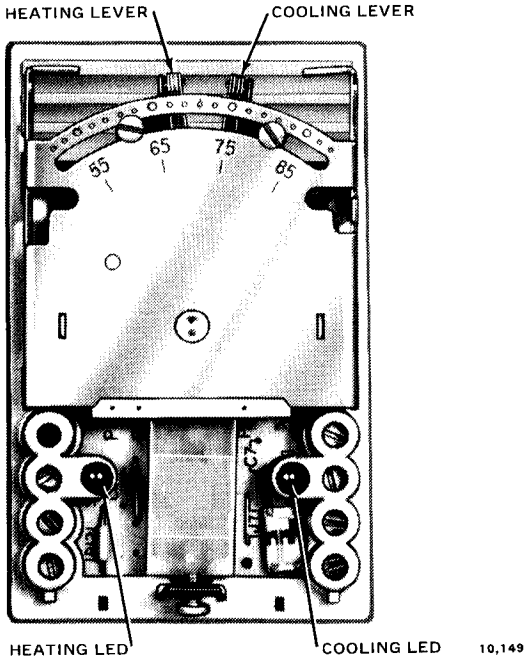


FIG. 13–T7067 THERMOSTAT (COVER REMOVED).

3. Remove cover from T7067 thermostat; note red diagnostic light emitting diodes (LED's). See Fig. 13.

4. Move thermostat cooling set point (blue lever) below room temperature to call for cooling. Cooling LED on the right side of the T7067 should begin to glow. The observe cooling equipment. If the enthalpy of the outdoor air is below the H205 set point the economizer damper will modulate open as the first stage of cooling. Modulating low limit will operate and modulate the economizer damper closed if discharge temperature drops below 62 F [17 C]. The economizer dampers will drive to minimum position as the discharge temperature drops to 50 F [10 C].

If the mechanical cooling does not come on, jumper stage 1 cooling normally open contacts. If the compressor still does not come on, the problem is not with the W973 system.

5. Move thermostat cooling set point above room temperature. Cooling equipment should cycle off and cooling LED intensity should decrease to a faint glow or go off completely. Economizer should drive to minimum position.

6. Move thermostat heating set point (red lever) above room temperature. Heating LED on the left side of the T7067 should begin to glow. Heating equipment should cycle on. If heating equipment does not cycle on, jumper stage 1 heating normally open contacts. If heating still does not come on, the problem is not with the W973 system.

7. Move heating set point below room temperature. Heating equipment should cycle off, and heating LED intensity should decrease to a faint glow or go off completely.

8. Return heating and cooling set point to desired setting, lock set points as desired. Return subbase switches, if used, to desired positions.

COMPONENT CHECKOUT

CAUTION

This control system must be checked with the system powered. Disconnect power before checking the wiring and use care to avoid electrical shock or equipment damage.

The following checkout procedure determines that:

1. The W973 Logic Panel will control the heating and cooling equipment properly.

2. The system components are correctly wired to the W973.

Perform the following checks on initial startup, as the first step in troubleshooting, and after completing any service or adjustment procedures. If system operation is not as described, check each component individually. Refer to individual instruction sheets to check out component and auxiliary controls.

EQUIPMENT NEEDED

Volt-ohmmeter (Simpson 260 recommended).

S963D Thermostat Simulator (optional) allows modulating check of W973 output stages for individual inspection of each stage and inspection of equipment with motors in midposition. Follow the checkout instructions packed with the S963D.

ELECTRONIC SENSORS

T7067 THERMOSTAT

1. Set the meter to the 20 Vdc scale.
2. Check for power to the thermostat. Connect negative (−) lead to terminal 1 and the positive (+) lead to terminal 2. Meter should read 20 Vdc.
3. Connect the negative (−) lead to terminal 1 and the positive (+) lead to terminal 4.
4. Slowly move the cooling lever below room temperature to simulate a call for cooling. The meter reading should gradually increase to about 16 Vdc.
5. Move the cooling lever above room temperature. The meter reading should drop to less than 2 Vdc.
6. Remove the (+) meter lead from terminal 4 and connect it to terminal 5.
7. Slowly move the heating lever above room temperature to simulate a call for heating. The meter reading should gradually increase to about 16 Vdc.
8. Move the heating lever below room temperature. The meter reading should drop to less than 2 Vdc.

DISCHARGE SENSOR

1. Set the meter to resistance scale R x 100.
2. Disconnect the lead from sensor terminal T1 on the W973.
3. Connect one meter lead to the W973 terminal T and the other meter lead to the loose leadwire from the sensor.
4. Meter reading depends on the temperature at the sensor. Discharge sensor resistance should be between 1500 to 4500 ohms. For resistance readings at different temperatures, see Fig. 14.

For T7067 heating and cooling voltage output ramps, see Fig. 15.

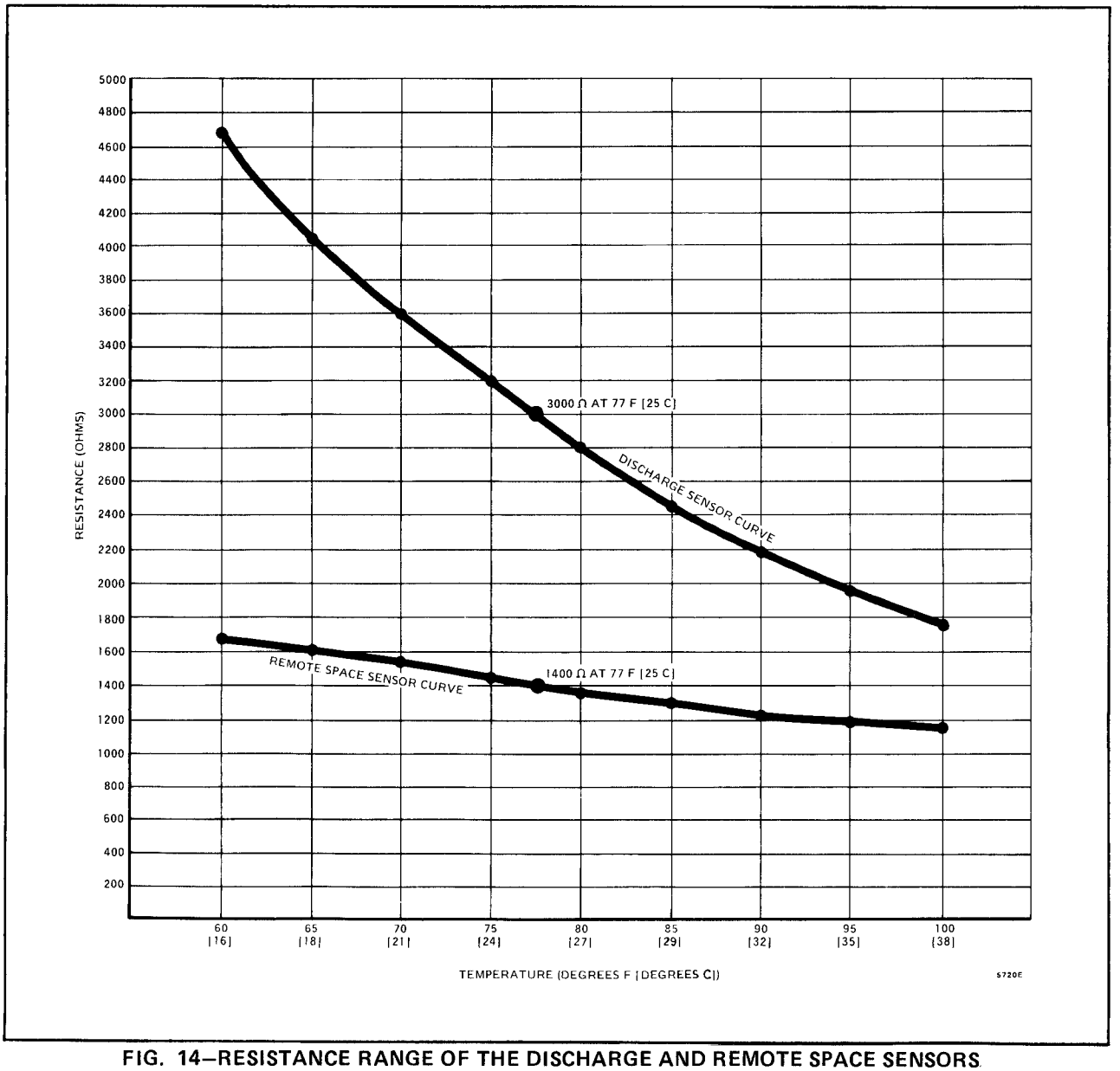


FIG. 14—RESISTANCE RANGE OF THE DISCHARGE AND REMOTE SPACE SENSORS

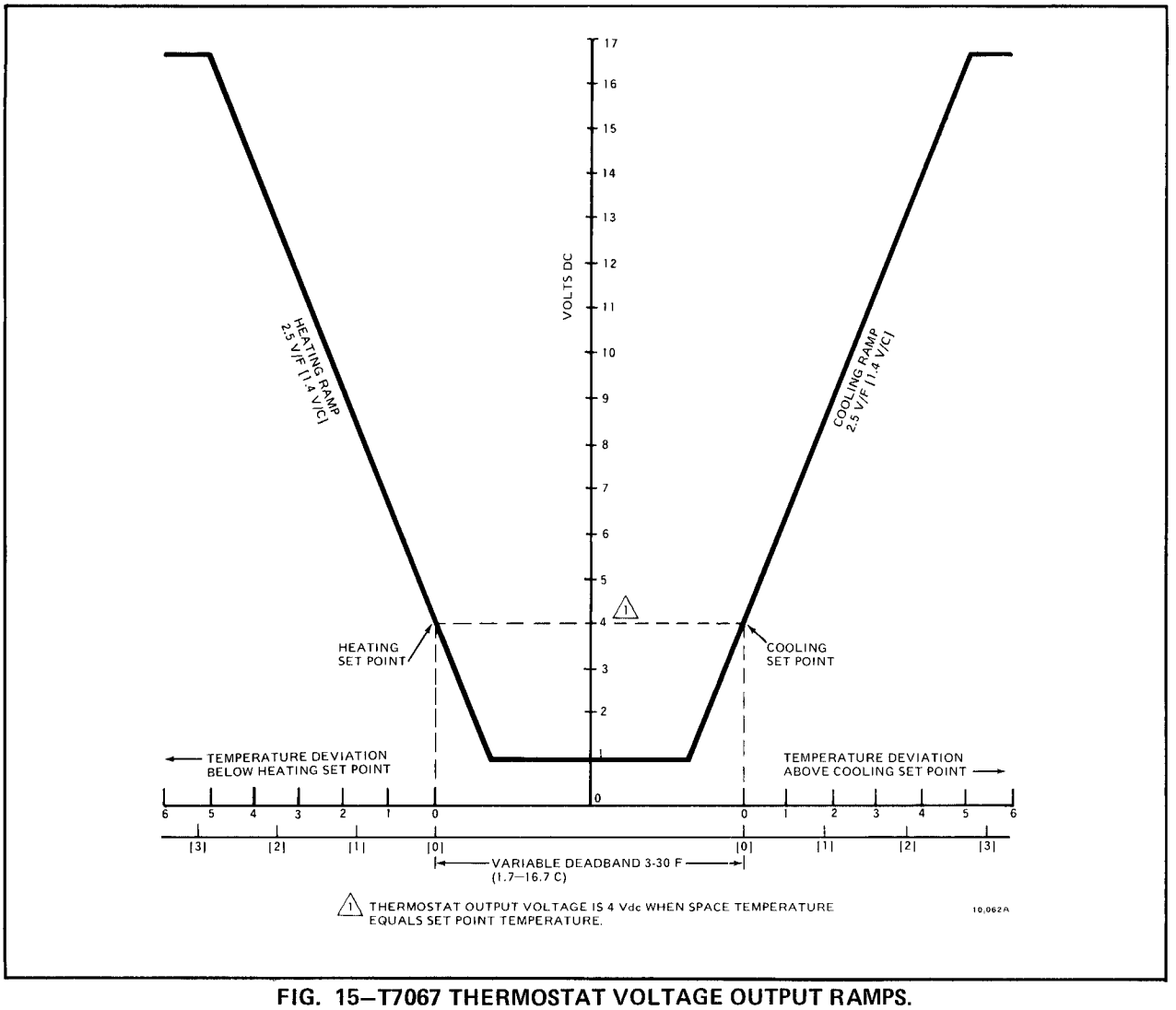


FIG. 15–T7067 THERMOSTAT VOLTAGE OUTPUT RAMPS.

W973 CHECKOUT

CAUTION

1. The W973 must be powered when making these checks.
2. Line voltage may be present on some terminals.
3. Disconnect power before making any wiring changes, and use care to avoid electrical shock.

NOTE: The following checkout procedure requires the use of the S963D Thermostat Simulator (refer to S963D specification sheet 60-2463). If the S963D is not available, check out as described below, except jumper terminals 2-4 on the W973 to operate cooling stages and jumper terminals 2-5 to operate heating stages. All stages energize simultaneously when jumpers are used.

CONNECT S963D THERMOSTAT SIMULATOR

1. Disconnect line power at the master switch.
2. Remove thermostat and discharge sensor leads from terminals 1, 2, 3, 4, 5 and T1 on W973. Connect leads from S963D Thermostat Simulator as follows.

LEADWIRE COLOR	W973 TERMINAL
White	1
Black	2
Blue	3
Red	4

3. Turn on power at master switch.

CHECK ON-OFF COOLING OUTPUT

1. Slowly turn "Heat/Cool" knob on S963D clockwise ↷ to simulate call for cooling.
2. In noisy areas, you may not hear the W973 output relays pull in. Check for relay operation by setting the meter to the volts ac scale equal to the relay switching voltage (50 V scale for 24 Vac; or 250 V scale for 120, 208, or 240 Vac relay switching voltage).
3. Connect the meter leads to the normally open contacts of each cooling relay. The meter will read zero if the relay is pulled in and the contacts are made (Fig. 16).

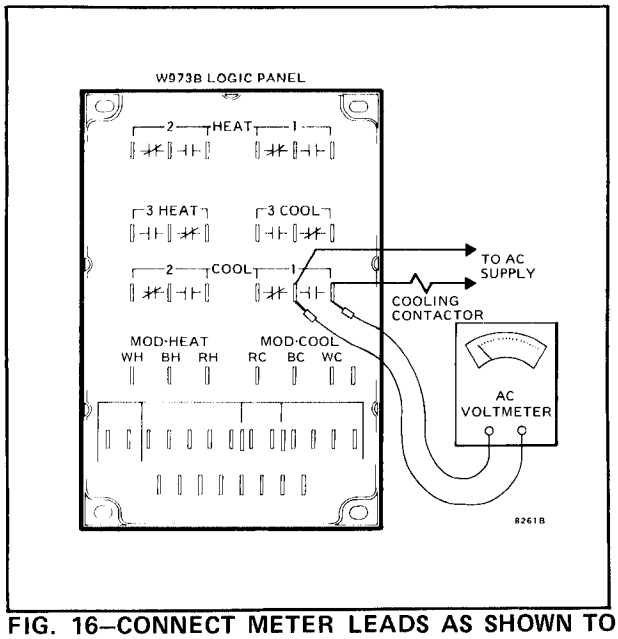


FIG. 16–CONNECT METER LEADS AS SHOWN TO CHECK COOLING RELAY OPERATION.

4. Slowly turn the Heat/Cool knob on the S963D counterclockwise to simulate a decrease in a call for cooling. Cooling relays will drop out and a voltage reading will appear on the meter.

CHECK ECONOMIZER OUTPUT/ECONOMIZER LOW LIMIT

1. Disconnect the economizer(s) from terminal W on the W973.
2. Set the meter to 2.5 volt dc scale. Connect the negative (–) lead to R and the positive (+) lead to W.
3. Turn economizer low limit knob full clockwise
4. Energize panel.
5. Slowly turn heat/cool knob on S963D clockwise to simulate a call for cooling.
6. The meter reading should rise from 0 to approximately 1.5 Vdc.
7. Slowly turn the economizer low limit knob counterclockwise to simulate a decrease in discharge temperature. The voltage should fall from 1.5 Vdc to 0.
8. Turn the economizer low limit knob fully clockwise to simulate a rise in discharge temperature. The voltage should rise to approximately 1.5 Vdc.
9. Slowly turn the heat/cool knob on S963D counterclockwise to simulate a decrease in a call for cooling. The voltage should return to 0 Vdc.
10. Connect the economizer back to terminal W.
11. Slowly turn heat/cool knob on S963D clockwise to simulate a call for cooling.
12. The economizer should open. If the economizer motor does not open and economizer terminals W and R have checked out as described in steps 1-7, check that all other controls in economizer circuit (morning warm-up thermostat, mixed air low limit, changeover control, and night setback relay) are closed. Make sure system selector switch is in COOL or AUTO position.
13. If the economizer motor does not operate with the economizer circuit closed, then follow the motor checkout procedure packed with economizer motor.
14. Slowly turn the heat/cool knob on S963D counterclockwise to simulate a decrease in a call for cooling. The economizer motor should close.

CHECK MODULATING COOLING OUTPUT

1. Disconnect the valve or damper motor(s) from cooling terminal W on the W973.
2. Set the meter to 2.5 Vdc scale. Connect the negative (–) lead to R and the positive (+) lead to W.
3. Slowly turn heat/cool knob on S963D clockwise to simulate a call for cooling.
4. The meter reading should rise from 0 to approximately 1.5 Vdc.
5. Slowly turn the heat/cool knob on S963D counterclockwise to simulate a decrease in a call for cooling. Voltage should drop to zero.
6. Connect the motor back to terminal W.
7. Slowly turn heat/cool knob on S963D clockwise to simulate a call for cooling.
8. If motor does not open and voltage is correct between terminals R and W, check the system wiring. Make sure all limit controls or relay contacts in the motor circuit are closed and that system selector switch is in the COOL or AUTO position.
9. If wiring is correct and motor does not open, follow the motor checkout procedure packed with the cooling valve motor.
10. Slowly turn the heat/cool knob on S963D counterclockwise to simulate a decrease in a call for cooling. The valve or damper motor should close.

CHECK ON-OFF HEATING OUTPUT

1. Disconnect red S9630 lead wire from W973 terminal 4 and connect the leadwire to W973 terminal 5.
2. Slowly turn the heat/cool knob on S963D clockwise to simulate a call for heat.
3. In noisy areas, you may not hear the W973 relays pull in. Check relay operation by setting the meter to the voltage being switched by the relays (50 V scale for 24 Vac, or 250 V scale for 120, 208, or 240 Vac). The system selector switch must be in the HEAT or AUTO position.
4. Connect the meter leads to the normally open contacts for each heating relay. Meter will read zero if the relay is pulled in and contacts are made (Fig. 17).
5. Slowly turn heat/cool knob on S963D counterclockwise to simulate a decrease in the call for heat. As heating relay drops out, a voltage reading will appear on the meter.

CHECK MODULATING HEATING OUTPUT

1. Disconnect the valve or damper motor from terminal W on the W973.
2. Set meter to 2.5 Vdc scale. Connect the negative (–) lead to R and the positive (+) lead to W.
3. Slowly turn the heat/cool knob on S963D clockwise to simulate a call for heat.
4. The meter reading should rise from 0 to at least 1.8 Vdc.

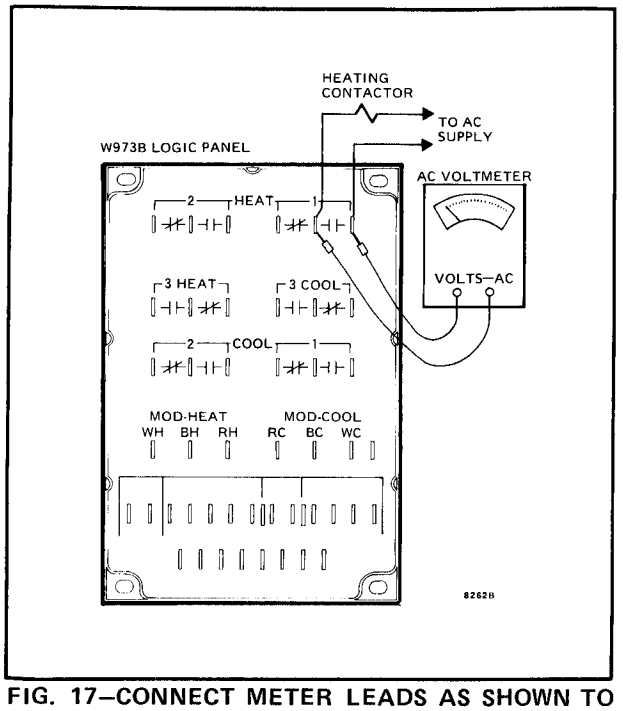


FIG. 17–CONNECT METER LEADS AS SHOWN TO CHECK HEATING RELAY OPERATION.

5. Slowly turn heat/cool knob on S963D counterclockwise to simulate a decrease in the call for heat. The voltage should drop to zero.

6. Connect the motor back to terminal W.

7. Slowly turn the heat/cool knob on S963D clockwise to simulate a call for heat.

8. If the motor does not open with correct voltage between R and W, check the system wiring. Make sure all limits and relay contacts in the motor circuit are closed and the system selector switch is in the HEAT or AUTO position.

9. If wiring is correct and motor does not operate, follow the motor checkout procedure shown in the instructions packed with he heating valve motor.

10. Slowly turn heat/cool knob on S963D counterclockwise to simulate a decrease in the call for heat. The motor should close.

UPON COMPLETION OF CHECKOUT

1. Disconnect power and remove S963D. Replace thermostat and discharge sensor leads and restore power.

2. Adjust set points as indicated under Suggested Settings.

W973 QUICK CHECK PROCEDURE

This checkout will help you determine whether a system fault is in the HVAC equipment or in one of the units of the W973 modular control system.

The quick checkout does not replace the System Checkout (page 13) which is performed after a W973 installation.

Before performing the quick checkout, observe system operation and record all malfunctions. Follow the steps in order, observing all notes and precautions.

STEP 1. VERIFY T7067 THERMOSTAT OPERATION.

NOTE: Ambient temperature must be within the T7067 range of 55 F to 85 F [13 C to 29 C] for this step.

A. Simulate a call for cooling by moving both T7067 set point levers to the left end of the scale. The red, cooling LED (light emitting diode) should start to glow within several seconds, indicating proper cooling signal output.

B. Simulate a call for heating by moving both set point levers to the right end of the scale. The heating LED should start to glow, indicating proper heating signal output.

NOTE: When heating or cooling LED is glowing, the opposite LED may display a faint glow. This is not a cause for concern.

FAULT – LED's do not glow:

Check wiring–particularly terminals 1 and 2.

Follow the more detailed analysis given in T7067 specification sheet, 60-2421, page 9.

STEP 2. BYPASS ENTHALPY CONTROLLER AND MORNING WARMUP THERMOSTAT.

NOTE: Changeovers and lockouts must be jumpered out of the system to allow uninterrupted operation. Do not override system limit controls, however, be aware of their possible influence.

A. Jumper terminals 2 and 3 on the H205 Enthalpy Controller.

B. Jumper terminals R and W on the T675 Morning Warmup Thermostat.

STEP 3. PLACE SYSTEM IN OCCUPIED MODE.

This step further insures uninterrupted operation.

A. Jumper terminals 13 and 14 on the W974 night setback panel.

STEP 4. VERIFY OPERATION OF INDIVIDUAL HVAC STAGES.

In this step, individual HVAC stages are activated with jumpers at the W973 panel.

CAUTION

Shut off power to HVAC equipment when connecting jumpers. Note manufacturer's precautions regarding minimum off time for compressors.

A. Jumper normally open contacts of stage 1 heating, return power to the HVAC equipment and verify proper operation of stage 1 heat.

B. Repeat step A for all stages of the equipment to insure proper HVAC operation.

FAULT–HVAC stages will not activate:

Check HVAC equipment fuses, fuse holders, filters and wiring.

Provide necessary service to HVAC equipment.

STEP 5. VERIFY OPERATION OF W973 LOGIC PANEL.

NOTE: H205 and T675 should be jumpered to allow economizer operation during this step.

CAUTION

Do not connect terminal 2 to terminal 1 or any other terminals except those specified in this procedure.

A. Simulate a call for full cooling by jumpering terminals 2 and 4 (which are adjacent) on the W973 panel and verify that all cooling stages are activated and economizer drives full open.[a]

B. Simulate a call for full heating by jumpering terminals 2 and 5 on the W973 panel and verify that all heating stages are activated.

FAULT: W973 stages will not activate, economizer will not activate.

Follow W973 panel checkout with an S963D Simulator as described on page 15.

IMPORTANT

Remove all jumpers and overrides after system checkout is completed.

[a]The economizer is still influenced by the low limit inherent in the system. If discharge air is below 62 F [17 C], the economizer will begin to modulate closed and will be fully closed at 50 F [10 C]. In this case, the regular economizer checkout procedure on page 16 is recommended.

SUGGESTED SETTINGS

Field adjustable settings in the W973 system include:

1. Space temperature.
2. Outdoor air changeover.
3. Compressor lockout.
4. Heating setback.
5. Cooling setup/shutdown.
6. Morning warmup.
7. Minimum position potentiometer.

SPACE TEMPERATURE

Desired space temperature is set on the T7067 dual set point thermostat. Heating and cooling set point levers are independently adjustable. Minimum deadband between heating and cooling is 3 F [1.7 C]. The further apart the heating and cooling levers are set, the less energy will be required to heat and cool the building.

OUTDOOR AIR CHANGEOVER

The outdoor air changeover controller limits the economizer to the minimum position when temperature or enthalpy is above controller set point. An H205 Enthalpy Controller, T675A or L6018C Temperature Controller provides outdoor air changeover. Recommended setting if changeover is provided by the T675A or L6018C is 70 F [21 C]. If H205 is used, set controller to "A" setting for maximum economy.

COMPRESSOR AMBIENT LOCKOUT

Compressor ambient lockout is used to lock out mechanical cooling when the economizer can handle the full load. It reduces unnecessary compressor operation and extends equipment life, thus increasing air conditioning economy. Use a T675A or L6018C Temperature Controller for compressor lockout. Recommended set point is 55 F [13 C].

HEATING SETBACK

Heating setback lowers the heating temperature control point when the building is unoccupied to minimize equipment operating time and save energy. The W974 Setback Module can be set to control 4, 8, 12, or 15 F [2.8, 4.4, 6.7, or 8.3 C] below the occupied setting. See W974 specification sheet.

COOLING SETUP/SHUTDOWN

Cooling setup/shutdown can be set to raise or lockout the cooling temperature control point when the building is unoccupied. W974 models that include cooling setup can be set to control 4, 8, or 12 F [2.8, 4.4, or 6.7 C] above the occupied setting or completely lockout cooling. See W974 specification sheet.

MORNING WARM-UP

Morning warm-up is used with heating setback to provide additional energy savings. It allows the heating equipment to raise the space temperature to the occupied setting as quickly as possible with minimum use of fuel. When the system shifts from the unoccupied to the occupied cycle, the economizer motor would normally move to minimum position to admit outdoor air. The addition of outdoor air during the warm-up period slows the process and uses extra fuel. In the W973 system, morning warmup is provided by a T675A thermostat mounted in the return air and set about 5 F [2.8 C] below desired space temperature.

MINIMUM POSITION POTENTIOMETER

The minimum position potentiometer keeps the outdoor air damper from closing completely during the occupied cycle to provide ventilation air. To adjust the minimum position potentiometer, disconnect the lead to terminal 4 on the W973; the economizer motor will run to the minimum position. Adjust the potentiometer to provide 10 percent outdoor air, or the amount required by local codes. See also Energy Management Demand-Oriented Control System with Integrated Economizer Specifications section. After the minimum position has been set, reconnect the lead to terminal 4.

ENERGY MANAGEMENT DEMAND-ORIENTED CONTROL SYSTEM WITH INTEGRATED ECONOMIZER SPECIFICATIONS

1. Each air conditioning unit shall include an energy management control system consisting of the following basic controls.
   a. W973 Logic Panel.
   b. T7067 Space Thermostat.
   c. M955 Damper Motor or equivalent. See page 4.
   d. H205 Enthalpy Changeover Controller.

2. The control system shall operate a Honeywell D640 or equivalent low leakage damper (leakage not to exceed 3 percent). The dampers shall be linked so that the outdoor damper closes tightly when the return damper is full open. The return air damper shall close tightly when the outdoor air damper is open. The outdoor damper shall open 45 to 50 angular degrees as the M955 operates through full stroke (open). See Fig. 18.

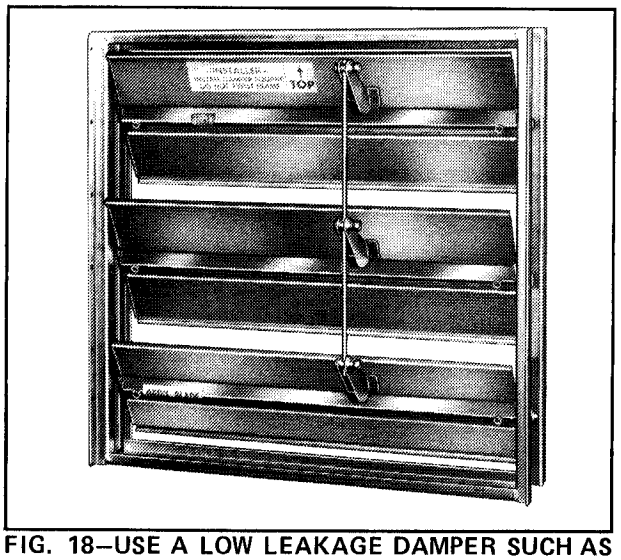


FIG. 18–USE A LOW LEAKAGE DAMPER SUCH AS THE D640 WITH LEAKAGE NOT EXCEEDING 3 PERCENT.

3. The minimum position of the outdoor air dampers shall be adjusted to allow the minimum amount of fresh air required by local codes to enter the building. (Use the procedure outlined below to make the adjustment.) Refer to Fig. 19.

NOTE: This adjustment can be made only when there is at least 10 F or 6 C temperature difference between outdoor air and return air. The following sample calculation is made using Fahrenheit temperature only.

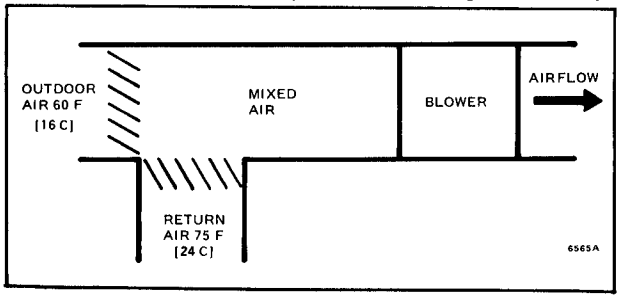


FIG. 19–ADJUST MINIMUM POSITION OF THE OUTDOOR AIR DAMPER.

EXAMPLE: Assume local codes require 10 percent outdoor air during occupied conditions, outdoor air is 60 F and return air is 75 F. Under these conditions, what is the temperature of the mixed air when 10 percent outdoor air is allowed to enter the building?

10 percent Outdoor Air (OA) = .1 x 60 F (OA temp)	= 6.0 F
90 percent Return Air (RA) = .9 x 75 F (RA temp)	= 67.5 F
	73.5 F

Mixed air will be 73.5 F when OD air is 60 F and RA 75 F with 10 percent outdoor air entering the building.

Adjust the minimum position potentiometer until the mixed air temperature, as calculated above (73.5 F), is reached. Care must be taken to insure thermometer is sensing air that is well mixed.

NOTE: Use a quality thermometer, capable of reading to 0.5 F [0.25 C].

4. With the outdoor air damper full open, the blower and/or fans shall be capable of bringing in 100 percent outdoor air. A powered exhaust system or barometric dampers may be necessary to relieve positive air pressure in the building.

5. The economizer must contain an H205 Enthalpy Changeover Control to sense temperature and humidity of outdoor air. The H205 shall be set between the "A" and "B" set points. See Fig. 20.

6. Outdoor air conditions permitting, the economizer shall provide the first stage of cooling. Mechanical cooling shall operate only if outside air cannot meet the cooling demand of the space.

7. The air conditioning unit shall be equipped with an S6005 Timer and W974 Setback Module to provide a selectable amount of heating setback and cooling shutdown, or a selectable amount of cooling setup. The fan shall operate only with the heating and cooling equipment.

8. A T675A Morning Warmup Thermostat shall be used to keep the outdoor air dampers closed during the warmup period following heating setback.

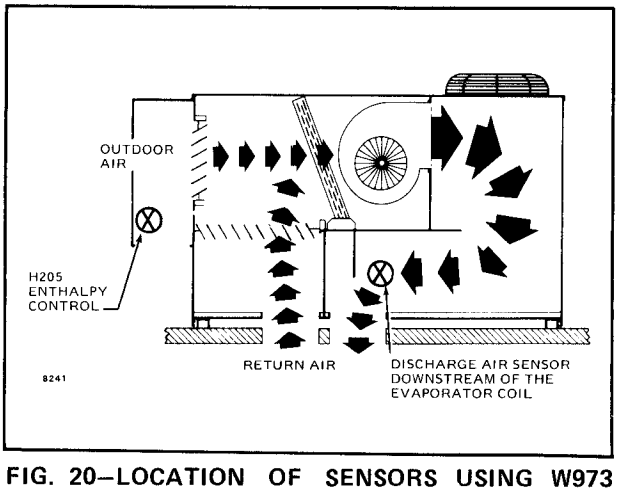


FIG. 20–LOCATION OF SENSORS USING W973 SYSTEM.

Dear Customer,

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