

## VII - SCHEMATIC WIRING DIAGRAM OPERATING SEQUENCE

Each of the following steps within this section are labeled in the corresponding diagram.

The breakdown of operation is as follows:

### SINGLE PHASE LOW SPEED

- A - 24 Volt Control Circuit (Figure 13)
- B - Compressor Starting Circuit (Figure 14)
- C - Compressor Run Circuit (Figure 15)
- D - Current Limiting Device Function (Figure 16)

### SINGLE PHASE HIGH SPEED

- A - 24 Volt Control Circuit (Figure 17)
- B - Compressor Starting Circuit (Figure 18)
- C - Compressor Run Circuit (Figure 19)

### THREE PHASE OPERATION

- A - Compressor Circuit - Low Speed (Figure 20)
- B - Compressor Circuit - High Speed (Figure 21)

### ACCESSORY SEQUENCE

- A - Latent Load Discriminator Kit (Figure 22)

### SINGLE PHASE LOW SPEED

#### A - 24 Volt Control Circuit (Figure 13)

- 1 - Thermostat demand on first stage (Y1) energizes K1 control relay No. 1 thru K7-2 N.C. time delay relay contacts.
- 2 - Thru:

- Protection Module N.C. Circuit - P2 to K1
- S1 - High Pressure Switch
- S2 - Low Pressure Switch
- K2-1 - Control Rly No. 2 N.C. Contacts
- K5-2 - High spd Contactor N.C. Auxiliary Contacts
- K1-1 - Control Rly No. 1 N.O. Contacts (Now Closed)

The fan motor relay K3 is energized. Also thru the compressor interlock and K2-2 N.C. Control relay No. 2 contacts, K4 low speed compressor contactor is energized.

If there is any power interruption to the compressor interlock, it will lockout the compressor contactor K4 for a nominal 71 seconds to prevent fast cycling.

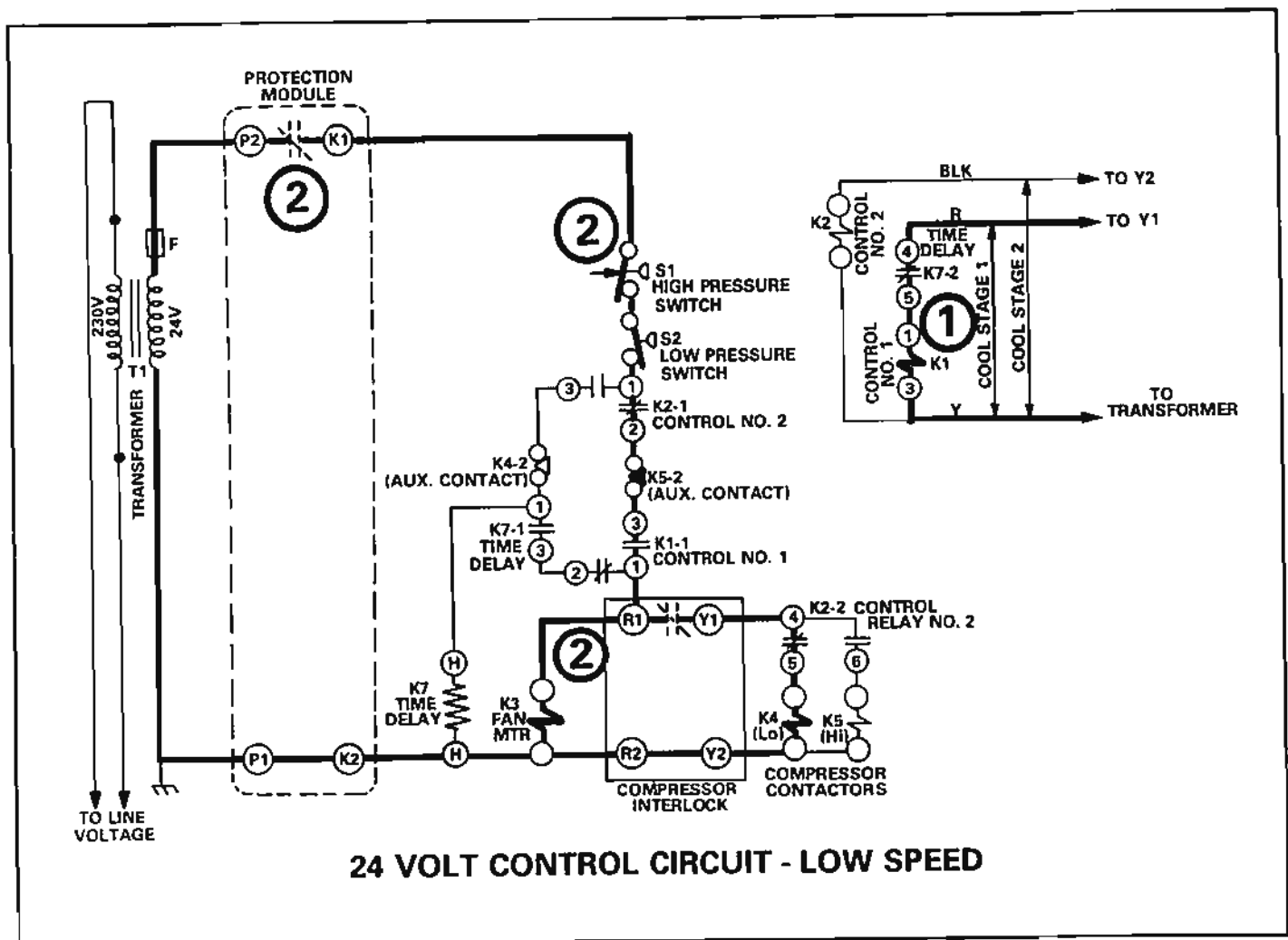


FIGURE 13

**B - Compressor Starting Circuit (Figure 14)**

1 - To energize the start windings with the proper torque the start and run capacitors are in parallel for maximum capacitance value.

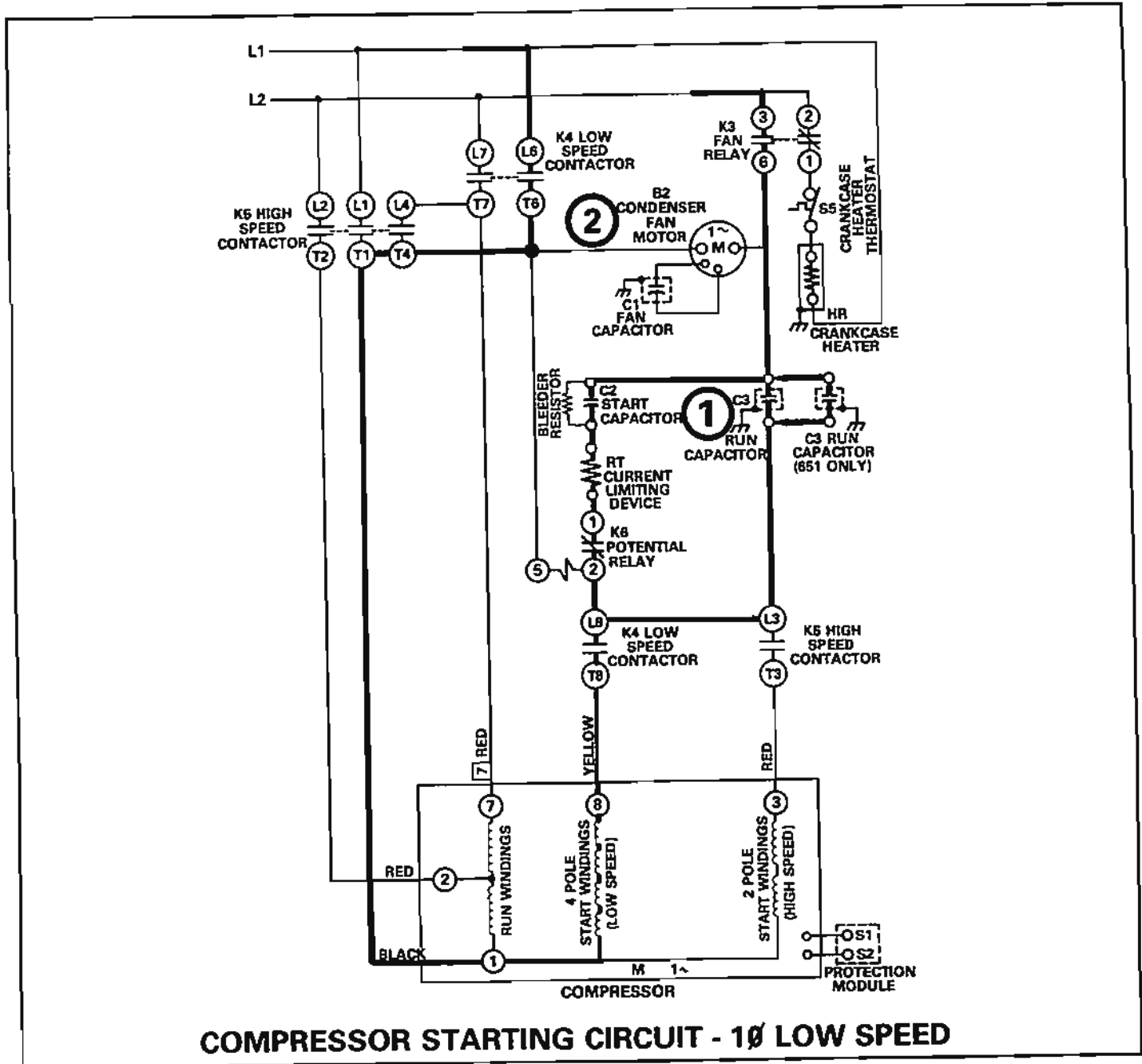
- L2 Thru:
- K3 - Fan Relay N.O. Contacts
  - C2 - Start Capacitor
  - C3 - Run Capacitor(s)
  - RT - Current Limiting Device
  - K6 - Potential Relay N.C. Contacts
  - K4 - Low Speed Contactor L8-T8 Contacts

The low speed start windings are energized at terminal 8.

The start winding connects to common terminal 1 and

completes the circuit to L1 thru K4 low speed contactor L6-T6 contacts.

2 - The fan motor is also energized thru K3 fan relay contacts when K4 compressor contactor contacts close.



**COMPRESSOR STARTING CIRCUIT - 1Ø LOW SPEED**

**FIGURE 14**

**C - Compressor Run Circuit (Figure 15)**

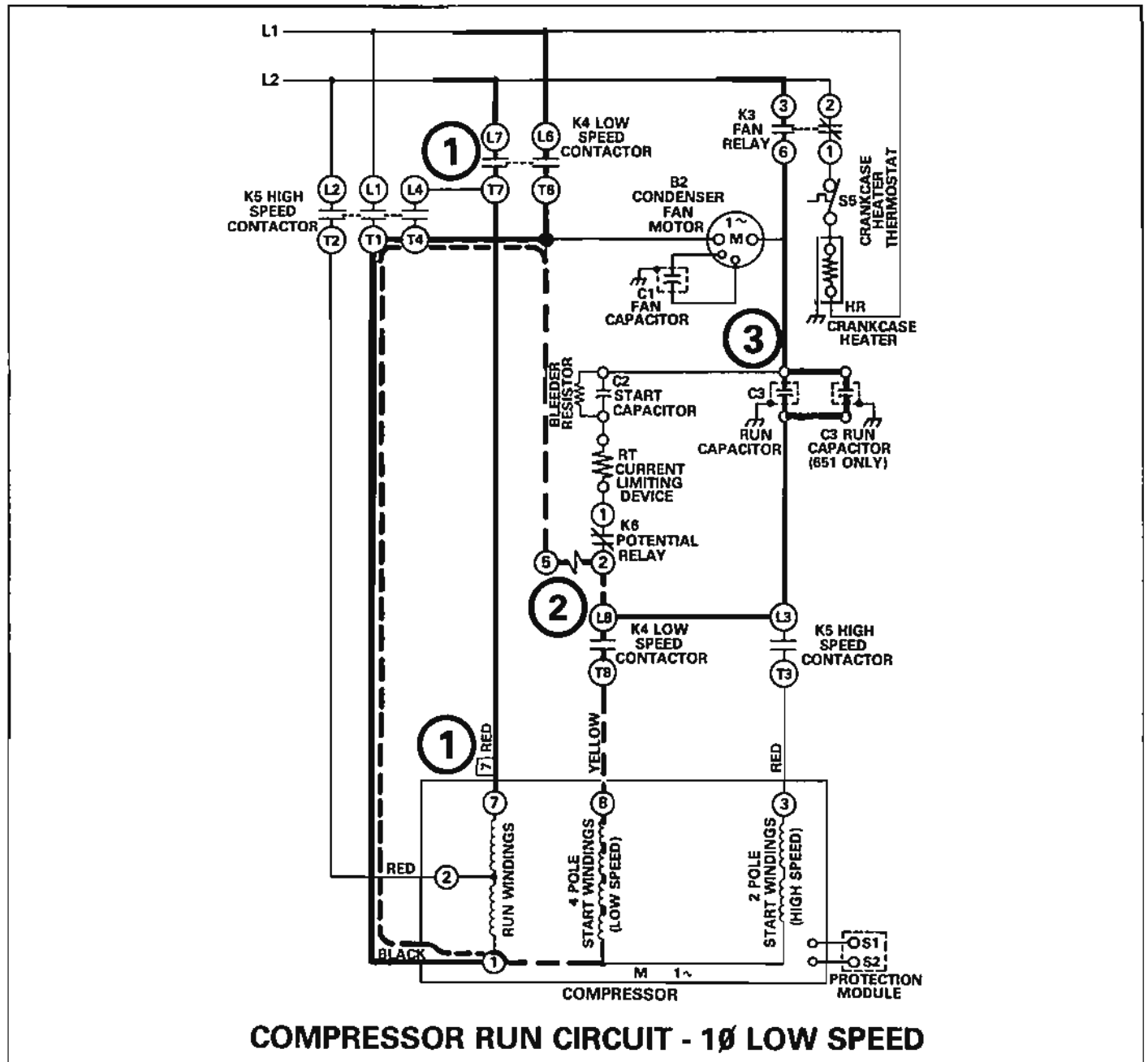
- 1 - At the same time the start windings are energized the compressor run windings (in series) are powered thru K4 low speed contactor (contacts L6-T6 & L7-T7).
- 2 - As the compressor comes up to speed K6 potential relay coil is energized by the voltage from the motor windings thru K4 contacts L8-T8. This voltage will usually be in the range or above the pickup voltage of the potential relay. It varies with each compressor.

K6-N.C. contacts open taking the start capacitor out of the circuit.

- 3 - The run capacitor(s) remain connected to the start windings thru K3 fan relay and K4 contacts L8-T8. The run capacitors create the proper amount of voltage phase shift to improve the power factor and increase torque.

Note - If the run capacitor(s) fail the compressor may not start and if it does it will run with a very poor power factor creating high electric bills. The run capacitor(s) provide 2 functions:

- 1 - Increasing starting capacitance when in parallel with start capacitor.
- 2 - Improving power factor and torque characteristics during run.



**FIGURE 15**

### D - Current Limiting Device Function (Figure 16)

The current limiting device (RT) is a NTC thermistor (increase in temperature equals decrease in resistance).

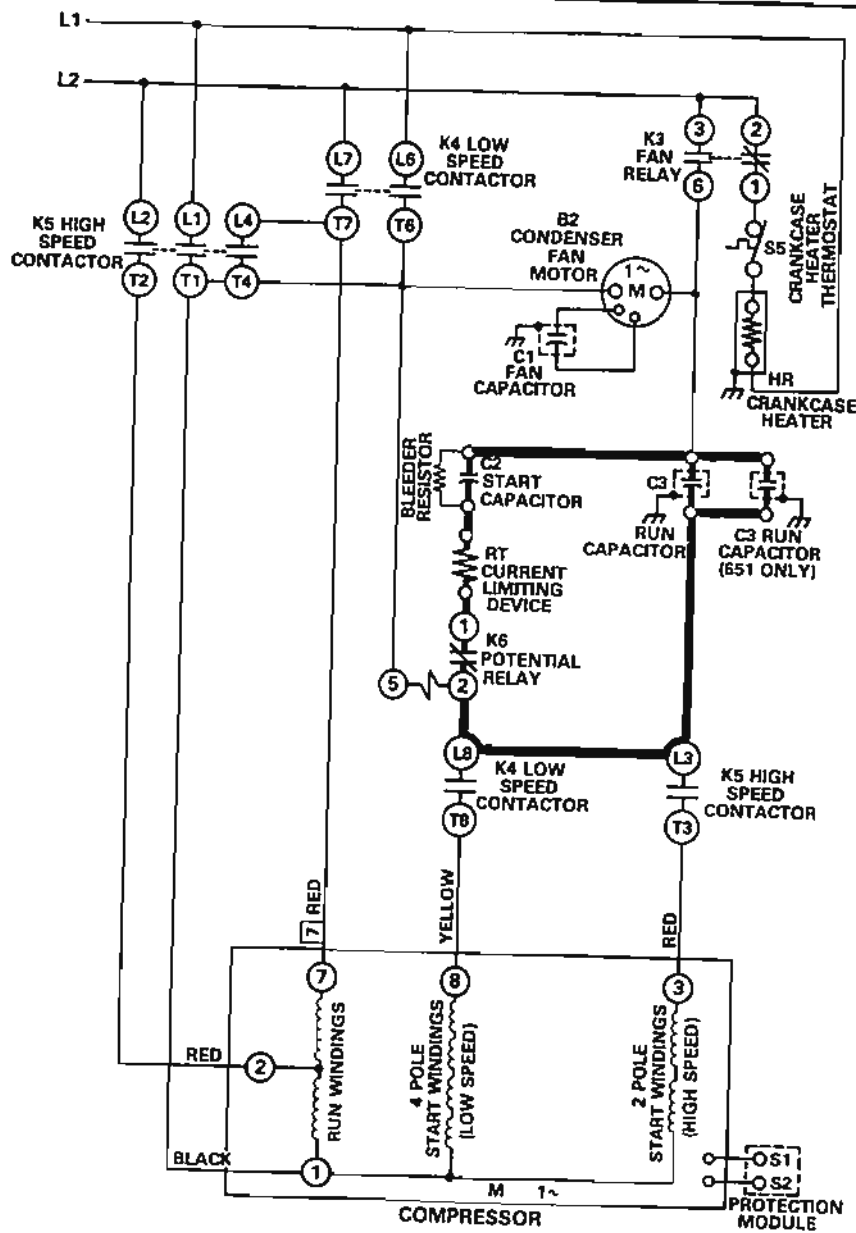
It is used in the compressor starting circuit in series between the potential relay contacts and the start capacitor.

- 1 - As the compressor is started RT heats fast lowering its resistance due to the high initial starting current.
- 2 - When the compressor is up to speed, K6 potential relay contacts open breaking the circuit to RT (& the start capacitor). RT cools down during the compressor run cycle - increasing its resistance again. The start capacitor is discharged by the bleeder resistor across it.

3 - When the compressor is cycled off and K4 contactor opens, the potential relay K6 drops out immediately. This is when RT provides its function.

4 - When the potential relay contacts close, RT is in series with the contacts, start capacitor and the fully charged run capacitor(s). The resistance of RT absorbs the current surge created as the run capacitor(s) are discharged, dissipating it as heat.

This protects the potential relay contacts from welding when they close and discharge the run capacitor(s).



**CURRENT LIMITING DEVICE FUNCTION**

**FIGURE 16**

# SINGLE PHASE HIGH SPEED

## A - 24 Volt Control Circuit (Figure 17)

- 1 - Thermostat demand on second stage (Y2) energizes K2 control relay No. 2.
- 2 - Thru:
  - Protection Module N.C. Circuit - P2 to K1
  - S1 - High Pressure Switch
  - S2 - Low Pressure Switch
  - K2-1 - Control Rly No. 2 N.O. Contacts
  - K4-2 - Low Spd Contactor N.C. Contacts (Now Closed)
  - K7 time delay is energized.
- 3 - After a delay of 20 to 40 seconds, K7-2 N.C. time delay contacts open to de-energize K1 control relay No. 1.
- 4 - At the same time K7-1 contacts close to energize K3 fan motor relay. Also thru the compressor interlock and K2-2 control relay No. 2 N.O. contacts - K5 high speed compressor contactor is energized.

Any power interruption to the compressor interlock will lockout the compressor contactor K5 for a nominal 71 seconds to prevent fast cycling.

**IMPORTANT** - The K7 time delay and compressor interlock give the following timing sequences:

- INITIAL DEMAND FIRST STAGE - No delay.
- INITIAL DEMAND SECOND STAGE - There is a 20 to 40 second (time on) delay thru K7 providing over nominal 71 seconds (interlock timing) have expired from end of last cycle.
- CHANGING FROM FIRST TO SECOND STAGE - There is a 20 to 40 second (time on) delay at K7 plus 30 to 50 second remainder at compressor interlock. Compressor and fan will stop. (Fan only starts at end of K7 timing.)
- CHANGING FROM SECOND TO FIRST STAGE - There is a 30 to 50 second (time off) delay at K7 plus 20 to 40 second remainder at compressor interlock. Compressor and fan will stop. (Fan only starts at end of K7 timing.)

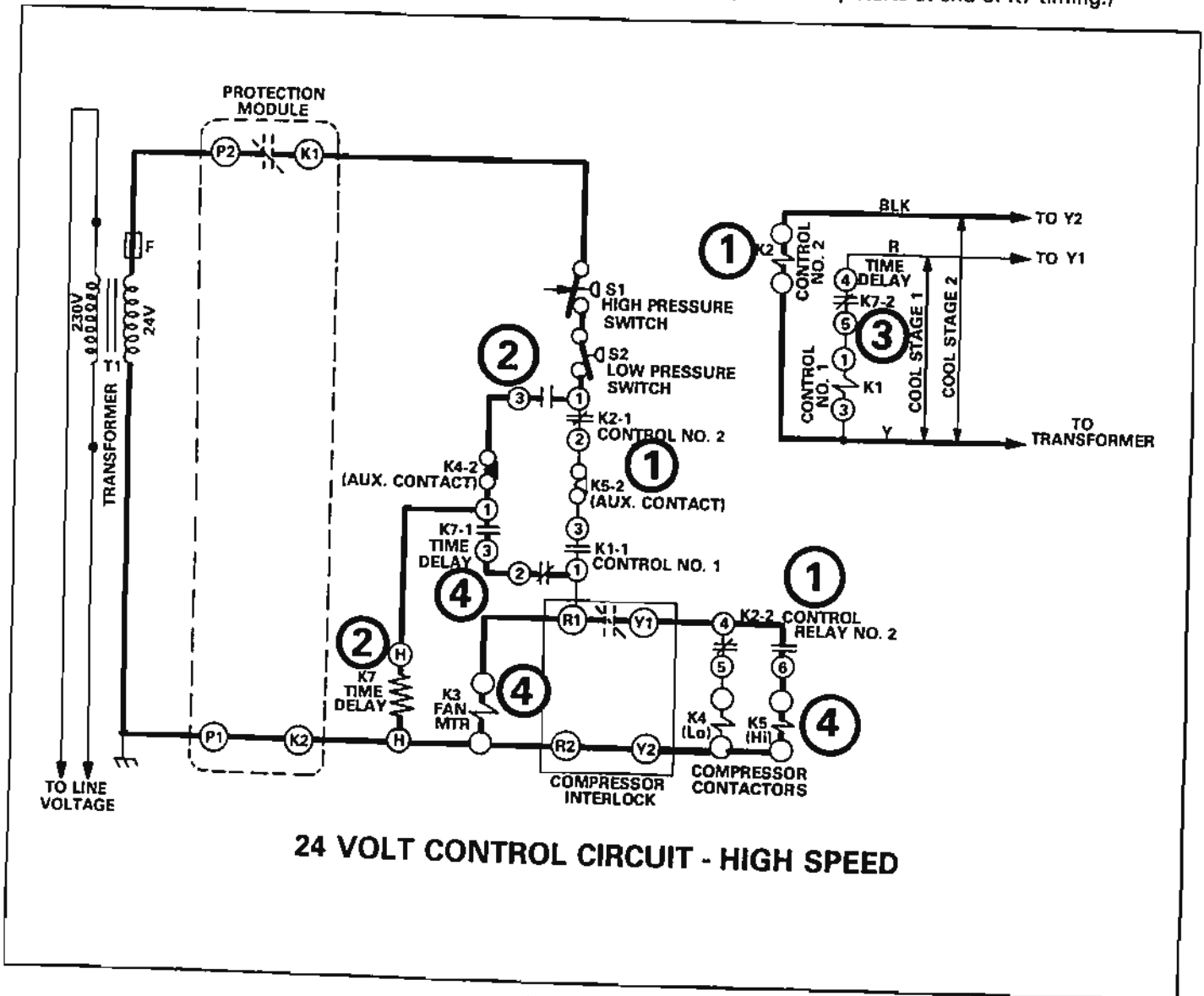


FIGURE 17





### THREE PHASE OPERATION

The 3 $\phi$  low voltage circuits operate the same as the 1 $\phi$  low voltage circuits. (Refer to figures 13 & 17)

No starting components or run capacitors are required on 3 $\phi$  motors.

### A - Compressor Circuit - Low Speed (Figure 20)

- 1 - K4-1 low speed compressor contactor and K3-2 fan relay are energized by low voltage circuit.
- 2 - Fan is energized, crankcase heater is de-energized by K3-2 fan relay contacts.
- 3 - Compressor terminals 1, 2 & 3 energized thru K4-1 contacts L6-T6, L7-T7, L8-T8 to form a series Y connection to the motor windings for low speed.

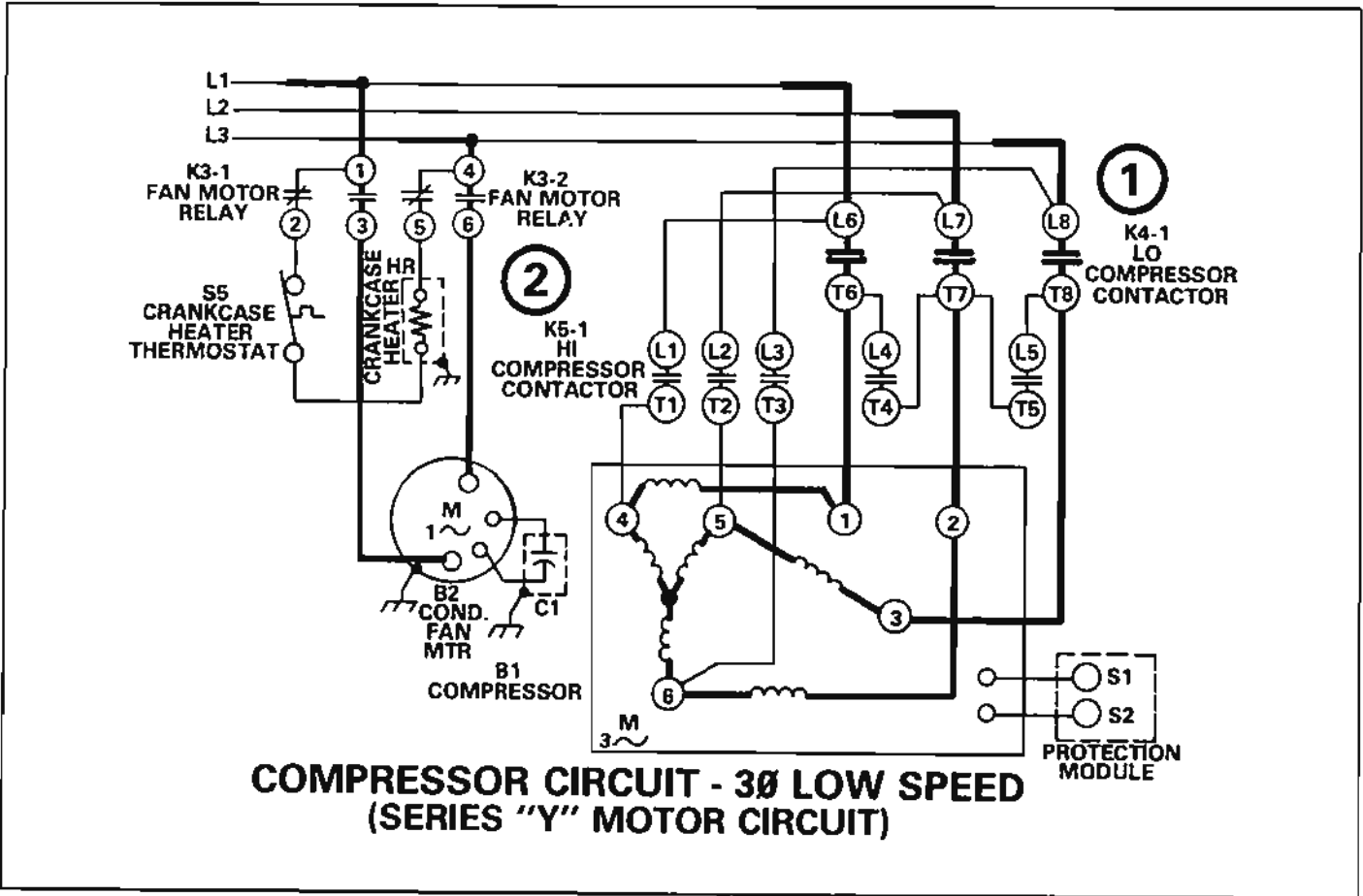


FIGURE 20

**B - Compressor Circuit - High Speed (Figure 21)**

- 1 - K5-1 high speed compressor contactor and K3-2 fan relay are energized by low voltage circuit.
- 2 - Fan is energized, crankcase heater is de-energized by K3-2 fan relay contacts.
- 3 - Compressor terminals 4, 5, & 6 are energized thru K5-1 contacts L1-T1, L2-T2 & L3-T3. And compressor winding terminals 1, 2 & 3 are connected together by K5-1 contacts L4-T4 & L5-T5 to complete the parallel Y connection to the motor for high speed.

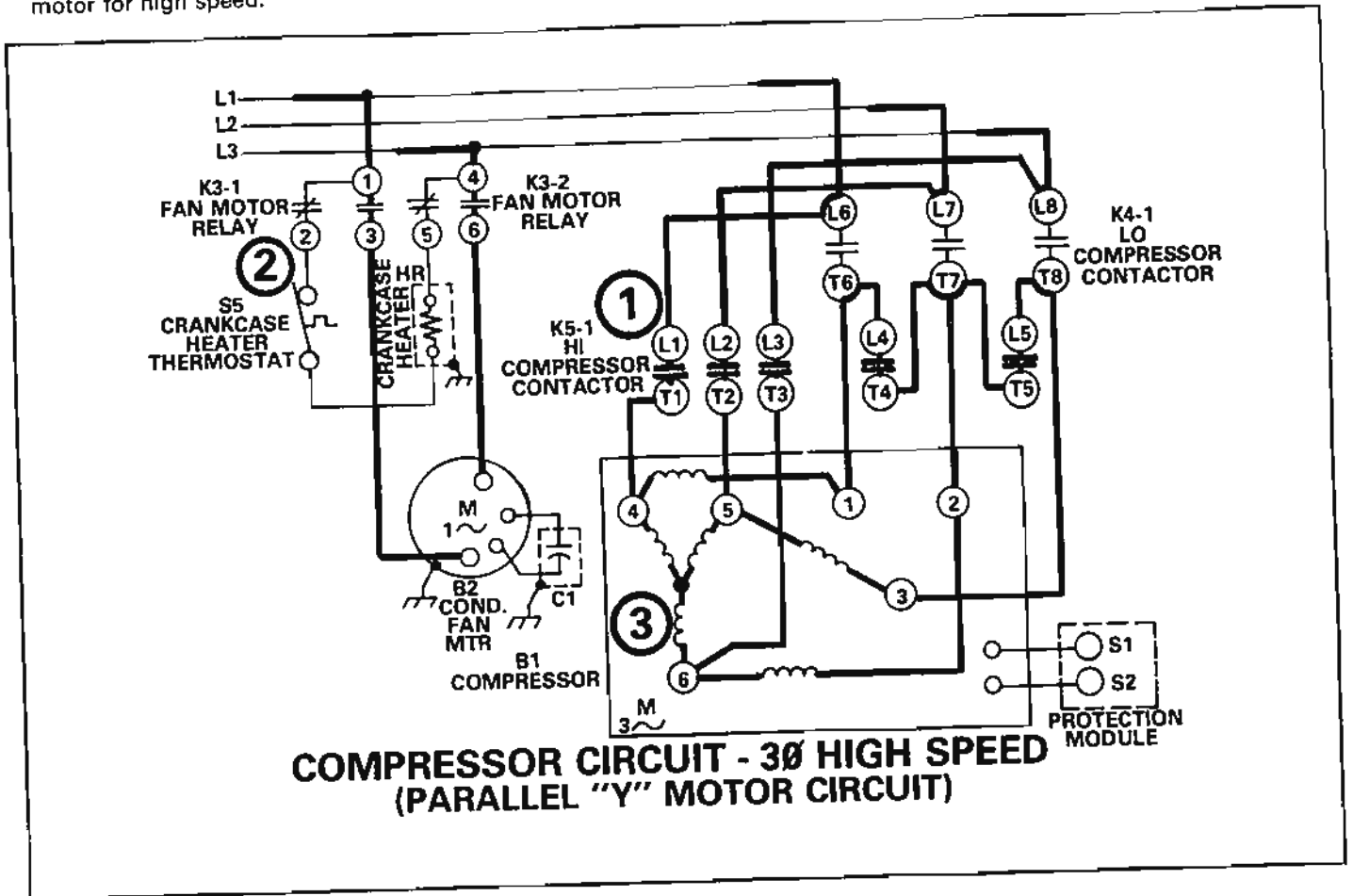


FIGURE 21

## ACCESSORY SEQUENCE

### A - Latent Load Discriminator Kit (Optional) (Figure 22)

The latent load kit functions during low speed compressor operation to lower the indoor blower motor speed for increased dehumidification when needed.

- 1 - Blower operation during cooling or continuous operation is thru the blower relay N.O. contacts and latent load relay N.C. contacts to the high speed tap.
- 2 - During first stage cooling (Y1 terminal powered at thermostat) the latent load relay coil is energized by the dehumidistat thru the high speed relay N.C. contacts, if the

humidity rises sufficiently.

The latent load relay N.C. contacts open de-energizing high blower speed & the N.O. contacts close energizing low speed.

- 3 - During second stage cooling (Y2 terminal powered at thermostat) the high speed relay coil is also energized. The high speed relay N.C. contacts open preventing the latent load relay from operating - the blower runs on high speed only.

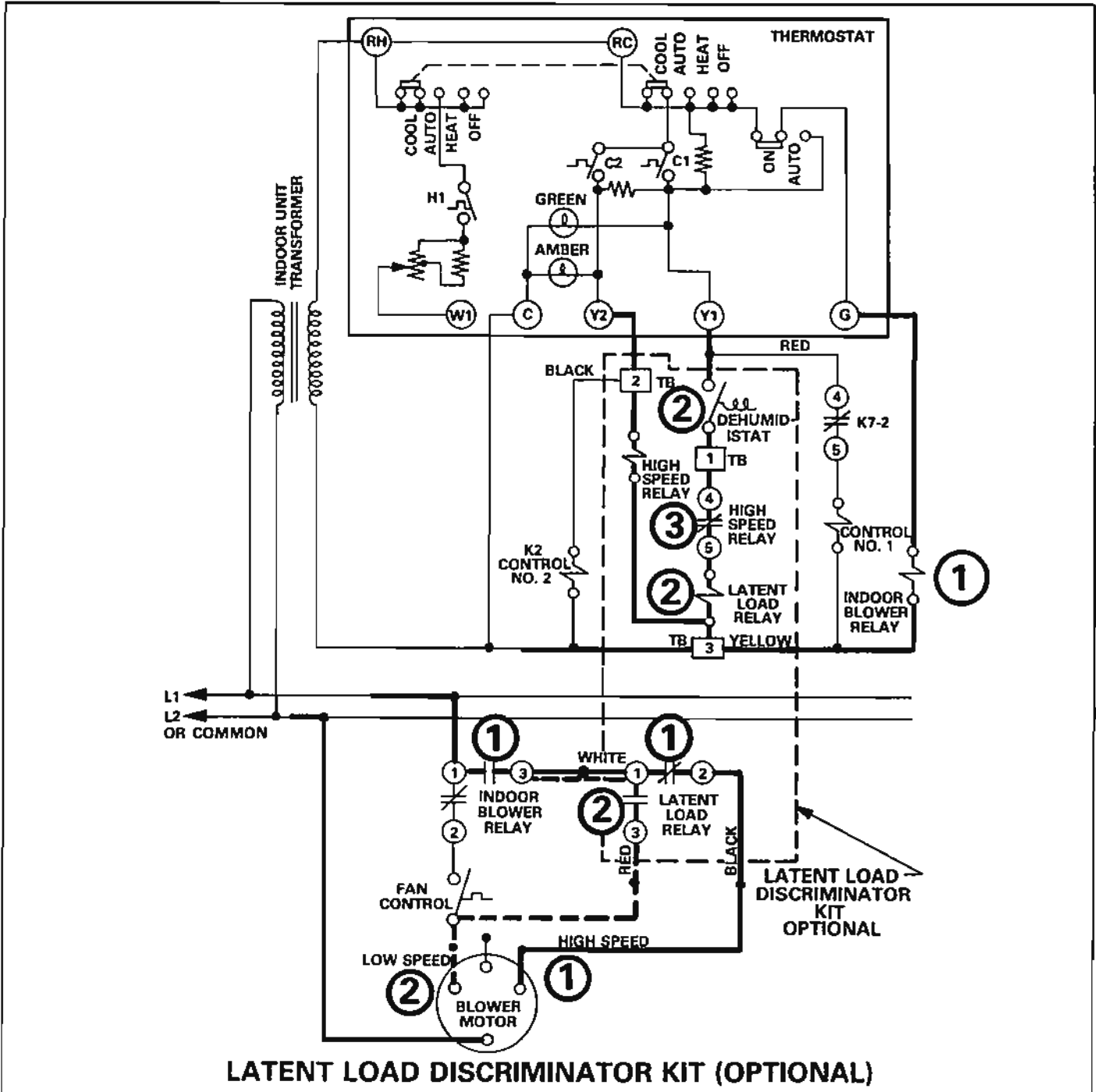


FIGURE 22