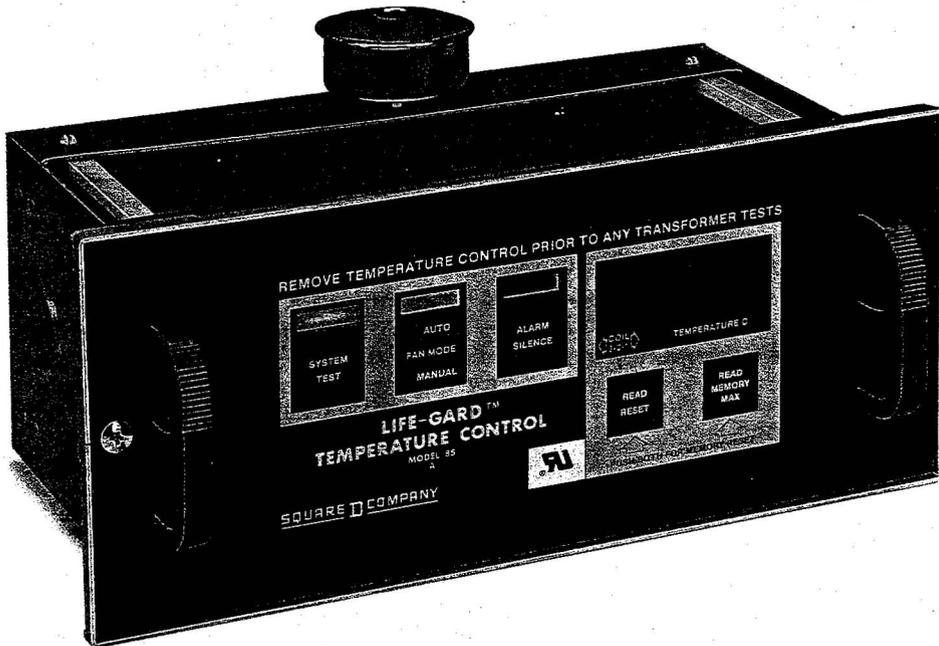


# MODEL 85A

FAN CONTROL SYSTEM



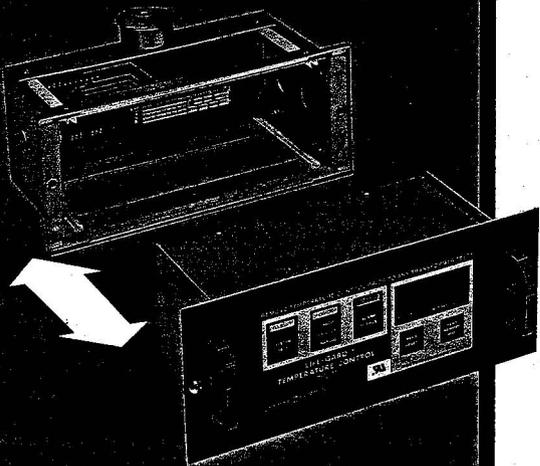
*Keeps Transformers  
Running Cooler.  
Adds 33 1/3%  
Reserve Capacity.*



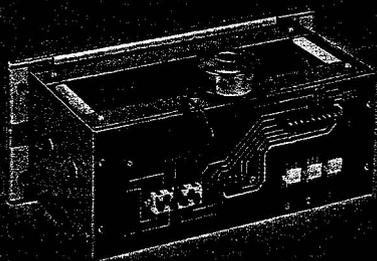
**SQUARE D COMPANY**  
*Dedicated to Growth • Committed to Quality*

# MODEL 85A

## Fan Control System



Drawout design permits inspection of control unit without exposure to high voltages.



Easily discernible circuit board connection on rear of control housing.

The Square D Model 85A "LIFE-GARD®" Fan Control System is state-of-the-art instrumentation that protects the transformer and adds up to 33-1/3% reserve capacity.

This system provides precision control through the use of three high accuracy thermistor type temperature sensors, one installed in an air duct of each phase coil of a transformer.

Internal coil temperatures are transmitted by these sensors to a microprocessor which is programmed to provide a digital display of temperature in degrees Celsius and the corresponding coil number.

### Digital Display

The digital LED display range is from 24°C to 255°C in 1°C increments. Characters are 0.56" high and clearly legible under all lighting conditions.

The Model 85A provides a choice of either:

- A. Continuous scanning of the three sensors with a three second display period for each coil temperature and corresponding coil number.
- B. Digital display of the temperature and number of the hottest coil only.

For each display mode, two additional options are available:

1. Continuous temperature display.
2. Display only when the "Read/Reset" or the "Read Memory Max" switch panels are pressed.

For all display modes, the highest temperature reached by any coil in any previous interval will be displayed for three seconds when the "Read Memory Max" switch panel is pressed. This temperature will be cancelled and replaced by the immediate maximum temperature when both "Read/Reset" and "Read Memory Max" switch panels are pressed simultaneously. Thereafter, any succeeding higher temperature will be retained in memory for later recall.

### Control Mode Light Panels

Three LED panels are provided to indicate control mode conditions. When the green panel is lighted, it indicates that the control module is energized. Similarly, the lighted yellow panel indicates that the fan circuit is energized. A lighted red panel indicates that one or more coils are above normal temperature and the alarm horn will sound.

If a temperature of 220°C\*\* is detected by one of the sensors, the control will initiate the emergency shutdown mode. Permanent insulation damage will occur above this maximum insulation system temperature. At this

point, the Red LED panel flashes and three dashes replace the temperature numbers.

Actual shutdown or other function can be accomplished by means of an optional, accessory relay.

### Fan Mode Control and Indicators

Selection of two modes of fan operation is provided by the "Fan Mode" switch panel. When this switch panel is depressed, the fan mode may be changed from manual to auto or vice versa. In the auto mode, the fans are turned on and off automatically at specified programmed temperature set points. In the manual mode, the fans operate continuously, totally independent of all temperature set points. The selected fan mode is indicated by one of the LEDs in the "Fan Mode" switch panel.

### Reference: ANSI Standard C57.12.51

Rated Average Transformer Temperature Rise*	Switch Set Points					Emergency Shutdown Cast Resin Transformers
	Fans On	Fans Off	Alarm On	Alarm Off	Emergency Shutdown	
80°C	110°C	100°C	125°C	123°C	220°C	185°C
115°C	145°C	135°C	160°C	158°C	220°C	185°C
150°C	180°C	170°C	195°C	193°C	220°C	—

\*Based on NEMA and ANSI Standards of 30°C average and 40°C maximum ambient for any 24 hour period below 3300 ft. altitude.

NOTE: The digital temperature displayed is always the TOTAL temperature of AMBIENT + HOT SPOT temperatures, not the AVERAGE temperature rise. (Example: A transformer is rated 150°C average temperature rise when carrying rated full load in a 20°C ambient temperature. The thermistor sensors are installed near the theoretical hot spot of the coils. NEMA and ANSI standards permit a 30°C maximum differential between average and hot spot temperatures. Therefore the digital display would indicate approximately 20°C + 30°C + 150°C = 200°C total. Note that the alarm would operate at this point providing ample warning that the transformer is approaching the maximum temperature limit of the insulation system.)

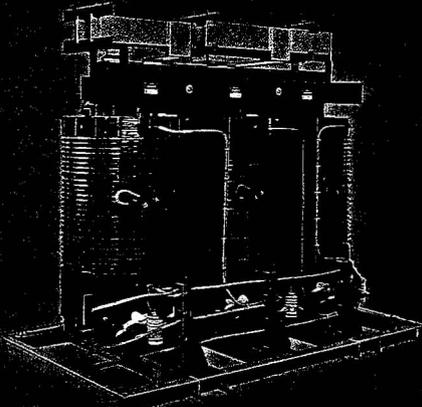
### High Temperature Alarm

If the operating temperature of the transformer coils increases to the programmed "alarm" set point, the red LED indicator and the alarm horn are activated, thus warning that the maximum designed temperature rise

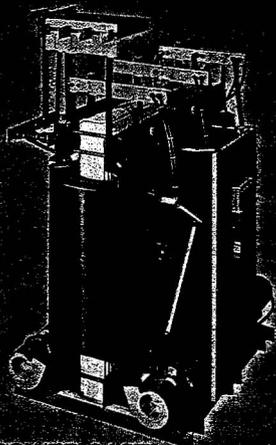


\*\*185°C for Cast Resin Transformers  
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# TYPICAL INSTALLATIONS



Cast Resin Insulated Transformers



POWER-CAST  
Solid Cast  
Transformers

has occurred (80°C, 115°C or 150°C). This temperature is within the maximum temperature rating of the insulation system, and the transformer may continue to operate. The alarm horn may be silenced by briefly depressing the "Alarm Silence" switch panel. The red LED panel, however, will remain lighted until the transformer temperature decreases to the programmed "Alarm Off" set point. The LED panel is then de-energized and the silencer relay is automatically reset.

## Control Sequence

The Model 85A Fan Control System provides switching at three levels of transformer temperature. This switching is pre-set prior to shipment based on the maximum rating of the insulation system and the designed temperature rise of the transformer 150°C, 115°C or 80°C rise.

At the first switching level, cooling fans are automatically switched on and off at the temperature set points to maintain the winding temperature well within the design limits.

At the second level, the alarm set point temperature is reached and the alarm circuit is energized, operating a visual and audible alarm. This indicates that the transformer has reached a temperature that is not more than 5°C higher than the designed *average* winding temperature rise based on a 40°C maximum ambient.

If kept within the maximum temperature rating of the insulation system (220°C\*\*), the transformer may continue to operate.

A third level operates when the maximum temperature rating (220°C\*\*) of the insulation system is reached. This energizes the Emergency Shutdown (E.S.) circuit. This circuit can be used for a remote alarm or to automatically drop transformer load and prevent damage to the transformer insulation.

The Model 85A Fan Control System provides two sets of auxiliary Form "C" relay contacts; one set switched by the fan control circuit and one switched by the alarm control circuit. Terminals for these contacts are located on the rear panel of the control.

The output for the emergency shutdown function is 6V D.C. at 300 MA maximum to power an optional external relay. Terminals for this output are also located on the rear panel of the control.

## System Test

The Model 85A Fan Control System also incorporates a programmed system test function which is initiated when the "System Test" switch panel is depressed. Each of the various indicators and each segment of the numerical displays are tested in sequence. The upper left segments of the coil and temperature displays are not active and are not lighted during the test sequence.

During the test sequence, the fans operate briefly. The alarm horn is also tested at the end of the sequence and the Emergency Shutdown is not activated.

## Remote Indication and Control

In addition to providing control and readout functions when installed in a transformer, the Model 85A Fan Control System has the capability of providing complete readout and control at a remote location. One control module with temperature sensors is mounted in the transformer enclosure and is designated as the "Master". A second identical control without temperature probes is designated as the "Slave" for installation remote from the transformer. By means of an IEEE RS-422 two-wire communication link, the temperature may be monitored and all functions controlled at a remote location.

Similarly, an installation with multiple transformers may be monitored and controlled from a single supervisory station or by a computer.

\*\*185°C for Cast Resin Transformers  
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**MODEL 85A**  
Fan Control System

## Fail-Safe Features

The Model 85A Fan Control System is capable of determining a shorted sensor condition. It will also detect a possible open sensor. When two probes read a temperature above 25°C and one reads a temperature of 25°C or less, the latter will be determined open. When either a shorted or open sensor is identified, the temperature display will indicate three dashes (instead of numerals) with the corresponding coil number.

For systems having a Slave Model 85A Fan Control System for remote control and monitoring, failure of the Master control at the transformer will cause all coil and temperature readouts of the remote control to be dashes and the alarm LED panel will flash every 20 seconds as the remote control attempts to reset to normal communication with the Master control.

## Typical Specifications

Provide a Square D LIFE-GARD® Model 85A, solid state, Fan Control System with factory pre-set, three level switching to maintain the winding temperature within the design limits during fan-cooled operation. For three phase transformers, the system shall consist of three high-accuracy thermistor sensors installed directly in the low voltage air ducts of each transformer coil to continuously monitor the internal coil temperature. The sequence of operations shall be as follows: If the temperature rises to the normal, self-cooled (AA) rating, a relay is activated to start the fans. Should the temperature continue to rise to the next pre-set point, a second relay operates to close the circuit for an audible alarm and a red warning light. If the temperature rises to the maximum rated temperature of the insulation system, a third circuit is activated. It may be used for an emergency shutdown, or remote trouble indication.

The control module shall be a "draw-out" design permitting inspection of the control unit without exposure to high voltages.

The system control module shall have a membrane front panel with switches to provide system tests, fan mode selection and alarm silencing. Function indicators shall be LED bars; Green for "Power On", Amber for "Fans On" and Red for "High Temperature".

The "System Test" switch shall initiate a test sequence which will allow verification that all control functions and numeric read-out segments are operational.

The "Fan Mode" switch, with built-in LED mode indicators, shall provide selection of manual or automatic fan control modes.

The "Alarm Silence" switch shall silence the sonic alarm, but allow the Red LED bar to remain "On" until the temperature decreases to normal.

The system control module shall provide a digital read-out of transformer coil temperature and numeric coil identification.

The system control module shall have a memory mode for retention of the maximum attained temperature during any prior interval with recall to occur when the "Read Memory Max" switch is pressed.

Minimum numeral height shall be 0.5 inch.

The system control module shall be capable of functioning at the transformer (Master Control) or at a remote location (Slave Control), using an RS-422 communication link to provide full control and read-out at both locations.

The system control module shall provide Fail-Safe indication of both shorted and open sensors.

Multiple cooling fans are to be installed at the bottom of each coil, front and rear, with a minimum of six for three phase and four for single phase transformers.

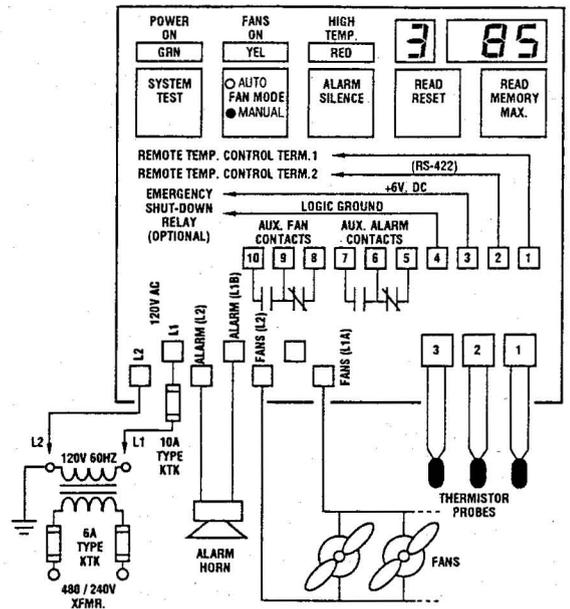
*NOTE: For voltages over 600 volts, a separate 120 volt AC source may be utilized. If none is available, a fused, high voltage transformer may be specified but this would require an additional compartment.*

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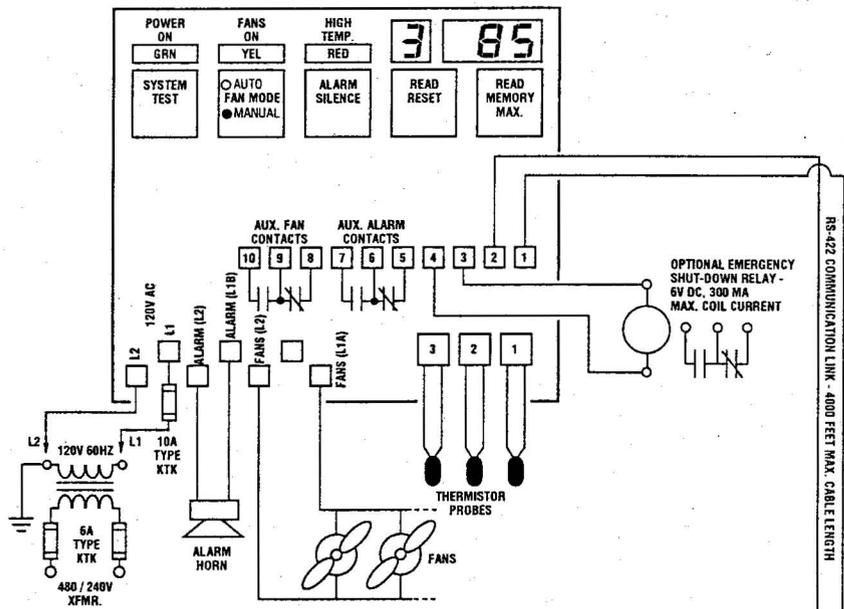
# Wiring diagrams

## Model 85A Fan Control System

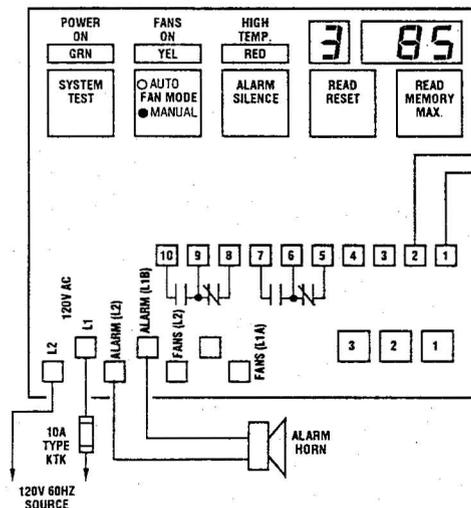
### Model 85A Master Control



### Master Control at Transformer



### Remote Control



#### NOTES:

1. Auxiliary fan and alarm contacts are rated 24 volts 3 amp. maximum.
2. Control fuse located on main circuit board. Schurter Cat. No. 034 - 1519 2A. 250V. Glass Tube Type. Remove top cover for access.

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