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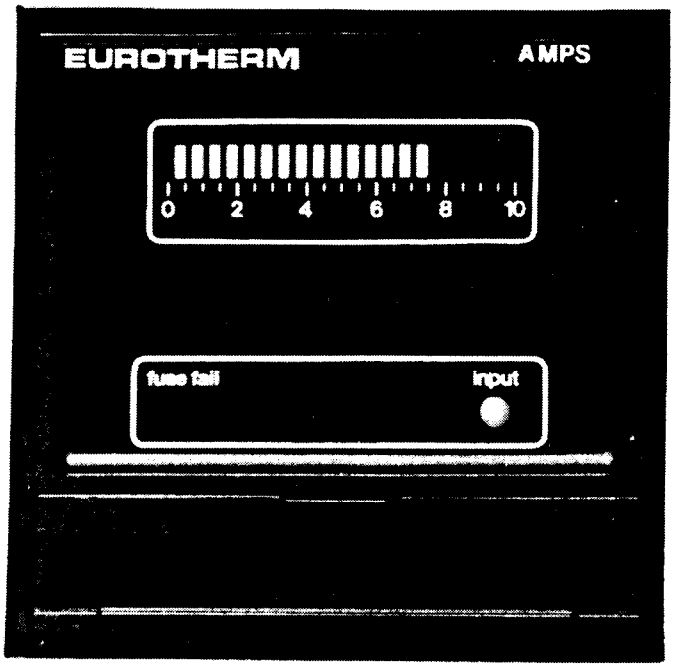
OPERATION AND MAINTENANCE MANUAL FOR



PANEL MOUNTING SCR ASSEMBLIES

MODEL 831

EUROTHERM CORPORATION
A EUROTHERM INTERNATIONAL COMPANY
11485 Sunset Hills Road ☐ Reston, Virginia 22090 ☐ Telephone: (703) 471-4870 ☐ Telex: 89-9449

CAUTION!

Before installing, operating or servicing equipment supplied by Eurotherm Corporation, please read the following:

INSTRUCTIONS FOR SAFE USE OF EUROTHERM EQUIPMENT

(Note: These instructions represent good engineering principles and are applicable to all control equipment of the same type, whether from Eurotherm or any other supplier.)

OVERCURRENT PROTECTION

It is recommended that AC power supplies to Eurotherm instruments be protected by fuses or automatic circuit breakers rated at not more than 2 Ampères.

VOLTAGE RATINGS

Care must be taken to ensure that maximum voltage ratings are not exceeded.
Unless otherwise stated in the specification of any particular unit, the maximum voltage which may be applied between any two isolated circuits, or between any isolated circuit and ground, is limited to the highest rated supply voltage for that unit.

ENCLOSURE OF LIVE PARTS

Some metal parts of certain types of Eurotherm equipment can become electrically "live" in some conditions of normal operation.
Unless clearly intended to be panel mounted and accessible during normal operation, all units should be installed inside a suitable grounded metal enclosure to prevent live parts being accessible to human hands and metal tools.
It is recommended that rear terminal covers (available as an option on most Eurotherm units) be fitted wherever possible.

WIRING

It is important to connect all equipment correctly in accordance with the installation data provided for each type of unit.
Unlabelled terminals must not be used as "tie points" for other wires (unless the installation instructions mention that this is permissible). Such unlabelled terminals may be internally connected. Any questions concerning the correct wiring of a Eurotherm unit should be directed to the nearest Eurotherm Sales and Service representative.
Most connections to Eurotherm equipment require correct polarity to be maintained, and due attention must be given to ensure this.
Wiring should conform to appropriate standards of good practice and local codes and regulations. Conductors should be commensurate with voltage and current ratings of the units.

OUT-OF-LIMITS ALARMS

In applications where excessive deviation of a controlled parameter due to equipment failure could cause damage to machinery or materials, or injury to personnel, it is recommended that an additional separate unit be used to give alarm indication or to shut down the process or both, as may be appropriate. (Note: "Alarm boards" fitted inside controllers may not give sufficient protection in these circumstances). When "alarm units" or "alarm boards" are used they should be checked for correct operation and calibration at regular intervals.

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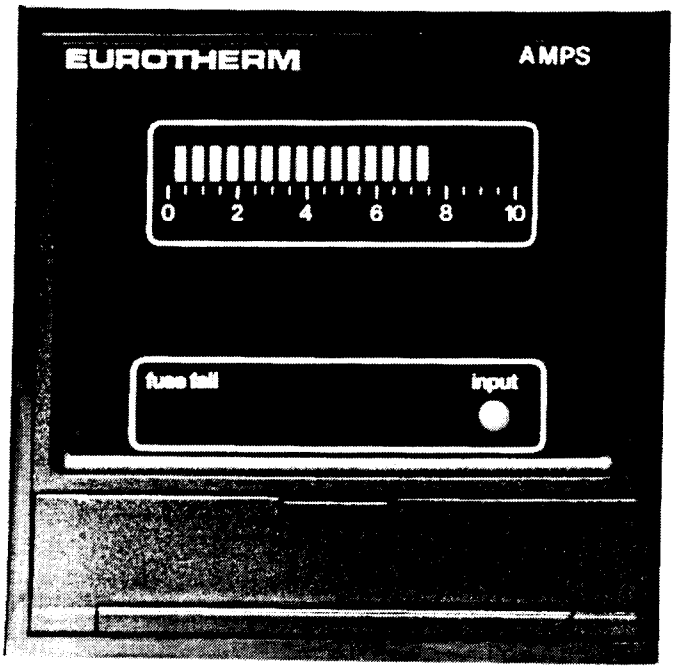


Figure 1.1
Model 831 SCR Assembly

SECTION I

GENERAL DESCRIPTION AND TECHNICAL DATA

1.1 General Description

The Model 831 is a plug-in, modular, single phase, solid state, silicon controlled rectifier (SCR) assembly designed for door or panel mounting.

The Model 831 SCR accepts a variety of input control signals. These input control signals may be either trigger pulsed signals or time proportioned signals. The trigger pulsed input control signals may be either zero crossover pulses (ZCP) or phase angle pulses (PAP). The time proportioned input control signals may be either a logic voltage signal (5-30VDC), a logic current signal (2-30mA), a logic AC voltage signal (85-135VAC), or a 4-20mA D.C. signal. There is also available a 4-20mA input control signal with an internal phase angle SCR driver circuit.

The Model 831 SCR may be triggered in either the zero crossover or phase angle mode depending upon the type of input control signal. The various input control signals for the zero crossover triggering mode include the ZCP pulses, the logic voltage, the logic current, the logic AC voltage, and the 4-20mA D.C. signals. The input control signals for the phase angle triggered mode include the PAP pulses or the 4-20mA D.C. signal with the internal SCR driver circuit. Each phase angle triggered SCR unit has as standard a front panel mounted current limit adjustment.

The Model 831 SCR has an option of a front panel mounted LED ammeter indication. The ammeter indication is a true RMS current indicating meter for SCR units being phase angle triggered or an average (mean) current indicating meter for SCR units being zero crossover triggered. The average (mean) current indicating ammeter is a heavily averaged indication of current being delivered to the load. It does not indicate the true RMS value of current being delivered to the load.

To assist in troubleshooting, the Model 831 SCR features a neon fuse fail indication, an LED indication of the presence of an input control signal, and a load test button. When depressed, the load test button allows the Model 831 SCR to deliver 100% power to the load, or 100% of limited current to the load for Model 831 SCRs with current limit.

Designed for the highest reliability, each Model 831 SCR features transient voltage dv/dt filtering, fast acting I^2t fuse protection, and a metal oxide varistor (MOV) for protection of the semiconductor device. Each unit is designed with an electrically isolated heat sink and for operation at ambient temperatures up to 60°C (10A, 20A and 30A units) or 50°C (40A units). All units are cooled by natural convection.

Each Model 831 SCR is ruggedly constructed and physically housed in its own panel mounting sleeve. The SCR unit dimensions are 3.78"W x 3.78"H x 7.87"D. The Model 831 SCR requires a 3.62 sq. inch ± 0.03 inch panel cut-out for mounting.

All electrical connections are made via the rear terminal block located on the back of the SCR unit sleeve. Labels affixed to the top of the SCR unit sleeve and to the right side of the SCR unit contain the rear terminal connecting information, the current and voltage rating, the model number, and the serial number of the SCR unit.

1.2 Technical Data

Pertinent technical data for the Model 831 SCR is listed in Table 1.1 Refer to the data bulletin located in the back of this manual for additional information.

Table 1-1 Technical Data

Data	Specifications
Operating Conditions	
Temperature	10, 20, 30 Amp Units: 0-60°C (32-140°F) 40 Amp Unit: 0-50°C (32-122°F)
Nominal Voltage Rating	120VAC/240VAC, 50/60Hz.
Minimum/Maximum Voltage Operating Limits	85VAC/265VAC, 50/60Hz.
Maximum Current Ratings	10, 20, 30, 40 Amperes
Firing Mode	Zero Crossover or Phase Angle
Inputs	Zero Crossover Firing Mode Zero Crossover SCR Pulses (ZCP)— Typical Pulse Ratings 20μsec On 200μsec Off (10% duty cycle at 5KHz) 8V to 10V pulse height. Logic Voltage Signal— Turn On Voltage: 5-30VDC Turn Off Voltage: 2VDC Logic Current Signal— Turn On Current: 2-30mA DC Turn Off Current: 0.3mA AC Voltage Signal— Turn On Voltage: 85-135VAC Turn Off Voltage: 20VAC DC Current Signal— 4-20mA for 0-100% Power Maximum voltage drop: 6VDC Phase Angle Firing Mode Phase Angle SCR Pulses (PAP)— Typical Pulse Ratings 20μsec On 200μsec Off (10% duty cycle at 5KHz) 8V to 10V pulse height. DC Current Signal— 4-20mA for 0-100% Power Maximum voltage drop: 6VDC
Fusing	Thyristor (I^2t) Fast Blow Type (See Table of recommended fuses, Table 5-2)

SECTION II

PRINCIPLES OF OPERATION

2.1 Scope

This section contains the mechanical and electrical principles of operation of the Model 831 SCR. The discussion is keyed to the mechanical assembly drawing (Figure 2-1) and to the schematics and printed circuit board layout drawings (Figures 2-2 through 2-20) of the Model 831 SCR. A brief description of the electrical operation of the SCR unit is provided below so the user may gain a better understanding of the Model 831 SCR.

2.2 Display Board

(Reference Figure 2.2 and 2.3)

The display board serves as the motherboard for the SCR unit. It provides interconnecting pins for the control board and for the phase angle sub board if fitted. Also, the display board may contain either an average (mean) current display input circuit or a true RMS current display input circuit, and the ammeter display circuit. The signal from either one of the display input circuits is used to drive the ammeter display circuit.

A. Average (Mean) Current Display Input Circuit

Current transformer T2, located on the control board, provides a 1000:1 stepdown in load current at pins 4 and 5 of connector J1. Potentiometer P1 is a variable burden resistor for the current transformer, T2. Potentiometer P1 is adjusted to produce a nominal 1.77V RMS (2.5V peak) full scale at resistor R3 for load currents of 10, 20, 30 and 40 amps. Integrated circuit (IC) U1-A with resistors R3 and R4 form a 1/2 wave rectifier with a gain of 4.1. The 2.5V peak load current signal at resistor R3 is amplified by IC U1-A to produce a 10.25V peak signal at IC U1-A Pin 1. Resistor R5 and capacitor C1 form a low pass filter with a time constant of 2.6 seconds. This low pass filter network averages the 10.25V peak load current signal at IC U1-A Pin 1 to 3.26V at IC U1-B Pin 5. IC U1-B with resistors R6 and R7 form a non-inverting amplifier with a gain of 3.06. The 3.26V load current signal at IC U1-B Pin 5 is amplifed to a nominal 10V full scale load current signal at IC U1-B Pin 7. This 10V full scale average (mean) load current signal is then fed to the ammeter display circuit.

B. True RMS Current Display Input Circuit

Current transformer T2, located on the control board, provides a 1000:1 stepdown in load current at Pins 4 and 5 of connector J1. Resistor R8 and Potentiometer P1 form an 18 Ω burden resistor for the current transformer, T2. Potentiometer P1 is adjusted to provide 178mV RMS full scale at IC U2 Pin 4 for load currents of 10, 20, 30 and 40 amps. IC U2 is a true RMS-To-DC current IC; therefore, IC U2 produces 17.8 μA at pin 10. This 17.8 μA D.C. load current signal produces 0.909VDC at IC U1-B Pin 5. IC U1-B with resistors R6 and R7 form a non-inverting amplifier with a nominal gain of 11. IC U1-B amplifies the 0.909VDC load current signal to a 10V full scale load current signal at IC U1-B Pin 7. This 10V full scale true RMS load current signal is then fed to the ammeter display circuit.

C. Ammeter Display Circuit

ICs U3 and U4 are two 10 element, LED bargraph displays. All elements of each IC display are connected in series and powered from an 8mA peak, half wave current source provided at connector J1 Pin 3. The current source is developed on the control board. ICs U5, U6, U7, U8 and U9 are quad comparators whose 20 positive inputs are tied together and fed by the input display circuit with the 0 to 10V full scale load current signal. Resistor networks U10, U11, U12, and U13 together with R12 form a voltage divider chain which divides the nominal 10V signal at the bottom end of R12 into 20 0.5V steps. These 20 0.5V reference voltages feed the negative comparator inputs. When the load current voltage signal is greater than the reference voltage for the first comparator, the first LED bargraph is lit. As the load current voltage signal increases, subsequent LED bargraphs are lit.

2.3 Control Board

(Reference Figures 2.2 through 2.17)

All 831 SCR control boards have in common a half-wave 8mA rectified ammeter display current source at connector J1 Pin 3, a + 15VDC supply at connector J1 Pin 1, and a common at connector J1 Pin 2. The nominal 120VAC or 240VAC present at rear terminals 1 and 3 is spike filtered by resistor R23 and capacitor C10 (50μ low pass filter), fused by F2 (1/16A fuse), and half-wave rectified by diode D9. This half-wave rectified AC signal is current limited by two (2) similar, two (2) transistor circuits (transistors Q3 and Q5 with resistors R24, R25, R28, R30, and transistors Q4 and Q6 with resistors R26, R27, R29, and R31). The ammeter display current source limits current to a nominal 8mA peak to drive the ammeter LED bargraphs. The 15VDC supply limits current to 30mADC. The 15VDC supply is filtered by capacitor C13 and voltage regulated by zener diode Z2. For the Model 831 with the internal phase angle SCR driver, 4-20mA-PA, an unregulated 25VDC supply is taken from the plus (+) side of capacitor C13 to power the electronics on the phase angle sub board.

Also common to all 831 SCR control boards is a 1000:1 current transformer, T1 or T2 (T2 is the current transformer designation for the pulse type input control signals); a snubber network, capacitor C11 and resistor R20; a 275VRMS metal oxide varistor (MOV), resistor R19; a 120K, 1W resistor from rear terminal 1 to connector J1 Pin 6, resistor R22 (used for the fuse failure indication neon on the display board); a semiconductor fuse, F1; and a semiconductor device, V2.

A. Time Proportioned Input Control Signals

(Reference Figures 2.10 through 2.13)

4-20mA Input

This is a signal powered circuit which utilizes the 4-20mA input control signal and converts it to a 0 to 100% duty cycle (150ms ON, 150ms OFF at a 50% duty cycle) to drive opto-isolator IC U2 and the input LED, E1. IC U1-B is an integrator and IC U1-A is a voltage comparator with hysteresis. With a 4mA input control signal, the voltage present at IC U1-B Pin 6, determined by resistors R1, R2, R3, and zener diode Z1, causes the output of the integrator, U1-B Pin 7, to be below the voltage comparator threshold set by resistors R5 and R6; therefore, IC U1-A Pin 1 is low and opto-isolator U2 is off. As the input control signal current increases, the voltage dropped across sense resistor R3 increases. This causes the integrator to ramp its output up. As the integrator ramps up, the voltage comparator threshold is crossed. When the voltage comparator threshold is crossed, the voltage comparator output, IC U1-B Pin 1, goes high and switches opto-isolator U2 on. Switching on opto-isolator U2 will trigger SCR device V2 into conduction. Current feedback through resistor R7 will cause the integrator to ramp its output down until a new voltage comparator threshold, set by positive feedback through resistors R8 and R4, is crossed. The voltage comparator output then goes low switching opto-isolator U2 off. As opto-isolator U2 switches on and off due to the input control signal, SCR device V2 switches power to the load on and off. See the zero crossover trigger circuit description below for more information on how IC U2 controls the triggering of SCR device V2. As the 20mA input control signal is reached, the voltage comparator output is high 100% of the time. Current feedback through resistor R7 will balance the integrator above the voltage comparator threshold; thus, SCR device V2 will be conducting 100% of the time. Because of component tolerances, the zero SCR output will vary between input control signals of 4.0mA to 4.5mA; the span SCR output will vary between input control signals of 18.0mA and 20.0mA.

Logic Voltage Input

This circuit takes a 5 to 30VDC logic voltage signal and applies it, through current limiting resistor R10, to opto-isolator U2. In series with opto-isolator U2 is the input LED, E1. As opto-isolator U2 switches on and off due to the input control signal, SCR device V2 switches power to the load on and off. See the zero crossover trigger circuit description below for more information on how IC U2 controls the triggering of SCR device V2. Diode D1 provides protection against reversed input control signal voltages. The input current is 2-30mA and the minimum dropout voltage is 2VDC.

Logic Current Input

This circuit takes a 2-30mADC logic current signal and applies it to opto-isolator U2. Opto-isolator U2 is in series with the input LED, E1. As opto-isolator U2 switches on and off due to the input control signal, SCR device V2 switches power to the load on and off. See the zero crossover trigger circuit description below for more information on how IC U2 controls the triggering of SCR device V2. The maximum voltage drop across the input is 4VDC, and the minimum dropout current is 0.3mA.

Logic AC Voltage Input

This circuit operates by full-wave rectifying and filtering the 85VAC to 135VAC input control signal present at the input terminals. This rectified and filtered input control signal is applied to opto-isolator U2 which is in series with the input LED, E1. As opto-isolator U2 switches on and off due to the input control signal, SCR device V2 switches power to the load on and off. See the zero crossover trigger circuit description below for more information on how IC U2 controls the triggering of SCR device V2. The approximate input impedance is 3.0K and the minimum dropout voltage is 20VAC.

B. 4-20mA Input Control Signal With Internal Phase Angle Driver SCR Driver
(Reference Figures 2.14 through 2.17)

The 4-20mA-PA input control signal circuitry is identical to the 4-20mA time proportioned input control signal circuitry described above. The only difference is that the integrator capacitor, C2, has been changed to a 0.01uF capacitor. This allows the 4-20mA-PA input control signal circuitry to operate at a higher frequency (333 Hz at a 50% duty cycle). Also, the zero crossover transistor and its associated components have been removed from the circuit so that SCR device V2 can be phase angle triggered; otherwise, the circuit operates as previously described.

C. Pulse Type Input Control Signals
(Reference Figures 2.4 through 2.9)

This circuit operates around isolation transformer T1. Transformer T1 is a 1:1:1 turns ratio transformer which splits its primary input control signal pulses into two (2) equal and isolated pulse trains at its secondary. A single pulse train is used to trigger Model 831s with triac SCR devices; both pulse trains are used to trigger Model 831s with SCR devices. A typical pulse train duty cycle of 20us ON and 200us OFF is required for triggering the SCR device. The input control signal pulses can be synchronized to either zero crossover or phase angle pulses from the external controller.

2.4 4-20mA-PA Phase Angle Sub Board

(Reference Figures 2.14 through 2.17 and Figures 2.18 and 2.19)

The phase angle sub board of the Model 831 SCR provides the necessary electronics to convert the 4-20mA input control signal into an appropriate control signal to phase angle trigger SCR device V2. The phase angle sub board circuitry can be broken down into three (3) basic circuits: A.) the zero crossover and sawtooth waveform generator circuits, B.) the duty cycle to DC converter circuit, and C.) the integrator and comparator circuits. Each circuit is discussed below.

A. Zero Crossover and Sawtooth Waveform Generator Circuits

This circuit consists of resistor R19 on the control board, resistors R1, R2, R3, R4, R15, capacitors C1, C2, C3, C5, C8, diodes D1, D2, and IC U1-A, -B, -C, -D on the phase angle sub board. IC U1-A pin 1 is AC coupled to the AC power line via resistor R19 and capacitor C2. Resistor R1 and R2 bias IC U1-A at 7.5V, and capacitors C1 and C3 provide filtering. A square wave whose edge transitions represent the zero crossover of the AC power line is present at IC U1-A pin 2. This signal is differentiated by capacitor C5 and resistor R4 for positive going edge transitions and by capacitor C4 and resistor R3 for negative going edge transitions. Inverters IC U1-B, U1-C, and U1-D provide short pulses of current to charge capacitor C8 at each zero crossover of the AC power line. Resistor R15 discharges capacitor C8 between each zero crossover. This produces a sawtooth waveform at IC U2-B pin 5.

B. Duty Cycle to DC Converter Circuit

This circuit is evaluated assuming that current limit has not been initiated. The circuit consists of IC U2 on the control board and transistor Q1, IC U1-E, resistor R12 and capacitor C7 on the phase angle sub board. Since there is no current limit action, transistor Q1 is on and the 0 to 100% duty cycle signal from IC U2 pin 5 on the control board is inverted by IC U1-E. IC U1-E pin 10 drives a low pass filter consisting of resistor R12 and capacitor C7. This low pass filter converts the 0 to 15VDC time proportioned 0 to 100% duty cycle signal to a 0 to 15VDC level signal at IC U2-A pin 3.

C. Integrator and Comparator Circuits

This circuit consists of IC U3 on the control board, and resistors R16, R17, R18, capacitors C10, C11 and ICs U2-A, U2-B, and U1-F on the phase angle sub board. IC U2-A is configured as an integrator, and IC U2-B is configured as a comparator. Integrator U2-A has as its positive reference, pin 3, the 0 to 15VDC level signal proportional to the 4-20mA input control signal. With a 4mA input control signal, 0VDC is present at IC U2-A pin 3. The output of the integrator, IC U2-B pin 6 which drives the negative input of the comparator, is below the sawtooth waveform at IC U2-A pin 5. The comparator output, IC U2-B pin 7, is therefore high and IC U1-F pin 12 is low. With IC U1-F pin 12 low, IC U3 on the control board is off, and SCR device V2 is prevented from triggering.

As the input control signal current increases, the DC voltage at IC U2 pin 3 causes the integrator to ramp its output up. As the integrator ramps up, the comparator threshold is crossed and negative pulses are produced at the comparator output, IC U2-B pin 7. The pulse width of these pulses is determined by comparing the sawtooth waveform at IC U2-B pin 5 with the integrator output at IC U2-B pin 6. These negative pulses are inverted by IC U1-F and fed via resistor R18 to the control board to switch IC U3 and trigger SCR device V2. To balance the integrator, positive pulses are fed back to the integrator input via resistor R16. The sawtooth waveform signal at IC U2-A pin 5 controls the timing and frequency of the pulses (1 per 1/2 cycle of the AC line), and the 0 to 15VDC level signal at IC U2-A pin 3 controls the pulse width of the pulses (0 to 1/2 cycle width of the AC line). With a 15VDC level signal at IC U2-A pin 3, IC U1-F pin 12 is high 100% of the time to balance the integrator; therefore, SCR device V2 is triggered at the beginning of every half-cycle for 100% output power.

2.5 SCR Device Trigger Circuits

The discussion below pertains to the zero crossover trigger and phase angle trigger circuits.

A. Zero Crossover Trigger Circuit

(Time Proportioned Input Control Signals Only)
(Reference Figures 2.10 through 2.13)

The trigger circuit consists of opto-isolator IC U2, transistors Q1 and Q2, triac V1, and resistors R12 through R18 and R21. The trigger circuit components can be thought of as occupying the center of a bridge rectifier consisting of diodes D5 through D8. Line 1 (L1) is connected to one side of the bridge at the anode of diode D6. Line 2 (L2) or neutral is connected to the other side of the bridge through the load at the anode of diode D5. If the anodes of diodes D7 and D8 are taken as a reference, the full-wave rectified line voltage signal appears across triac V1. When IC U2 switches on, the collector of Q1 goes high. Current flow through resistor R16 triggers triac V1 into conduction which in turn triggers the forward biased side of SCR device V2 through diode D7 or D8. By connecting L1 to the top of the load, the bridge rectifier is shorted out and the voltage across the bridge collapses stopping current flow through triac V1. Transistor Q2 is the zero crossover detector or "window" detector transistor. Q2 is biased by resistors R14 and R15 such that its collector is high when the rectified line voltage present at the anode of triac V1 is less than 14V. Thus, V1 is only allowed to trigger whenever the line voltage is within this 14V "window" about the zero crossover point of the AC line voltage. Triggering of V1, and thus V2, is inhibited by Q2 whenever the rectified line voltage present at the anode of V1 is greater than 34V.

B. Phase Angle Trigger Circuit
(PAP or 4-20mA-PA Input Control Signals Only)
(Reference Figures 2.14 through 2.17)

The circuit consists of IC U3, transistor Q1, resistor R10 through R14 and R17, capacitors C4 through C7 and C10, and diodes D1 through D4. The circuit operates principally the same as the zero crossover trigger circuit described above with the exception that the zero crossover detector or "window" detector transistor has been removed from the circuit so that SCR device V2 can be phase angle triggered.

2.6 Current Limit

The current limit option is only available on Model 831s that are phase angle triggered. This only includes the PAP type input control signal or the 4-20mA control signal with the internal SCR driver.

A. Current Limit with the PAP Type Input Control Signal
(Reference Figures 2.4, 2.6, 2.7 and 2.9)

PAP type input control signal Model 831s will have the current limit feedback circuitry consisting of transformer T3, diodes D1, D2, D3, D4 and adjustable burden resistors R1 and R3 with potentiometer P1 installed. Transformer T3 provides a 1000:1 stepdown in load current. This load current signal is full-wave rectified by diodes D1 through D4 and fed to the adjustable burden resistors R1 and R3 with potentiometer P1. This circuitry provides a full-wave rectified, phase angled, current limit feedback waveform of 7V peak at rear terminals when the 831 is operating at full rated RMS current and potentiometer P1 is turned to its "MAX" position. If potentiometer P1 is turned to its "MIN" position, the 7V peak current limit feedback signal will be produced at approximately one-fourth full rated RMS current. This allows for a current limit turn down ratio of 4 to 1. The 7V peak current limit feedback signal is fed back to Eurotherm 800 or 900 series controllers or drivers where the controller or driver initiates RMS current limit.

B. Current Limit with the 4-20mA-PA Input Control Signal
(Internal SCR Driver)
(Reference Figures 2.18 and 2.19)

This circuit consists of IC U2-C, resistors R5, R6, R7, R8, R10, transistor Q1, and potentiometer P1. Potentiometer P1 with resistors R5 and R6 set a reference voltage at inverting amplifier U2-C pin 10 of 2VDC for minimum RMS current limit (current limit potentiometer to its "MIN" position) or 10VDC for maximum RMS current limit (current limit potentiometer to its "MAX" position). This allows a current limit turn down ratio of 5 to 1. The 0-10VDC true RMS load current signal developed on the display board by IC U2 is fed to IC U2-C pin 9 on the control board via resistor R10 and connector J2 pin 2. If the load current signal at IC U2-C pin 9 is greater than the reference voltage at IC U2-C pin 10 set by potentiometer P1, then IC U2-C pin 8 switches low. When ICU2-C pin 8 switches low, transistor Q1 turns off. This reduces the voltage at IC U2-A pin 3, thus limiting current to the load.

2.7 Power-Up, Power-Down, Reset, and Soft-Start Circuit
(Reference Figures 2.18 and 2.19)

This circuit only applies to Model 831 SCRs with the internal SCR driver. The circuit consists of IC U2-D, resistors R11, R13, R14, diodes D3, D4, D5, capacitors C6, C7 and transistor Q2. Should IC U2-D pin 13 fall below a 2VDC reference voltage at IC U2-D pin 12 because of an AC line failure or drop-out, IC U2-D pin 14 will switch high. This signal will switch transistor Q4 on and discharge capacitor C7. This effectively prevents SCR device V2 from triggering, and thus the output power is 0%. On power-up while capacitor C6 charges up, transistor Q2 is held on preventing capacitor C7 from charging. As capacitor C7 charges, due to transistor Q2's collector releasing, the phase angle is slowly advanced, thus providing phase angle soft-start.

1 FASCIA SINGLE HOLE COVER
2 SCREW 6-32 X 5/8 PH FL HD
3 BEZEL TRIM
4 FASCIA (SEE TABLE I)
5 FASCIA GASKET
6 "Amps" BEZEL TRIM INSERT
7 FASCIA DOUBLE HOLE COVER
8 DOOR & HINGE ASSY.
9 ANNEALED MOUNTING SCREW
10 LOCKING CATCH
11 CATCH SPRING
12 LOCKING NUT
13 BUSHING
14 FLAT WASHER
15 BEZEL
16 POT ADJUSTER
17 SCREW 4-40 X 5/16 PH PA HD
18 SCHROLL BUTTON
19 CURRENT POT SUB-BOARD
20 4-20 P/A SUB-BOARD
21 T/P AVG DISPLAY BD
22 4-20 P/A RMS DISPLAY BD
23 ZCP AVG DISPLAY BD
24 PAP RMS DISPLAY BD
25 4-20 P/A RMS DISPLAY BD
26 PAP, ZCP RMS, AVG DISPLAY BD
27 TIME-PROP AVG DISPLAY BD
28 SCREW 6-32 X 1/2 SO BU HD
29 LABEL SERIAL NO.
30 HEATSINK
31 TRIAC
32 EXTERNAL TOOTH WASHER #6
33 DUAL SCR (SEE TABLE I)
34 SPLIT LOCK WASHER #10
35 SCREW 10-32 X 5/8 SO BU HD
36 FUSE (SEE TABLE I)
37 TIME-PROP. SCR CONTROL BD (SEE TABLE II)
38 4-20 P/A SCR CONTROL BD
39 PULSE INPUT SCR CONTROL BD
40 TIME-PROP. TRIAC CONTROL BD (SEE TABLE II)
41 4-20 P/A TRIAC CONTROL BD
42 PULSE INPUT TRIAC CONTROL BD
43 COVER
44 TORQUE LIMITER ASSY.
45 COMPOSITE LABEL BLANKS
46 SLEEVE
47 MILLS PIN
48 OUTER CONNECTOR SUPPORT
49 BLANK CONNECTOR
50 INNER CONNECTOR SUPPORT
51 SCREW CAP
52 NUMBER STRIP
53 SEMS SCREW M3.5 X 10mm
54 TERMINAL WASHER
55 SCREW INSERT
56 CONTACT ASSY.
57 CONNECTOR BODY
58 CONNECTOR SUPPORT
59 CONNECTOR HOUSING
60 SEMS SCREW 10-32 X 1/2
61 SPRING SUPPORT
62 OUTER SPRING CONNECTOR
63 INNER SPRING CONNECTOR

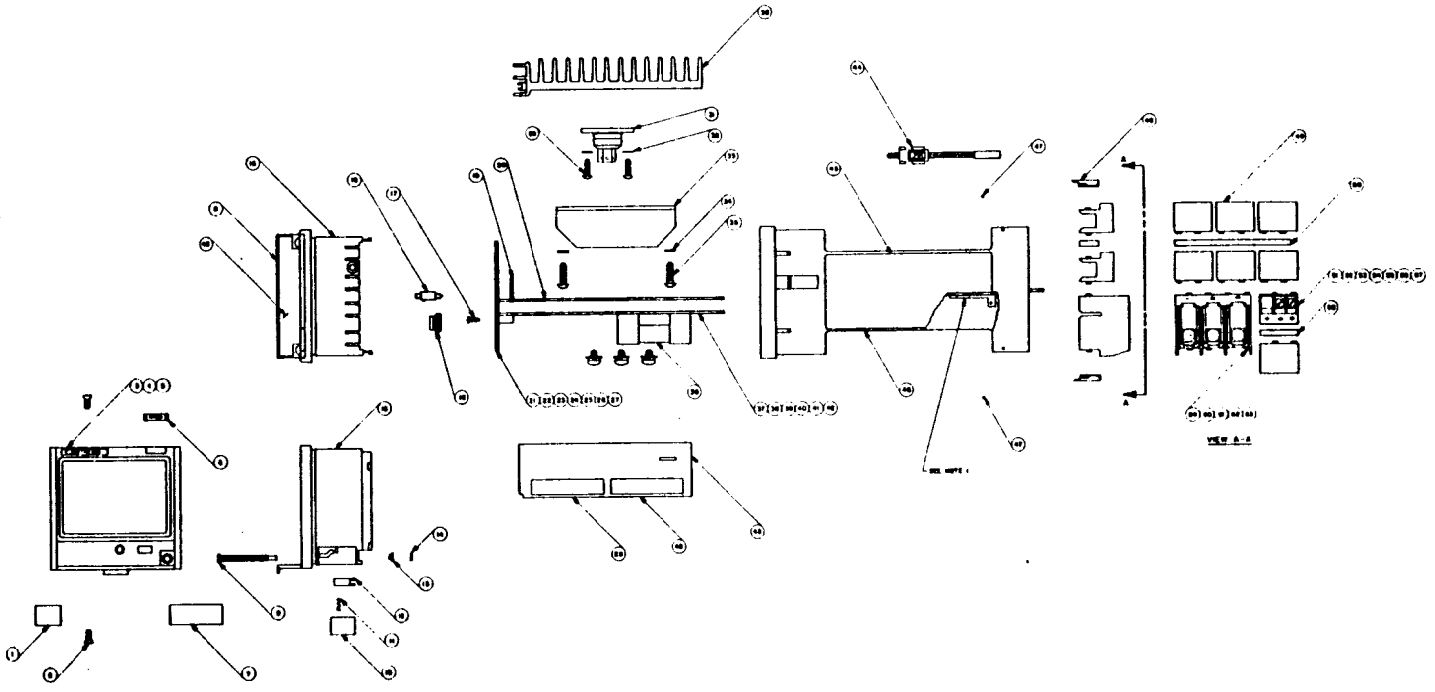


Figure 2.1
Mechanical Assembly of 831
SCR Assembly

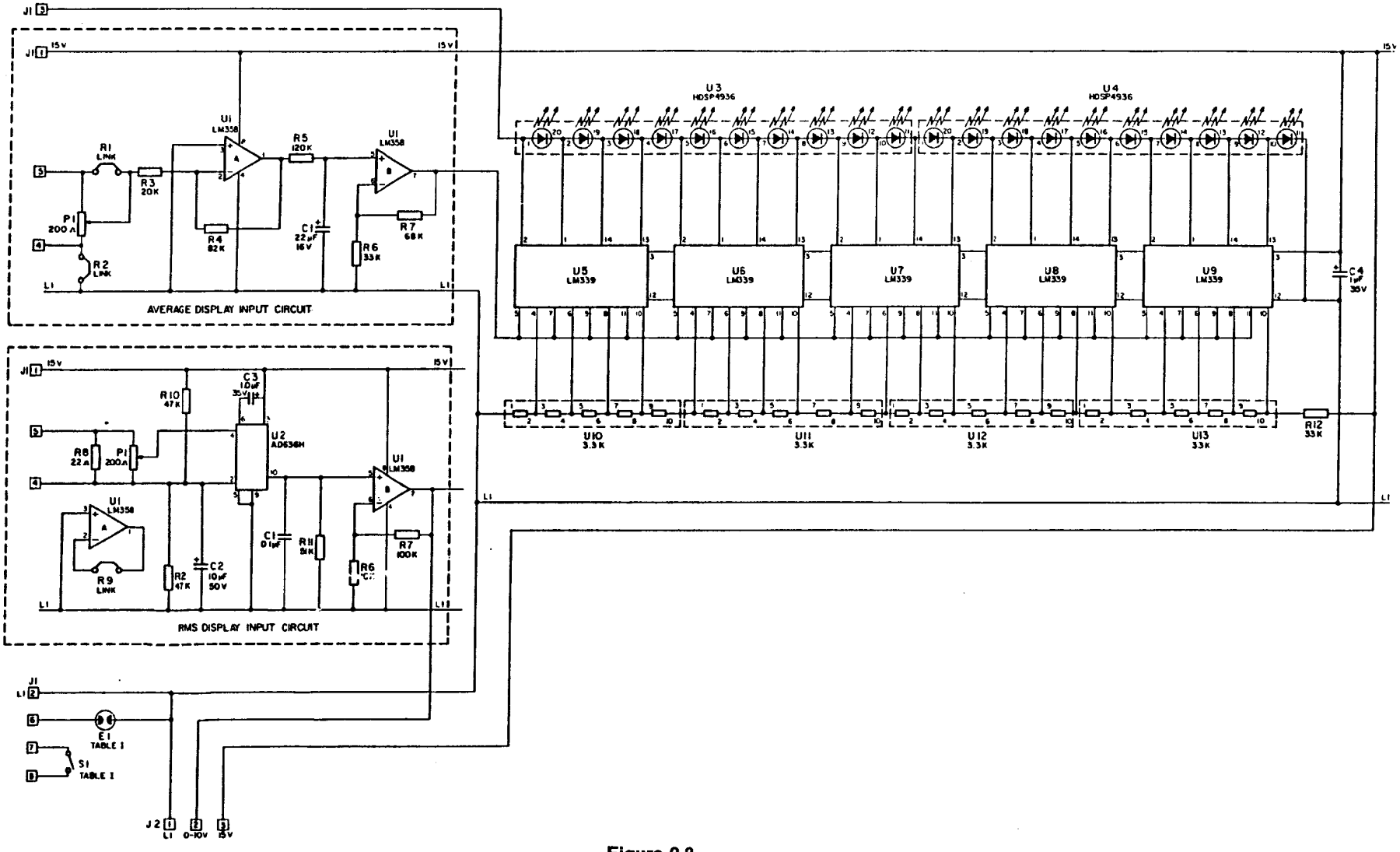


Figure 2.2
831 Display Board Schematic

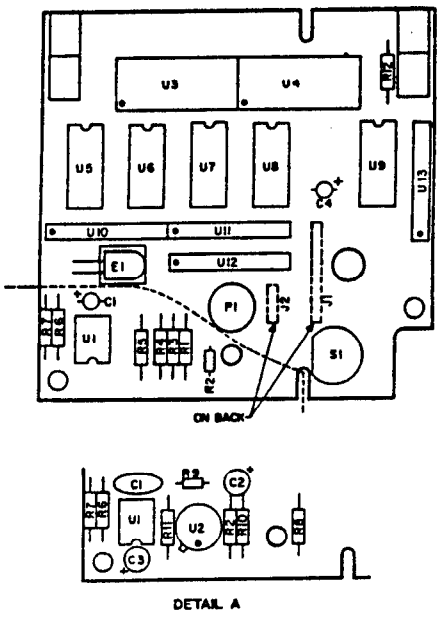


Figure 2.3
831 Display Board Layout

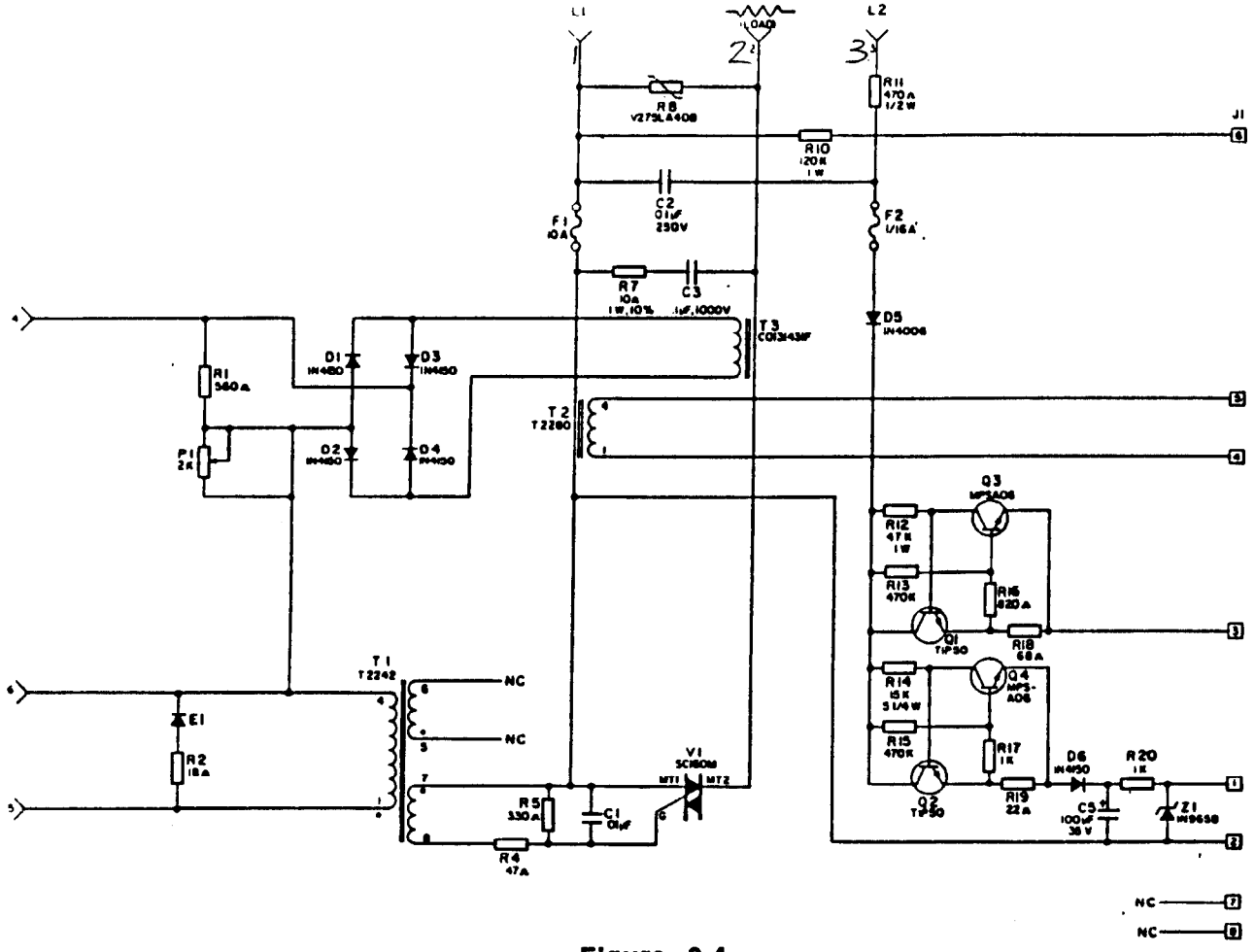


Figure 2.4
831 Triac Control Board Schematic
(PAP version)

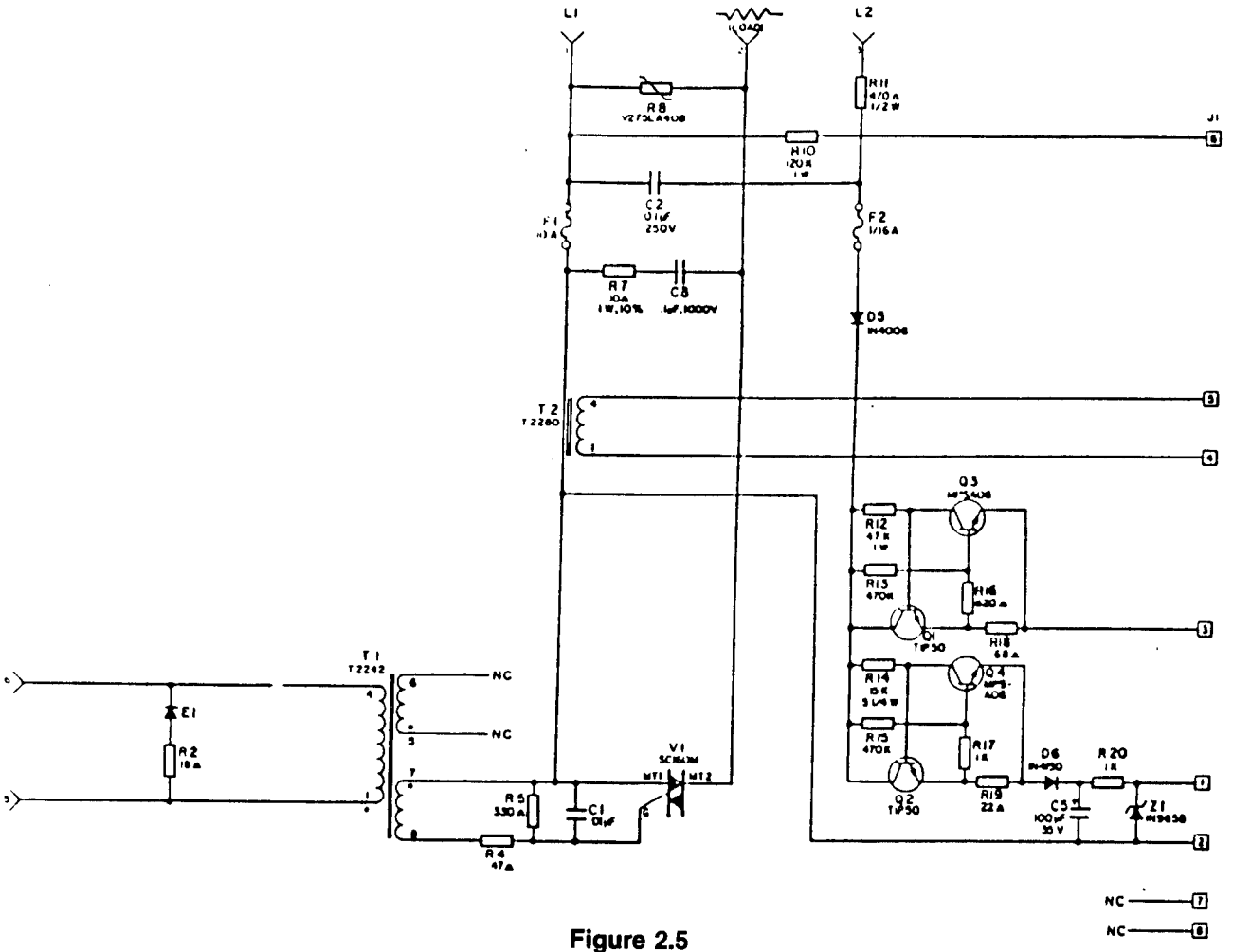


Figure 2.5
831 Triac Control Board Schematic
(ZCP Version)

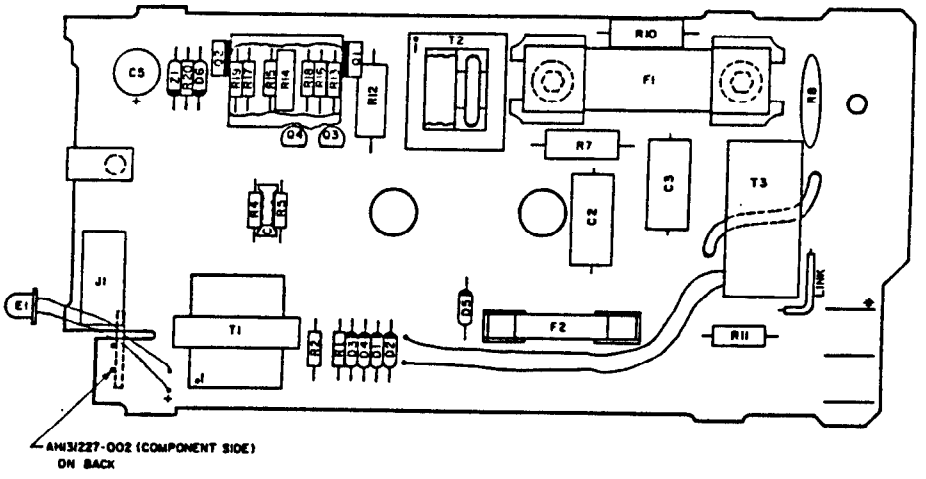


Figure 2.6
831 Triac Control Board Layout

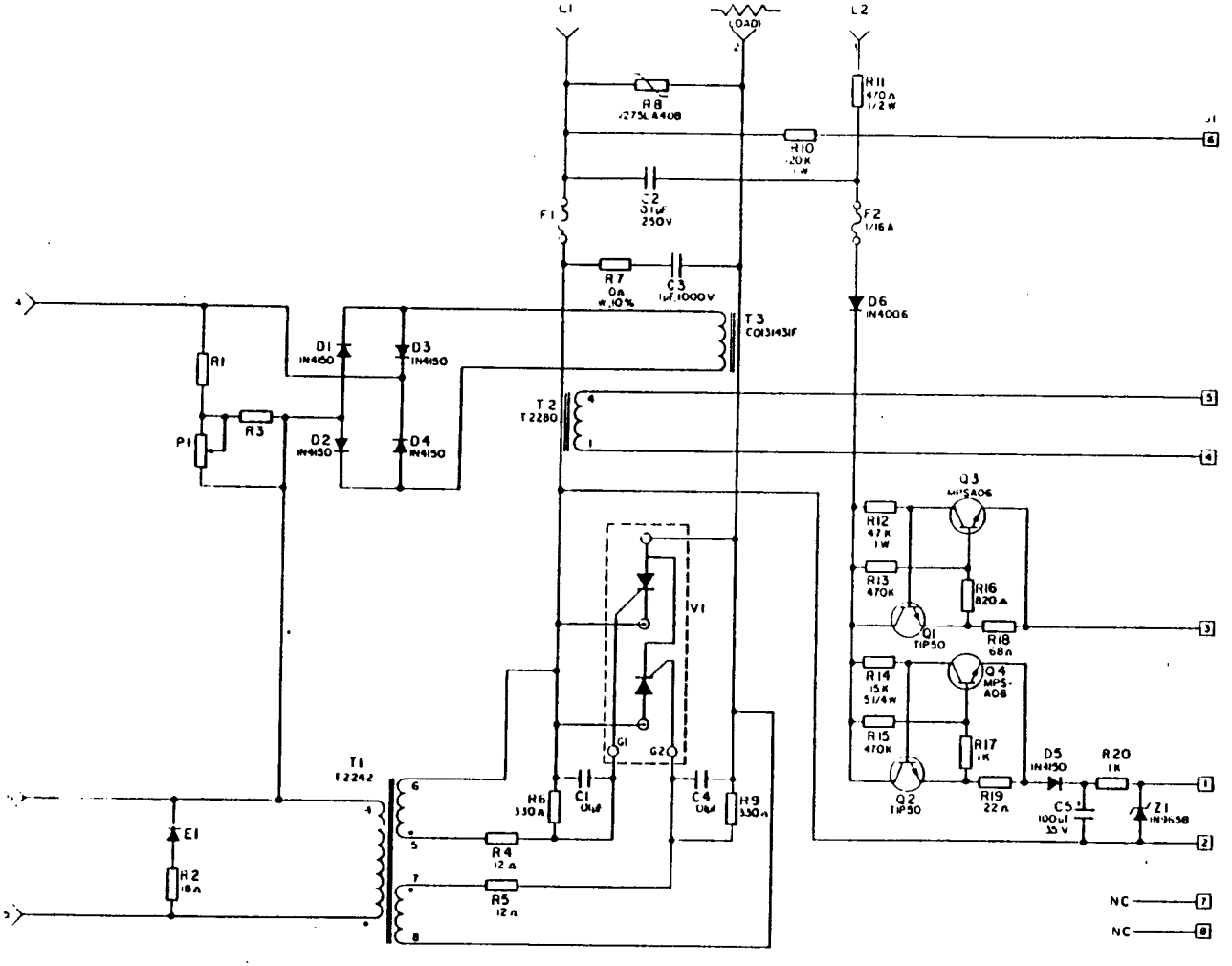


Figure 2.7
831 SCR Control Board Schematic
(PAP Version)

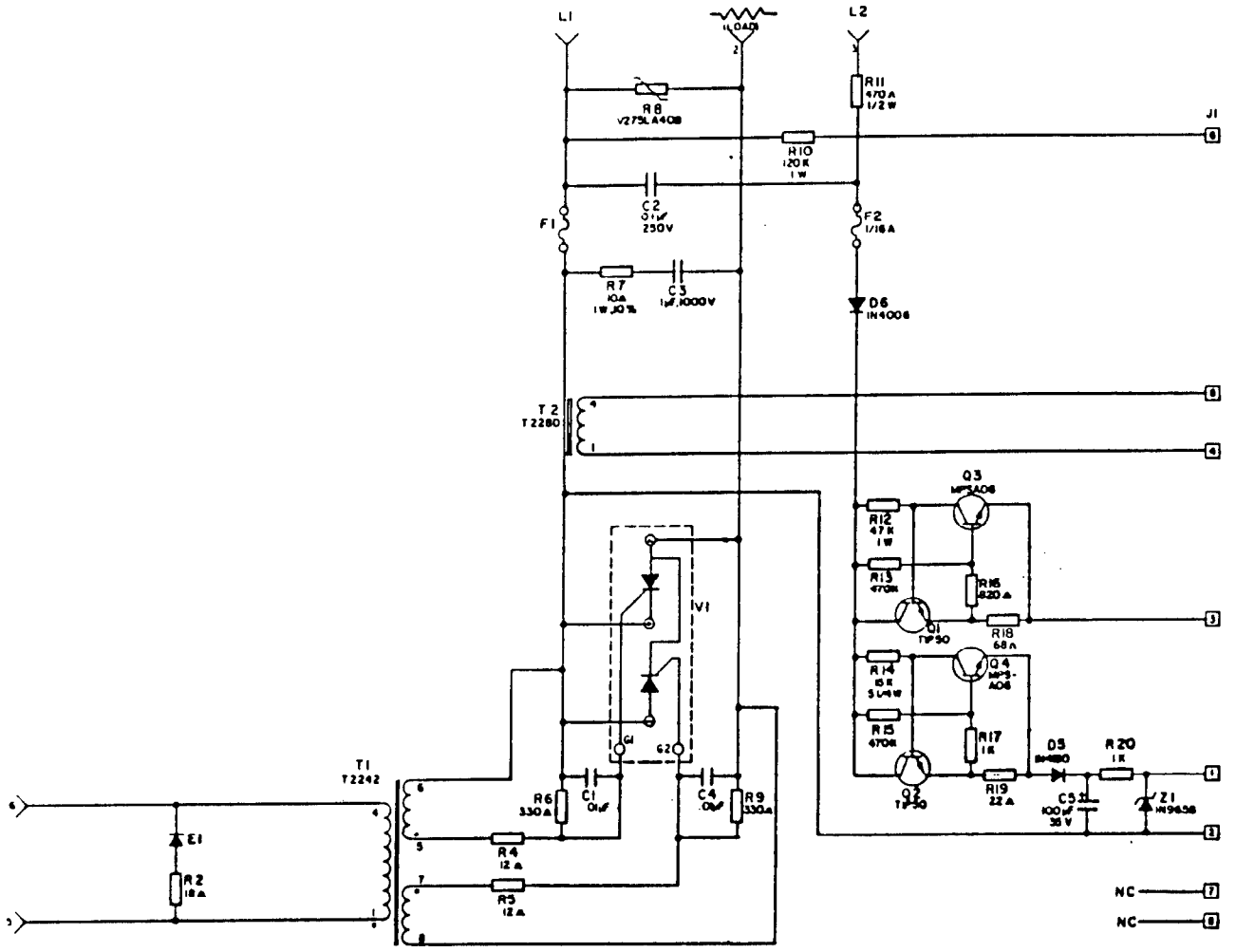


Figure 2.8
831 SCR Control Board Schematic
(ZCP Version)

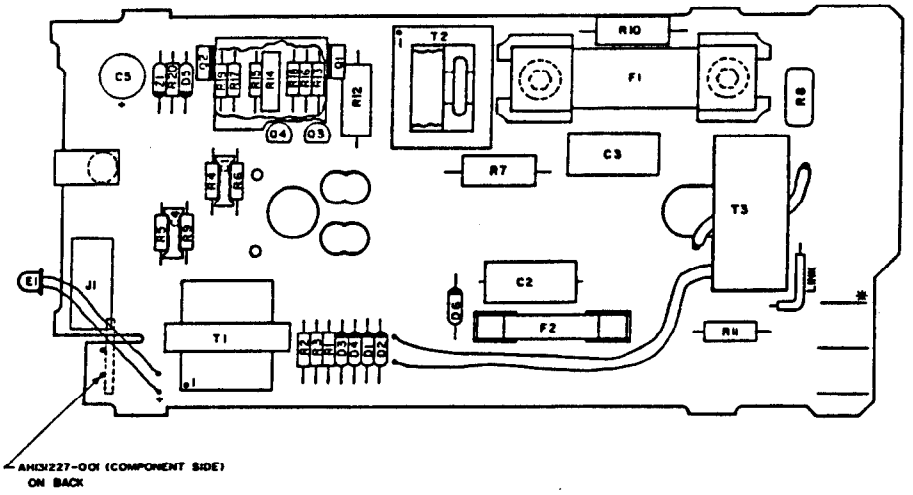


Figure 2.9
831 SCR Control Board Layout

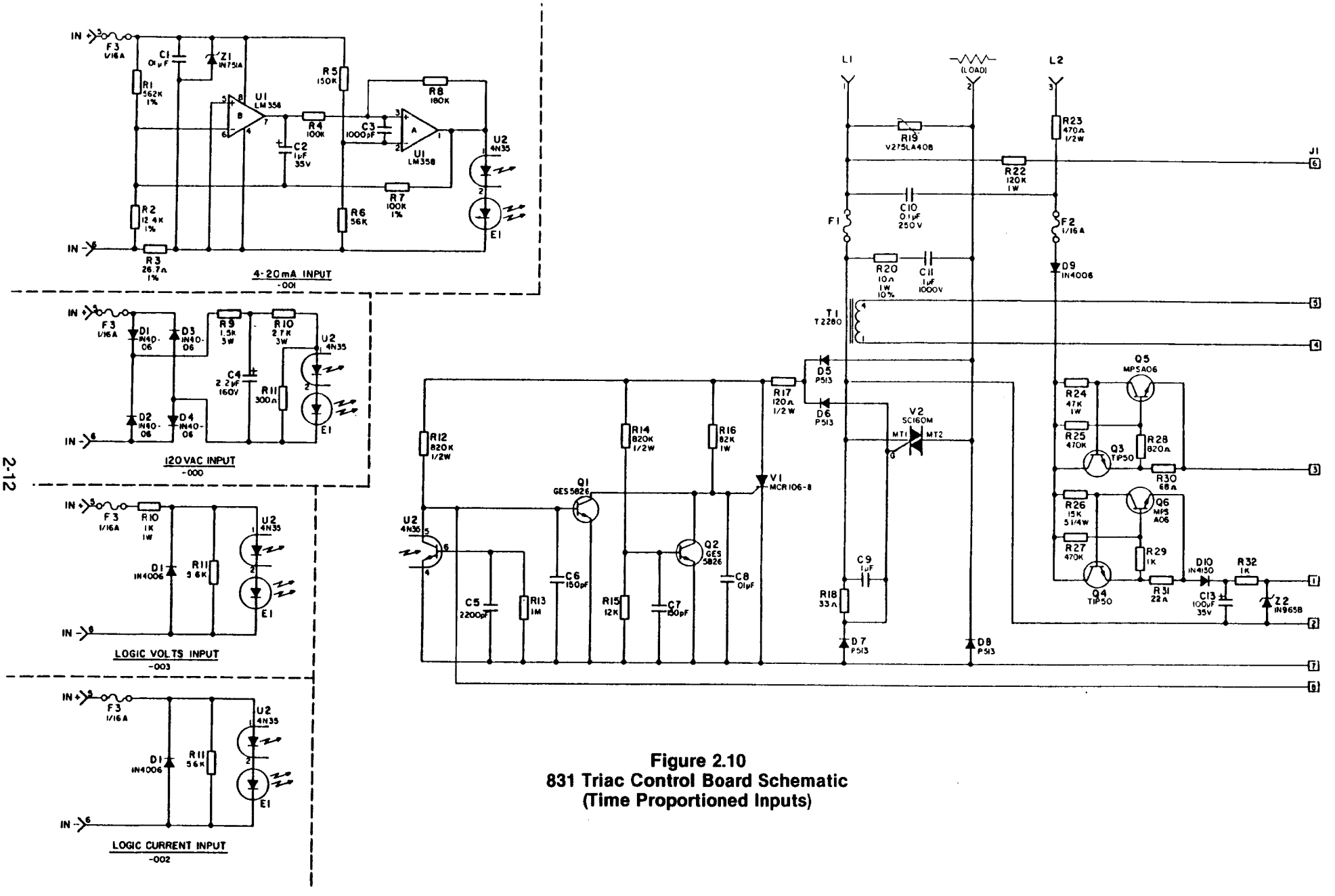


Figure 2.10
831 Triac Control Board Schematic
(Time Proportioned Inputs)

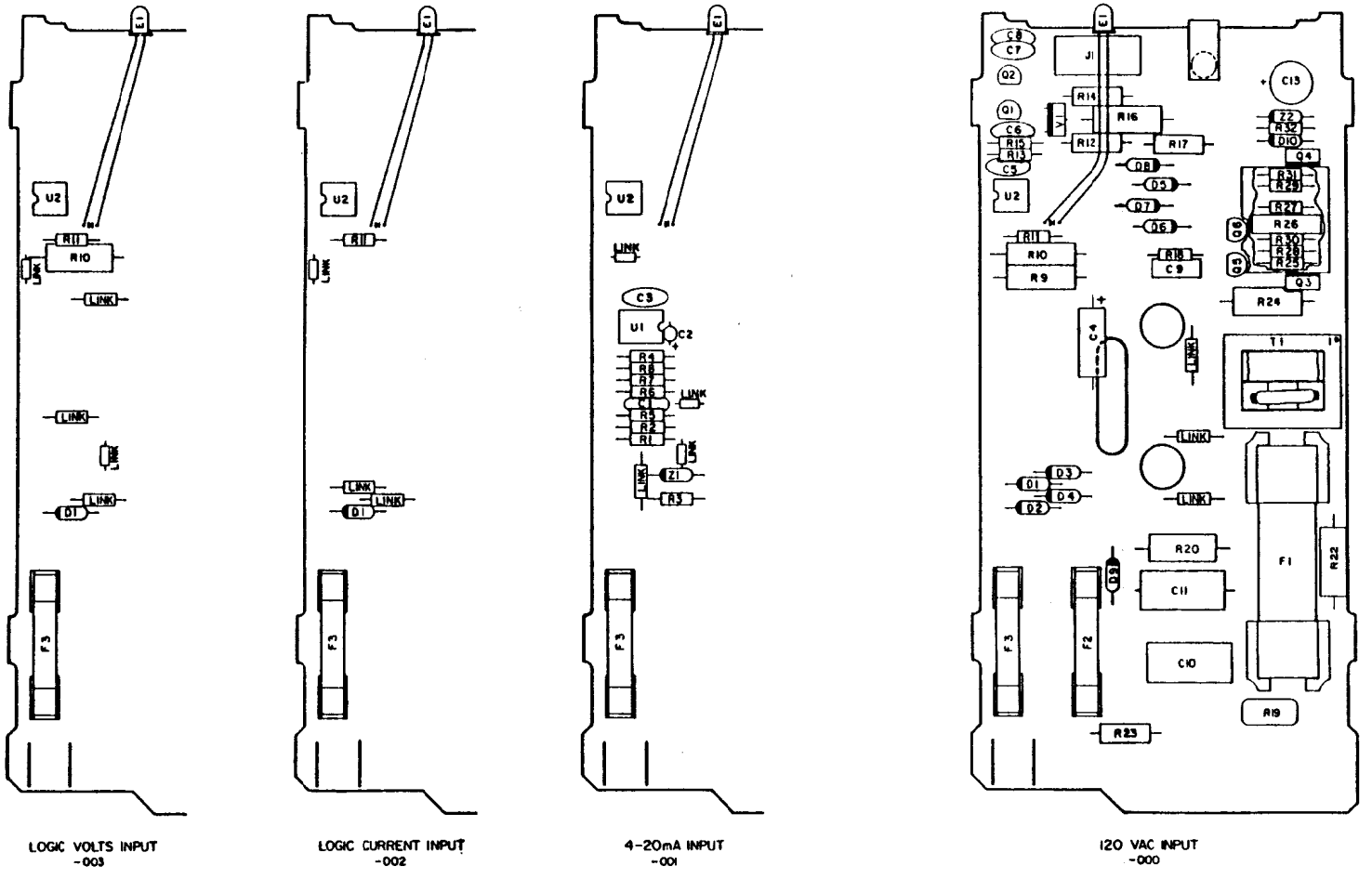


Figure 2.11
831 Triac Control Board Layout
(Time Proportioned Inputs)

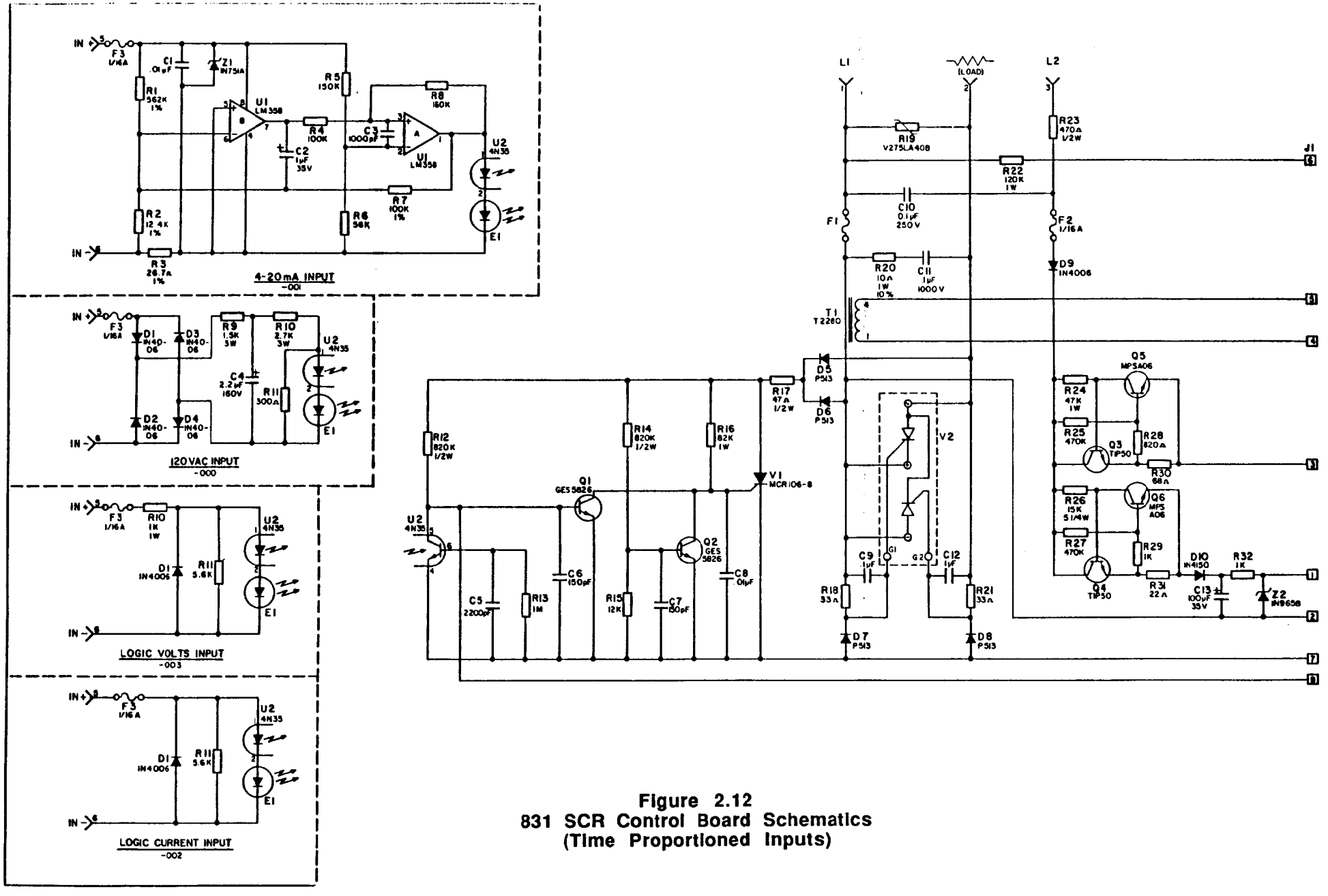


Figure 2.12
831 SCR Control Board Schematics
(Time Proportioned Inputs)

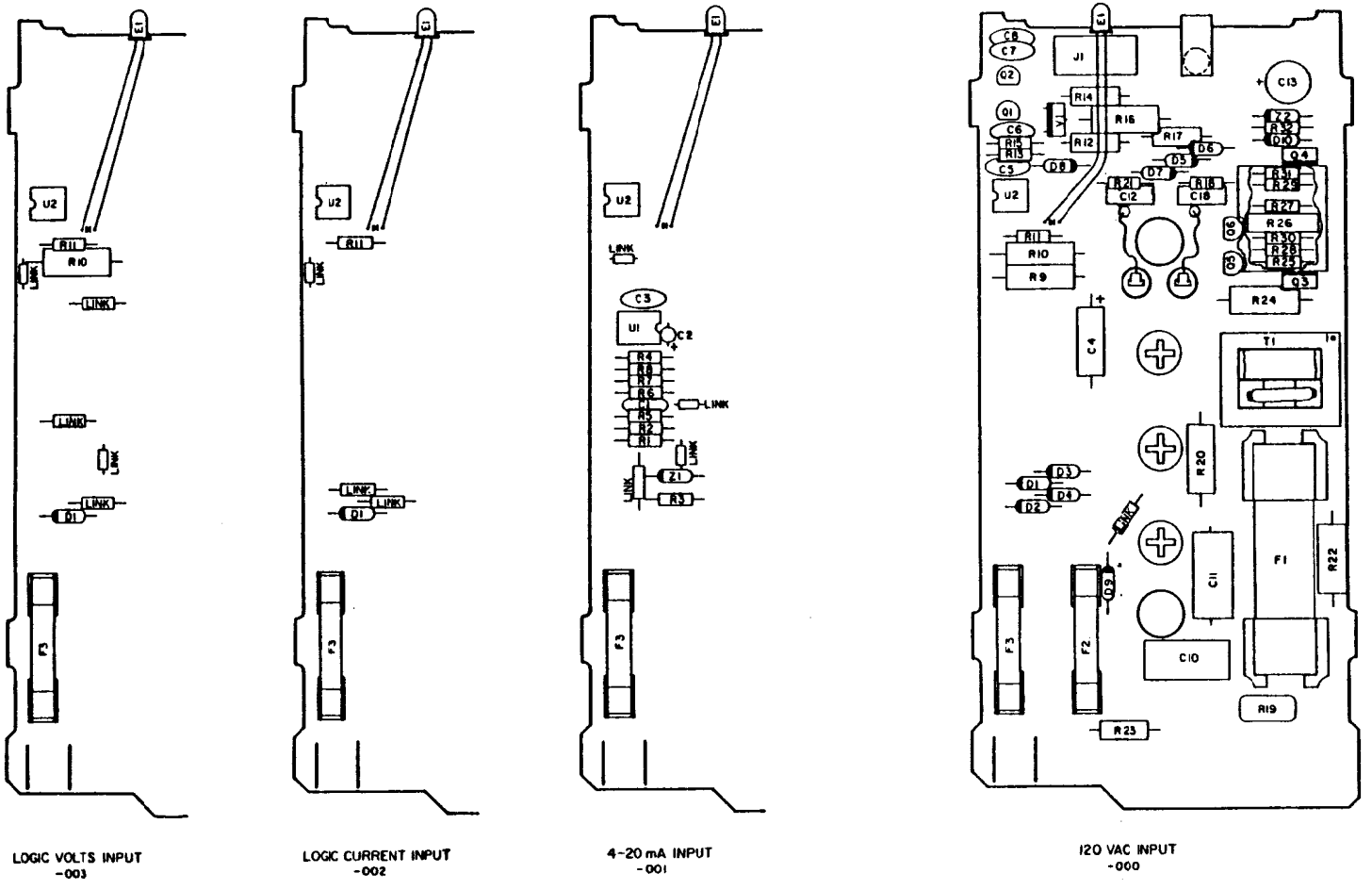


Figure 2.13
831 SCR Control Layout Board
(Time Proportioned Inputs)

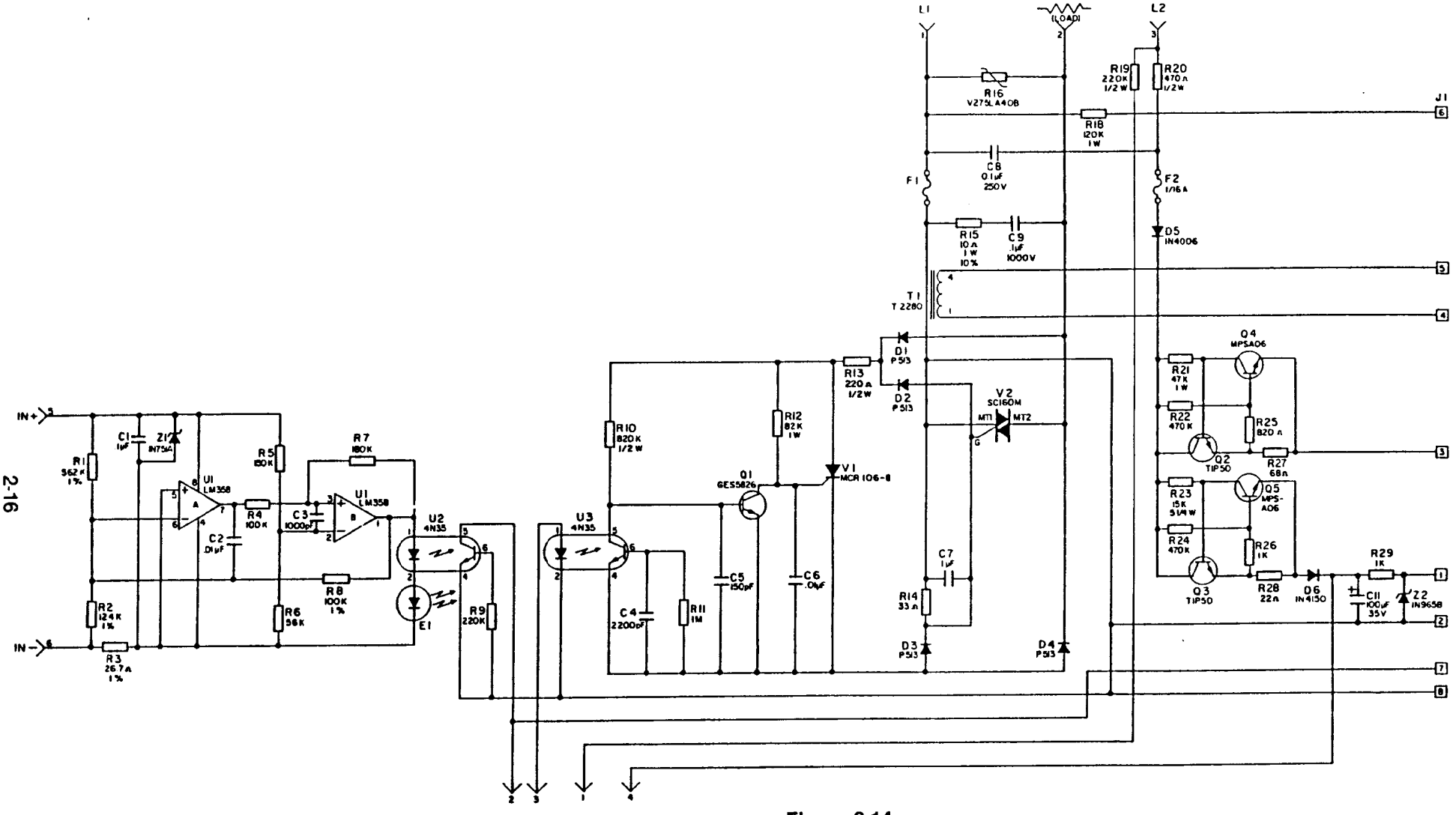


Figure 2.14
831 Triac Control Board Schematic
(4-20mA-PA Input Version)

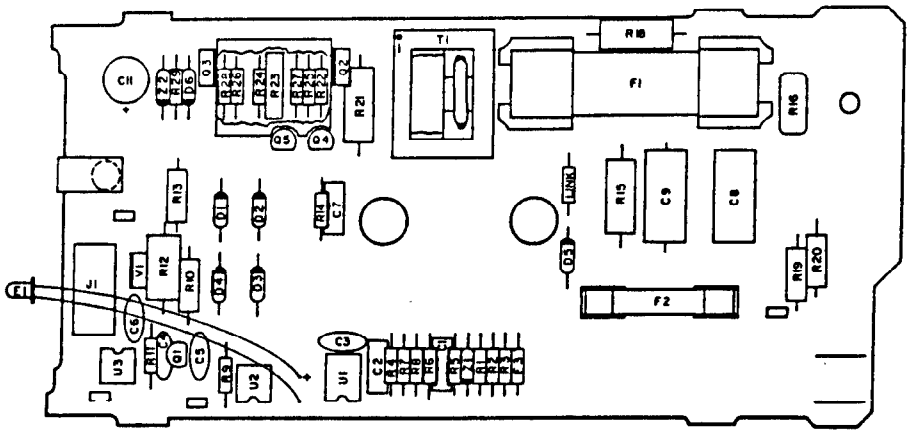


Figure 2.15
831 Triac Control Board Layout
(4-20mA-PA Input Version)

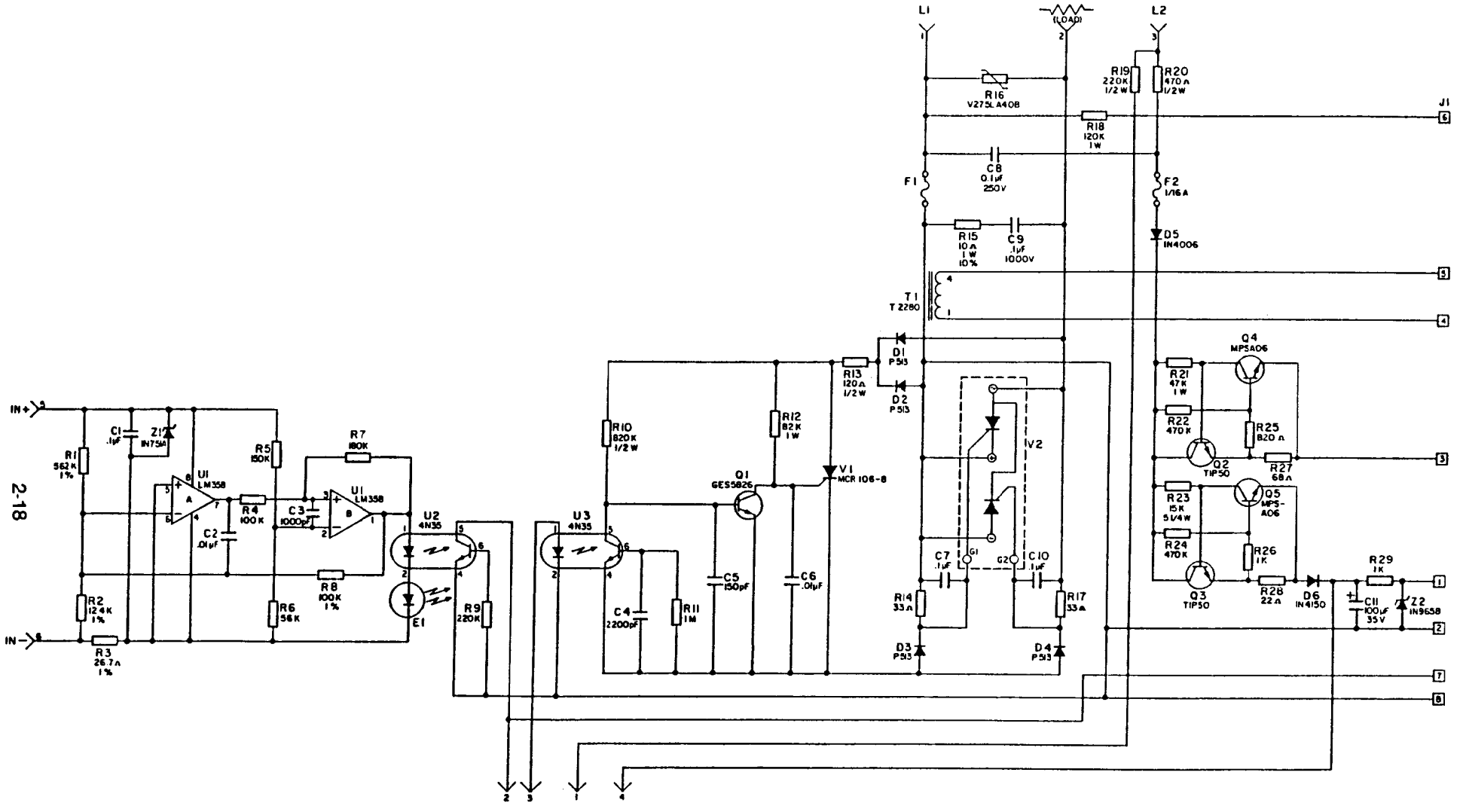


Figure 2.16
831 SCR Control Board Schematic
(4-20mA-PA Input Version)

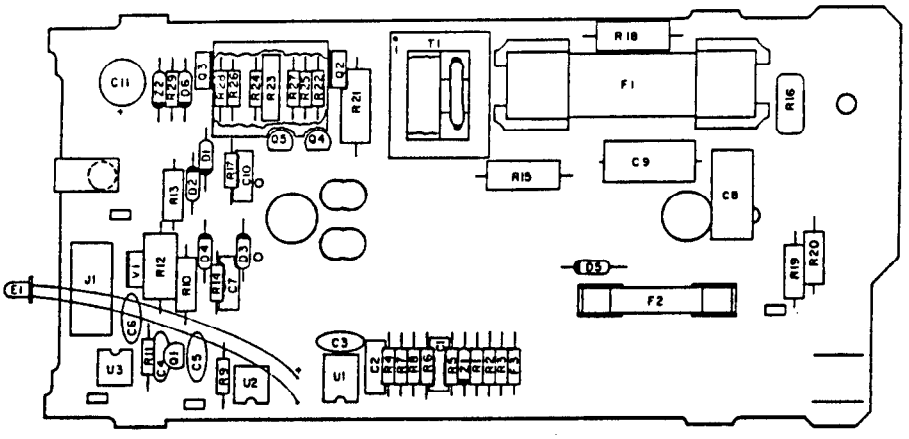


Figure 2.17
831 SCR Control Board Layout
(4-20mA-PA Input Version)

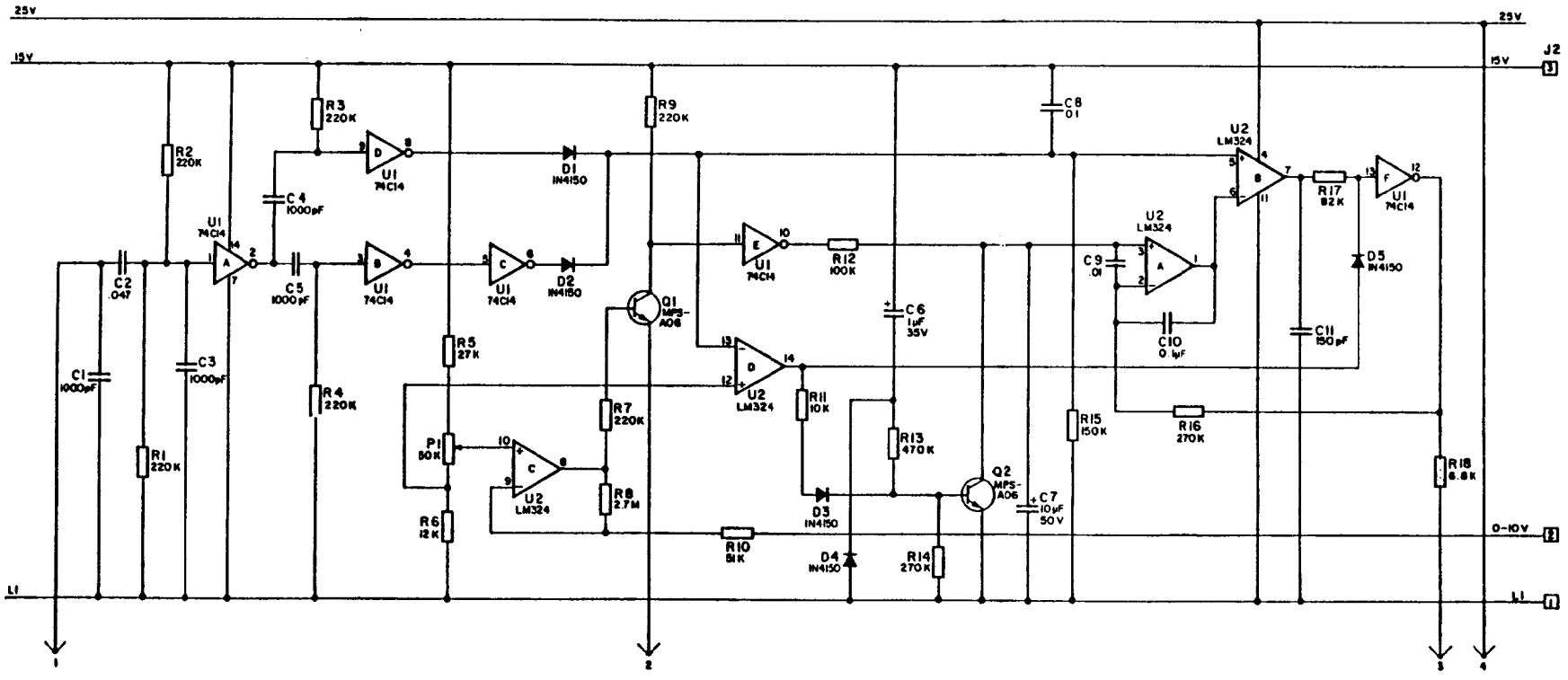


Figure 2.18
831 Phase Angle Sub Board Schematic

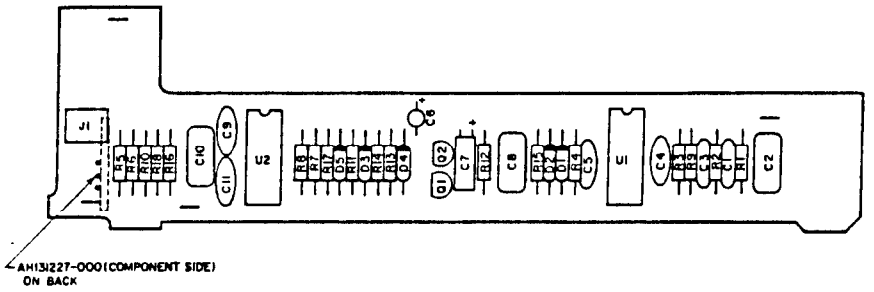


Figure 2.19
831 Phase Angle Sub Board Layout

Figure 2.20
831 Current Pot Sub Board

SECTION III

INSTALLATION AND TERMINATION PROCEDURES

3.1 Installation Instructions

The Model 831 SCR assembly is designed for fixed panel or door mounting in a 3.62 sq. inch ± 0.03 inch panel cutout (see Figure 3.1 for the SCR unit dimensions). The SCR unit is retained in the door or panel by two (2) mounting clips. A six (6) position screw terminal block mounted on the rear of the SCR unit sleeve is supplied for all interconnections.

3.2 Mounting Procedure

The mounting procedure is keyed to Figure 3.2.

The SCR unit must be removed from its sleeve before it can be mounted. The SCR unit can be removed from its sleeve by opening the front panel access door and turning the locking screw in the bottom right-hand corner counter-clockwise with a screwdriver. The SCR unit will start to withdraw from its sleeve as the locking screw is turned. Once the locking screw has been turned to its furthest extent, the SCR unit may be removed from the sleeve by hand. Remove the top and bottom mounting clips from the sleeve by turning the mounting screw counter-clockwise until the mounting screw has been withdrawn enough to clear the sleeve. Gently ease the mounting clip downwards inside the sleeve and remove. Insert the sleeve through the panel cut-out via the front of the panel. Fit the mounting clips in the slots in the sleeve from the inside of the sleeve. From the rear of the mounting panel, tighten the mounting screws with a screwdriver until the sleeve is secure.

By hand, ease the SCR unit into the sleeve to its furthest extent. DO NOT FORCE the SCR unit into the sleeve. The SCR unit will be protruding approximately 1/2" from the sleeve. With a screwdriver, turn the locking screw clockwise. As the locking screw is turned, the SCR unit will be drawn into the sleeve. Once the locking screw is tight, the SCR unit will be secure in its sleeve.

Note: Do not install an SCR unit into or remove an SCR unit from a live (powered) sleeve. Be sure that all power to the SCR unit has been turned off before installing or removing an SCR unit. Also, to prevent electrical damage to the SCR unit, the three (3) high current rear terminal connections should be torqued to 35.0 in-lbs. Failure to follow the above procedures will void the 831 SCR assembly warranty.

3.3 SCR Unit Termination Connections

Electrical connections to the SCR unit are made on the rear terminal block of the sleeve, fitted with six (6) screw terminals. Rear terminals 1, 2, and 3 are the high current connections, and rear terminals 4, 5, and 6 are the low current connections. Wires connected to the high current connections should be sized appropriately to the current rating of the SCR unit. Number 16AWG wire size is adequate for the low current connections. A label mounted on the top of the SCR unit sleeve, Figure 3.3, identifies all connections relevant to the SCR unit. When wiring the sleeve, the terminal block on the sleeve is wired identically to the label on the instrument.

Note: Regular inspection of all high current connections and crimped wire terminations in the system should be made to ensure they are properly tightened and not a safety hazard. The three (3) high current rear terminal connections should be torqued to 35.0 in-lbs.

To facilitate wiring of the SCR unit, all pertinent data including connector functions, terminal block locations, and remarks are referenced in Table 3-1.

Table 3-1
Terminal Block Connections

Function	Terminal Connection	Remarks
Input Control Signal	5 & 6	All input control signal connections are made on terminals 5 and 6. Terminal 5 is positive with respect to terminal 6 for all inputs. See Figure 6-1.
Current Limit Feedback Signal (PAP Type Input SCR units only)	4 & 6	The current limit feedback signal connections are made on terminals 4 and 6. Terminal 4 is positive with respect to terminal 6. This feedback signal is in turn connected to an appropriate controller or driver current limit input. See Figure 6-6.
Line Input (L1)	1	"Hot" side of the AC line connection. (85VAC/265VAC minimum/maximum, 120VAC/240VAC nominal). See Figure 6-1.
Load Input	2	One side of the external load connection. See Figure 6-1.
Line Input (L2 or N)	3	"Cold" or other side of the AC line connection. Note: This connection must be made. The power supply for the SCR unit is developed from the AC voltage present at rear terminals 1 (L1) and 3 (L2 or N). See Figure 6-1.

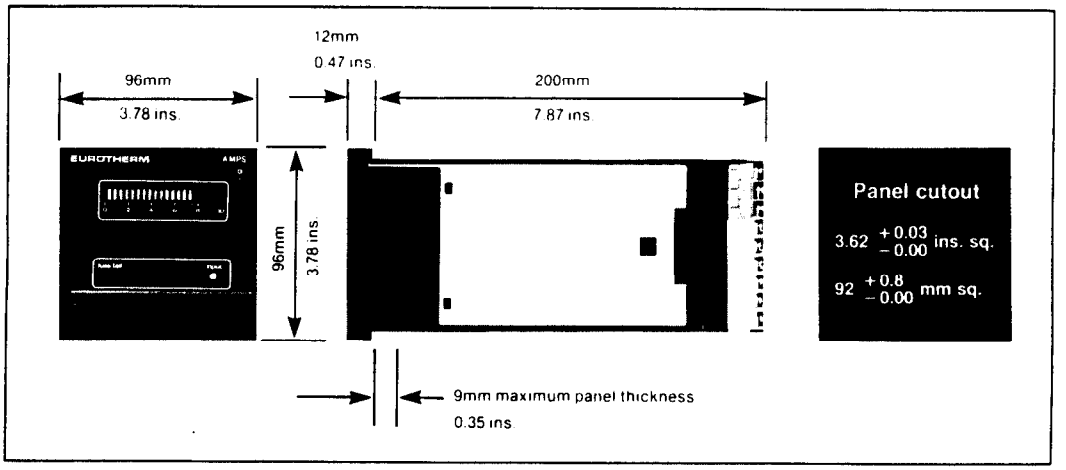


Figure 3.1
Model 831 SCR Dimensions

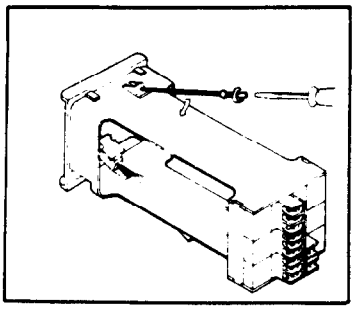


Figure 3.2
Model 831 SCR Mounting

EUROTHERM CORP.
11485 SUNSET HILLS RD.
RESTON, VA 22090
TELE: (703) 471-4870
TELEX: 89-9449

MODEL NO: 831/10A240V/ZCP-FC/M/ /

1. LINE 1
2. LOAD
3. NEUTRAL OR LINE 2
4. N/C
5. + INPUT PULSE (ISOLATED)
6. – INPUT (ISOLATED)

MADE IN U.S.A.

EUROTHERM CORP.
11485 SUNSET HILLS RD.
RESTON, VA 22090
TELE: (703) 471-4870
TELEX: 89-9449

MODEL NO: 831/10A240V/ZCP-FC/M/ /

MADE IN U.S.A.

Figure 3.3
Model 831 SCR Labels
(Typical Labeling Information)

SECTION IV

OPERATING INSTRUCTIONS

4.1 Operator Controls and Indicators

Operator controls and indicators are illustrated in Figure 4-1. Each control and indication is then described below.

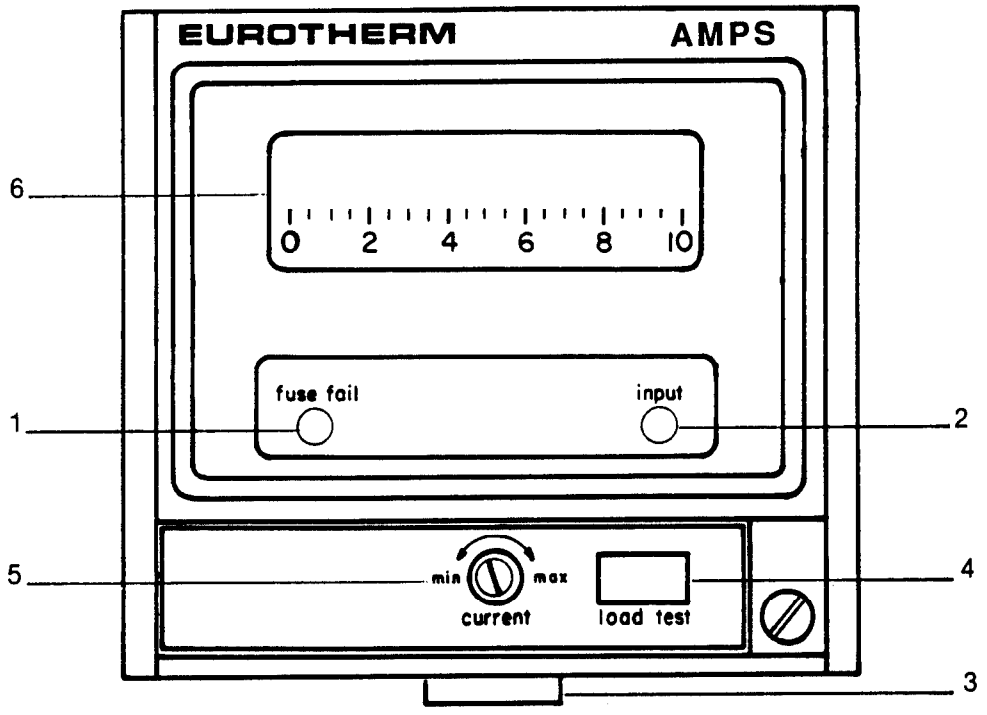


Figure 4-1
Model 831 Controls and Indicators

1 Fuse Failure: Neon indication of a fuse failure—if the fuse opens, the neon will light indicating a fuse failure.

2 Input Indication: LED indication of the presence of an input control signal—with the presence of an input control signal, the LED will light. With the logic voltage, the logic current, the logic A.C. voltage, the 4-20mA D.C. or the zero crossing pulse type inputs, the LED blinks on and off as the SCR switches power on and off. With the 4-20mA-PA or the phase angle pulse type inputs, the LED brightness intensifies as the phase angle is increased.

3 Front Panel Access Door: Allows access to the load test button and the current limit adjustment potentiometer (if fitted).

4 Load Test Button: Pressing the load test button will cause the Model 831 SCR to deliver 100% power to the load. For SCR units with current limit, pressing the load test button will cause the Model 831 SCR to deliver 100% of limited current to the load.

5 Current Limit Potentiometer Adjustment: This adjustment is only fitted on SCR units with current limit. Adjustments of this potentiometer will limit the maximum amount of current delivered to the load. Adjusting the potentiometer fully clockwise allows 100% of rated current to be delivered to the load. Adjusting the potentiometer fully counter-clockwise allows either 1/4 or 1/5 of the rated current to be delivered to the load. The PAP type input models have a current limit turn down ratio adjustment of 4:1 (potentiometer adjusted fully clockwise = 100% of rated current, potentiometer adjusted fully counter-clockwise = 25% of rated current). The 4-20mA-PA type input models have a current limit turn down ratio of 5:1 (potentiometer adjusted fully clockwise = 100% of rated current, potentiometer adjusted fully counter-clockwise = 20% of rated current).

6 Ammeter Display: The ammeter display is a 20 element, red LED, bargraph indication of current being delivered to the load. If the SCR unit is being zero crossover triggered, the ammeter indication will be an average or mean indication of the current being delivered to the load. If the SCR unit is being phase angle triggered, the ammeter indication will be a true RMS indication of the current being delivered to the load.

SECTION V

MAINTENANCE INSTRUCTIONS

5.1 Troubleshooting Guide

If upon completion of installation or during normal operation the Model 831 SCR unit fails to function, check all installation wiring for loose or faulty wiring connections. If these items are correct, refer to Table 5-1, "Troubleshooting Guide," to assist in isolating common malfunctions.

Table 5-1
Troubleshooting Guide

Condition	Fault	Action
No Output Power	1. External fuse failure. 2. Internal 831 fuse failure. 3. Load open. 4. No input control signal. 5. Reverse polarity on input control signal. 6. Input control signal circuitry failure.	1, 2 & 3. Remove all power and check fuses and load. 4. Check input LED for indication of input control signal. 5. Check input control signal wiring and input signal LED indication. 6. Consult Eurotherm.
Low Output Power	1. Low input control signal. 2. One SCR open or faulty trigger circuit.	1. Check and confirm input control signal. 2. Check for a D.C. voltage across the load/consult Eurotherm.
Continuous Output Power	1. One or both SCRs are shorted. 2. Faulty input control signal. 3. AC voltage supply exceeds SCR unit rating. 4. Voltage spikes causing the SCR to avalanche.	1. Remove input signal and check for shorted SCR. Consult Eurotherm. 2. Check input control signal and confirm. 3. Check supply and SCR unit rating. 4. Noise on power line or RFI.
Frequent I^2t Fuse Failure on Start-up	1. System mismatch. 2. Low cold resistance load with no current limit. 3. Low cold resistance load with incorrect current limit connections. 4. Current limit feedback circuitry failure. 5. Improper power-on sequencing. 6. AC supply voltage exceeds SCR unit rating. 7. Large "spikes" on AC supply causing spurious firing. 8. Zero crossover firing a transformer. 9. Incorrect phasing.	1. Load current exceeds SCR unit rating. 2. Use an SCR unit that is phase angle triggered and has provisions for current limit. 3. Check current limit connections and wiring. 4. Consult Eurotherm. 5. Correct power on sequencing (see Note 1). 6. Check AC supply and SCR unit rating. 7. Filter supply or use higher voltage rated SCR unit. 8. Use an SCR unit that is phase angle triggered. 9. SCR unit and controller are not referenced to the same phase to the supply. Check wiring.

Table 5-1
Troubleshooting Guide

Condition	Fault	Action
Erratic output power (On-Off action) with phase angle pulse type input	1. SCR unit and controller on different electrical phases.	1. Check wiring and reference both the SCR and the controller to the same phase of the supply.
No current limit action	1. Current limit feedback connections not connected or incorrectly connected. 2. Faulty current limit circuitry.	1. Check connections. 2. Consult Eurotherm.
Low output power on SCR units with current limit	1. Current limit potentiometer set at less than maximum.	1. Check current limit potentiometer behind front panel access door.
Ammeter indication reads incorrectly when compared to test meter	1. Comparison meter is not of the same type. 2. Internal SCR unit current transformer failure. 3. Ammeter display circuitry failure.	1. Use comparable meter (see Note 2). 2. Replace current transformer. 3. Repair/replace ammeter display.

Note 1: For proper "Soft Start" action on phase angle pulsed (PAP) input SCR units, power should be applied simultaneously to the controller and SCR unit or sequenced such that power is first applied to the SCR unit and then to the controller or driver. The procedure should be reversed when shutting power off.

For proper "Soft Start" action on the 4-20mA-PA phase angle fired SCR units, power should first be applied to the controller and then to the SCR unit. The procedure should be reversed when shutting power off.

Note 2: Since the SCR unit ammeter display is an "average over time" current indicating meter for all input control signals except the PAP type input or the 4-20mA-PA type input, significant errors will be found if the SCR unit meter is compared to a true RMS meter when operating at less than 100% of full current.

Table 5-2
SCR Fuse Rating and Eurotherm Part Number of Fuse

	Operating Voltage	
	Both 120VAC and 240VAC	
Current	**Fuse Rating**	**Part Number**
10A	10A/250V	696
20A	30A/250V	694
30A	40A/250V	695A
40A	50A/250V	697

Table 5-3
Type of SCR Device and Eurotherm Part Number of SCR Device

	Operating Voltage	
	Both 120VAC and 240VAC	
Current	**SCR Device**	**Part Number**
10A	Triac	461
20A	Silicon Control Rectifier (SCR)	656A
30A	SCR	656B
40A	SCR	656J

Table 5-4
Major Assemblies of the SCR Unit

Part Number	Nomenclature
1937	Display Board (1)
1939	Control Board (2)
1940	Phase Angle Sub-Board
1964	Current Pot Sub-Board

(1) Specify whether an RMS or a mean indicating meter.

(2) Specify voltage and current rating, input control signal type, and firing mode.

SECTION VI

INTERCONNECTING DIAGRAMS

6.1 Interconnections

Typical interconnection information relating to the Model 831 SCR assembly is shown in Figures 6-1 through 6-6.

Note: To prevent electrical damage to the rear terminal connections, the three (3) high current rear terminal connections should be torqued to 35.0 in.-lbs.

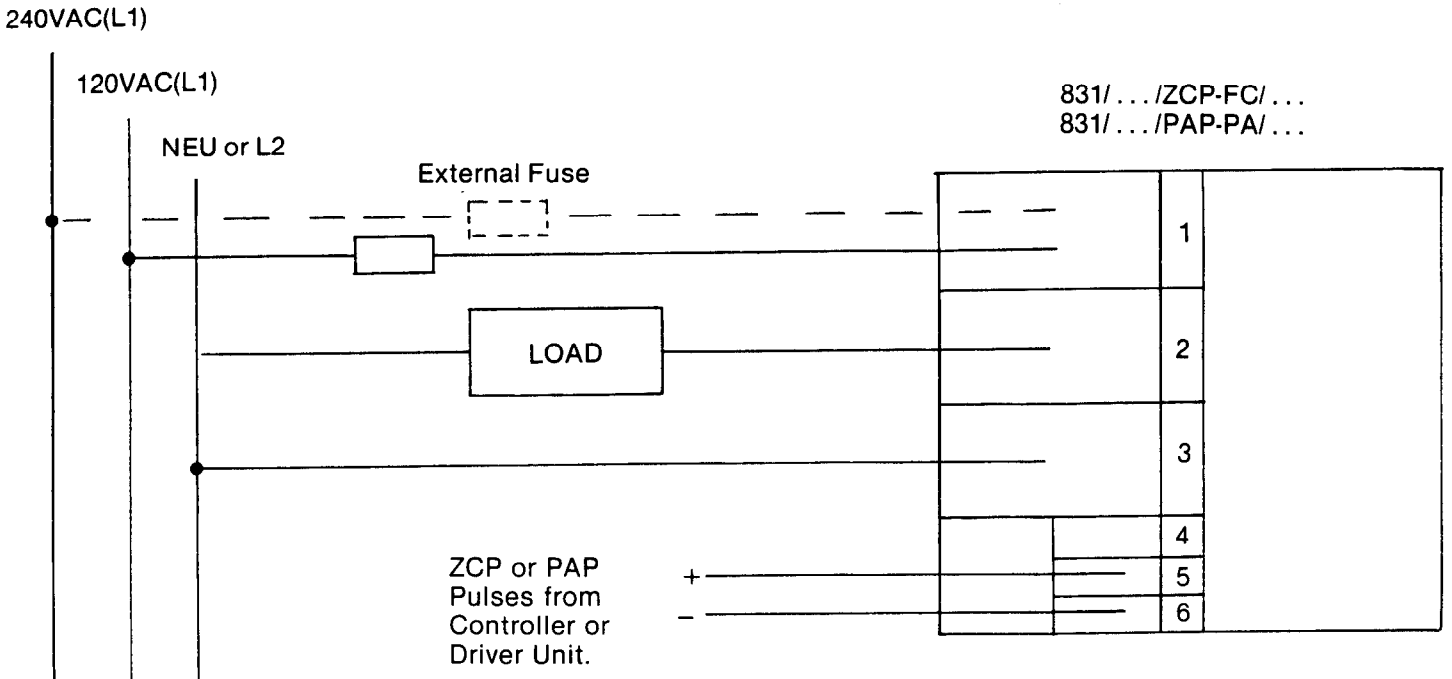


Figure 6-1
ZCP, PAP Input Connections

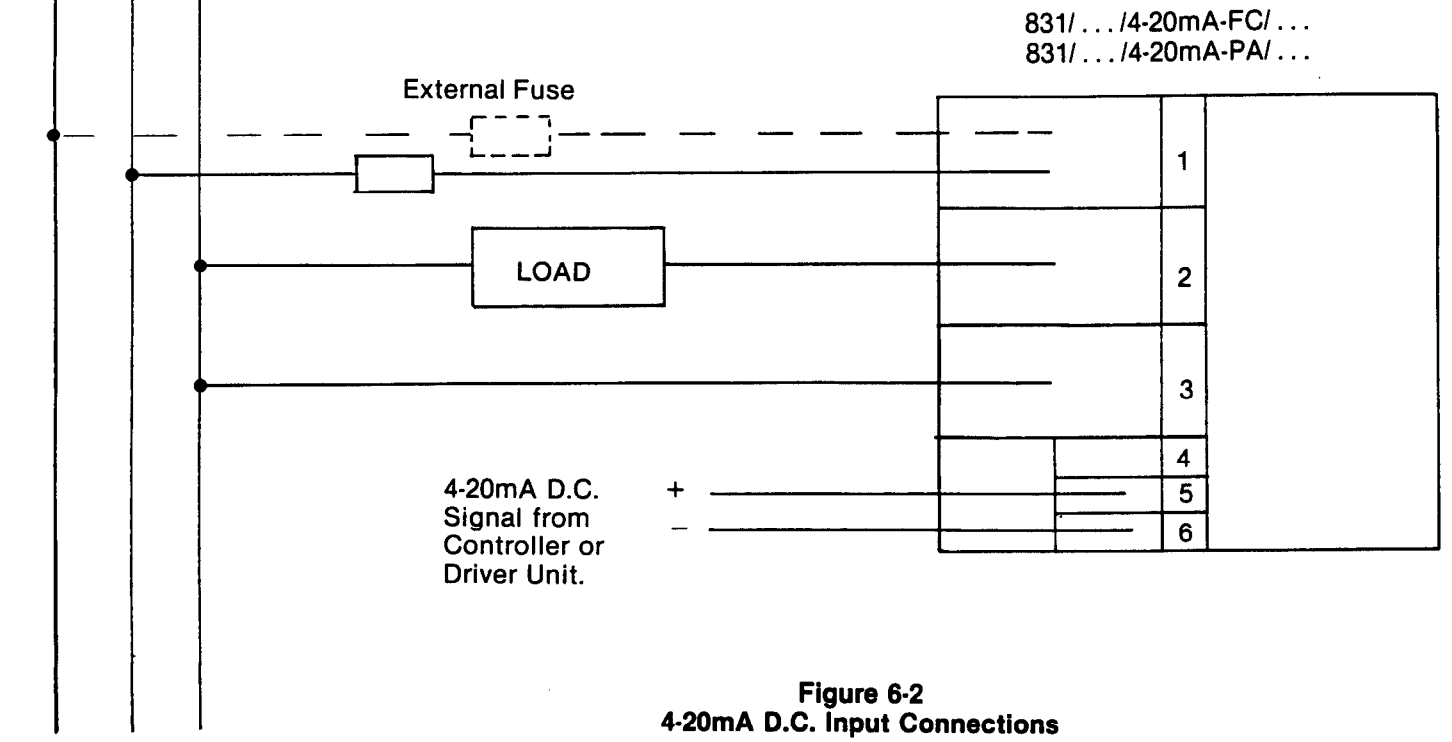


Figure 6-2
4-20mA D.C. Input Connections

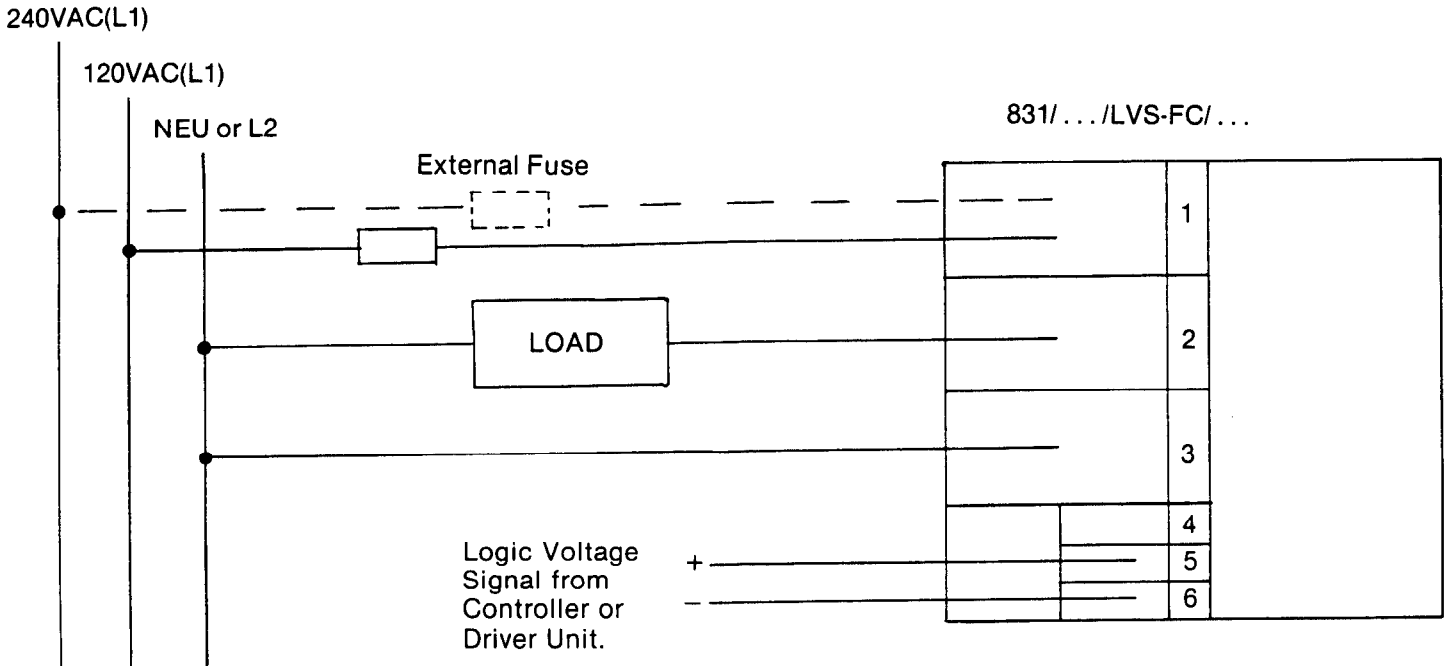


Figure 6-3
Logic Voltage Input Signal (5-30VDC) Connections

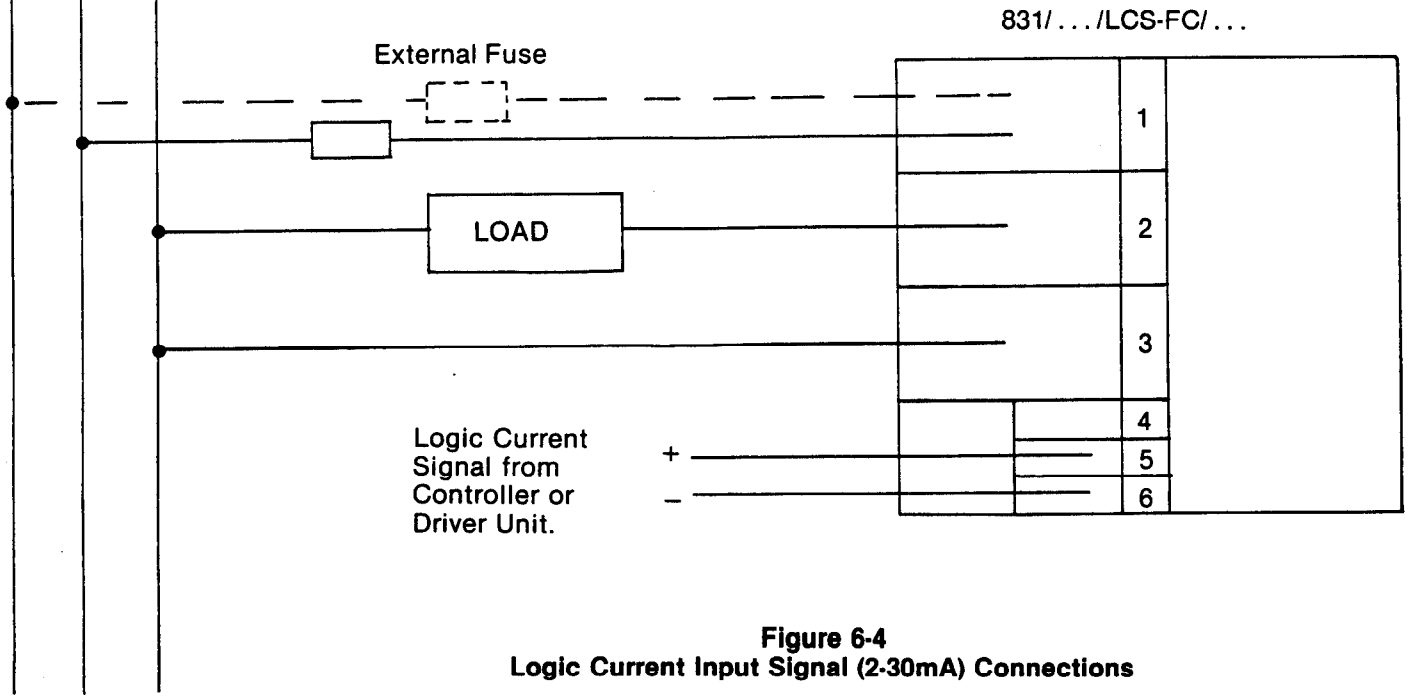


Figure 6-4
Logic Current Input Signal (2-30mA) Connections

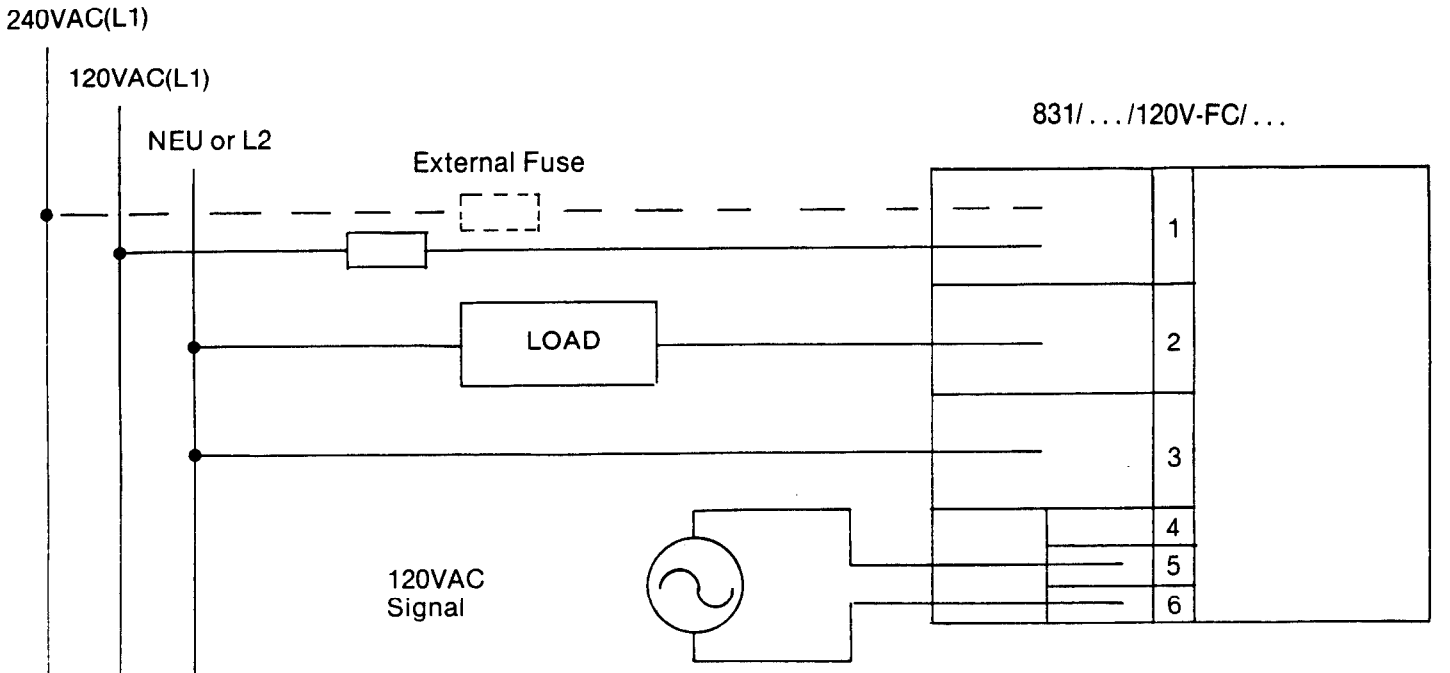


Figure 6-5
Logic AC Voltage Input Signal (85-135VAC)

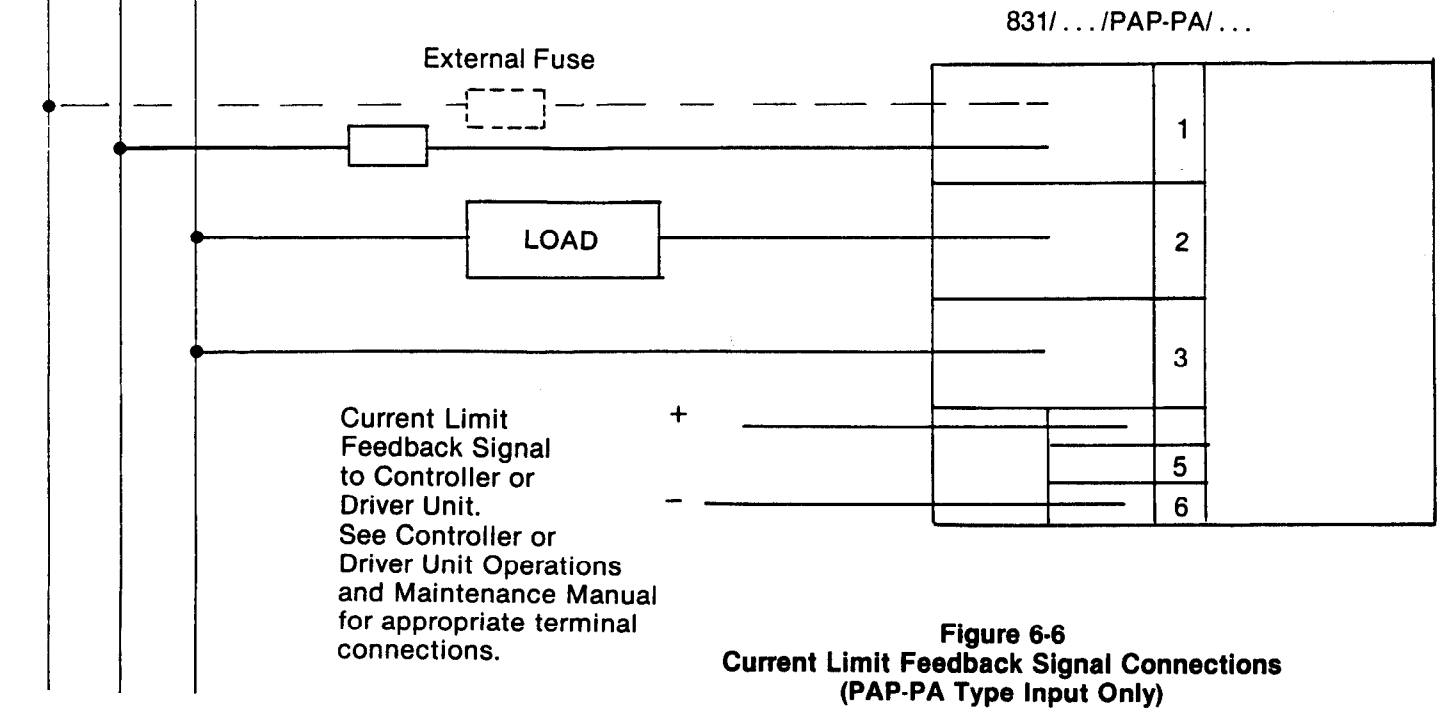


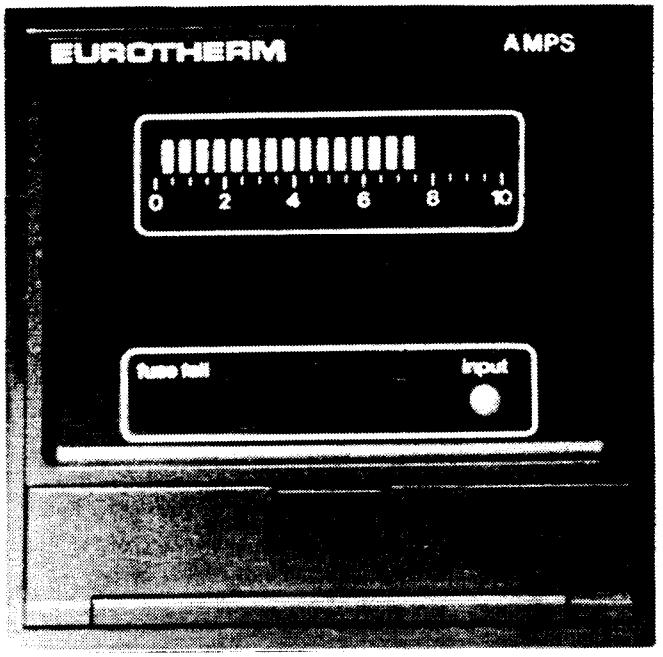
Figure 6-6
Current Limit Feedback Signal Connections
(PAP-PA Type Input Only)

EUROTHERM

Front panel mounting SCR assembly/ solid state contactor

Model 831

- **Compact 1/4-DIN sized sleeve**
- **Plug-in construction**
- **Current ratings from 10A to 40A**
- **Single 120/240V design**
- **Fully protected electronics and isolated heat sink for safety**
- **Available with fast cycle, ON/OFF or pulse-input firing**
- **Analog, logic and SCR pulse inputs available**
- **Incorporated fuse with front-panel fuse failure indication** (external fuse and fuseholder required for 40A models)
- **Optional 20-segment red LED bargraph ammeter**
- **Front panel LED indicating presence of input signal**
- **Full protection against line voltage spikes**



*Model **831**. 120/240V, 10A.*

The Model **831** SCR assemblies are plug-in, door mountable units for general purpose applications requiring load currents up to 40A.

They are available in 2 basic types: zero-crossing solid state contactors with logic inputs for resistive loads, and SCR assemblies with an analog current input for fast-cycle firing. The **831** can also accept SCR pulses from Eurotherm controllers for phase-angle or fast-cycle firing.

All inputs are isolated from the power line. No supplementary control power supply is required; the **831** control electronics are powered by the load supply.

As an option a front-panel bargraph ammeter is available. It indicates the true rms current for phase-angle fired loads and the mean (average) current for time proportioned loads. Other indications on the fascia include a fuse failure lamp and an LED that lights when the input signal is present.

The units fit into standard 1/4-DIN size panel cutouts and are retained by two mounting screws; units can be removed from their sleeves without unwiring. Wiring connections are made on the rear of the sleeve to screw terminals with pressure plates.

Eurotherm backs the Model **831** with a 2-year warranty.

FEATURES

Mechanical features

The 831 SCR assembly is housed in a 1/4 DIN-size sleeve for front-panel mounting into a 3.62 inch square cutout. The sleeve is held in place from the rear side of the panel by 2 mounting screws. The unit itself (composed of the SCRs, heatsink, and control electronics boards all connected to the fascia) slides into the sleeve from the front. It is held secured in the sleeve by a locking screw accessible behind the fascia-panel access door.

The 831 can be removed from the front without access to the panel interior; it is not necessary to disconnect any power or signal wiring made to the rear of the sleeve assembly. Both the signal and power wiring connections are made to 6 appropriately sized screw terminals with pressure plates.

All control electronics are mounted on printed circuit boards inside the unit for physical protection. A cutout in the sleeve exposes the isolated heatsink for convection cooling of the SCRs.

Inputs and firing modes

Three basic types of inputs are available. The pulse inputs are transformer coupled for isolation and can accept input signals from Eurotherm SCR pulse-output controllers. They can be either zero-crossing synchronized pulses for time-proportioned firing, or phase-angle pulses. In both cases the controller synchronizes the pulses to the load voltage.

For operation as a solid state contactor, both AC and DC optically coupled logic inputs are available: DC current and voltage, and AC voltage. The DC current input is used when one controller drives several Model 831s with separate loads; the inputs are connected in series. The 831 synchronizes the input signal to the zero-crossings of the load voltage to minimize RFI.

A 4-20mA analog current input can be selected for fast cycle firing outputs only.

Current limit (pulse input, phase angle firing only)

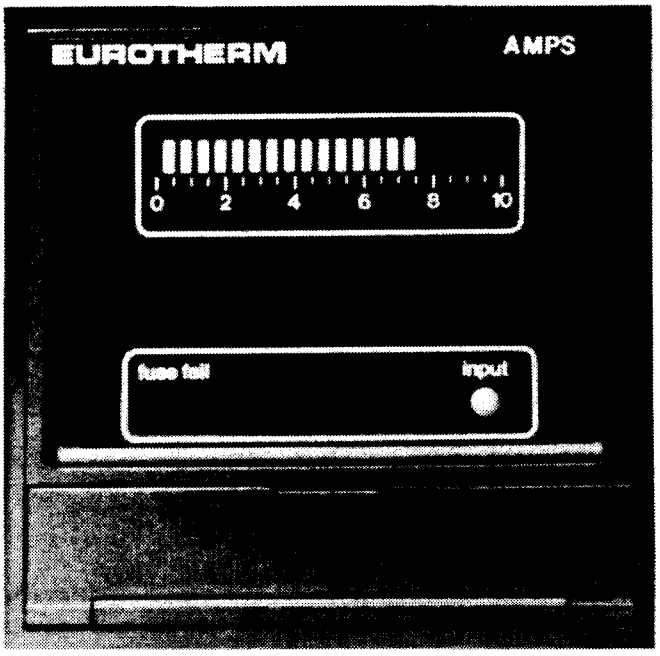
In phase-angle pulse input units, the full-wave rectified load current signal is available at the output terminals for current limiting by the controller. This signal is isolated from the load voltage.

Front panel

An optional 20-segment red LED ammeter is available on all versions. On the phase-angle firing models it indicates the true rms load current. On all others, the mean (avarage) current is displayed.

The neon "fuse fail" lamp lights when the incorporated semiconductor fuse is blown. The red "input" LED indicates when the input signal is present.

Behind the front-panel access door is threshold adjustment potentiometer for the current limit feature. Also there is a "load test" pushbutton on all units with logic or analog signal inputs. When depressed this button applies 100% output current to the load.



*Model **831** SCR assembly.*

Specifications

ABSOLUTE MAXIMUM RATINGS

Voltage between input signal(s) and load	264Vac rms
Operating temperature range (heatsink fins vertical)	0 to 60°C (32 to 140°F)—10, 20, and 30A units 0 to 50°C (32 to 122°F)—40A unit

1. OUTPUT

Voltage

Nominal load supply voltage	85-264Vac

Current

Rated load current	10Arms, 20Arms, 30Arms, or 40Arms

2. INPUTS

Analog (fast cycle outputs only)

Current	4-20mA
Range	6V
Minimum required source compliance	

Logic (ON/OFF output)

DC Voltage	
Turn-on range	5-30Vdc
Required source current	2mA (@5Vdc) to 30mA (@30Vdc)
Maximum turn-off voltage	4Vdc
DC Current	
Turn-on range	2-30mAdc
Required source compliance	4Vdc
Maximum turn-off current	0.3mAdc
AC Voltage	
Turn-on range	85-135Vac
Input impedance	3kΩ
Maximum turn-off voltage	20Vac

Pulse (output from any Eurotherm pulse-output controller or driver is suitable)

Required output voltage of driver	8-10V
Pulse train duty cycle	20µs ON, 200µs OFF
Pulse repetition frequency	5kHz (approx.)

3. FIRING MODES

Fast cycle (zero-crossing) (zero-crossing pulse or analog inputs only)

Cycle time at 50% output duty cycle	600ms
Minimum ON or OFF time	150ms

Phase angle (phase-angle pulse input only) — Follows input pulses

ON/OFF (zero-crossing) (logic inputs only) — Synchronized with load voltage

4. CURRENT LIMIT (phase-angle firing only; phase-angle pulse input)

External feedback signal — Full-wave rectified signal, 7Vpeak @ nominal load current

5. PROTECTION

Overcurrent	Incorporated semiconductor fuse
Spike suppression	Varistor and dV/dt filter

6. GENERAL

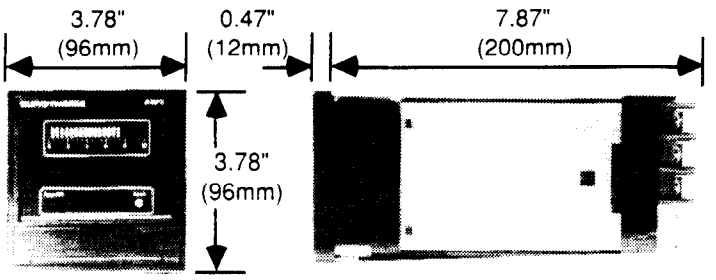
Control electronics power supply — Powered directly from load power supply

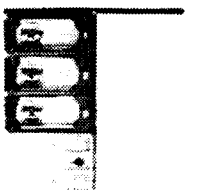
Front panel

Indicators	Fuse fail neon lamp, input signal present LED, 20-segment LED horizontal bargraph display [RMS current for phase angle firing, average (mean) current for all others]
Ammeter (optional)	Current limit setting
Adjustments	Load test (applies 100% limited current to load)
Pushbutton	

Weight — 2.4lb (5.3kg)

Dimensions



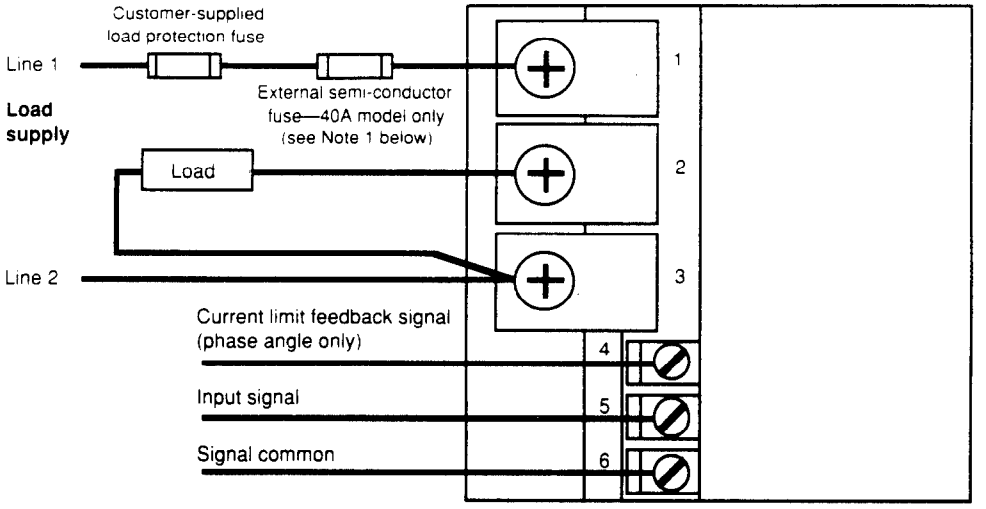


3.63x 3.63"	+0.03 -0.00
92x 92mm	+0.8 -0.0

Panel Cutout

Max. panel thickness: 0.35" (9mm)

Rear terminal connections



Product code

Model	*current rating*	*voltage rating*	*input*	*firing mode*	*option*
831 /	/	240V /	/	/	/ //

current rating

10A	10A rms	
20A	20A rms	
30A	30A rms	
40A	40A rms	*[1]*

voltage rating

240V	120/240V ac

input

ZCP	Zero-crossing pulse	*[2]*
PAP	Phase-angle pulse	*[3]*
LVS	DC logic voltage	*[2]*
LCS	DC logic current	*[2, 4]*
120V	AC logic voltage	*[2]*
4-20mA	4-20mA dc	*[2]*

firing mode

FC	Fast cycle
PA	Phase angle

option

M	Front-panel ammeter

NOTES:

1. *External fuse and fuseholder required. Order part no.* **409/40A250V**.
2. *Specify* **FC** *firing mode.*
3. *Specify* **PA** *firing mode.*
4. *Specify when driving more than one Model* **831** *from a controller logic output. Minimum of* $4V_{dc}$ *source compliance required per* **831**.

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(CONTINUED FROM INSIDE FRONT COVER)

GROUNDING

All "ground" terminals must be securely connected to ground by conductors appropriate to the current ratings of the units.
Most Eurotherm instruments have internal circuits which are isolated or "floating." This is necessary to prevent the occurrence of a "ground loop" in signal circuits. To avoid possible shock hazards in the event of an internal fault causing breakdown of insulation, it is recommended that all equipment connected to any Eurotherm unit be enclosed in a grounded metal enclosure. Sheaths of thermocouples (or other sensors) should be properly grounded by a separate conductor (instead of being dependent on grounding via the machine framework).

SUPPLY ISOLATORS

Every electrical system should be provided with means for isolating the system from the AC supply to allow safe working during repair and maintenance. SCRs and triacs are not adequate means of isolating the supply, and should always be backed by a suitable mechanical disconnect switch.

TEMPERATURE SENSOR FAILURE

In the event of sensor failure (i.e., thermocouple break or open input circuit) the instrument might display erroneous readings before indicating the input fault condition. For example, upon thermocouple break, the display reading rises rapidly before an indication occurs.

HAZARDOUS ATMOSPHERES

Unless otherwise stated in the published specification of any particular unit, Eurotherm products are not suitable for use in areas subject to hazardous atmospheres. No Eurotherm product should be connected to a circuit which passes into or through a hazardous area unless appropriate precautions are taken (even though the instrument itself may be located in a safe area). Such an installation should conform to the requirements of the relevant Authority. (In the USA: Factory Mutual Research Corporation and Underwriters' Laboratories, Inc.).

PROCEDURE IN THE EVENT OF TROUBLE

Before beginning any investigation of a fault, the electrical supplies to all equipment concerned should be switched off and isolated. Units suspected of being faulty should be disconnected and removed to a properly equipped workshop for testing. Any attempt to troubleshoot while installed could be hazardous to personnel and equipment.

IF IN DOUBT, ASK !

If you have any questions regarding any aspect of installing, operating or servicing your Eurotherm equipment, please contact your nearest Eurotherm Sales and Service Representative.