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EUROTHERM

ANALOGUE INPUT THYRISTOR UNITS TYPE 461-464

Maintenance Manual



Part No. HA016970

461-464M-3

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1.0 GENERAL DESCRIPTION 461 TO 464

This range of single-phase thyristor units has current ratings from 15A to 150A at supply voltages up to 660V. They use two thyristors connected in inverse parallel. The triggering circuit is transformer-isolated from the thyristor circuit. The circuit is arranged so that the load power is proportional to the input signal, for any fixed value. The circuit caters for two basic types of input, Auto or Manual. The Auto mode is for a d.c. analogue input, adjusted for zero and span. Manual mode provides a reference voltage supply for an external 5K ohm setpoint potentiometer and a separate input connection. The input ranges are user selectable by means of a dual-in-line (DIL) switch on the PCB.

Thyristor firing mode options are Fast Cycle, Slow Cycle, Single Cycle, Phase Angle (PA) or Phase Angle Start Fast Cycle. These are also user selectable by DIL switch. A high speed fuse protects the thyristors and the load. Partial Load Failure (PLF) detection is a feature which continuously monitors the load resistance and indicates an increase arising, for example, from failure of one arm of a parallel connected load.

The current limiting action is applicable to all firing modes. Overcurrent detection causes the unit to change to Phase Angle firing mode and the firing angle is reduced to limit the current.

Three basic sizes of unit are used to accommodate the various power requirements. All models are intended for mounting inside cubicles or equipment housings and are plugged into baseplates. These baseplates can be mounted either on wall bulkheads or DIN rails. A 'lever and secure' action is employed with a single quarter-turn fastener at the top of the unit. Thyristor units should not be mounted one above the other. Allowing adequate ventilation will ensure trouble-free service.

Units rated at 100A and above have fan cooling. With fan cooled installations a fan-failure detection method is used. The standard method is a temperature switch which switches off the control circuit supply at heatsink temperature above 70°C. The control supply will automatically be re-applied when the heatsink cools to around 55°C.

The control electronics are mounted on a single printed circuit board in the side of the unit, which has an earthed heatsink. The front panel lamp labelled 'fuse fail' will indicate fuse failure provided that the load is connected.

A type 260 Diagnostic Unit is available for use with the current version. Twenty diagnostic points are brought out to a front panel connector where the diagnostic unit can be used for commissioning or fault finding.

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2.0 TECHNICAL SPECIFICATION

INPUT		
D.C. Voltage	0-5V 0-10V 1-5V	
D.C. Current	0-5mA 0-10mA 0-20mA 4-20mA	
OUTPUT		
Current and Voltages	Up to 40A, 500V Up to 75A, 660V Supply Voltage Off-state current	Type 461 Up to 100A 660V Type 463 Type 462 Up to 150A 660V Type 464 +10%, -15% of nominal <30mA
General	Operating temperature range Storage temperature range	0°C to 50°C with heatsink fins vertical -10°C to + 70°C
Terminals	Light current High current	Screw or faston 0.5-2.5mm^2 wire size, single or multi-strand Screw with clamp Cable size: 15-40A 6-16mm^2 50-75A 16-50mm^2 100-150 50mm^2
Partial load failure option	General Discrimination Adjustment Indication Alarm output	Compares load current: voltage to detect load resistance increases 20% of current setting. Not affected by normal supply voltage variations Front-panel mounted potentiometer with a range of 10:1 Red l.e.d. on front panel Relay. Fail-safe operation by being off in alarm state. Contact rating 0.25A 250V a.c. or 30V d.c.
Other Facilities	Inhibit Current Limit Slave Drive Output Current Out Manual Input Diagnostic Socket	+10V will inhibit output at the next zero crossing. Open circuit to release. Internal pre-set potentiometer or 0-10V external signal in cascade with pre-set potentiometer. Output may be used to slave other solid state contactors. Nominally 10V at 10mA Signal (PLF only) for monitoring or diagnostic purposes. Rectified signal proportional to current in load. Nominally 5V mean at rated current Provision for an external 5K ohm set point potentiometer or type 403 unit. 20 monitor signals for commissioning adjustment and system fault finding

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Dimensions and Weight	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
Model				
461	247	76	236	3
462	247	114	236	4
463/464	280	152	236	5

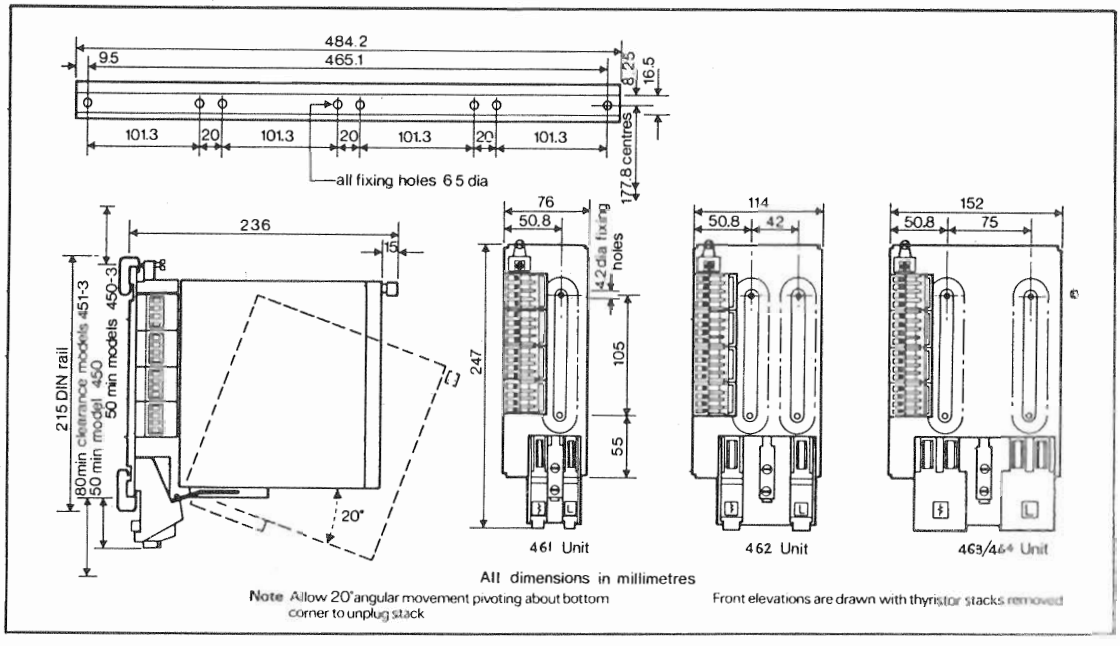


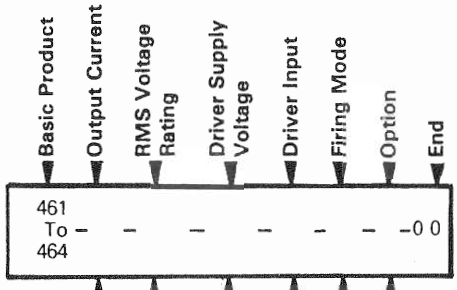
Figure 2 Installation and Dimensional Details

Note: When using phase angle switching with inductive loads ensure that the load circuit is made simultaneously with or before the supply to the instrument. The 'soft' start feature will then limit the inrush load current which could otherwise blow the semiconductor fuse.

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3.0 Ordering Information/Product Identification Code.

You are welcome to order by description or from the code below which is a useful checklist.



Output Current and Voltages

Basic product	Rating	Code	Rating	Code
461	15A	081	240V	13
	25A	082	440V	28
	40A	083	500V	29
462	55A	062	240V	13
	75A	113	440V	28
			500V	29
463	100A	114	240V	13
			440V	28
			500V	29
464	125A	117	240V	13
	150A•	100	440V	28
			500V	29

Driver Supply Voltage

110–130V, 200–260V	50/60Hz	19
200–260V, 350–450V	50/60Hz	43

Acceptable Driver Input Signals

0-5 V d.c.	008
0-10V d.c.	060
1-5 V d.c.	068
0-5mA d.c.	069
0-10mA d.c.	071
0-20mA d.c.	072
4-20mA d.c.	073

Acceptable Firing Modes

Fast cycle	001
×Slow cycle	050
Single cycle	160
Phase Angle	002
Phase Angle Start Fast Cycle	055

Option

Gated pulses (not 461)	22

Standard Features

Current Limit (0-5V including CT)	
Partial Load Failure (PLF)	

×To special order.
• Consult your local Eurotherm Engineer

Diagnostic Unit

110V	10
240V	13

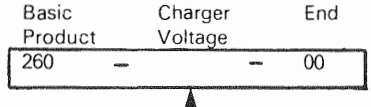
If required 484mm (19 inch) DIN rails to DIN 46277, drilled as detailed overleaf may be ordered as a separate item (Eurotherm Part No. BA016165).

463/464 fan is run from the Driver Supply.

For higher voltage consult your local Eurotherm engineer.

Write: 462-113-28-19-00

Example Order
To specify:
Thyristor unit rated at 75A (462-113) and 440V, 50Hz (28), driver supply 240V (19), driver input signal 0-5V (008), firing mode fast cycle (001).
Write: 462-113-28-19-008-001-00



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4.0 BASEPLATE WIRING

4.1 Supply Connection

a) Heavy Current. The L terminal must be connected to the load supply. One end of the load must be connected to the —WW— terminal, while the other end of the load is returned to Neutral or L2 as appropriate.

b) Control. The control supply is connected to terminals 8 and 9 or 10. Terminal 8 is the neutral or reference line connection while terminal 9 is used only when the control supply is 240V. Terminal 10 is used for the line supply other than 240 (as specified in the instrument code). The control supply must be within +10% to -15% of the nominal rating.

RMS Voltage Rating

The Heavy Current supply voltage must be within 10% of the Rated Voltage:

240V	216-264 volts RMS	440V	396-478 volts RMS	660V	594-726 volts RMS

4.2 Control Signal Input

The analogue signal from a controller should be connected to terminals 5 and 6. The correct polarity of this supply must be observed. ie. terminal 5 is positive and terminal 6 is zero volts reference. For Manual input terminal 4 is positive, and terminal 12 is the Reference Voltage Out (for an external 5K ohm setpoint potentiometer or Type 403 unit).

4.3 Partial Load Failure Output

Partial Load Failure detection is fitted to the stack and a relay output is available from terminals 1 and 2, contacts being open in the alarm state (Fail Safe). Relay contact rating is 0.25A at 250Va.c. or 30V d.c. maximum. Release of this relay coincides with the illumination of the Partial Load Failure indicator mounted on the stack. When the load current and voltage signals indicate that part of the load is open-circuit, then the indicator will be illuminated and the relay output will switch. Suitable for driving a Eurotherm Type 603 Alarm Collection Unit.

4.4 Current Limit

Current Limit is supplied and a front panel control is fitted. Alternatively an external current limit potentiometer (10K ohms) may be wired to terminal 12 Reference Voltage Out, zero volts terminal 6 and current limit setpoint input terminal 14. Turn front panel setpoint control to maximum for external use. If external current limit is not used , link terminals 12 and 14.

4.5 Other Facilities

Terminal 16 is the Inhibit Input. Connect +4 to +32 volts to inhibit the output at the next zero crossing. Open circuit or -2 to +1 volt to release. Terminal 13 is the Slave Drive Output which may be used to slave other solid-state contactors. This is a digital signal,

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nominally 10 Volts at 10mA. Terminal 3 is the Current Out signal for monitoring or diagnostic purposes. It is a rectified d.c. signal directly proportional to the current in the load and nominally 4.8 Volts mean at the rated current. Terminal 15 is the Volt signal which is the full-wave rectified voltage output signal for monitoring or diagnostic purposes.

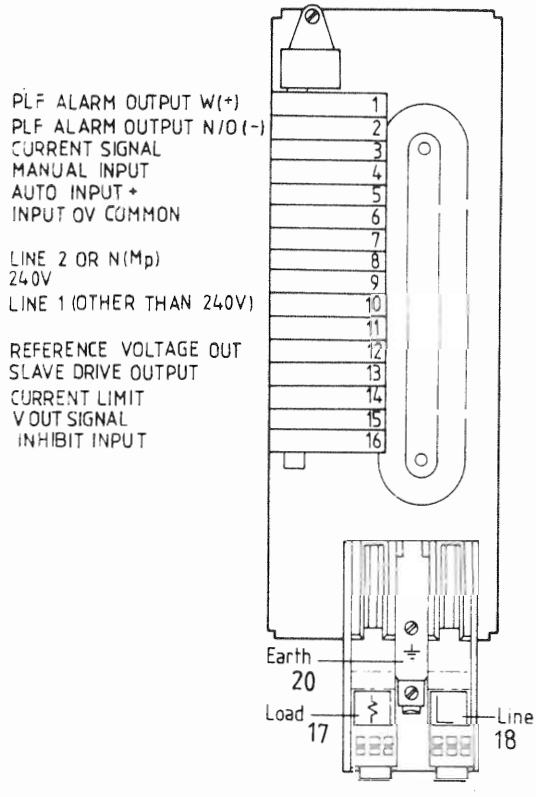


Figure 3. Connections.

4.6 Connection for Multi-Drive

Voltage Signal Inputs

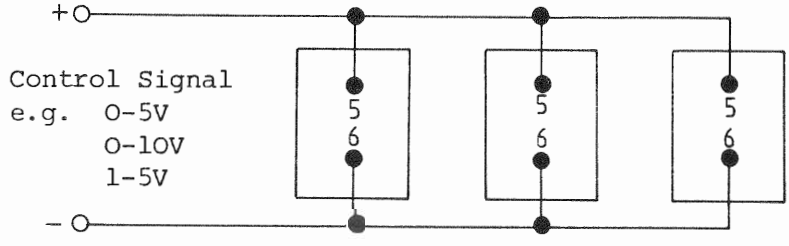


Figure 4. Voltage Signal Input Connection

Parallel Connected. All thyristor Units must be the same type and input selection e.g. all 0-5V input.
Input impedance is nominally 100K Ohms. Current requirements is 0.1mA per unit.

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Current Signal Inputs

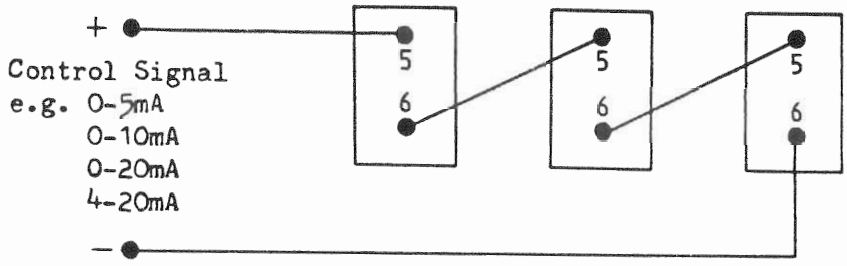


Figure 5. Current Signal Input Connection.

Series Connected. For current drive a minimum of 5 volts per unit is required.

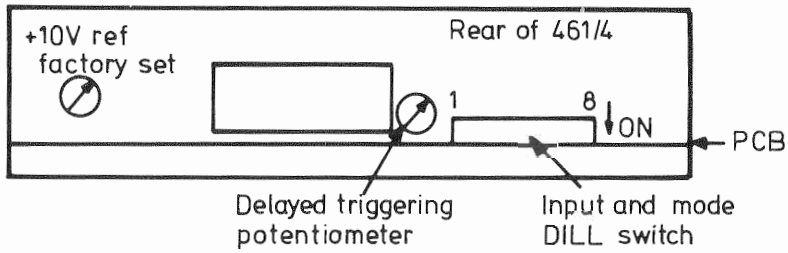
4.7 PLF Set-Up Procedure

Turn PLF multi-turn potentiometer clockwise until the PLF LED comes on. Then turn the pot back anti-clockwise slowly until the LED just goes off. Check that it has been set up correctly by pressing the test button S1. The LED should come on, and when the button is released, go off after a short delay. The PLF is now set for an 8% to 10% increase in load resistance. If the LED does not come on repeat the above procedure more carefully.

4.8 Current Limit Set-Up Procedure

With the load connected turn the current limit potentiometer to minimum position (fully anti-clockwise). Set the input signal to zero and switch on the supplies. The rms output voltage should be minimal. Increase the input signal to approximately 100%. The output voltage should remain below 15% of the supply voltage. Gradually increase the current limit potentiometer and check that the current increases smoothly. Leave the current limit set at the maximum safe current for the load.

4.9 Preset and DIL Switch Locations



Preset Delayed Triggering and Phase Angle Start

See Preset and DIL Switch Locations. Delayed triggering is used on single cycle control or slow cycle static switching. With DIL switch 5 ON, delayed triggering is obtained by adjusting the potentiometer clockwide. Up to 90 degrees trigger angle in the first half cycle is obtainable. Delayed triggering of the first cycle when using slow cycle control (switch 6) can similarly be obtained. Switch 7 allows longer soft start time periods up to approximately 0.25 seconds when in the slow cycle mode.

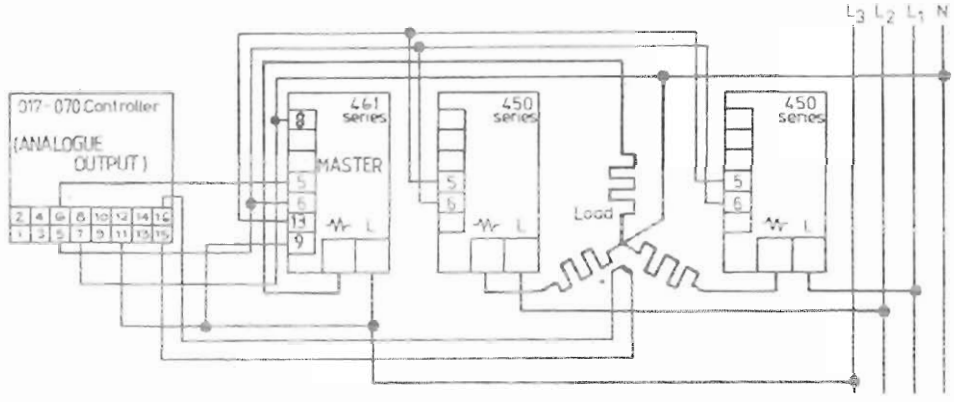
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5.0 Typical Wiring Schemes

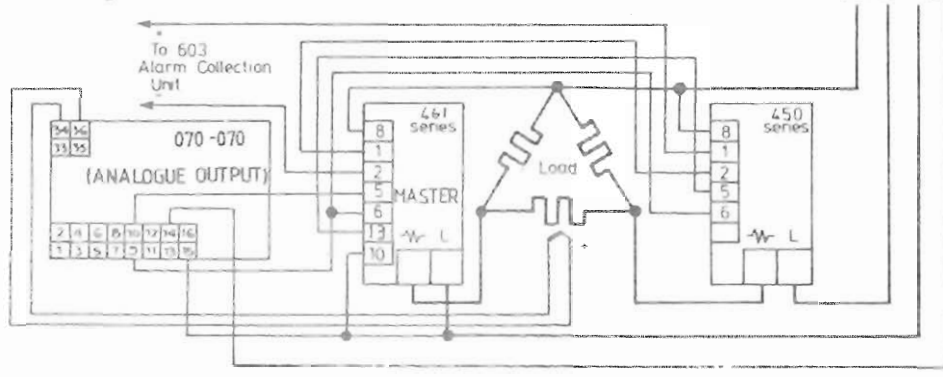
Suitable Eurotherm Controllers and their appropriate options are listed below:

Controllers		Output Options			
093	071	008	070	013	024
017	147	060	071	015	123
018	148	068	072	017	125
070	601	069	073	021	
810					

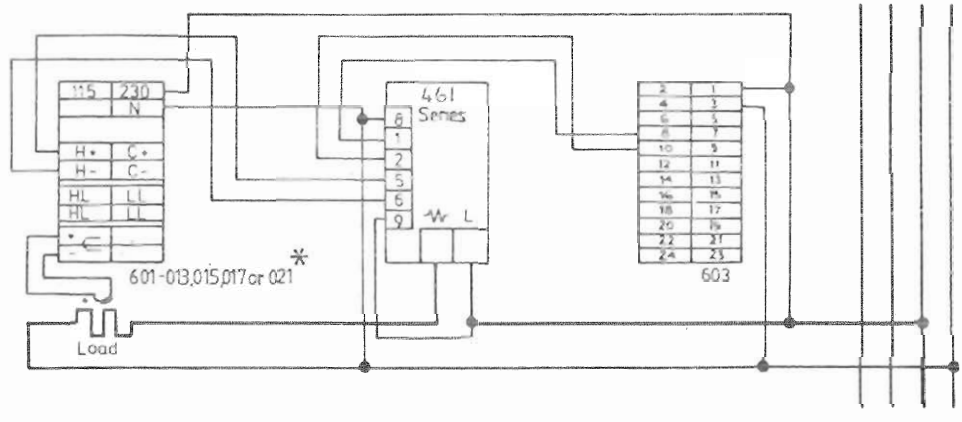
a) Three Phase Fast Cycling Synchronised Four Wire Star Load using an 017 Controller.



b) Three Phase, Fast Cycling, Closed Delta Synchronised System using an 070 Controller with P.L.F. to Indicate Loss of Arm.



c) Single Phase Fast Cycling System using a 601 Controller and Giving Audible Warning of Partial Load Failure using 603 Module.



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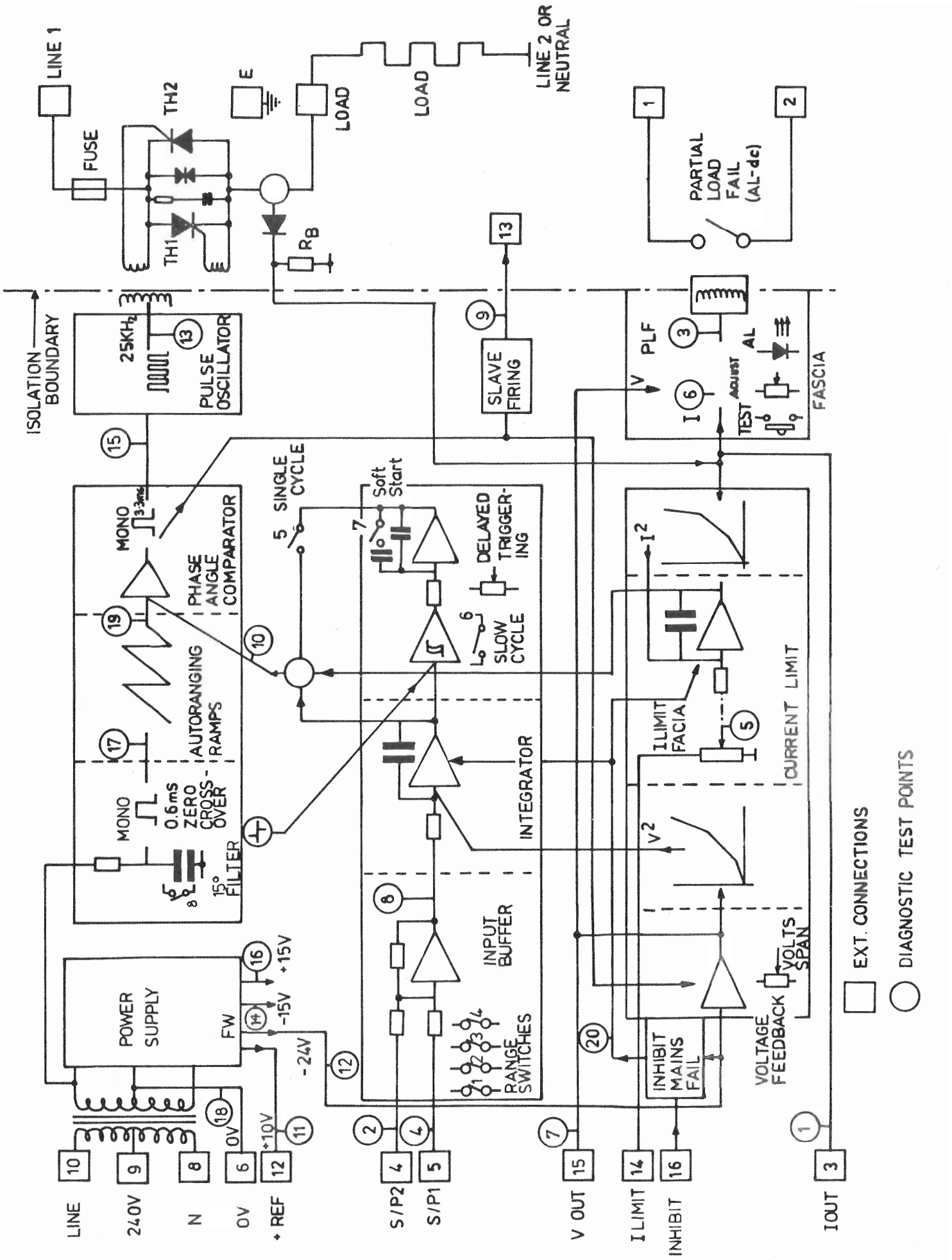


Figure 6. Block Diagram - 455/461 Series.

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6.0 CIRCUIT DESCRIPTION

6.1 Power Supplies

The control a.c. supply is applied to pins 8 and 9 or 10. Pin 9 is always 240V control supply input while pin 10 is 120V or line voltage (other than 240V) specified by the customer.

The transformer secondary is centre-tapped at a nominal 24V a.c. The output is full-wave rectified by diodes D1 to D4 and smoothed to provide the d.c. supplies for the pulse triggering transformer and the +15V, -15V and +10V circuits.

The stabilised +15V generated by IC2/7 and T1 adjusted by P1, and -15V rail generated by IC2/1 and T2 supply the control circuit. The +10V reference on pin 12, generated by IC3/1 from the -15V rail, only supplies an output for manual control or an external current limit setpoint.

6.2 Mains Synchronising

The mains signal required for synchronising the firing is derived from the secondary of the mains power supply transformer. This signal is filtered (15°) to prevent line disturbances from affecting the ramps. The filter is frequency compensated for 50 or 60Hz. The a.c. signal is 0.5ms wide and is available at diagnostic point 17. This is the zero-crossover reset pulse. The pulse is so positioned that control is achieved from 10 to 180° conduction.

The zero-crossover pulse is used to reset the auto-ranging ramps IC5/7 and IC5/1, available at diagnostic point 19.

6.3 Load Voltage Feedback

The load voltage signal is derived from the full-wave rectified voltage of the mains transformer (diagnostic point 12), gated with the command to fire signal at IC8/7. Varying the gain of this voltage feedback amplifier with P3 adjusts the output load voltage to setpoint relationship. This is normally set to give maximum output at 0.85 of input (4.2V span, zero at 0.15V), so that with -10% mains, full power can still be obtained. Supply rejection is $\pm$ 1.5V for $\pm$ 10% supply variation.

6.4 Control Circuit

The control signal to the input buffer IC8/1 is available on diagnostic point 4. It is applied between pins 5 (+) (diagnostic point 2) and pin 6 (0V). The inputs are summing, so unused inputs should be disconnected.

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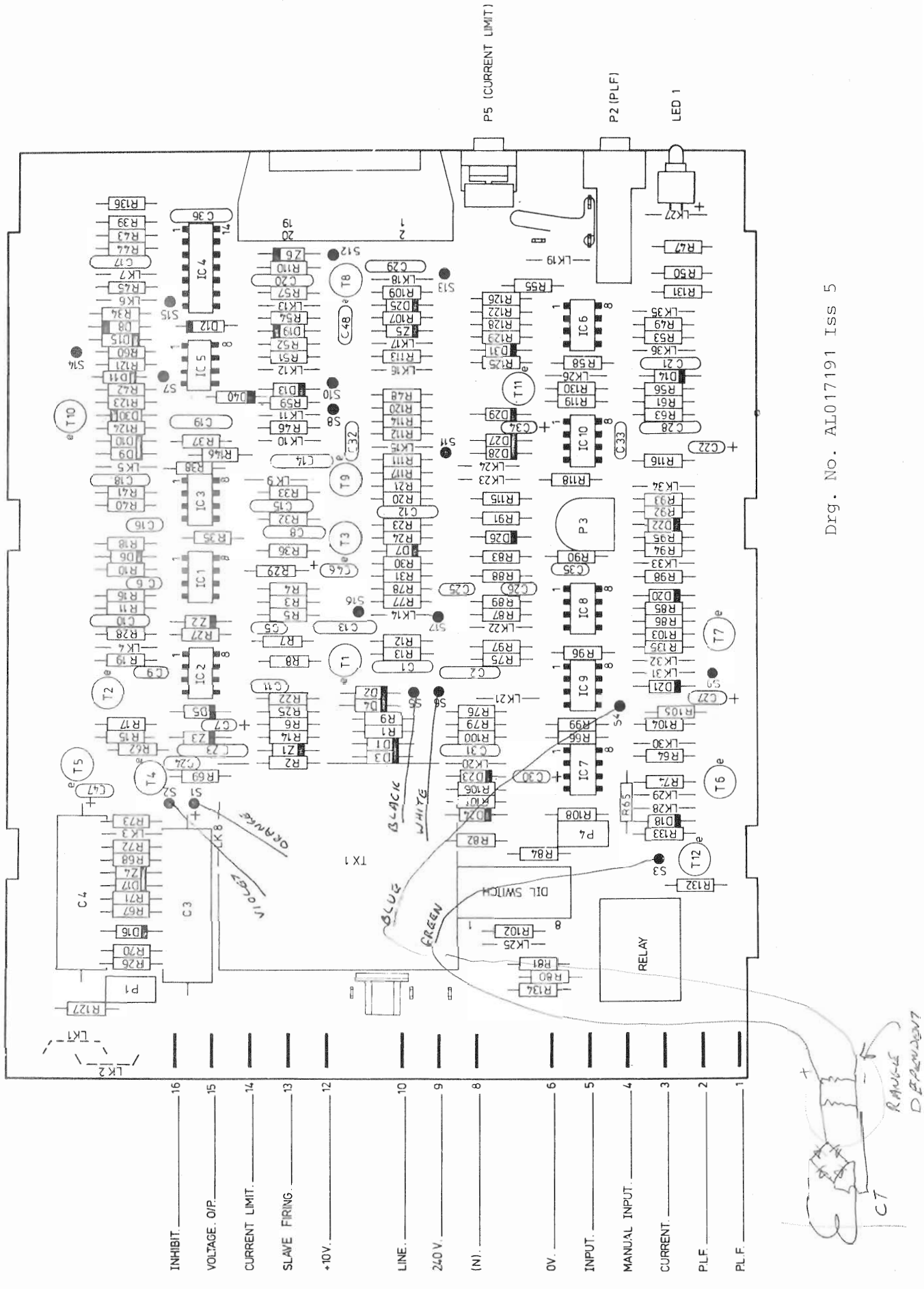


Figure 7. Component Layout - 461 to 464 with PLF

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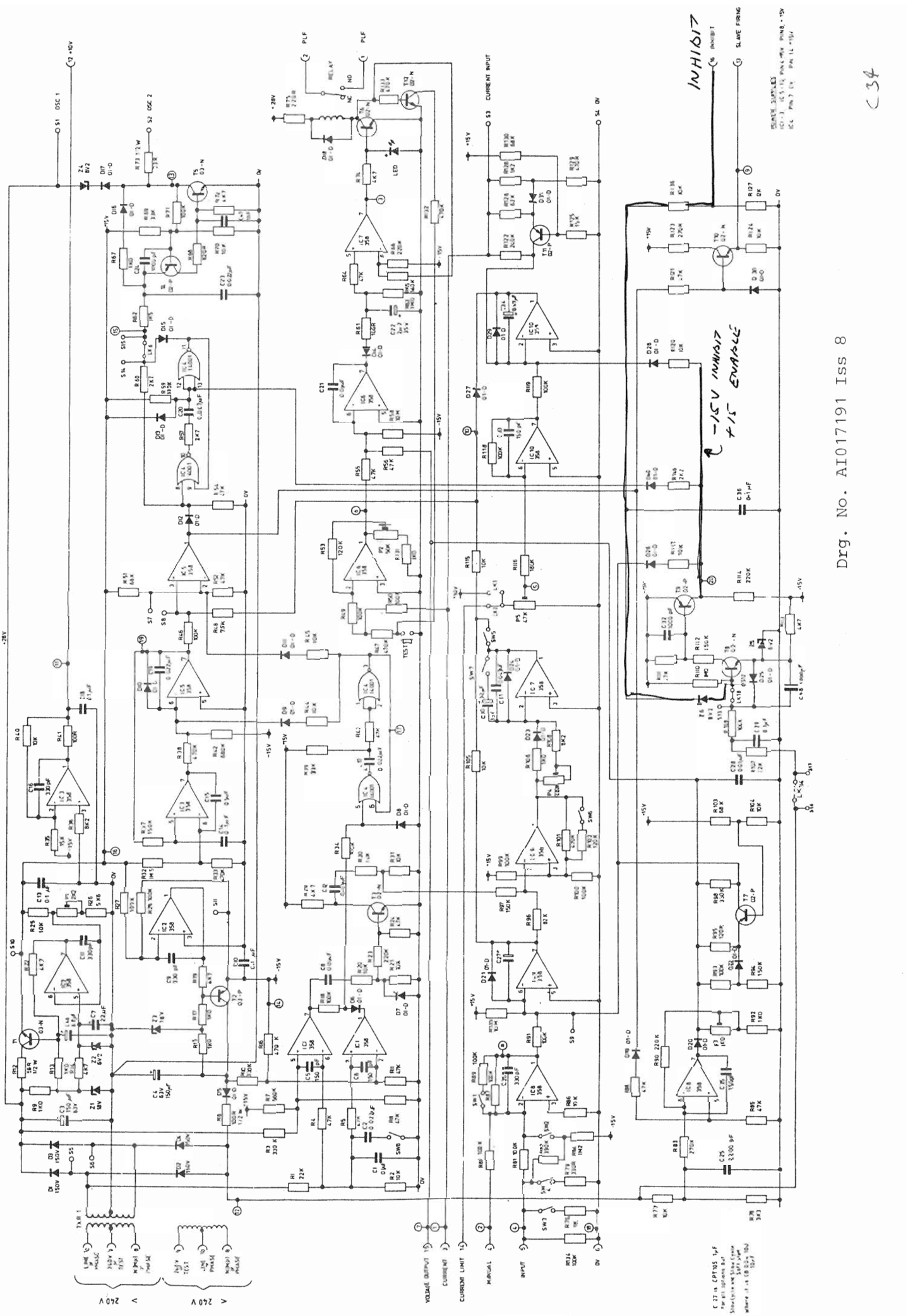


Figure 8. Circuit Diagram - 461 to 464 with PLF

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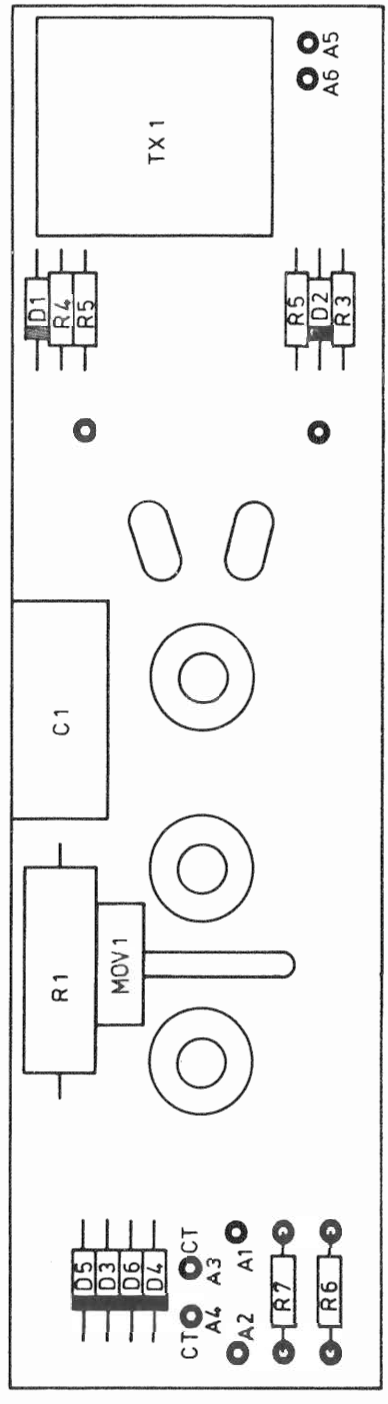


Figure 9. Component Layout - Suppression Board

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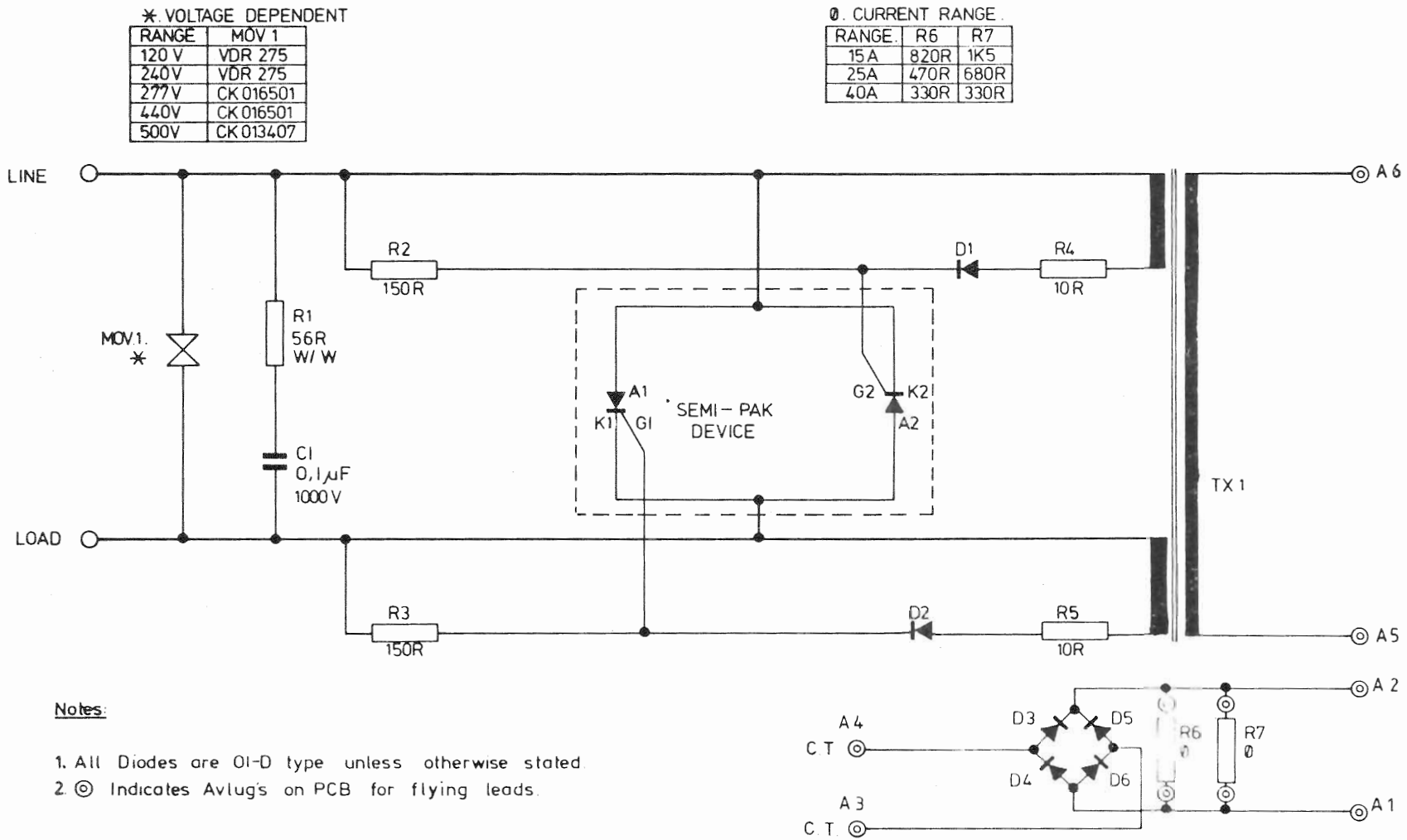


Figure 10. Circuit Diagram - Suppression Board

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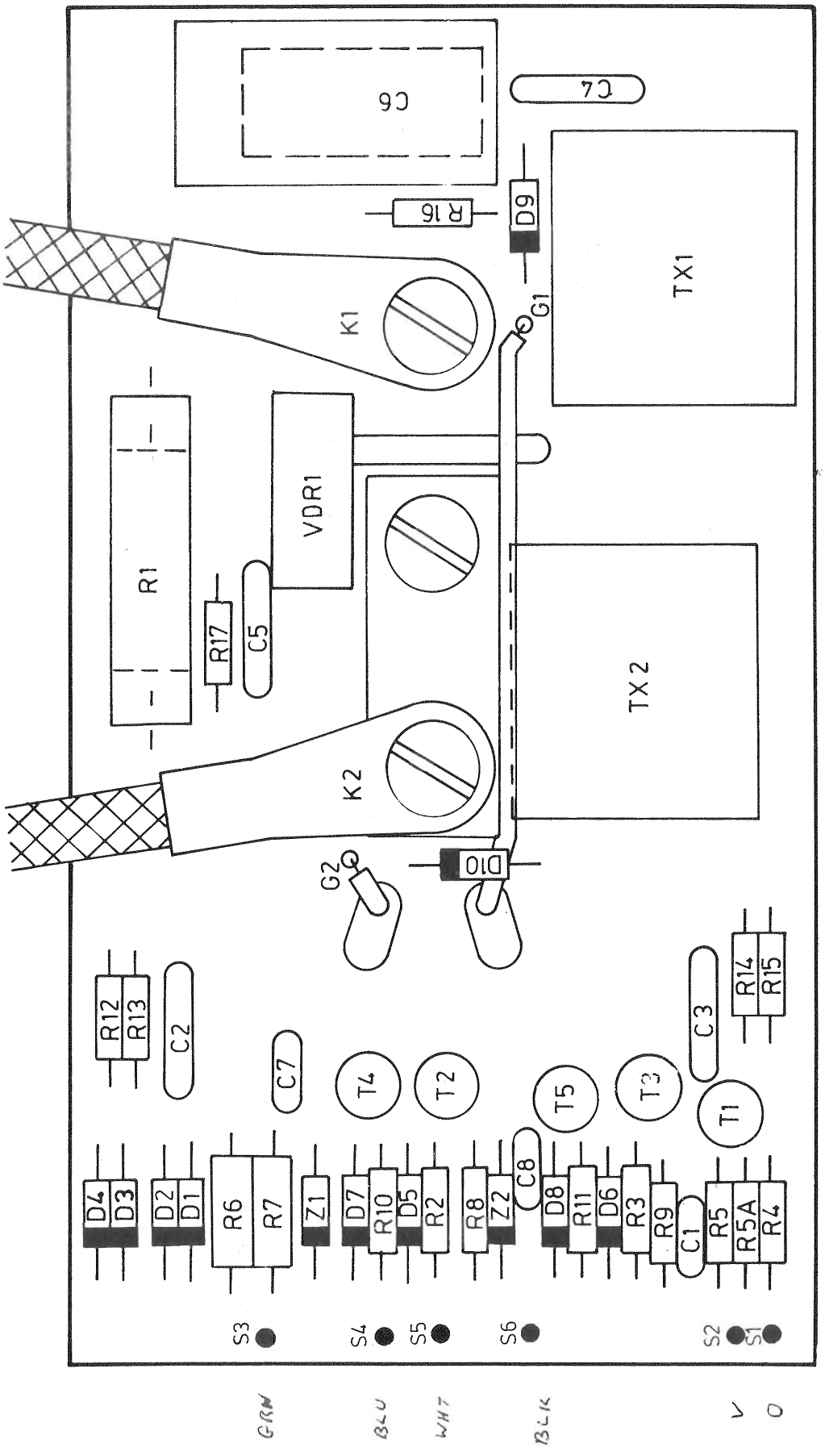


Figure 11. Component Layout - Suppression and Gating Board.

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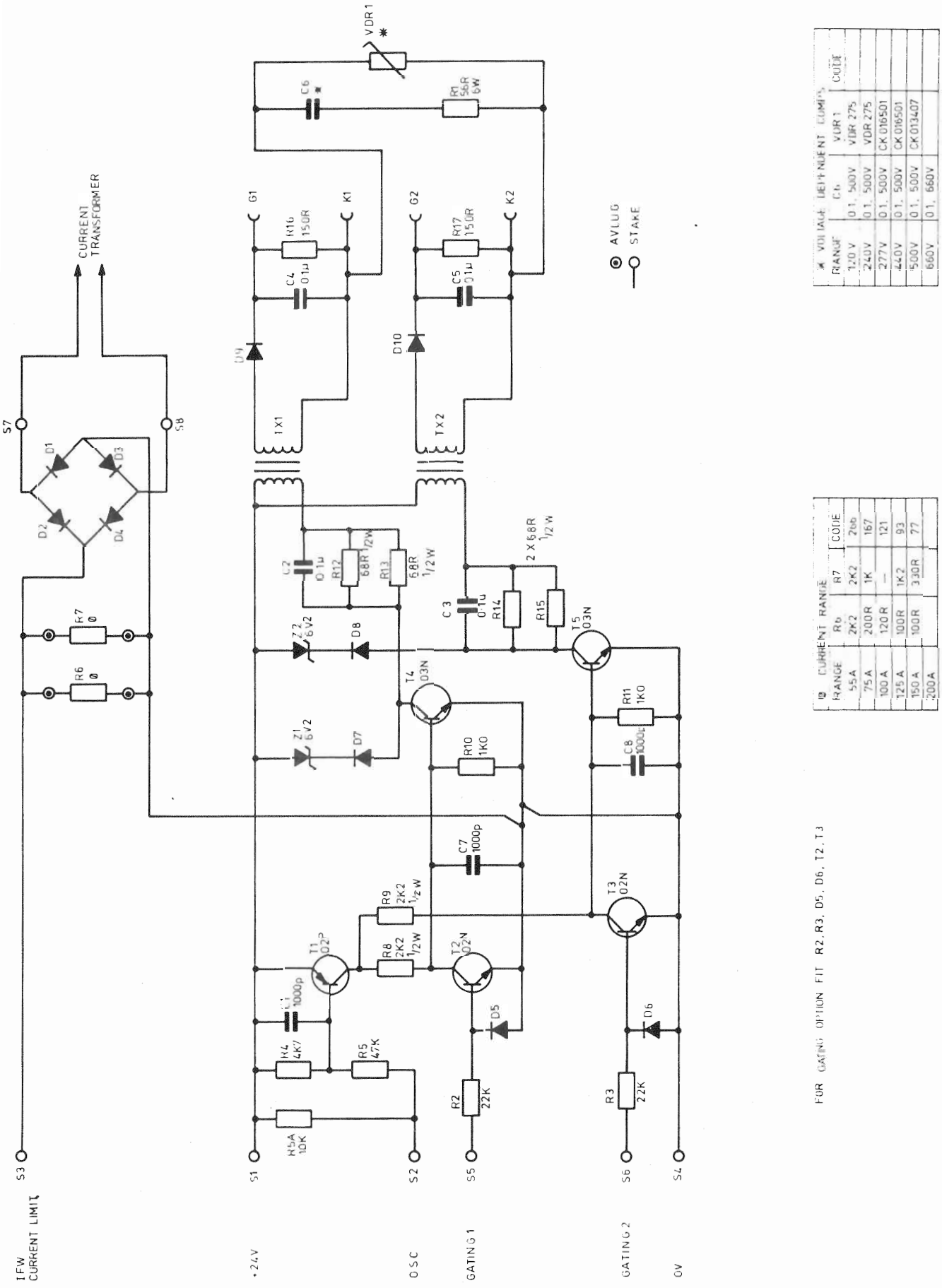


Figure 12. Circuit Diagram - Suppression and Gating Board.

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6.4 Control Circuit Cont...

The input switches 1 to 4 can be set to cater for a wide range of voltage or current inputs.

Table 1 Input Amplifier Switches 1 - 4

Input Range	Switch 1	Switch 2	Switch 3	Switch 4
0-5V	0	0	0	0
0-10V	1	0	0	0
1-5V	0	1	0	0
1-9V	1	1	0	0
0-5mA	0	0	1	0
0-10mA	1	0	1	0
1-5mA	0	1	1	0
1-9mA	1	1	1	0
0-20mA	0	0	1	1
4-20mA	0	1	1	1

1 denotes ON

The manual input can be used for test or manual control. Switches 1 and 2 set the input scaling (normally 0-5V for control) in the following table:

Table 2.

Input Range (Manual)	Switch 1	Switch 2
0-5V	0	0
0-10V	1	0
1.25-6.25V	0	1
1.25-11.25V	1	1

The input buffer is normalised for 0-5V control. It is available on diagnostic point 8 and is compared with the load voltage feedback signal (i.e. V^2 feedback). The signal is then integrated by IC9/7 to form the phase angle demand signal for triggering the thyristor (dignostic point 10).

The phase-angle demand signal is compared (IC5/1) with the mains synchronised ramps. When the ramp voltage exceeds the demand, the comparator switches (diagnostic point 15) to start the pulse oscillator T4 and T5 which will trigger the thyristors. The high frequency pulse oscillator (25KHz at diagnostic point 13) ensures that load 'pick-up' problems do not occur with highly inductive loads. The pulse train length is limited to 3.3ms to improve power supply drain and gate dissipation.

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6.5 Firing Modes and Supply Frequency

This thyristor unit can fire in five possible modes which are selected by switches on the printed circuit board. These modes are:

a) Phase Angle (P.A.)

b) Single Cycle

c) Fast Cycle (F.C.)

d) Slow Cycle (S.C.)

e) P.A. Start F.C. or Slow Cycle.

The switches to select each mode are tabulated below. O means OFF, 1 means ON.

Table 3 Mode Switches

Mode	Switch 5	Switch 6	Switch 7	Switch 8
Phase Angle	O	O	O	-
Single Cycle	1	O	O	-
Fast Cycle*	1	1	O	-
PA Start FC	1	1	1	-
5O Hz	-	-	-	1
6O Hz	-	-	-	O

*Slow cycle switch positions are the same as for Fast Cycle, but capacitor C27 is increased in value.

Link 8 must be used to set the 15^{O} filter to the supply frequency.

The input signal, which appears as O to 5 volts at IC8/1, is integrated by LC9/7 and C27 which is 1µf for all modes except slow cycle when it is 1Oµf. Load voltage feedback (V^2) and current limit feedback (I^2) are fed into the input of the integrator.

The output of the integrator is fed with the current limit signal to the phase-angle comparator IC5/1. For whole cycle operation, the integrator output also goes to hysteretic switch IC9/1 which has a squarewave output with variable mark-space ratio. The ON period of the mark-space ratio is determined by the input voltage and the OFF period by the load feedback voltage. This will give a trapezoidal shape to the waveform, with equal ON/OFF ratio at 5O% power.

The signal is then passed through a time-delay amplifier (IC7/1) which is adjustable by P4 and normally set anticlockwise for no delay. Preset delayed triggering is used for whole cycle control where up to 90^{O} trigger angle in the first half cycle is obtainable.

Switch 7 is made when a preset 'soft-start' (phase angle start)

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is required. This dramatically increases the ramping up time constant, for use on fast cycle or slow cycle. For phase angle firing the hysteretic switch IC9/1 and integrator IC7/1 are out of circuit.

6.6 Current Limit

Current limit action is obtained by phase angle firing control and can be used in all firing modes. For front panel current limit setting using P5, the +10V reference on pin 12 must be connected to the current limit setpoint pin 14. If external current limit control is used, the +10V reference should be connected to the external current limit potentiometer with its anticlockwise end connected to OV pin 6.

The wiper connects to the current limit setpoint pin 14 and P5 is turned to its maximum position. Current limit setpoint is inverted and buffered by IC10/7. The setting current signal and a load current square signal are compared by an error integrator IC10/1. This error integrator has a time constant which is about ten times the mains periodic square signal. Note that the current signal is full wave rectified and applied to the squaring circuit around T11.

Vo is the output voltage change of the error integrator.

I set is the pre-set current limit.

I load is average value of load square current.

The voltage Vo is normally high when I set > I load and reverse biases diode D27. An overload condition occurs when I load > I set and Vo goes low, thus forward biasing the diode D27. This low signal will inhibit the gate pulses, so providing current limit.

6.7 Inhibit and Mains Fail

Transistor T8 is held in a non-conducting state by the negative current derived from D2/D4 in the power supply. With T8 off, T9 is held off and its collector will be at -15V.

When the +10V volt inhibit signal is applied to terminal 16 it overrides the negative current at T8 base and turns it on. T9 is therefore turned on, and its collector goes to +15 volts.

Current through R120 and D28 resets the current integrator IC10/1 which operates current limiting. Current through R117 and D26 resets the input integrator.

When the mains voltage fails, the negative current fed from D2/D4 to T8 base is removed immediately, allowing R110 to turn on T8 before the supply rails collapse.

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6.8 Partial Load Failure (PLF) Operation

The rectified current transformer signal provides an input via R50/R49 to the inverter/scaler IC6/1 which represents the load current. This is adjusted by P2, the set PLF control, with correct load current applied. It provides a negative signal via R55, nominally equal and opposite to the load voltage signal via R56 applied to the virtual earth comparator IC6/7. The sum of two nominally equal and opposite currents is compared with zero.

The signal from the current transformer is full-wave rectified (unsmoothed) before being applied to the PLF circuit. This is to average-out any inequalities between positive and negative half-cycles.

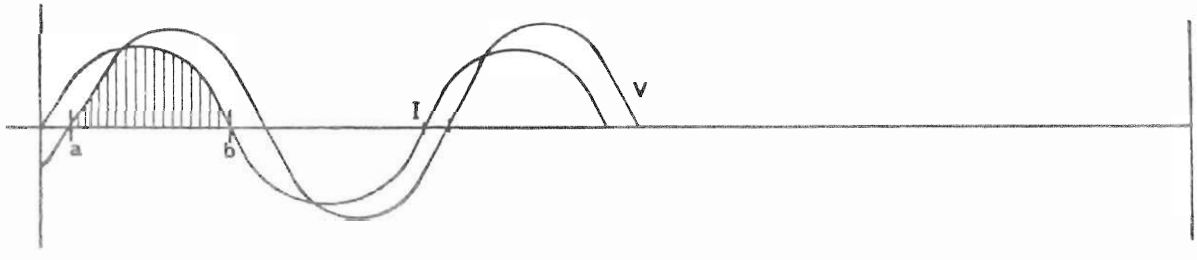
Under normal load conditions, the output of IC6/7 will be pulsing negative with each half cycle, charging C22 negatively but at a value more positive than that at IC7/6. The output of comparator IC7/7 will be positive, keeping T6 switched on and the relay energised. When the load current decreases, due to failure of one element of a parallel load for instance, the output of IC6/7 increases negatively. The output of IC7/7 goes negative, turns on the PLF LED and turns off T6, releasing the relay. Transistor T12 latches the system.

6.9 SUPPRESSION AND GATING BOARD

Refer to Figure 12 - Suppression and Gating Board Circuit

Pulse gating is necessary to avoid misfiring and fuse blowing when thyristors are used to supply a load with a leading power factor.

For a leading power factor the triggering of the thyristor at maximum power has to be inhibited until the voltage has also risen through zero at point (a) (see below). Once a thyristor has fired, the trigger pulses are removed to ensure that the thyristor turns off as the forward direction current reduced to zero, point (b), thus ensuring that the thyristor only supplies the load while voltage and current are in the same direction. Should the power demand be less than maximum the thyristor will fire as dictated by the phase angle trigger pulses, provided that load voltage and current are in the same direction, any firing when load voltage and current are in opposite direction being inhibited.



Pulse-gating Load Voltage and Current Waveforms

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Oscillator pulses from the main board are fed to S1 (+24V) and S2. They are bursts of pulses at 25kHz of 3.3 ms duration. T1 is normally on. The positive going oscillator pulses turn T1 off. The gating signals on S5 and S6 are anti-phase voltages derived from the mains transformer on the main board. Depending on which of the gating signals is positive going, the pulses are routed via T5 or T4 to TX1 or TX2. When S5 is positive the pulses are routed to TX2 and when S6 is positive they are routed to TX1.

Z1, D7 and Z2, D8 clamp the negative swings on TX1 and TX2, for core 'flux resetting' at the high pulse frequency.

Components for current feedback operation are also located on this board. Current in the load is detected by the current transformer, rectified by the diode bridge D1-D4 and a voltage developed across burden resistors R6 and R7. This is then fed via S3 to the main board.

6.10 Additional Features

These include Slave Firing, Fuse Fail Indication, Current Out, Voltage Out and Diagnostic Facility. Terminal 13 is the slave firing output which may be used to slave other thyristor units. This is a digital signal, nominally > 10 volts at 10mA. If a fuse fails, the front panel fuse fail lamp illuminates, provided the load is still connected. Terminal 3 is the current out signal for monitoring or diagnostic purposes. It is a rectified d.c. signal directly proportional to the current in the load, and nominally 4.8volts mean (on high impedance meter) at the rated current. Terminal 15 is the voltage out signal which is the full-wave rectified voltage output signal for monitoring or diagnostic purposes.

The diagnostic facility is a 20 way fascia socket on the thyristor unit front panel, which is wired to 20 monitoring points in the circuit. Connection of the type 260 diagnostic unit allows monitoring, commissioning or testing for fault conditions. The digital panel meter allows accurate measurements to be made of all the important analogue signals within the unit, the signal being displayed on an oscilloscope by direct connection to the diagnostic unit. Positions 1 to 20 of the rotary switch allow measurements which can be compared with those illustrated on the diagnostic unit test cards.

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7.0 DISMANTLING INSTRUCTIONS

7.1 Module Disconnection

The units are plugged into baseplates which are wired and secured to either a wall/bulkhead or DIN rails. Units may be unplugged with power on but it is advisable to switch off the power first when there is a possibility of a fault condition which could cause arcing across the contacts.
WARNING: THE HEATSINK MAY BE HOT. TAKE GREAT CARE.

Release the top quarter-turn fastener and pull the unit down to 20^{o} below horizontal and unclip the lower edge.

To refit the unit in the baseplate locate the bottom corner pivot with the unit at 20^{o} to horizontal and lever the unit into its horizontal position. Secure with the quarter-turn fastener at the top.

7.2 Fuse Rating and Access

If a fuse fails, indicated by illumination of the Fuse Failure indicator, disconnect the supply from the thyristor unit and unplug it from its baseplate as described above. The fuse is located at the rear and is visible. Take out the faulty fuse by removing the screw at either end of the fuse. Replace the faulty fuse with the correct replacement type as indicated in the table in the Suggested Spares section. Do not use any other type or fuse wire as this will almost certainly cause considerable damage to the unit the next time a short circuit load fault occurs. The use of any other fuse than that recommended in the table of suggested spares will invalidate the guarantee.

7.3 Access to the Printed Circuit Board

Remove the unit from its baseplate as described above. Lay it on a flat surface with the heatsink on the underside. Lift the back edge of the black cover clear of the casting at the back of the unit, at the same time sliding the cover towards the back. The cover will slide all the way out. Press down on the plastic tabs at the top and bottom of the printed circuit board and at the same time slide the board to the rear slightly. The board can then be lifted for access to the component side.

Before refitting the board, note that the "load fail" LED and "adjust" control must locate in the front panel.

To refit the board, place the cut-out sections in position and slide the board to the front of the unit. It will then latch in place. The black cover must be refitted with the corner cut-outs facing the back of the unit.

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8.0 SUGGESTED SPARES

The table below gives some of the parts, together with their Eurotherm part numbers, which may be useful for servicing these units. It is recognised that it is not comprehensive - only full parts lists could be - but the table should assist in obtaining replacement parts.

Please refer to the exploded view when ordering mechanical parts.

FUSES

	Up to 227V		Up to 660V							
	15A	25A	15A	25A	40A	55A	75A	100A	125A	150A
English Electric Type	-	GSA 25	-	GSG 1000 /25	GSG 1000 /40	GSG 1000 /55	GSG 1000 /85	GSG 1000 /110	GSG 1000 /150	*
International Rectifier Type	L350 /16	L350 /25	E1000 /15	E1000 /25	E1000 /40	-	EE1000 /90	EE1000 /110	EE1000 /150	*
Eurotherm Part Number	FUD 016	FUG 025	FUF 015	FUH 025	FUH 040	-	FUH 085	FUH 110	FUH 150	*

* Consult your local Eurotherm Engineer.

THYRISTOR/TRIAC ASSEMBLY TYPES (CONTROL ELEMENT)

	15A	25A	40A	55A	75A
Up to 240V	SOH060	SQH060	STH060	SUH060	CFO16267
277 to 440V	SOH120	SQH120	STH120	SUH120	CFO16269
480 to 500V	CFO16270	CFO16271	CFO16272	CFO16273	CFO16275
550 to 660V	CFO16276	CFO16277	CFO16278	CFO16279	CFO16281

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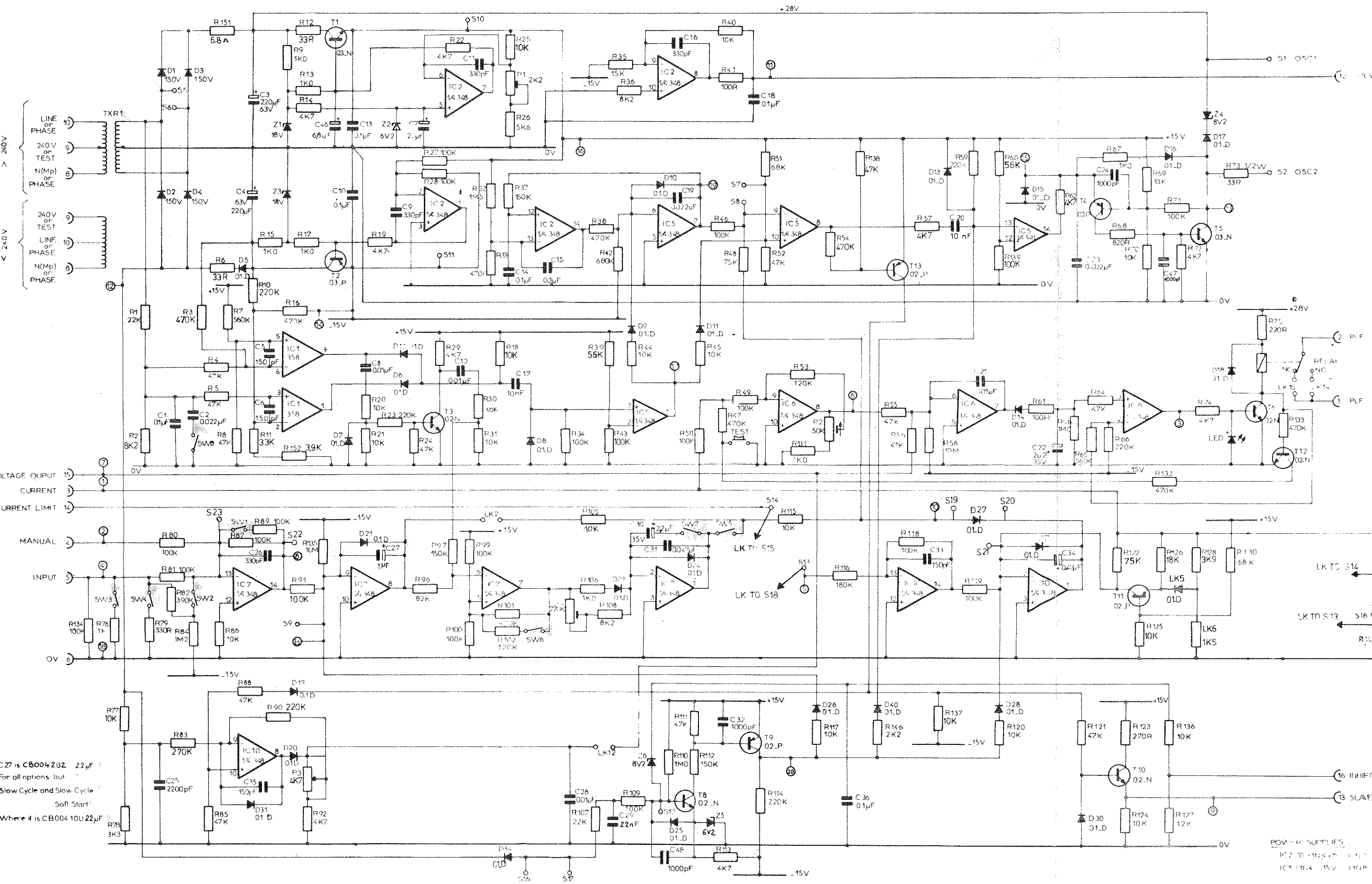


Figure 16 Circuit Diagram Main Board
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