LOW-VOLTAGE POWER SUPPLY

General

The Low-Voltage Power Supply circuit provides the operating power for this instrument from three regulated supplies and three unregulated supplies. Electronic regulation is used to provide stable, low ripple output voltages. The voltage input stage includes the Voltage Selector Assembly which permits selection of the nominal operating voltage and regulating range for the instrument, and the Preregulator stage to maintain a constant output of the low-voltage transformer should changes in the line voltage occur. Fig. 3-16 shows a detailed block diagram of the Low-Voltage Power Supply.

Power Input

Power is applied to the primary of transformer T705 through fuse F700, interlock S700, POWER switch, S701, thermal cutout S703, the Preregulator stage (to be discussed in subsequent paragraphs), Voltage Selector switch, S704, and Range Selector switch S705. S704 connects the split primaries of T705 in parallel for 115-volt nominal operation, or in series for 230-volt nominal operation. S705 allows two ranges of regulation by changing the taps on the primary windings to fit different line requirements. A second fuse, F704, is connected into the circuit when S704 is set to the 230 V position to provide the correct protection for 230-volt operation.

Thermal cut out S703 provides thermal protection by interrupting power if the instrument overheats. When the temperature returns to a safe level, S703 automatically closes to re-apply the power.

Preregulator Circuit

The Preregulator Circuit limits the peak-to-peak voltage across the T705 primary to maintain a constant output of the secondary winding. Bridge rectifiers CR706 and CR726 through CR729 ascertain correct voltage polarity for operation of the regulating circuit, which consists of pass element Q716 and its control transistors, Q718 and Q725. Silicon Controlled Rectifier (SCR) Q707 operates only at instrument turn-on to handle the in-rush current and limit the voltage across Q716.

When the instrument is turned on, the line voltage initially appears across the T705 primary winding and bridge rectifier CR706. When the voltage across CR706 reaches approximately 30 volts, Q707 turns on. R707 is placed in series with the primary winding, and its resistance, together with the inductive reactance of the winding, limits the in-rush current. Also, the shunt path formed by R707 and Q707 limits the voltage across Q716.

As the secondary voltages build up, Q718 receives base drive and collector voltage from rectifiers CR726 and CR729. Q716, as it comes into conduction, starts to share the primary current with Q707. When the rectifier voltage from CR726 and CR729 reaches about 80% of its final value, Q711 receives base drive through R713 and VR713. The conduction of Q711 causes Q707 to turn off, transferring the total current load to Q716. The secondary voltages will continue to increase until the voltage reaches a level that turns on Q725.

Biasing conditions of Q725 require either pin 9 or 11 of the feedback winding to be driven sufficiently negative with respect to pin 10. When the current through the network consisting of R722, R723, R724, R725, CR723 and CR727-CR728 is sufficient to produce a voltage drop of 6.2 volts across R724 and part of R723 (to the CR723 cathode), Q725 will be forced into conduction. The required 6.2-volt drop is established by Zener diode VR725. CR723 offsets the Q725 base-emitter voltage and provides thermal compensation for the transistor.

When Q725 turns on, the current forced into R720 reduces the Q716-Q718 base drive. This causes a voltage to be developed across Q716, thus limiting the voltage across T705. The degree of limiting, and hence control of the voltages across the secondary windings, is dependent upon the setting of R723. R723, the Reg Set control, provides an adjustment of the resistive network across the feedback winding, which changes the current requirements necessary to produce the 6.2-volt drop.

+240-Volt Supply (Preregulated)

Bridge Rectifier CR730A-D provides the output for the +240-Volt Supply. The negative side of the +240-Volt Supply is referred to ground. The output is filtered by C730A, and is stable because of the Preregulator Circuit. The winding is center tapped to provide a +120-volt supply for the flood gun anode in the storage circuit.

+50-Volt Supply

The +50-Volt Supply, besides providing power to circuitry throughout the instrument, provides a voltage source to establish operating levels in the feedback regulators in the +15-Volt and −50-Volt supplies. The stable output from the secondary of T705 is rectified by bridge rectifier CR732A-D. This voltage is filtered by C730B, then applied to the +50-Volt Series Regulator stage to provide a highly stable output. The Series Regulator stage is a feedback amplifier system of the non-inverting type as described earlier in this section of the manual under "Basic Feedback Amplifiers."

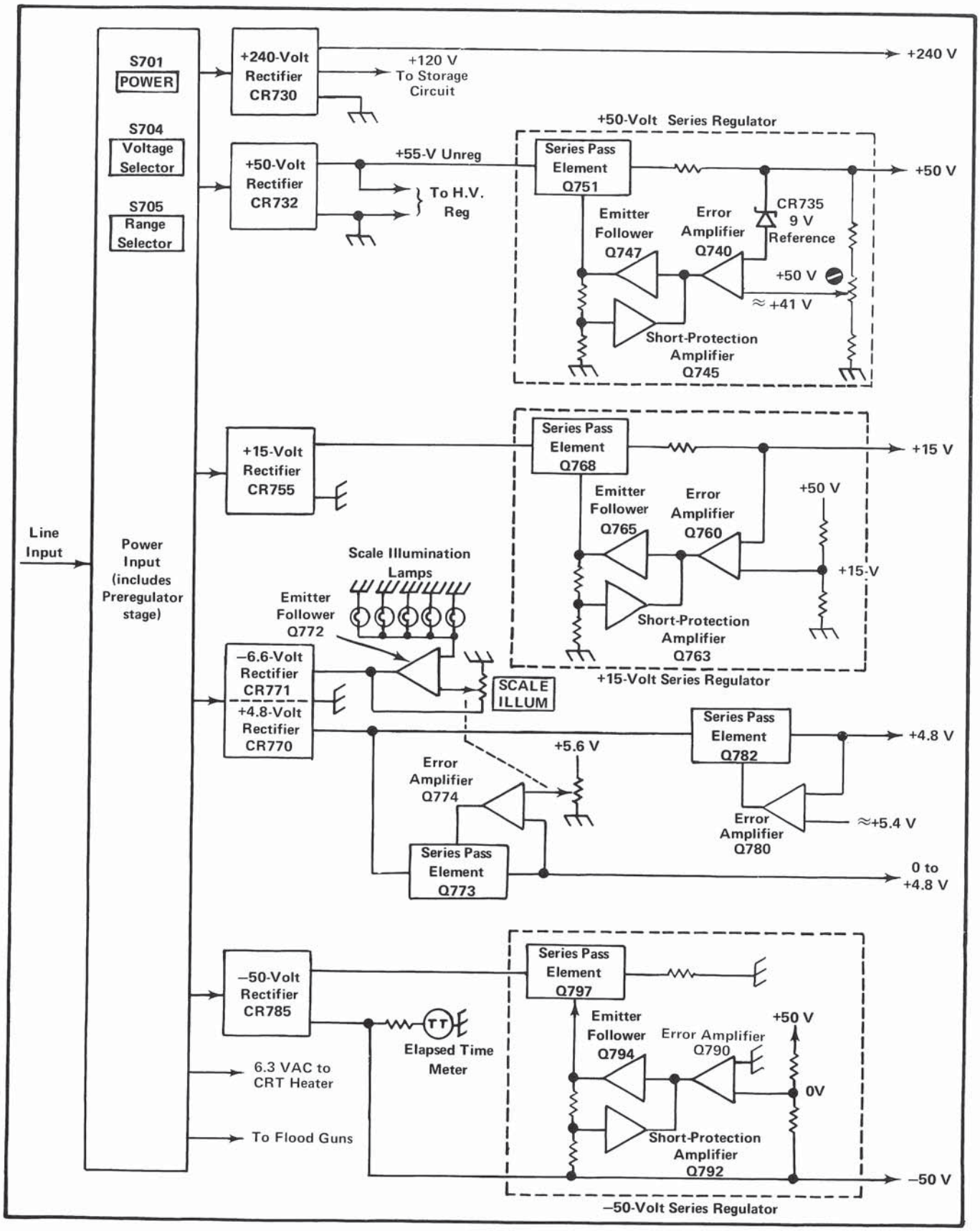

Fig. 3-16. Low-Voltage Power Supply detailed block diagram.