ASTRON CORPORATION

SERVICE MANUAL

RS-70A, RS-70M

9 Autry
Irvine, Ca 92618
949-458-7277
astroncorporation@yahoo.com
www.astroncorp.com

SECTION 1:
GENERAL INFORMATION

1.1 INTRODUCTION

The ASTRON "70" series are heavy duty power supplies capable of supplying 37 amps cont. at 13.8 VDC from 115 VAC line voltage. The output voltage is adjustable from approximately 11-15VDC.

These supplies are protected against overload and short circuits by fold-back current limiting. The load is protected against over voltage by a "crowbar" circuit which initiates latched current limiting upon over voltage, dropping the output voltage to safe levels.

The RS-70 and RS-70M are the same except the "A" models do not have meters.

Two meters on the RS70M front panel provide measurement of voltage and current being supplied to the load. The current meter is calibrated for 0-70 amps and the voltmeter reads 0-15 VDC. The power switch on the front panel controls AC power to the supply and indicates the presence of AC power when it is in the ON position. AC line surge protection is provided internally and a 12 amp AC line fuse is accessible at the rear panel.

1.2 SPECIFICATIONS

Input	105-125 VAC, 60Hz
Output	
Voltage: (factory adjust)	13.8VDC +/- .05V
Current:	57 amps continuous
	70 amps ICS
Ripple:	5mv max
	(full load, low line)
Regulation:	.5% overload and line range
Overload Protection	
Current limit:	75 amps
Foldback current:	4 amps
Operating Temperature:	
Range:	-10°c to +40°c for rated output
	(Derated to 50% load @ +50°c)
Dimensions:	70A/M
Height:	6"
Depth:	13½"
Width:	11"
Weight:	48lbs

1.3 PRECAUTIONS

WARNING: LETHAL VOLTAGES

The RS-70A/M contains voltages that may be lethal. The case of the supply should not be removed without first disconnecting the AC power. Servicing should be done only by qualified technicians.

CAUTION: HANDLE WITH CARE

The weight of the RS70A/M is 48lbs so care is needed when lifting it.

CAUTION: HEATSINK TEMPERTURE

Under some conditions the power supply heatsink may reach high temperatures. Handle with extreme care after prolonged operation.

CAUTION: VENTILATION

Do not operate this power supply in a concealed cabinet.

CAUTION: EXTERNAL BATTERY FUSING

If the battery is used for standby operation & is connected directly across the power supply output, always connect a fuse & a blocking diode between the power supply & the battery. Failure to follow this procedure could result in battery destruction and/or damage to the power supply should the crowbar circuit trigger which will place a virtual short circuit across the battery. The battery should be disconnected when servicing the power supply to prevent accidental shorting of the battery voltage.

SECTION 2: CIRCUIT DESCRIPTION

2.1 LINE CIRCUIT AND RECTIFIERS

Reference RS-70M Schematic

The 110 VAC line voltage is supplied to transformer 8401 via the 12 amp back panel mounted fuse F1 & front mounted switch SW1. When the switch is on, the indicator lamp indicates the presence or absence of 110 VAC. VR1 (mov) provides protection against short duration high voltage line transients. Diode CR101 and CR102 in conjunction with capacitor C5 form a high current rectifier circuit for the power supply load. CR1, CR2, & C1 provide DC voltage for the voltage regulator, crowbar & series pass drive circuits. CR7 protects the power transistors against over voltage when power is turned off and an external battery is connected across the load

2.2 SERIES PASS POWER CIRCUIT

The power series pass power circuit is a made up of two 2N3771 transistors operating in parallel as illustrated in the circuit showing Q101 & Q102. Resistors R101, R102... are provided in the emitter circuits for balancing the load among the two transistors. Transistor Q2 supplies base current drive to the two series pass transistors. It in turn, is driven by the voltage regulator circuitry contained on the PC board.

The battery should be disconnected when servicing the power supply to prevent accidental shorting of the battery voltage.

2.3 VOLTAGE REGULATOR

The UA723 IC (A1) in conjunction with the associated circuitry, performs the function of the voltage regulator, foldback current limiting & provides drive current for the series pass circuit. See IC manufacturers circuit data book for details on the internal operation of the UA723.

Refer to fig. 1 - Simplified Schematic

Voltage regulation is accomplished within the IC by comparing the scaled down supply output voltage (from wiper of R5) to an internal 7.2 volt reference voltage. The reference voltage (pin 6) is connected to the non-inverting input (pin 5) of an internal op amp. The scaled down power supply output voltage of R5 is connected to the op amp inverting input (pin 2) providing negative feedback.

If the power supply output voltage attempts to change, the IC output at pin 10 changes in the opposite direction thus, maintaining the output voltage constant for a given setting of R5.

The IC internal op amp maintains null between its two inputs,i.e., the inverting input, through negative feedback is maintained equal to the 7.2V reference. Therefore, the output supply voltage will go up or down to accommodate a change in the setting of R5. This allows the output voltage to be adjusted to any value between 11 & 15V with the voltage division ratio provided by the combination of R5, R6, & R7.

The current output from the LM723 IC is amplified by Q2 & applied to the base of the 2N3771 series pass drive transistor. As noted in the voltage chart on the schematic, the regulator IC output voltage increases to compensate for the increased voltage drop across R1, R1X, & the series pass circuit.

At full load, the voltage at the current limit input of the IC pin 2 is around 14V as determined by the ratio of R4 & R3, RX sets the point at which current limiting begins.

As the load is increased above full load, the differential between pin 2 & pin 3 (current sense input) increases until the internal current sense transistor begins to conduct (at 72 amps, factory set by R3X). Foldback current limiting then occurs & the load current & output voltage decrease with decreasing load resistance until the short circuit current of 4 amps is reached. The short circuit current is factory set by selecting the value of resistor R1X. Diodes D3 & D6 prevent damage to the circuits by the capacitive discharge. D5 stabilizes current in the limiting mode preventing over heating due to current drift.

2.4 CROWBAR CIRCUIT

The power supply load is protected from over voltage by the crowbar circuit which triggers at 16.5V. Zener diode CR4 maintains a voltage5.6V lower than the power supply voltage at the emitter of Q1 while the voltage at the base of the transistor is determined by the voltage divider R8 & R10.

As the power output voltage increases by the same amount while the base voltage increases according to the ratio R8 & R10. At 16.5V, the base becomes more negative than the emitter to the extent that Q1 conducts, producing a voltage across R11 sufficient to trigger SCR1.

When triggered, SCR1 acts as a virtual short circuit causing current limiting & subsequent low voltage output. Once triggered on, the SCR will continue conducting until power is turned off. Capacitors C6 & C102 in the gate circuit of SCR1 prevent false triggering from voltage transients.

SECTION 3: INSTALLATION

3.1 GENERAL

The RS-70A power supply generates appreciable heat when operated at full load & requires an adequate air flow for cooling. It should always be placed with adequate clearance above & below to provide convective cooling. Forced air cooling may be required if other equipment generates relatively high levels of heat is enclosed in a cabinet. DC output wiring should be of sufficient gauge to carry the current without excessive voltage drop.

CAUTION

If a battery is used for sandby operation as is connected directly across the power supply output, always connect a fuse and a blocking diode between the power supply and the battery. Failure to follow this practice could result in battery destruction and/or damage to the power supply should the crowbar circuit trigger, which will place a virtual short circuit across the battery. The battery should be disconnected when servicing the power supply to prevent accidental shorting of the battery voltage

Please see 1.3 External Battery Fusing

SECTION 4: SERVICING

4.1 PRECAUTIONS

See section 1.3

TECHNICAL BULLETINS

From time to time TB's may be issued to enable updating of equipment, provide information or to meet specific operation requirements.

4.2 MECHANICAL

Access to the inside of the power supply for servicing may be obtained by removing the four (4) screws holding the cover in place.

4.3 TEST AND ADJUSTMENTS

All power supply parameters previously defined are factory adjusted & normally will not require field adjustment. However, if certain components are replaced or a malfunction is suspected, it may be necessary to perform test & adjustment as described in the following sections.

4.3.3 OUTPUT CURRENT

Output current at rated load may be checked by connecting the amp meter in series with load and adjusting the load for 37 amps. If panel mounted current meter does not read 37 amps, it may be recalibrated by adjusting R103

TEST EQUIPMENT REQUIRED

Volt Meter:	DC, 0-25V sensitivity min. 20K ohms/volt
Ammeter:	DC, 0-100 amps
Variable load:	0-100 ohms, rated at 70 amps min

OUTPUT VOLTAGE

R5 controls output voltage & may be adjusted to set output to exactly 13.8 volts.

OUTPUT CURRENT

Output current at rated load may be checked by connecting the ammeter in series with the load.

FOLDBACK CURRENT

To check the foldback current limiting point, connect the load to the output & adjust for 22 amps. Decreasing the resistance of the load should cause current to begin decreasing to 1.2 amps when the load reaches zero resistance. Resistor R3 in parallel with RX (factory selected) determines the current limit point, i.e., the point where foldback begins. Resistor R1 in parallel with R1X determines the short circuit limit 1.2 amps. In the event of component replacement, it may be necessary to change the values of the RX resistors to reset these currents to design limits. Increasing the value of either network decreases their respective current values.

4.4 CROWBAR VOLTAGE

To test for proper operation of the crowbar circuit, momentarily short across resistor R7. This causes the output voltage to rise to approximately 17 volts & should trigger the crowbar circuit.

4.5 TROUBLESHOOTING

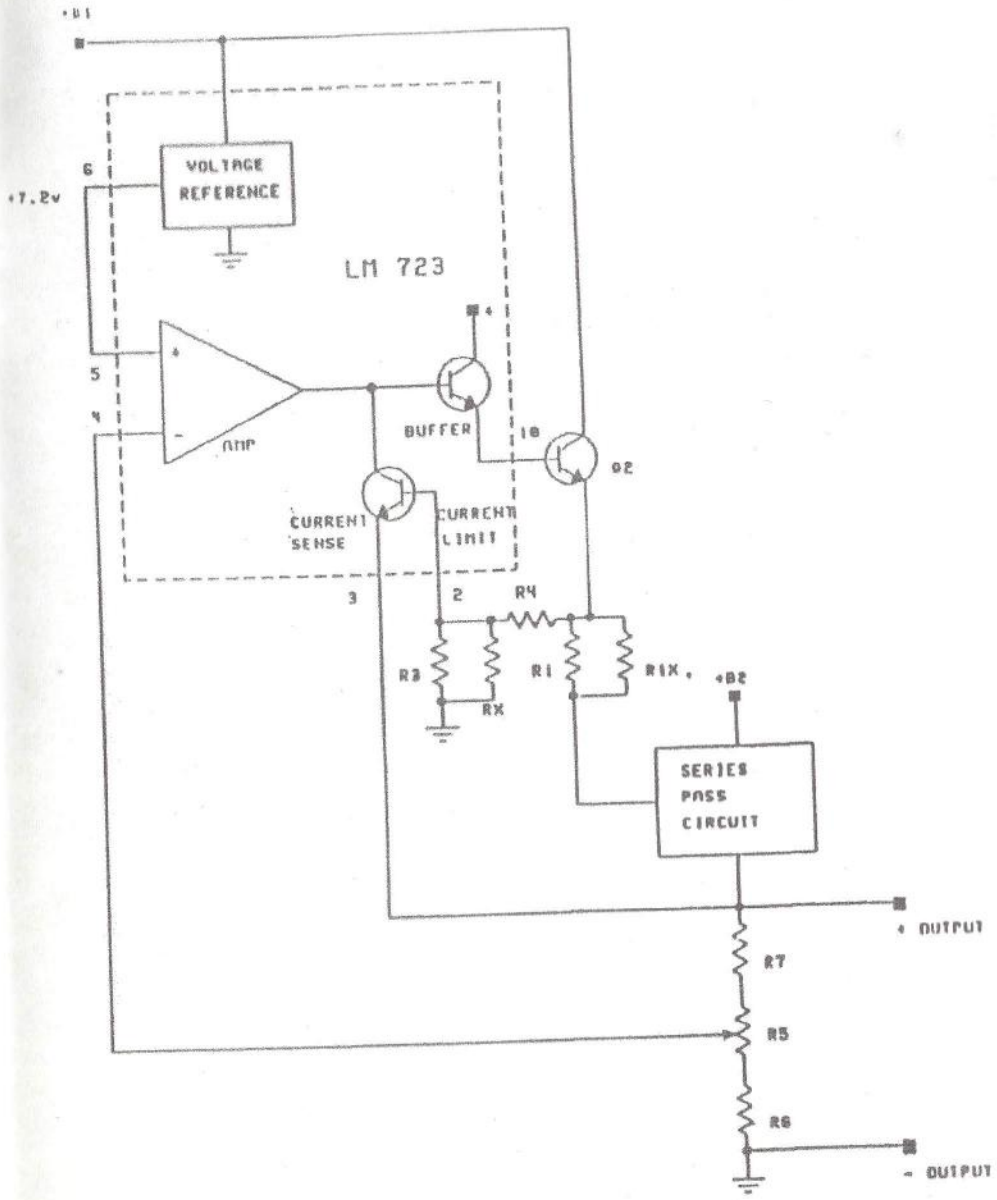
Reference Schematic: RS-20A

Remove the top cover to gain access to the inside of the power supply & check for proper operation of the transformer primary & secondary circuits including the power supply rectifier circuit- DB3501 & capacitor C5 (large chassis mounted electrolytic capacitor). A check of voltage present at the I/O pins of IC A1 (LM723 voltage regulator) as compared to the A1 voltage chart shown on the schematic should provide an indication of the nature of the problem. If the voltage regulator is suspected, it can be replaced by removing the two PCB mounting screws & replacing the IC in the socket provided. Since the heatsink mounted series pass transistors operate at high junction temperatures, a failure in this area is probable. Junctions maybe checked for shorts or opens by disconnecting one end of the .1 ohm balancing resistors (R101, R102...) in their emitter circuits.

SECTION 5: PARTS LIST

SCR1	SO 565J 50AMPS, 50VOLTS SCR
Q1	2N3906 transistor
Q2	TIP29
Q101-109	Transistor, 2N3771, 30amps, 40v
CR101,102	IN1184A rectifier diode, 40A 100V
CR1, CR2	IN5404 rectifier diode
D5	IN4002 diode 1amp, 100v
CR7	MR751 **or** IN5404
D3	IN4148
CR4	IN5232B trans. Suppresser, Moto
VR1	130LA10A mov. 130v, 10amps, GE
A1	IC, LM723CN voltage regulator, Moto, TI
R5	1K, .5w pot 1T
R101 - 109	.05ohm @ 5w wirewound
RXXX	All other resistors .5w, 5% C.F.
C1	2200 mfd 35v radial electrolytic
C2	.1 mfd 50v cap
C3	.001 mfd 100v cap
C4	100 mfd 25v electrolytic
C5	64K mfd 25v, computer grade
C101	2200 mfd 16v electrolytic
C102	.33 mfd 50v cer. Cap
IM	Panel meter, 0-70, Astron model 1-70
VM	Panel meter, 0-15, Astron model 1-15
T1	Transformer, Astron 8401

Note: Other manufacturers equivalent capacitors & resisters with same specs may be substituted for those specified above.



SIMPLIFIED SCHEMATIC