OWNERS MANUAL

SIGNAL PROCESSORS

12 STAGE PHASER



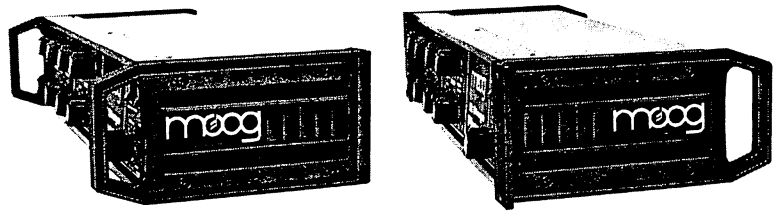
moog

12 STAGE PHASER

Moog Signal Processors are designed for the working musicians who demand the highest quality and the best value. Because they are built to specifically meet the demands of keyboard instruments, that is, to handle a very wide dynamic range and extend frequency response, Moog Signal Processors are unsurpassed in other applications such as guitar, P.A. systems and studio recordings.

FEATURES

- Two-way chassis: Flanges forward for rack mounting, handles forward for carrying. Tell your service center which way you want the chassis assembled.
- Fits standard 19" rack.
- Steel cabinet with die-cast end caps.
- Can be used as line drivers.
- May be operated by standard foot switch.
- Peak load indicator.
- Regulated power supply.
- Detachable line cord.
- Signal flow diagram on bottom of each unit.
- Internal compander—limiter to enhance dynamic range.
- Voltage controlled Phase Sweep.
- Voltage controlled Rate of Internal Sweep Oscillator.
- LED to indicate Rate of Sweep.
- Selectable number of Phasing Stages.
- Selectable number of Resonance Stages.
- Stereo outputs for spatial phasing effects.
- Electronic circuit to simulate the starting-up and slowing-down of rotating speaker systems.
- CHAIN-MIX switch allows the phasing chain to be used for vibrato effects or mixed with original signal for standard phasing effects.
- Resonance control for harmonic phasing effects.



Moog's Signal Processors are designed for both the studio and the road, right down to the two-way chassis. In one position the carrying handles protect the front panel, extending beyond the controls. In the other position there are two flanges, complete with screw holes, for mounting in a standard 19" rack space.

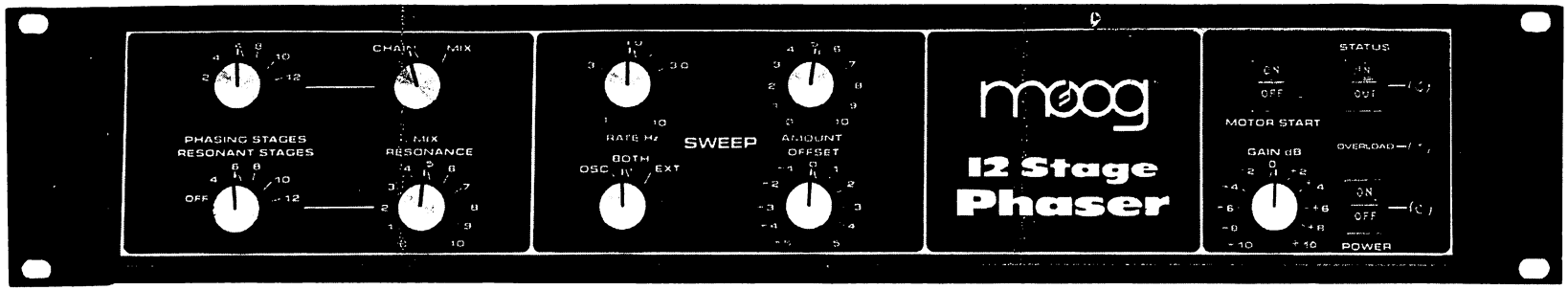
SPECIFICATIONS—12 STAGE PHASER

INPUT IMPEDANCE	1M ohm unbalanced
Maximum Recommended input level	+10dBm
Output impedance (both + and - output)	600 ohm unbalanced
Maximum output level (both + and - output)	+20dBm ±2dB into 10K ohm or higher +14dBm ±2dB into 600 ohm
Equivalent input noise 30Hz to 15KHz, BW, short ckt. on input	-90dBm + output -85dBm - output
Insertion Gain	Adjustable over ±10dB range
Overall Frequency Response	20 to 20kHz ±2dB
Overload indicator threshold	+16dBm
Maximum number of phasing stages	12
Maximum number of resonance stages	12

CONTROL SECTION

RATE OSCILLATOR	
Sweep waveform	Triangle
Frequency Range	
Front Panel Control	.1Hz to 10Hz
External Input	.01Hz to 30Hz
Ext. Input scale factor	1.2 volts/oct ±20%
Maximum output level from rear panel jack	15V peak to peak into 2K load
Triangle offset	±.5 volt max.

SWEEP SECTION	
Maximum sweep amount	9 oct.
Maximum sweep offset	±3.5 oct.
External Input scale factor	.9 volts/oct.
Electronic Motor effect simulator (used to simulate the inertia of rotating speakers).	
Start up time	3.0 sec.
Slow down time	3.0 sec.
Overload Test configuration	Overloads are detected at all critical circuit points simultaneously.
MOTOR START AND STATUS SWITCH OPERATION	Motor start switch sets the mode of operation of the Status Switch. In Motor Start "OUT," status switch activates CMOS switches to switch audio signal from Direct to Processed Signal. In Motor Start "IN" position, Status Switch controls motor start simulation.
FOOT SWITCH OPERATION	When a ¼" mono phone plug is inserted in the rear foot switch jack, the panel status switch is disabled. A short circuit across the foot switch jack will put the Phaser in circuit and light the Status indicator.
POWER REQUIREMENTS	100 to 135 VAC@60 Hz or 200 to 270 VAC@50 Hz Selected by rear panel switch 15 watts maximum
SHIPPING WEIGHT	7 pounds.



A. Set the Voltage selector switch on the rear panel to the correct line voltage.

B. Set the following controls as listed:
Insertion gain—0
Motor Start—Off
Status Switch—Off
Power—Off

C. Connect input and output cables to unit and plug in line cord. (Use the plus (+) output).

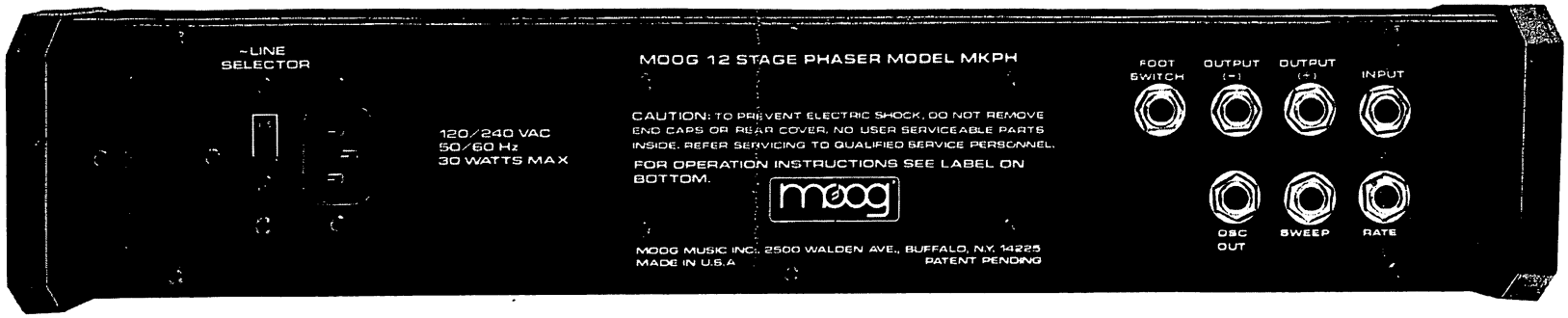
D. Set your amplifier system to its minimum volume and then turn on the unit by flipping the Power switch. The green power light will glow and the red overload light will flash on for a moment.

E. Adjust your amplifier gain for your normal working volume. The phaser should not affect your power in this mode of operation.

Note: It is important to always follow the above sequence, that is:
1. amplifier down
2. phaser on
3. adjust amplifier to normal working volume.

F. Flip the Status switch on. The yellow Status light should glow. The phaser is now in the circuit. The Status switch controls CMOS signal switches which select either the Direct or Phased signal.

G. The controls for the phaser can be adjusted for the overall sound desired. Phasing stages are selectable from 2 to 12 stages. Using more phasing stages results in a deeper, more complex phasing effect. CHAIN/MIX chooses either the chain position, which is the output of the phase chain alone, or mix, where the chain output and original signal are summed.



H. The SWEEP section determines the presence or absence of a dynamic phasing effect. An internal oscillator normally controls the speed of shift. The oscillator frequency is determined by the RATE control, and the intensity of sweep is determined by the AMOUNT control.

An external input may control the sweep in the EXT position. The external and internal sources work together in the BOTH position, and the internal oscillator is the only controller in the OSC position.

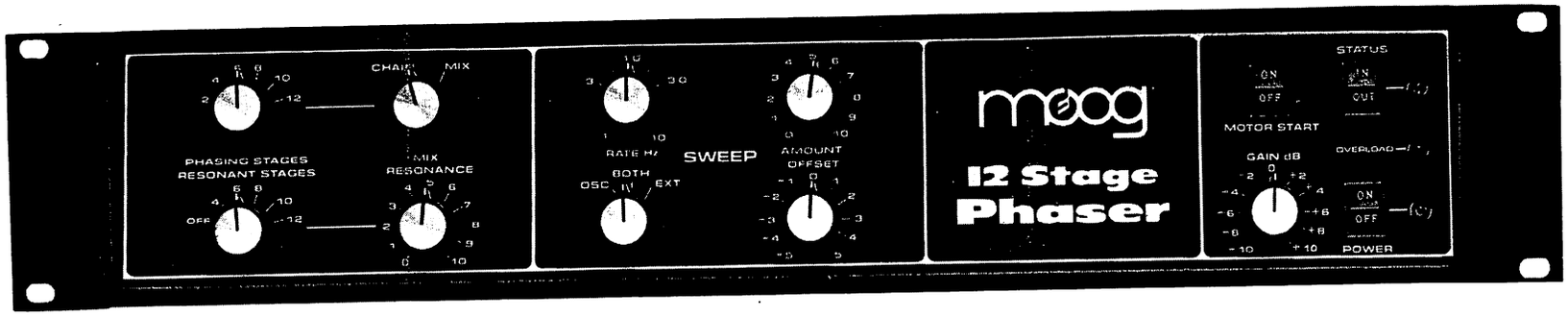
The OFFSET control determines the range of frequencies in which the phasing will sweep. The counter-clockwise position cause the phaser to sweep low frequencies. Turning the control clockwise moves the sweep effect to a higher frequency range.

The MOTOR START switch causes the phaser to accelerate and decelerate when the effect is switched in and out, simulating the response of a rotating speaker.

I. The insertion gain control can be adjusted for correct system gain, again making sure the overload light remains off.

J. Foot switch operation—a standard foot switch with a ¼" mono phono plug can be used to operate the phaser.

K. NOTE—This phaser is a highly regenerative device, and occasionally when switching between phasing stages and resonant stages, a brief howling sound will be heard when the switch is between two positions. This is *not* a malfunction.



PHASING STAGES
Selects the number of phasing elements employed in the phasing chains. Every 2 stages added equals 1 phasing notch added for a maximum of 6 notches.

RESONANT STAGES
Selects the number of phasing elements between the audio input and the Resonance Control. A portion of the phase shifted signal can be fed back to the input of the phase shift chain producing resonant peaks at frequencies where the phase shift of chain equals zero. This produces a harmonic phasing effect. With 12 available stages, 5 resonant peaks can be formed.

RESONANCE AMOUNT
Controls the amount of phase shifted signal fed back to the input of the phase shift chain. This controls the band width and height of the resonant peaks.

CHAIN/MIX SWITCH
Selects signals and routes them to the + and – outputs.

CHAIN: The output of the phase shift is routed to the outputs. This position is useful for vibrato and bandpass filter effects.

MIX: The output of the phase shift chain is summed in phase for the + output and out of phase for the – output. This position is useful for phasing and harmonic phasing effects.

SWEEP RATE
Controls the frequency of the internal triangle sweep oscillator. Dial is calibrated in Hz. Rate control is disabled by the use of rear panel external rate input.

RATE LED
Indicates frequency of rate oscillator.

SWEEP AMOUNT
Controls the amount of sweep of the phasing chain. Does not affect the external sweep input. Does control the amplitude of the rear panel oscillator output.

SWEEP SELECTOR
Selects the source used to move the phase shift chain.

OSC: The internal oscillator is used to sweep the phasing elements.

EXT: A user selected control voltage applied to the External Sweep input jack is used to sweep the phasing elements.

BOTH: The internal oscillator and external source are used to sweep the phasing elements.

SWEEP OFFSET
Controls the static phase shift of the phasing chain. The internal oscillator sweeps the phasing chain around this point. This control can be used for manual phasing.

GAIN
Controls the output level of the processed signal, but does not affect the Direct signal. In motor start mode, gain control also affects signal when Status switch is in OFF position.

STATUS
Selects either the Direct or Processed signal. Operation is interrelated to the Motor Start Switch.

MOTOR START
Selects operating mode of the Status Switch.

OFF: Status switch feeds the processed signal to the outputs in the "IN" position. The "OUT" position kills the-output and feeds the Direct signal to the + output.

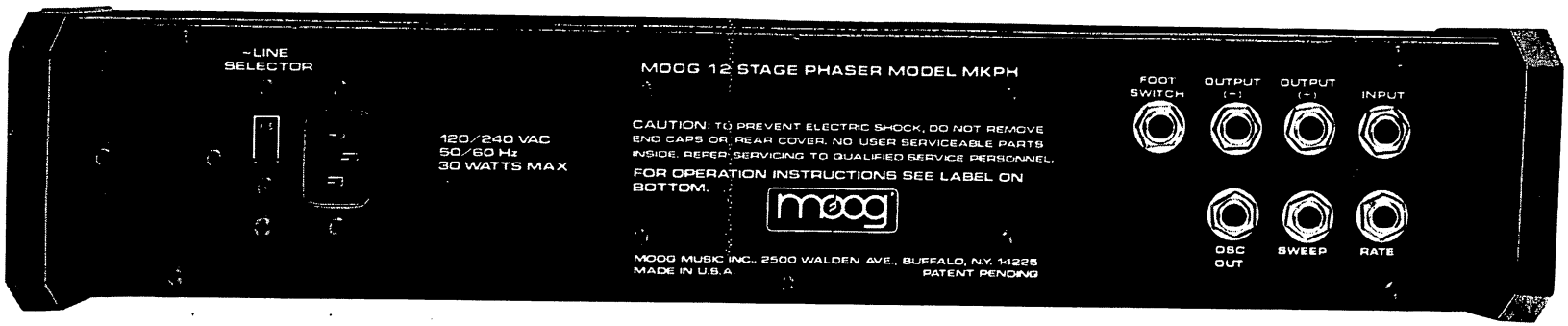
ON: Slowly speeds up rate oscillator and makes gradual transition between Direct and Processed signal when Status switch is moved from "OUT" to "IN." When Status switch is moved from "IN" to "OUT" the reverse is true. This mode is used to simulate rotating speaker sounds.

STATUS LED
Indicates the Phasing signal is at the outputs.

OVERLOAD LED
Indicates internal signal levels have exceeded +16dbm.

POWER
Applies power to unit.

POWER LED
Indicates power is being applied.



DESCRIPTION OF REAR PANEL CONTROLS AND CONNECTIONS

-OUT–Audio output used as a secondary output channel for spatial phasing effects. This output has four modes of operation which depend on the Motor Start and Status Switches.

Motor Start "OFF"

STATUS OUT—No output

STATUS IN—Phasing signal which is out of phase with+output.
Output level set by Gain control.

Motor Start "ON"

STATUS OUT—OUT level drops 20dB to put emphasis on the +output.

STATUS IN—Phasing signal which is out of phase with +output.
Output level set by Gain control

OSC—Output from internal triangle oscillator. The output level is set by the front panel "Amount" control.

RATE—Voltage control input for sweep rate. The front panel Rate control is disconnected while using this jack.

SWEEP—Voltage control input for phasing sweep. The Sweep selector switch must be in the "Both" or "Ext" position for this input.

FOOT SWITCH—Input for remote control of Status switch. While using this jack, the Status switch is disabled. Use a push-on-push-off switch with ¼" mono phone plug. When the tip is grounded, it is equivalent of Status "IN."

LINE SELECTOR—Sets power supply for either 115 or 230 volt operation.

In—Audio input connector

+OUTPUT—Audio output connector used as the primary output channel.
This output has four modes which depend on the setting of the Motor.
Start and Status Switch.

MOTOR START "OFF"

STATUS OUT—Input signal is passed through the input buffer, through the electronic signal switches and to the output. The Gain control has no effect.

STATUS IN—The input signal is compressed, processed by the phaser, expanded, passed through the electronic switch and to the output.
The Gain control sets the output level.

MOTOR START "ON"

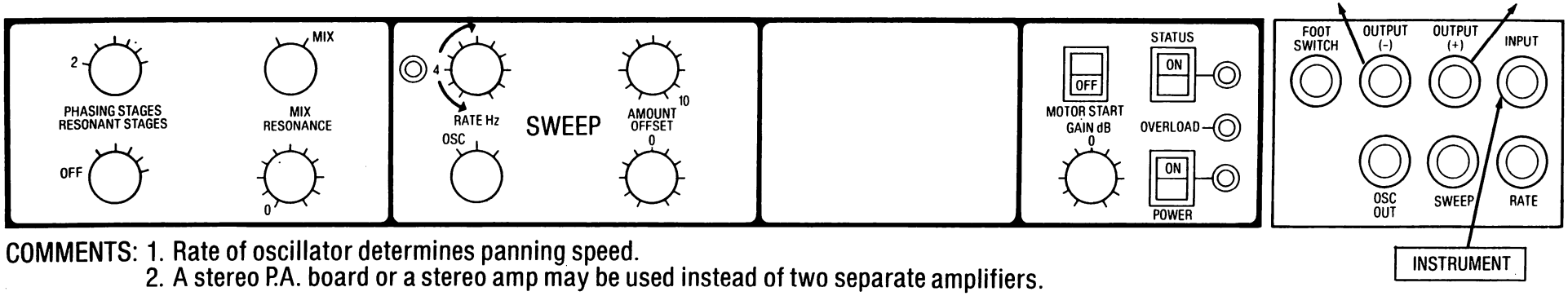
STATUS OUT-Input signal is passed through the input buffer, compressed expanded, passed through the Gain control, and to the output. The Gain control sets the level of the Direct signal.

STATUS IN—Input signal is passed through the input buffer, compressed, processed, expanded, passed through the Gain control, and to the output. The Gain control sets the output level of the processed signal.

APPLICATION

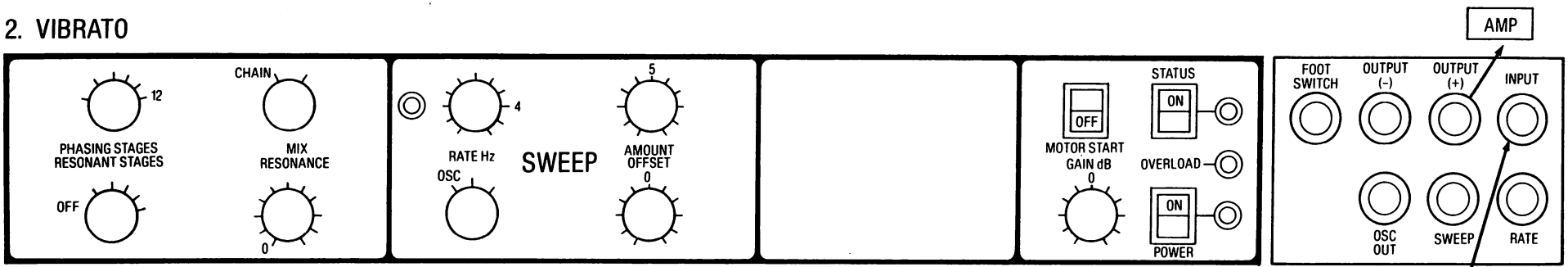
The Moog 12 Stage Phaser is designed from an "open system" approach; that is, various sections of the phaser may be controlled by external sources, or they may themselves be used to control external sources. Here are some examples:

1. STEREO PANNING



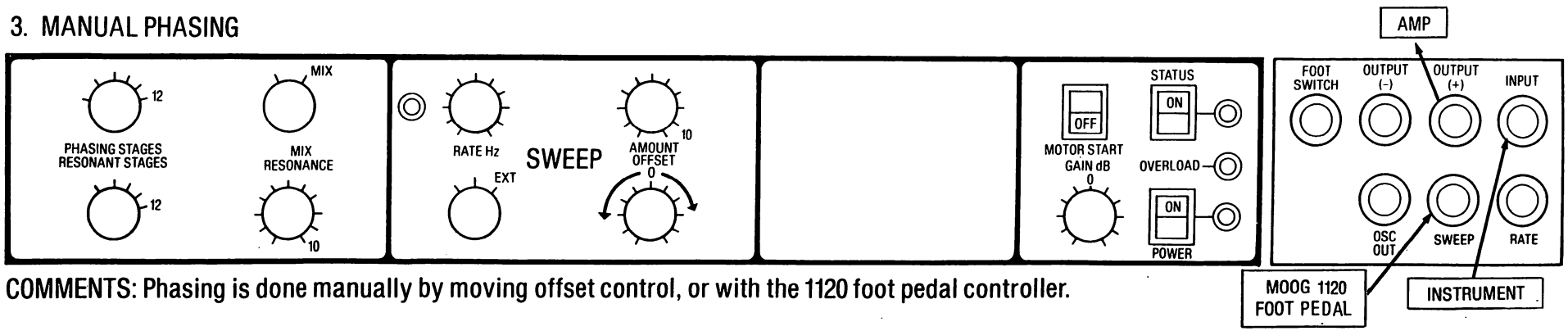
COMMENTS: 1. Rate of oscillator determines panning speed.
2. A stereo P.A. board or a stereo amp may be used instead of two separate amplifiers.

2. VIBRATO



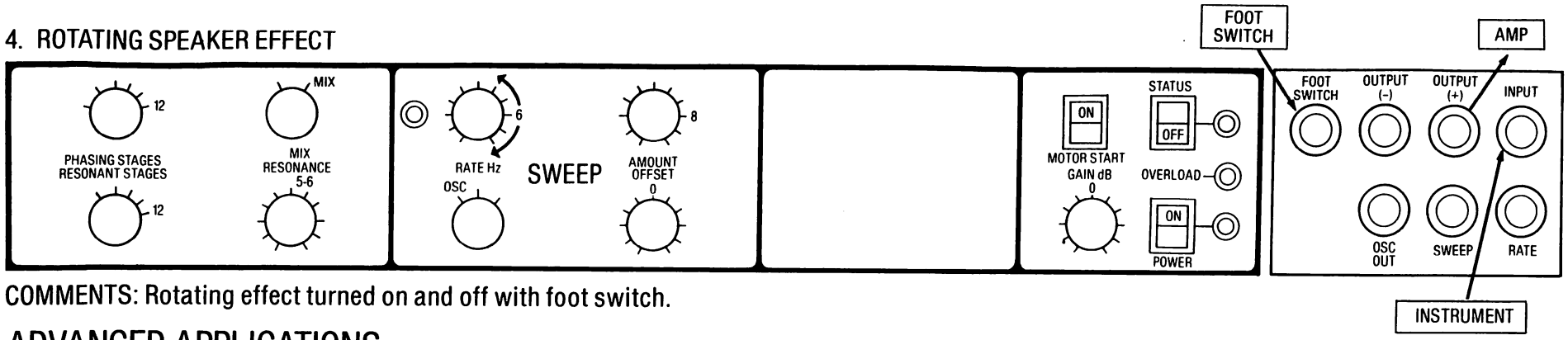
COMMENTS: 1. Rate of oscillator determines vibrato speed.

3. MANUAL PHASING



COMMENTS: Phasing is done manually by moving offset control, or with the 1120 foot pedal controller.

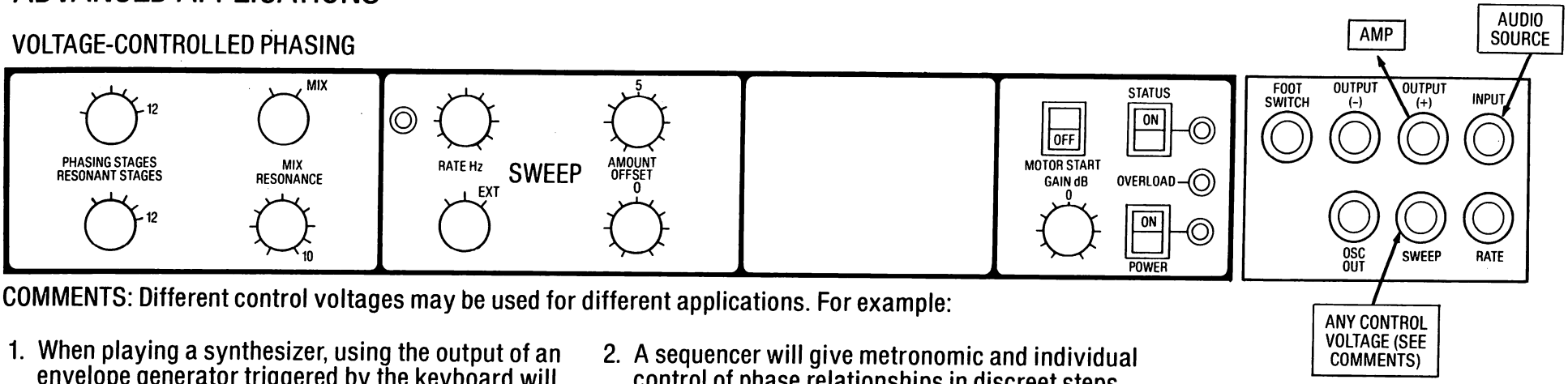
4. ROTATING SPEAKER EFFECT



COMMENTS: Rotating effect turned on and off with foot switch.

ADVANCED APPLICATIONS

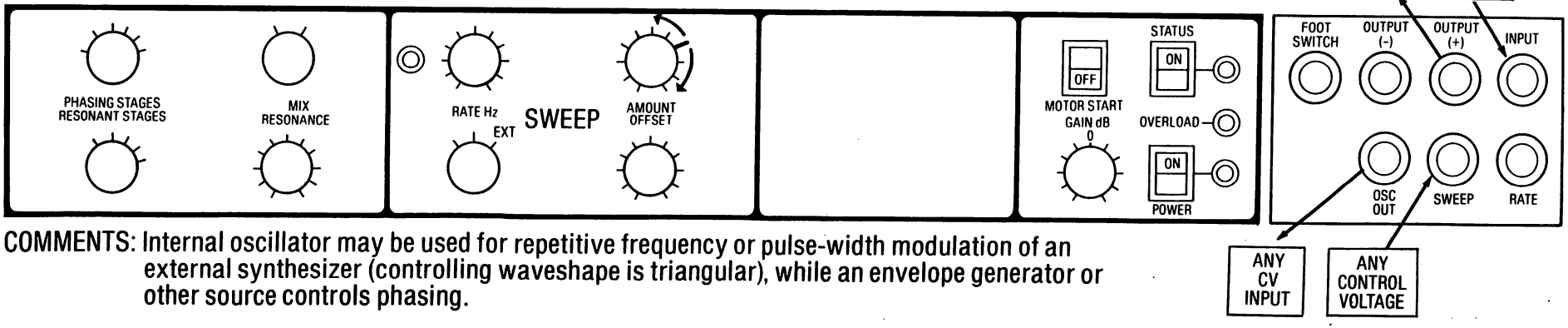
VOLTAGE-CONTROLLED PHASING



COMMENTS: Different control voltages may be used for different applications. For example:

1. When playing a synthesizer, using the output of an envelope generator triggered by the keyboard will give contoured phasing, dependent on keyboard technique.
2. A sequencer will give metronomic and individual control of phase relationships in discreet steps.
3. The output of an envelope follower will cause phase changes proportional to the amplitude of the input.

EXTERNAL USE OF INTERNAL OSCILLATOR



COMMENTS: Internal oscillator may be used for repetitive frequency or pulse-width modulation of an external synthesizer (controlling waveshape is triangular), while an envelope generator or other source controls phasing.

PARTS LIST

POWER SUPPLY

REF. DESIG.	PART NUMBER	DESCRIPTION	QTY.
	996-041659-001	Printed Circuit Board Assembly consisting of:	1
C1, C2	945-040209-007	Capacitor, Aluminum, Electrolytic, 470uf, 35V	2
C3, C4	947-040194-152	Capacitor, Disc, 0.0015uf	2
C5, C7	946-040231-002	Capacitor, Tantalum, 10uf, 20V	2
C6, C8	947-040200-103	Capacitor, Disc, 0.01uf	2
CR1 thru CR4	919-010623-003	Diode, Rectifier, 1N4004	4
IC101	991-041111-001	Integrated Circuit, Dual Regulator, ±15V, SG1468	1
P11	910-040303-005	Header, Printed Circuit, 5 Pin, Keyed (0.150 Centers), AMP640242-5	1
P12	910-041716-003	Header, Printed Circuit, 3 Pin, AMP350210-1	1
Q1	991-041050-001	Transistor, PNP, TIP30	1
Q2	991-041049-001	Transistor, NPN, TIP29	1
R1, R4	852-312027-001	Resistor, 2.7 Ohm, ±5%, 1/4W	2
R2, R3	852-312510-001	Resistor, 51 Ohm, ±5%, 1/4W	2
	967-040935-001	Heatsink, TO-220 Device	2

CONTROL BOARD

REF. DESIG.	PART NUMBER	DESCRIPTION	QTY.
	996-042430-001	Printed Circuit Board Assembly, consisting of:	1
A1, A4	991-041210-002	Integrated Circuit, Operational Amplifier, 36V, CA3094A	2
A2	991-041951-001	Integrated Circuit, Operational Amplifier, LF356N	1
A3, A5	991-041146-001	Integrated Circuit, Dual Operational Amplifier, 4558	2
C1, C2, C11, C12	946-040231-002	Capacitor, Tantalum, 10uf, 20V	4
C3	946-041978-102	Capacitor, Polyester, 0.001uf	1
C4, C5, C8, C9	947-042020-501	Capacitor, Disc, 5500Pf	4
C6	946-041978-104	Capacitor, Polyester, 500Pf	1
C7	946-041978-334	Capacitor, Polyester, 0.33uf	1
C10	946-041978-474	Capacitor, Polyester, 0.47uf	1
C13 thru C16	945-040209-001	Capacitor, Aluminum, Electrolytic, 10uf, 25V	4
C17	947-042020-101	Capacitor, Disc, 100Pf	1
CR1 thru CR6	919-041075-001	Diode, Signal, 1N4148	6
IC1	991-041104-001	Integrated Circuit, Transistor Array, CA3046	1
P21	910-040299-010	Connector, 10 Pin, CIS, Printed Circuit	1
P22	910-040299-009	Connector, 9 Pin, CIS, Printed Circuit	1
P23, P24	910-040299-006	Connector, 7 Pin, CIS, Printed Circuit	2
P25	910-040299-008	Connector, 8 Pin, CIS, Printed Circuit	1
P26	910-040299-006	Connector, 6 Pin, CIS, Printed Circuit	1
P27	910-040299-003	Connector, 3 Pin, CIS, Printed Circuit	1
Q1, Q3, Q4	991-041052-001	Transistor, PNP, Small Signal, 2N3906	3
Q2	991-041265-001	Transistor, NPN, Small Signal, TIS97	1
Q5	991-041051-001	Transistor, NPN, Small Signal, 2N3904	1
R1, R2, R4	852-312513-001	Resistor, 51K Ohm, ±5%, 1/4W	3
R3	852-312134-001	Resistor, 130K Ohm, ±5%, 1/4W	1
R5	852-312474-001	Resistor, 470K Ohm, ±5%, 1/4W	1
R6, R20	925-041870-003	Resistor, Rotary, Linear, 10K, SWEEP OFFSET and SWEEP RATE	2
R7	852-312824-001	Resistor, 820K Ohm, ±5%, 1/4W	1
R8, R24, R26	925-040275-004	Resistor, Trimmer, 10K Ohm, OFFSET TRIM, RATE TRIM AND MOTOR START TRIM	3
R9	852-312473-001	Resistor, 47K Ohm, ±5%, 1/4W	1
R10	852-312472-001	Resistor, 4.7K Ohm, ±5%, 1/4W	1
R11, R15, R16, R27, R37	852-312103-001	Resistor, 10K Ohm, ±5%, 1/4W	5
R12, R29, R31, R52, R53	852-512202-001	Resistor, 2K Ohm, ±5%, 1/4W	5
R13, R14, R17, R19, R22, R35, R40, R43, R49, R51	852-312104-001	Resistor, 100K Ohm, ±5%, 1/4W	10
R18	852-312681-001	Resistor, 680 Ohm, ±5%, 1/4W	1
R21, R25	852-312154-001	Resistor, 150K Ohm, ±5%, 1/4W	2
R23, R41	852-312105-001	Resistor, 1 Megohm, ±5%, 1/4W	2
R28	852-312394-001	Resistor, 390K Ohm, ±5%, 1/4W	1
R30, R55	852-312164-001	Resistor, 160K Ohm, ±5%, 1/4W	2
R32	852-312914-001	Resistor, 910K Ohm, ±5%, 1/4W	1
R33	852-312512-001	Resistor, 5.1K Ohm, ±5%, 1/4W	1
R34, R56	852-312102-001	Resistor, 1K Ohm, ±5%, 1/4W	2
R36	852-312821-001	Resistor, 820 Ohm, ±5%, 1/4W	1
R38	852-312101-001	Resistor, 100 Ohm, ±5%, 1/4W	1
R39, R57	852-512102-001	Resistor, 1K Ohm, ±5%, 1/2W	2
R42	925-041870-005	Resistor, Rotary, 100K Ohm, 10% CCW Log, RESONANCE	1
R44	852-312515-001	Resistor, 5.1 Megohm, ±5%, 1/4W	1
R45, R46	852-312273-001	Resistor, 27K Ohm, ±5%, 1/4W	2
R47	852-312303-001	Resistor, 30K Ohm, ±5%, 1/4W	1
R48	852-312132-001	Resistor, 1.3K Ohm, ±5%, 1/4W	1
R50	852-312203-001	Resistor, 20K Ohm, ±5%, 1/4W	1
R54	925-041870-004	Resistor, Rotary, Linear, 100K Ohm, SWEEP AMOUNT	1
R58, R59	852-312522-001	Resistor, 5.6K Ohm, ±5%, 1/4W	2
R60	925-041869-004	Resistor, Rotary, Dual, 50K Ohm, 20% CCW Log, INSERTION GAIN	1
R61	852-312392-001	Resistor, 3.9K Ohm, ±5%, 1/4W	1
SW5	960-042792-002	Switch, Rotary, 1P3T, SWEEP SELECTOR	1
SW6, SW7	960-042792-001	Switch, Rotary, 1P6T, RESONANT STAGES and PHASING STAGES	2
SW8	960-042792-003	Switch, Rotary, 2P2T, CHAIN MIX	1

MAIN BOARD

REF. DESIG.	PART NUMBER	DESCRIPTION	QTY.
	996-042434-001	Printed Circuit Board Assembly consisting of:	1
A1, A13 thru A24	991-041210-002	Integrated Circuit, Operational Amplifier, 36V, CA3094A	13
A2	991-041089-004	Integrated Circuit, Operational Amplifier, FET, LM3080AN	1
A3, A4, A6, A25	991-041951-001	Integrated Circuit, Operational Amplifier, FET, LF356N	4
A5, A7	991-041146-001	Integrated Circuit, Operational Amplifier, Dual, 4558	2
A8, A9	991-042661-001	Integrated Circuit, Operational Amplifier, Dual, TL082	2
A10, A11	991-042793-001	Integrated Circuit, Operational Amplifier, JFET, Selected	2
A12	991-041101-001	Integrated Circuit, Operational Amplifier, 741	1
C1, C23	946-041978-224	Capacitor, Polyester, 0.22uf	2
C2, C24	945-040209-036	Capacitor, Aluminum, Electrolytic, 10uf, 35V	2
C3, C5, C17 C18, C28, C29, C31, C32, C53, C54	947-040200-103	Capacitor, Disc, 0.01uf	10
C4, C27	946-041978-104	Capacitor, Polyester, 0.1uf	2
C6	947-042020-180	Capacitor, Disc, 18Pf	1
C7, C8, C19, C20, C36, C39, C42, C45, C48, C51	946-041978-334	Capacitor, Polyester, 0.33uf	10
C9	947-042020-221	Capacitor, Disc, 220Pf	1
C10, C52	947-042020-470	Capacitor, Disc, 47Pf	2
C11 thru C16, C21, C22	946-040231-002	Capacitor, Tantalum, 10uf, 20V	8
C25	947-042020-100	Capacitor, Disc, 10Pf	1
C26	946-041978-684	Capacitor, Polyester, 0.68uf	1
C30, C31, C34, C35, C37, C38, C40, C41, C43, C44, C46, C47, C49, C50,	946-043070-102	Capacitor, Disc, 100Pf	2
CR1 thru CR26	946-041978-102	Capacitor, Polyester, 0.01uf	12
IC1 thru IC3	919-041075-001	Diode, Signal, 1N4148	26
N1 thru N6	991-041086-001	Integrated Circuit, CD4007	3
P30	949-042425-001	Resistor Network (5 Resistors), 20K Ohm, ±1%	6
P31, P33	910-040303-003	Connector, Header, 3 Pin, CIS, Keyed (0.15 Centers)	1
P32, P34	910-040299-010	Connector, Header, 10 Pin, CIS, (0.1 Centers)	2
P35	910-040299-003	Connector, Header, 3 Pin, CIS, (0.1 Centers)	2
Q1 Q2 Q3, Q5, Q6	910-040299-007	Connector, Header, 7 Pin, CIS, (0.1 Centers)	1
Q4,	991-041052-001	Transistor, PNP, Small Signal, 2N3906	5
Q7	991-041051-001	Transistor, NPN, Small Signal, 2N3904	1
R1, R2, R5, R13, R26, R3, R73, R75, R4, R16, R35, thru R39, R49, R51, R53, R56 R6, R8, R10, R11, R20, R22, R30, R32, R41, R43, R44, R45, R55, R60, R144, R145 R7, R9, R12	991-041055-001	Transistor FET, E112	1
	852-312183-001	Resistor, 18K Ohm, ±5%, 1/4W	1
	852-312623-001	Resistor, 62K Ohm, ±5%, 1/4W	4
	852-312273-001	Resistor, 27K Ohm, ±5% 1/4W	3
	852-312103-001	Resistor, 10K Ohm, ±5%, 1/4W	11
	852-312104-001	Resistor, 100K Ohm, ±5%, 1/4W	16
R50, R82, R93, R104, R115, R126, R137, R14, R66, R70 R15, R18, R17, R19, R24, R33, R57, R61, R62, R88, R99, R110, R121, R132, R143	852-312105-001	Resistor, 1 Megohm, ±5%, 1/4W	13
	852-312203-001	Resistor, 20K Ohm, ±5%, 1/4W	10
	852-312332-001	Resistor, 3.3K Ohm, ±5%, 1/4W	3
	852-312204-001	Resistor, 200K Ohm, ±5%, 1/4W	2
R21, R31, R23, R25	925-040275-003	Resistor, Trimmer, 50K Ohm, (+) OUT NULL and (-) OUT NULL	2
	853-422002-031	Resistor, 20K Ohm, ±1%, 1/4W	2
R27, R34	852-312124-001	Resistor, 120K Ohm, ±5%, 1/4W	2
R28, R29	852-312224-001	Resistor, 220K Ohm, ±5%, 1/4W	2
R40	852-312102-001	Resistor, 1K Ohm, ±5%, 1/4W	1
R42	852-312472-001	Resistor, 4.7K Ohm, ±5%, 1/4W	1
R46	852-312512-001	Resistor, 5.1K Ohm, ±5%, 1/4W	1
R47	852-312475-001	Resistor, 4.7 Megohm, ±5%, 1/4W	1
R48, R76	851-152106-000	Resistor, 10 Megohm, ±10%, 1/4W	2
R52	852-312683-001	Resistor, 68K Ohm, ±5%, 1/4W	1
R54	852-312684-001	Resistor, 680K Ohm, ±5%, 1/4W	1
R58	852-312392-001	Resistor, 3.9K Ohm, ±5%, 1/4W	1
R59	925-040275-013	Resistor, Trimmer, 2.5K Ohm, MAX GAIN TRIM COMPRESSOR	1
R63, R67	852-312153-001	Resistor, 15K Ohm, ±5%, 1/4W	2
R64, R68	852-312202-001	Resistor, 2K Ohm, ±5%, 1/4W	2
R65, R69	852-312621-001	Resistor, 620 Ohm, ±5%, 1/4W	2
R71, R72, R74, R77 R78, R83, R89, R94, R100, R106, R111, R116, R122, R127, R133, R138 R80, R85, R91, R96, R102, R107, R113, R118, R124, R129, R135, R140	852-312473-001	Resistor, 47K Ohm, ±5%, 1/4W	4
	852-312331-001	Resistor, 330 Ohm, ±5%, 1/4W	12
	852-312303-001	Resistor, 30K Ohm, ±5%, 1/4W	12
RAT1, RAT2	948-042791-001	Isolator, Dual	2

REPLACEMENT PARTS LIST

REF. DESIG.	PART NUMBER	DESCRIPTION	QTY.
	997-042347-001	12 Stage Phaser Keyboard Modifier consisting of:	
	996-041659-001	Printed Circuit Board Assembly, KB Mod, Power Supply	1
	996-042430-001	Printed Circuit Board Assembly, Control, No. 2	1
	996-042434-001	Printed Circuit Board Assembly, Main, No. 3	1
F1	939-041620-004	Fuse 3AG, 1 Amp., Slo-Blo	1
F2, F3	939-041620-002	Fuse 3AG, 1/4 Amp., Slo-Blo	2
J1, J4	910-041306-002	Jack, Phone, 1 Circuit, Shorting, Switchcraft 112A	2
J2, J3, J5, J6,	910-041306-001	Jack, Phone, 1 Circuit, Switchcraft 111	4
J7	910-041306-004	Jack, Phone, 2 Circuit, Stereo, Switchcraft 112B	1
L1	939-041850-003	LED, Yellow, Opcoa LSM-26L	1
L2, L4	939-041850-001	LED, Red, Opcoa LSM 6L	2
L3	939-041850-002	LED, Green, Opcoa LSM-16L	1
P1	910-041739-001	Receptacle, 250V AC, Ga, Switchcraft EAC-31	1
P2 P3	910-041314-004	Plug, 4 Position, Univ. Mate-N-Lok, AMP1-480702-0	2
S2 S3	910-041315-004	Cap, 4 Position, Univ. Mate-N-Lok, AMP1-480703-0	2
S4, S5, S6, S7	906-040298-002	Housing, 2 Pin, CIS, 0.100 Centers, AMP350091-2	4
S11	906-040302-005	Housing, 5 Pin, CIS, Keyed, 0.150 Centers, AMP640117-1	1
S12	910-041717-003	Housing, Socket Connector, 3 Pin, 0.2 Centers, Mate-N-Lok	1
S21, S31, S33	906-040298-010	Housing, 10 Pin, CIS, 0.100 Centers, AMP350091-10	3
S22	906-040298-009	Housing, 9 Pin, CIS, 0.100 Centers, AMP350091-9	1
S23, S24, S35	906-040298-007	Housing, 7 Pin, CIS, 0.100 Centers, AMP350091-7	3
S25	906-040298-008	Housing, 8 Pin, CIS, 0.100 Centers, AMP350091-8	1
S26	906-040298-006	Housing, 6 Pin, CIS, 0.100 Centers, AMP350091-6	1
S27, S32, S34	906-040298-003	Housing, 3 Pin, CIS 0.100 Centers, AMP350091-3	3
S30	906-040302-003	Housing, 3 Pin, CIS, Keyed, 0.150 Centers, AMP640115-1	1
SW1	960-041303-001	Switch, Selector, DPL Wipe, 115-230V, Switchcraft 46256LFE	1
SW2, SW4	960-041311-003	Switch, Rocker, DPDT, Legend, ON-OFF, Carling SGD0410-TB-B	2
SW3	960-041314-002	Switch, Rocker, SPDT, Legend, IN-OUT, Carling SGB0410-TB-B	1
T1	954-041647-002	Transformer, 250 Ma, Shielded	1
	801-055446-000	Nut, Hexagon, 8-32	1
	806-054039-005	Screw, Pan Hd., Phillips, 6.32 x 5/16 in., Black Oxide	2
	806-045039-007	Screw, Pan Hd., Phillips, 6-32 x 7/16 in., Black Oxide	6
	806-045039-010	Screw, Pan Hd., Phillips, 6-32 x 0.625 in., Black Oxide	4
	806-055039-006	Screw, Pan Hd, 8-32 x 3/8 in., Black Oxide	1
	811-040039-008	Screw, Self Tapping, 6A x 1/2 in.	14
	811-040039-010	Screw, Self Tapping, Pan Hd., Type A, 6A x 5/8 in., Black Oxide	8
	816-040239-006	Screw, Self Tapping, Flat Hd., Type B, 6B x 3/8 in., Black Oxide	6
	902-040500-001	Nut, Speed, No. 6A	22
	902-040504-007	Nut, 3/8-32	12
	902-041394-009	Nut, 6-32, Hexagon	8
	904-040495-016	Washer, Lock, No. 6	16
	904-040495-021	Washer, Lock, 3/8 in.	12
	904-041390-017	Washer, No. 6	12
	904-042026-001	Washer, Flat, Conical, 3/8 in.	12
	905-040498-034	Rivet, Pop, 1/8 in. Dia.	6
	906-041331-003	Fuse Black, Littlefuse Series 357-003	1
	910-040308-001	Contact, Female, CIS, AMP350090-1	85
	910-040310-001	Plug, Keying	9
	910-041313-001	Contact, Socket, Univ. Mate-N-Lok, AMP350570-1	8
	910-041316-001	Contact, Pin, Univ. Mate-N-Lok, AMP350699-1	8
	910-042049-001	Connector, Mate-N-Lok, Crimp Socket	3
	911-040189-002	Lug, No. 8, AMP61436-1	1
	913-042007-001	Decal, Fuse	1
	913-042422-001	Overlay, Front Panel	1
	913-042459-001	Label, Instruction	1
	916-041834-001	Machine Screw Bumper	4
	957-041794-001	Power Cord, Belden 17250-B	1
	963-042801-001	Cover, Rear	1
	964-041896-001	Insert, Molded Foam	2
	967-040734-001	Cover, Top	1
	967-040734-004	Cover, Bottom	1
	967-042545-001	Bracket, Transformer	2
	968-040733-003	Front Extrusion	1
	973-040508-058	Spacer, 6-32 x 0.312 in., 1/4 Hex., Brass	4
	973-041308-018	Standoff, PEM, 6-32 x 1/4 in., PEMSO-632-8	2
	973-041308-020	Standoff, PEM, 6-32 x 3/8 in., PEMSO-632-12	6
	976-041851-001	Grommet and Ring, Opcoa OC-1	4
	997-041867-001	Knob Assembly, Pointer	9
	997-041886-001	End Plate Subassembly, L.H.	1
	997-041886-002	End Plate Subassembly, R.H.	1



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