SHURE®
THE SOUND OF THE PROFESSIONALS™
222 HARTREY AVENUE
EVANSTON, ILLINOIS 60202-3696 U.S.A.

PROFESSIONAL PRODUCTS

GENERAL

The FP31 is a portable electronic news gathering (ENG) electronic field production (EFP), or film production, mixer that provides the quality and features needed for remotes.

FEATURES

Inputs

- Three transformer-coupled, 3-socket XLR-connector inputs; each switchable to low-impedance microphone or line level
- Lo-Cut filters available at each input to reduce extraneous low-frequency interference
- (Phantom) simplex or A-B power for condenser microphones available at each microphone input
- Built-in tone oscillator for level checks or line tests
- Slate microphone with automatic gain control (AGC) for take identification or for emergency use
- Slate tone for identifying take locations during editing

Outputs

- Two transformer-coupled, 3-pin XLR-connector outputs, each switchable either to low-impedance balanced microphone or to 600-ohm balanced line level
- Tape output to feed tape recorder input or other unbalanced Aux-level input
- Front and side panel stereo headphone jacks (8 to 2,000 ohms, ¼-inch and 3.5 mm jacks) with separate Phones level control. Either or both jacks can drive Aux or unbalanced line-level inputs. Four separate sources can be driven from these two headphone outputs.

Controls and Indicators

- Active, feedback-type input gain controls permit direct input of high-level sources without input attenuators
- Built-in Limiter with adjustable threshold—prevents output clipping of mixer or input overload of amplifier, telephone line or tape recorder
- LED indicator flashes with Limiter operation or to signal overload with Limiter defeated
- Professional VU meter, factory set for 0 VU = +4 dBm, internally adjustable for other VU levels
- VU lamp, stays illuminated while pushbutton is depressed, automatic 5-second turnoff after button is released.
- Battery check function with readout on VU meter
- Master gain controls level at Line/Mic and Tape outputs as well as tone oscillator level
- Phones level control adjusts output at both headphone jacks

Power

- Mixer is powered by two standard 9V alkaline batteries that also supply simplex power for condenser microphones
- Extremely low battery drain provides 8-hour minimum battery life under normal conditions
- Separate 9V alkaline battery supplies A-B power for condenser microphones; third battery is not required if A-B power is not used
- Spring-loaded battery compartment prevents incorrect insertion of batteries; batteries available for replacement instantly when compartment door is opened
- Mixer can be powered from any 11 to 18 Vdc source such as: standard belt pack, automotive electrical system, video tape recorder, or ac power converter

Mechanical characteristics

- Extremely rugged and durable construction
- Very small size and light weight
- Carrying case and detachable shoulder strap supplied
- All input and output connectors are professional standard types

Performance

- Reliable operation under wide extremes of temperature and humidity
- Extremely low noise and low RF susceptibility permits use near microwave transmitters and in strong hum fields
- Wide, flat response, extremely low distortion, and up to +18 dBm output level provide studio-quality performance in a portable mixer

27A8080 (KG)
Printed in U.S.A.

SPECIFICATIONS

Frequency Response
30 Hz to 20 kHz ±2 dB

Distortion
Less than 0.25% total harmonic distortion at +4 dBm, 50 Hz to 20 kHz

Noise
Less than −129 dBV equivalent input noise

Common Mode Rejection
65 dB minimum at 100 Hz, −30 dBV input

Inputs

	IMPEDANCE		Input Clipping Level
	For Use With	Actual	
Mic	19 to 600Ω*	1 kΩ	−47 to −17 dBV (4.5 to 141 mV)
Line	Less than 10 kΩ	66 kΩ	+3 to +33 dBV (1.4 to 44V)

*Including simplex or A-B powered, and dynamic or ribbon microphones

Tone Oscillator
1 kHz nominal at +4 dBm, Master at approx. 7

Slate Tone
400 Hz, 1 sec, each time button is depressed

Slate Microphone
Electret condenser, omnidirectional, with AGC, activated while slate button is depressed

Outputs

	IMPEDANCE		Output Clipping Level
	For Use With	Actual	
Mic	Any low-Z mic input	0.5Ω	−34 dBV (20 mV) minimum into 150Ω
Line	600Ω	150Ω	+18 dBm minimum into 600Ω
Tape	8 kΩ or greater high level input	2.5 kΩ	−6 dBV (0.5V RMS) into 47 kΩ
Phone	8Ω to 2 kΩ	180Ω	+4 dBV (1.6V RMS Max) into 200Ω

Phase
3-pin Input & Output connectors in phase; pin 3 in phase with tip of phone & mini jacks

Gain (at 1 kHz)

INPUT	OUTPUT		
	Mic	Line	Tape
Mic	40 dB	90 dB	68 dB
Line	−10 dB	40 dB	18 dB

Controls

CHANNEL GAIN: Active, feedback type, individual for each input; Channel 1 control pulls out to activate tone oscillator

MASTER GAIN: Controls Line/Mic and Tape outputs, and tone oscillator and slate levels

LOW-CUT FILTERS: 7 dB rolloff at 100 Hz, −6 dB/octave slope

PHONES LEVEL: Controls both headphone outputs

LIMITER: Controls Line/Mic and Tape outputs; +14 dBm factory-set threshold, internally screwdriver adjustable down to +3 dBm; 3 msec attack, 500 msec recovery time typical

SIMPLEX/DYNAMIC/A-B SELECTORS: Individual for each input, supplies 11 to 18 Vdc Simplex (phantom) or 9 Vdc A-B power with Input in MIC position; supplies no power with Selector in DYN position (for dynamic or ribbon microphones) or with Input in LINE position

Control Interaction
Less than 1 dB with any control combination

Output Isolation
Shorting one output shall cause no more than 8 dB level drop at 1 kHz at other output

Overload and Shorting Protection
Shorting outputs, even for prolonged periods, shall cause no damage. Microphone inputs will not be damaged by signals up to 3 volts.

Indicators

POWER ON: Green LED flashes at approximately 1-second repetition rate as long as power switch is on

PEAK/OVERLOAD: Limiter IN — Red LED flashes to indicate onset of limiting; Limiter OUT — flashes 6 dB below output clipping level

BATTERY CHECK: Converts VU Meter to battery condition or circuit voltage indicator; 0 VU or higher indicates good batteries or adequate (11 to 18 Vdc) external power source

VU METER: Factory-set at 0 VU = +4 dBm; 0 VU level internally screwdriver adjustable

VU LAMP: Illuminates meter while button is depressed; automatic shutoff 5 seconds after release

Power

MIXER AND SIMPLEX (PHANTOM) POWER: Supplied by two internal 9V standard alkaline batteries (Duracell MN1604 or equivalent) or external 11 to 18 Vdc supply; 8-hour battery life under normal operation

SIMPLEX POWER: 11 to 18 Vdc nominal through 620Ω

A-B POWER: Supplied by additional 9V standard alkaline battery

Connectors

LINE/MIC INPUTS AND OUTPUTS: 3-pin XLR type

TAPE OUT: 3.5 mm mini jack

PHONES: Stereo jacks; one standard ¼-inch phone and one 3.5 mm mini

12 VDC EXTERNAL POWER: Single-pin dc power jack

Temperature Range
OPERATING: −18 to +57°C (0 to 135°F)
STORAGE: −29 to +71°C (−20 to +160°F)

Dimensions
48.3 mm H x 160 mm W x 135 mm D (1-7/8 x 6-5/16 x 5-5/16 in.)

Net Weight (less batteries)
1 kg (2.2 lb)

Supplied Accessories
Removable shoulder strap, carrying case

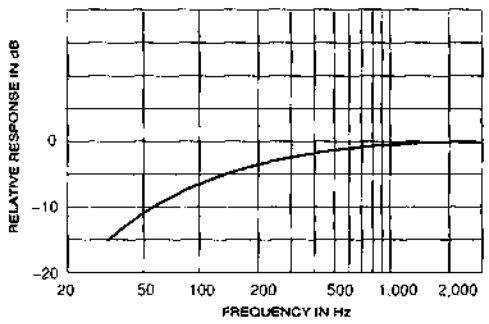
OPERATION

Line/Mic Inputs and Outputs

XLR-type 3-pin connectors, transformer-coupled balanced-line circuits; pins 2 and 3 are signal conductors; pin 1 is ground. All XLR connectors are in phase with one another.

Lo-Cut Filters

Activated by In/Out switch above each Channel Gain Control to provide low-frequency rolloff as shown in Figure 1. Reduce undesirable low-frequency signals such as wind noise.



LO-CUT FILTER ACTION
FIGURE 1

Channel Gain Controls

Determine preamplifier gain and provide preamplifier output attenuation. As gain is reduced, input clipping level increases for channel. Optimum signal-to-noise ratio occurs with Channel controls set as high as possible (consistent with maintaining adequate control range and input clipping level).

Tone Oscillator

Activated by pulling out Channel 1 control knob; stable 1 kHz oscillator; level determined by Master gain control. Oscillator signal appears at all outputs. When not in use, Channel 1 control knob should be pushed in.

Slate

Depressing Slate button activates 1-second 400 Hz tone and turns on Slate Microphone. Omnidirectional electret Slate Microphone remains on while button is depressed, can be used to identify recorded segments or as emergency field microphone. Slate Tone and AGC'd microphone audio levels are controlled by Master Gain Control.

Master Gain Control

Determines output levels at Line/Mic and Tape outputs. Also sets Tone Oscillator level when Channel 1 knob is pulled out, and Slate-tone and -microphone level when Slate button is pushed.

Headphone Jacks

Two stereo phone jacks: one mini 3.5 mm (front panel) and one 1/4-inch phone (side panel). Combined output, including Tone Oscillator, Slate Tone and Slate Microphone, appears at headphone jacks. Can be used to drive up to four headphones or Aux-level recorder or amplifier inputs. To wire either connector for two outputs, connect one conductor to tip; connect other conductor to ring; and connect shield(s) to sleeve of appropriate mating stereo plug. Tip and ring of headphone jacks in-phase with pin 3 of XLR Line/Mic input and output connectors.

Phones Control

Sets output level at headphone jacks.

Limiter

Limiter In/Out switch turns on fast-acting, peak-responding limiter circuit to cut overload distortion during loud program intervals without affecting normal program levels. Limiter switch In (operating) restricts maximum mixer output to approximately +14 dBm. Increasing individual Channel or Master gain controls increases both average output and amount of limiting. To change Limiter threshold, see section on Limiter Threshold Adjustment.

Peak LED

Indicates Limiter operation with Limiter switch In. With switch Out, flashes at 6 dB below output clipping. Peak indicator responds much faster than meter, activated by even shortest transient peak, yet remains lit long enough to provide easy recognition.

VU Meter

Factory calibrated for +4 dBm = 0 VU with 600-ohm load at Line output. (Microphone output levels are 50 dB below Line output.) Supplied 0 VU level is recommended for normal use to provide approximately 14 dB headroom between operating level and clipping level. To change 0 VU level, see section on VU Meter Adjustment.

VU Lamp

Illuminates meter while button is depressed; automatically turns off 5 seconds after release to prevent battery drain.

Tape Outputs

3.5 mm jack to feed unbalanced Aux-level input of tape recorder or amplifier. Tip of connector in phase with pin 3 of XLR connectors.

Telephone Lines

In Line position, output transformer will operate with dc-biased "dialed up" telephone lines although there may be slight increase in distortion. When connecting FP31 to telephone line, use FCC-Registered* interface adapter between mixer and telephone line.

*DOC-Certified in Canada

Condenser Microphone Power

Condenser microphones, either 12 to 18 Vdc phantom (simplex) powered or 9 Vdc A-B(T) powered, can be supplied from any Mic input of FP31. Below batteries, inside battery compartment, are three 3-position switches. Center position is for dynamic microphones (no dc power supplied to Mic input); left position is for 9-Vdc A-B power, right position is for 11- to 18-Vdc phantom power.

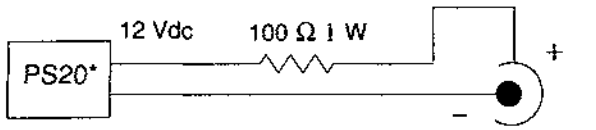
NOTE: No power is supplied to any input with Line/Mic switch in Line position. No A-B power is supplied unless right-side battery is present.

Mixer Powering

In ordinary portable use, the FP31 is powered by two standard 9-Vdc alkaline batteries installed in leftmost

battery compartment positions. Phantom power is also supplied by these batteries.

The FP31 can also be powered by an 11 to 18 Vdc external source, such as an automotive battery, battery beltpack, Shure PS20 AC Adapter or other low-ripple ac power converter (see Figure 2), using the12 Vdc single-pin coaxial input connector in the left-side panel. To filter possible power-supply hum and noise, install a 100 Ω resistor on the "+" side of the dc output. The outside barrel of the mating connector is positive.



***Wire with white stripe is 12 V+** Coaxial Power Plug

Cut off molded dc power plug of PS20 and wire new connector as shown

POWERING FP31 FROM EXTERNAL AC ADAPTER
FIGURE 2

Parts Required:

1 Shure PS20 AC Adapter or equivalent (dc output = 12 Vdc, 100 mA minimum)

1 100 Ω 1 W resistor

1 *Coaxial dc power plug to fit FP31 external dc power jack* (2.1 or 2.5 mm I.D.) Radio Shack #274–1567A

Batteries can be left in place as backup in case of failure of external source. Switchover to internal batteries is performed by disconnecting external plug.

CAUTION

12 Vdc input circuit is not fused. Any external source should be provided with in-line fuse, 0.25 A, 250 V, as safety precaution.

Battery Check

Depressing BATT button converts VU Meter to readout of battery condition (two mixer-powering batteries) or of supply voltage. Readings of 0 VU or higher indicate good batteries or adequate external supply.

VU METER ADJUSTMENT

To set the VU Meter for a value different from the supplied 0 VU = +4 dBm, proceed as follows.

1. Connect a 600-ohm load to one of the Line outputs.
2. Connect an ac voltmeter (e.g., HP 400GL) in parallel with the load.
3. Pull out the Channel 1 knob to activate the Tone Oscillator.
4. Adjust the Tone Oscillator level with the Master gain control until the ac voltmeter reading is at the level desired.
5. With a screwdriver, adjust the VU Level trimpot (left of the A-B/DYN/SPLX Selector switches) until the VU Meter reads 0.

LIMITER THRESHOLD ADJUSTMENT

To adjust the Limiter threshold for a value different from the supplied +14 dBm, proceed as follows.

1. Connect a 600-ohm load and an ac voltmeter to a Line output as described in steps 1 and 2 above.
2. Pull out the Channel 1 knob to activate the Tone Oscillator.
3. With Limiter switch Out, adjust Master gain control until the ac voltmeter reading is at the level desired.
4. Move the Limiter switch In, and adjust Limiter Threshold trimpot (left of the VU Level trimpot) until the level drops 0.5 dB.

FURNISHED ACCESSORIES

Carrying Case 95B8066
Shoulder Strap 90BX2600

REPLACEMENT PARTS LIST

Reference Designation	Replacement Kit	Replacement Kit Consists Of: Qty.	Part No.	Description	Commercial Alternate
C102, C104, C106	– –	–	86V628	Capacitor, Electrolytic, 22 μF, 6.3V	Panasonic ECEBOJK220
C107, C109, C115, C119, C126, C130, C205, C302, C303,C305	– –	–	86T628	Capacitor, Electrolytic, 4.7 μF, 25V	Panasonic ECEB1EK4R7
C112, C120, C153	– –	–	86AC629	Capacitor, Electrolytic, 4.7 μF, 25V	Marcon CESSM1E4R7
C114, C154,	– –	–	86AD629	Capacitor, Electrolytic, 470 μF, 16V	Marcon CESSM1C471
C122, C150, C211, C154, C212	– –	–	86S629	Capacitor, Electrolytic, 470 μF, 16V	Marcon CESSM1C471A
C128	– –	–	86Y629	Capacitor, Electrolytic, 33 μF, 10V	I.C.C. 336RSS010M
C129, C131, C206	– –	–	86S628	Capacitor, Electrolytic, 1 μF, 25V	Panasonic ECEB1HK010
C133	– –	–	86R629	Capacitor, Electrolytic, 220 μF, 16V	Marcon CESSM1C221
C144	– –	–	86X629	Capacitor, Electrolytic, 220 μF, 25V	I.C.C. 227RMR025M
C145, C146, C147	– –	–	86Z629	Capacitor, Electrolytic, 47 μF, 10V	Marcon CESSM1A470
C148	– –	–	86W629	Capacitor, Electrolytic, 100 μF, 16V	I.C.C. 107RMR016M
C149, C157, C158, C159	– –	–	86AB629	Capacitor, Electrolytic, 22 μF, 16V	I.C.C. 226RSS016M
C152	– –	–	86V629	Capacitor, Electrolytic, 1000 μF, 25V	I.C.C. 108RMR025M
D101-D112, D115, D117, D120, D201, D202, D203 D306	– –	–	86A415	Diode, Silicon, Computer, 75V	TI 1N4148
D113, D114, D302, D303, D304, D305	RKC19	4	86A405	Diode, Germanium, 30V	RCA 1N48, 1N60
D118, D119, D205	RKC21	4	86A404	Silicon Rectifier, 100V, ½A	Motorola IN4002
D204	– –	–	86A8405	Diode, Light Emitting, Green	Rohm SLR34MG3
D301	– –	–	86B8405	Diode, Light Emitting, Red	Rohm SLR34OR3
J1, J2, J3	– –	–	95A8060	Connector, Three Socket	ITT Cannon XLR-3-31-F77
J4, J5	– –	–	95A8061	Connector, Three-Pin	ITT Cannon XLR-3-32-F77
J101, J301	– –	–	95A8062	Phone Jack, Miniature, 3.5mm	None
J102	– –	–	95A8063	Phone Jack, ¼ in.	None
J201	– –	–	95A8064	Power Jack, Coaxial	None

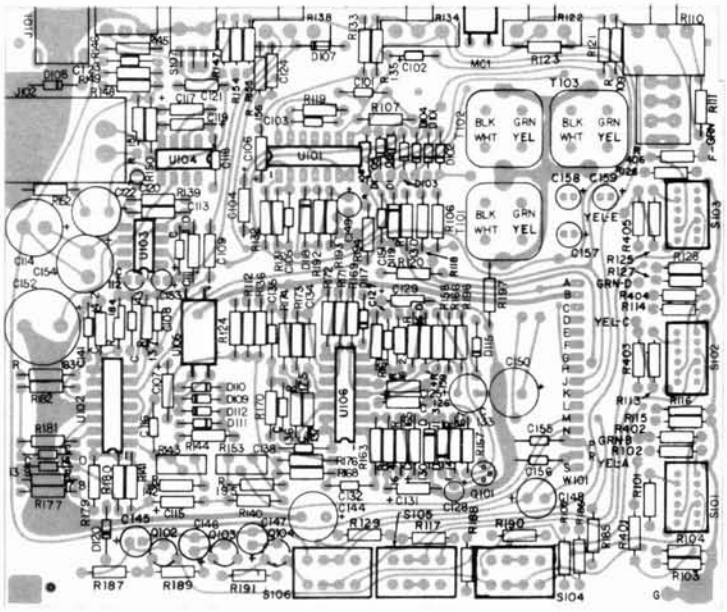
Parts listed as RKC Kits should be ordered by that kit number. Orders received for piece parts where RKC Kit number is shown will be shipped in RKC quantities.

Reference Designation	Replacement Kit	Replacement Kit Consists Of: Qty.	Part No.	Description	Commercial Alternate
L1-L10	– –	–	80A250	Ferrite Bead Ring	Stackpole 57-0181
L201, L202 L301	– –	–	80A365	Ferrite Bead Ring	Stackpole 57-3425
M1	– –	–	95A8068	VU Meter (Special VU Range)	None
MC1	– –	–	95A8069	Cartridge, Electret	Radio Shack 270-090
MP1-MP3	– –	–	95D8080	Knob, MIC 1-3	None
MP4	– –	–	95B8080	Knob, MASTER	None
MP5	– –	–	95D8081	Knob, PHONES	None
MP6	– –	–	90BW2600	Battery Cover	None
PL1	– –	–	95A8070	Lamp, T1, 10V, .027A	Precision Lamp PL7218
Q101	RKC89	4	86A350	Transistor, NPN	Motorola 2N5210
Q102, Q103, Q104, Q301	– –	–	86A349	Transistor, NPN	Farranti FST185L
Q302	RKC66	1	86A335	Transistor, PNP	TI TI593
R110 & S108	– –	–	46A8009	Potentiometer, 100k, with SPDT Switch	None
R122, R134	– –	–	46A8010	Potentiometer, 100k	None
R138	– –	–	46A8013	Potentiometer, 50k	None
R143	– –	–	46A8008	Potentiometer, 100k	Piher PT10Lh(2.5)100k
R146	– –	–	46A8011	Potentiometer, 50k	None
R153	– –	–	46C8008	Potentiometer, 50k	Piher PT10Lh(2.5)50k
S101, S102, S103	– –	–	55A8019	Switch, Slide, 4PDT	Alcoswitch MSS4200RG
S104, S105, S106	– –	–	55A8022	Switch, Slide, DPTT	Alcoswitch SLS-230PC
S107, S207, S201-S205	– –	–	55A8020	Switch, Slide, DPDT	None
S206, S301, S302	– –	–	55A8021	Switch, Pushbutton, SPDT	None
T101, T102, T103	– –	–	51D243	Transformer, Input	None
T201	– –	–	51A8015	Transformer, Output	None
U101, U102	– –	–	86B808	Integrated Circuit, Quad Op Ampl (Selected for NF)	Raytheon RC4156N
U103, U104	– –	–	86A8818	Integrated Circuit, Audio Power Amplifier	National Semiconductor LM386N-4
U105	– –	–	86A8900	Opto-Isolator	None
U106	– –	–	86A808	Integrated Circuit, Quad Op Ampl	Raytheon RC4156N
U201	– –	–	86A8819	Integrated Circuit, Dual Comparator	Motorola LM393N
U202	– –	–	86A8820	Integrated Circuit, 10V Regulator	TI UA78L10ACLP
U301	– –	–	86A806	Integrated Circuit, Quad Comparator	Raytheon LM339DB

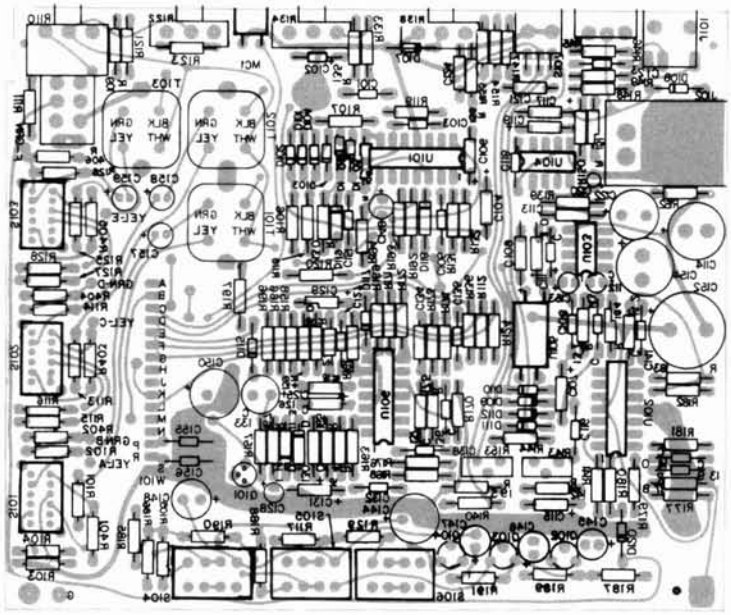
Parts listed as RKC Kits should be ordered by that kit number. Orders received for piece parts where RKC Kit number is shown will be shipped in RKC quantities.

PC BOARDS

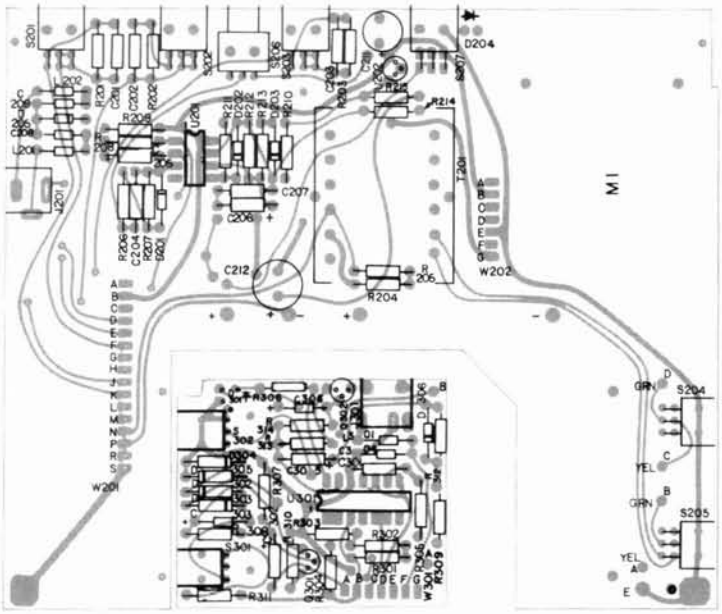
BOTTOM BOARD – COMPONENT SIDE



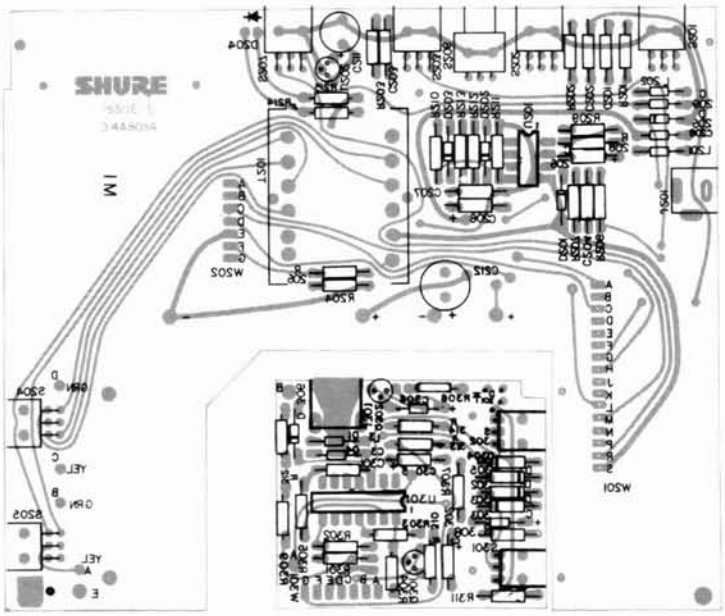
BOTTOM BOARD – SOLDER SIDE



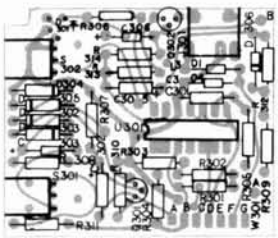
TOP BOARD – COMPONENT SIDE



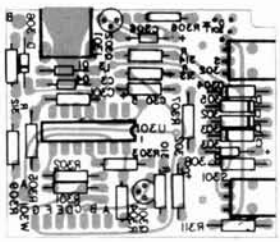
TOP BOARD – SOLDER SIDE



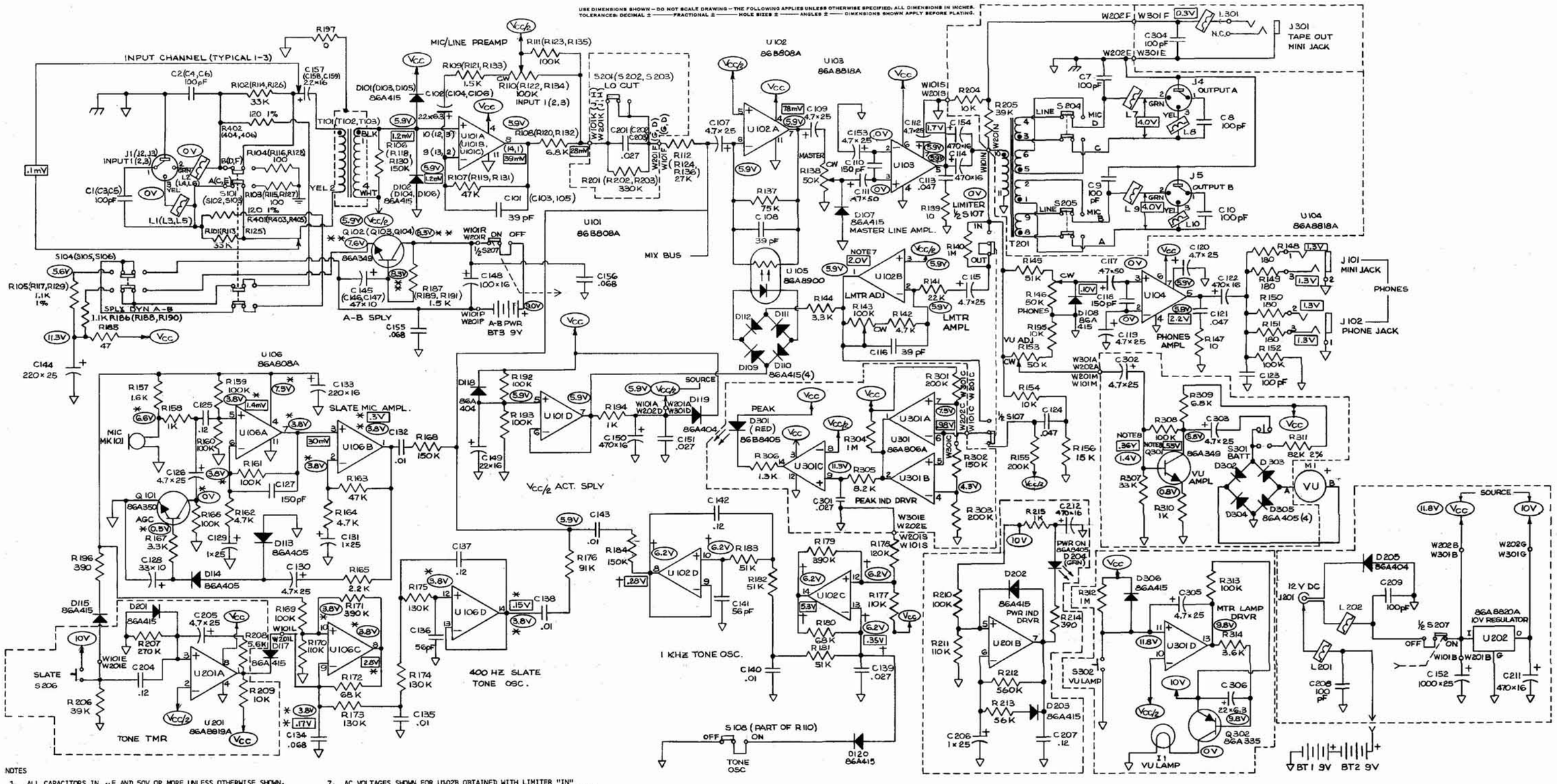
METER BOARD – COMPONENT SIDE



METER BOARD – SOLDER SIDE



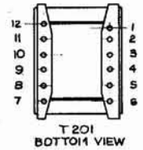
CIRCUIT DIAGRAM



NOTES

1. ALL CAPACITORS IN μF AND 50V OR MORE UNLESS OTHERWISE SHOWN. ELECTROLYTIC CAPACITORS SHOWN IN μF X VOLTS.
2. ALL RESISTORS 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
3. FOLLOWING SYMBOLS DENOTE:

   CHASSIS GROUND — CIRCUIT BOARD GROUND — DC VOLTAGE — AC VOLTAGE
4. ALL VOLTAGES MEASURED WITH 12.5 VOLTS DC APPLIED TO "12V DC" POWER INPUT CONNECTOR. ALL SWITCHES IN POSITIONS SHOWN, EXCEPT AS NOTED. MIC 1 INPUT LEVEL -80 DBV (0.1 mV RMS) ACROSS PINS 2 AND 3 OF J1, SUPPLIED BY 150 OHM, 1 KHZ SOURCE. LINE OUTPUT (J4 OR J5) LOADED WITH 600 OHMS. PHONES OUTPUTS LOADED WITH 200 OHMS FROM TIP AND RING TO SLEEVE. TAPE OUT LOADED WITH 47K OHMS. INPUT 1 AND MASTER CONTROLS CLOCKWISE. PHONES CONTROL SET FOR 0.1V RMS ON WIPER (APPROXIMATELY MID POSITION). VOLTAGES ARE MEASURED WITH RESPECT TO GROUND EXCEPT WHERE SHOWN. DC AND AC VOLTAGES MEASURED WITH 10 MEGOHM METERS. VALUES ARE TYPICAL (AC VOLTAGES ARE RMS VALUES) AND MAY VARY ± 20%.
5. VOLTAGES SHOWN FOR U102C AND D OBTAINED WITH TONE OSC SWITCHED ON.
6. VOLTAGES SHOWN FOR U106 OBTAINED WITH SLATE SWITCH DEPRESSED. AC VOLTAGES SHOWN FOR SECTIONS A AND B OF U106 WILL VARY WITH ACOUSTICAL INPUT TO MK101. VALUES GIVEN ARE TYPICAL FOR AN AC COUPLED (1 μF) 1 KHZ, 3 mV RMS SIGNAL APPLIED AT THE JUNCTION OF R157 AND R158. THIS MAY BE APPROXIMATED BY A STEADY WHISTLE WITHIN 6" OF THE FRONT PANEL. VOLTAGES SHOWN FOR SECTIONS C AND D OF U106 ARE BEST READ WITH R209 SHORTED OUT TO PREVENT THE SLATE TONE TIMER FROM TIMING OUT THE SLATE TONE OSCILLATOR.
7. AC VOLTAGES SHOWN FOR U102B OBTAINED WITH LIMITER "IN" (THRESHOLD AT +14 DBM) AND WILL VARY DEPENDING UPON CIRCUIT PARAMETERS AND SETTING OF LIM ADJ CONTROL (R143).
8. AC VOLTAGES SHOWN FOR Q301 OBTAINED WITH VU ADJ CONTROL (R153) SET TO INDICATE 0 VU AT +4 DBM LINE OUTPUT.



T 201
BOTTOM VIEW

W101		W201A Vcc/2
	B	B Vcc
	C	C PK IND. DRIVE
	D	D MIX CHAN 3
	E	E SLATE TONE PWR
	F	F MIX CHAN 1
	G	G MIX CHAN 2
	H	H PREAMP 3 OUT
	J	J PREAMP 2 OUT
	K	K PREAMP 1 OUT
	L	L SLATE TMR OUT
	M	M VU DR
	N	N PROG
	P	P A-B BATT -
	R	R A-B BATT +
	S	S GND

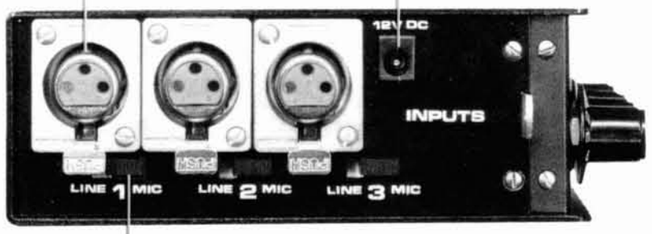
W202		W301A VU DR
	B	B Vcc
	C	C PK IND DR
	D	D Vcc/2
	E	E GND
	F	F AUX
	G	G 10V

U 202
BOTTOM VIEW

8044-11-3

The **three 3-socket professional audio input connectors** are **individually switchable** to balanced 600-ohm line or low-impedance microphone level. In the MIC position, either simplex (phantom) or A-B power is available at each input for powering condenser microphones. Each input transformer is Mumetal shielded for maximum resistance to electrical hum.

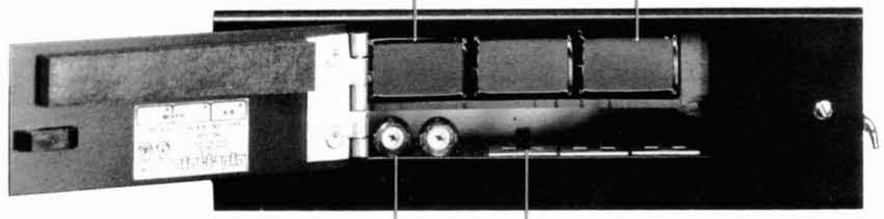
A **single-pin coaxial 12 Vdc external power jack** permits the mixer to be powered from an 11 to 18 volt source such as a video tape recorder, automotive electrical system or ac power converter. Such an external source will also provide simplex power to the microphone inputs, but a battery is still required for A-B power.



The mixer requires 11 to 18 Vdc for operating power. Internal power is supplied by **two standard rectangular 9-volt alkaline batteries** (Duracell MN1604 or equivalent) which also provide simplex (phantom) power to the microphone inputs. Battery life is approximately 8 hours.
IMPORTANT: Use only alkaline batteries.

When powering the mixer from an external source, the batteries may be left in place as backup in case of failure of the source. Switchover to battery power is performed by removing the plug from the 12 Vdc jack. To prevent the possibility of damage caused by leaking batteries, remove the batteries during any prolonged period of storage or nonuse.

A third 9-volt battery is used to supply **A-B power** at each microphone input. When the input selector switch is in the Line position, the power is automatically off for that input.



The **Slate pushbutton** inserts a 1-second low-frequency tone (400 Hz) each time it is depressed, and it keeps the slate microphone on as long as it is depressed.

Using **the On/Off switch** to turn the power on starts the **green Power On indicator LED** flashing with a repetition rate of approximately 1 second. The LED continues to flash so long as the switch is on.

Individual Lo-Cut filter switches for each input reduce low-frequency interference from air-conditioner or fan noise, wind, strong hum fields, or similar sources. The filters insert a 7 dB rolloff at 100 Hz with a slope of −6 dB per octave.

The **VU Meter** is supplied set for 0 VU = +4 dBm. This level can be changed by an internal adjustment (see section on VU Meter Adjustment).

The **Limiter Threshold and VU Meter trimpots** are located through screwdriver slots below the battery compartment and to the left of the A-B/Simplex switches.

Simplex or A-B power is selected by means of **switches** directly below the battery compartment, inside the battery door. In the DYN position, no power is supplied to the Mic inputs.

On **Channel 1, the Gain Control knob** pulls out to activate a 1 kHz tone oscillator that serves as a level-setting aid. The oscillator level is set with the Master control and is indicated on the VU Meter.

The **VU Lamp pushbutton** momentarily illuminates the meter dial. An automatic timed release shuts off the lamp after 5 seconds. The lamp remains lit while the button is depressed.

The **red Peak LED** flashes to indicate the onset of limiting. When the Limiter is Out, the red LED acts as an overload indicator and begins flashing at 6 dB below output clipping level.

The **Battery check pushbutton** converts the VU Meter to a battery condition or circuit voltage indicator while the button is depressed.

A **3.5 mm mini jack** provides an Aux-level Tape output with minimum clipping level of 0.5V RMS (−6 dBV).

A built-in pushbutton-operated, electret condenser **slate microphone** can be used either for identifying recorded segments or as an emergency field microphone.

Each **input channel has its own gain control.** The input clipping level for microphones is from −47 to −17 dBV depending on the channel control setting. For line inputs, the clipping level ranges from +3 to +33 dBV, again depending on the control setting.

The **Master gain control** sets the output level at the Line/Mic and Tape Outputs. Gain is 40 dB from Mic In to Mic Out or from Line In to Line Out; 90 dB from Mic In to Line Out, 68 dB from Mic In to Tape Out, and 18 dB from Line In to Tape Out.

The **output Limiter** has a threshold of +14 dBm at the 600-ohm Line output (4 dB below clipping), with comparable levels at the Mic and Tape outputs. The threshold can be internally adjusted down to +3 dBm (see section on Limiter Threshold Adjustment). The Limiter attack time is 3 msec typical, with 500 msec typical recovery time, for unobtrusive operation.

A **3.5 mm mini jack** and a **quarter-inch phone jack** provide two stereo headphone outputs that can be used simultaneously. They are designed to drive mono or stereo headsets with impedances of 8 to 2,000 ohms. They can also be used to drive up to four Aux-level tape recorder or amplifier inputs.

A **separate Phones volume control** sets the level at the headphone outputs; maximum output is 1.6V RMS (+4 dBV) to 200 ohms.

Two 3-pin professional audio output connectors are **individually switchable** to 600-ohm line level or low-impedance microphone level. Minimum clipping levels are +18 dBm (Line) and −34 dBV (Mic).