STUDIO & KC25
Operating Manual

This manual applies to the London Power models:
“All-Tube STUDIO Power Amplifier”
“KC25 All-Tube EL-84 Power Amp”
musical instrument amplifier models manufactured from 2016 onward

The original 1995 version of the 10W London Power Studio amplifier was the first production amplifier with Power Scaling, continuing the legacy of innovation from 1985 when Power Scaling and Super Scaling were devised by Kevin O’Connor

The Quiet Revolution starts here

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Section-1: WARNING

RISK OF SHOCK
Electronic amplifiers are powered from the AC mains distribution. High AC voltages and AC currents are present in the chassis and constitute a risk of shock to the user. Lethal power levels are available from the mains. Keep hands clear of mains wiring.

HIGH VOLTAGE
Vacuum tube electronic circuits operate at high voltages. High DC voltages are derived from high AC voltages and both represent a significant shock hazard. Injury and death may result from contact with these voltages. Keep hands clear of secondary wiring and high-voltage circuitry.

RISK OF SHOCK FROM UNPOWERED EQUIPMENT
Capacitors can store electric charge for very long time periods. Electronic equipment that is unplugged from the mains and has not been powered for days can still hold enough charge to cause injury or death. Carefully discharge capacitors using recommended techniques (not shorting) prior to working on the unit. London Power's products incorporate automatic discharge circuits so that internal voltages will be reduced to near-zero within minutes of power-'off'

FIRE RISK
Electronic equipment creates heat during operation. Proper air circulation and/or fan cooling will remove this heat from the unit. Do not obstruct ventilation or otherwise impede heat removal. Do not defeat protection circuitry or any devices such as fuses, current limiters, temperature monitors, fan servo circuits, or power reduction circuits.

HOT SURFACES
Electronic devices and chassis containing them can become hot to the touch. Avoid contact of skin with these surfaces as severe injury can result. Tube envelopes can be 250°C at their hottest point. Soldering iron temperatures approach 450°C.

SOLDER FUME & MATERIALS HAZARD
Solder used to secure electronic devices contains tin and lead. Solder for electronics use also includes a resin core to clean the connection while soldering. The resin and solder create fumes that may be hazardous to health if inhaled. Exhale gently while soldering. A low-speed fan to extract the fumes is recommended. Ventilation to outside air is preferred. When wet, surface residue on electronic components may be hazardous to health. Wash hands with cold water and soap after working with electronic components.

WARNING (cont'd)

OPERATOR RESPONSIBILITY
The equipment operator must exercise due care in heeding safety advice presented in this manual. The operator must assure a proper environment to use the equipment in and a stable surface to support the equipment. Never leave equipment unattended if powered.

ERRORS AND OMISSIONS
Every effort has been made on the part of the author and the publisher to assure that the text and drawings are correct. Neither the publisher nor author shall be responsible for errors or omissions in the text, or for loss of income, injury, upset or death or any misuse or misinterpretation of the content of this text on the part of the reader.

LOUD SOUND DAMAGES HEARING
Exposure to loud sounds over extended periods of time will damage your hearing. The louder the sound, the shorter the time required to cause temporary or permanent hearing loss. Ringing in ears, numbness or pain, and feeling "deaf" are all signs that the sound was too loud for the time exposed to it. Health regulating bodies, such as OSHA, prescribe specific times for given sound pressure levels (SPL) in decibels, to provide a safety protocol for workers subjected to noisy environments. London Power finds these recommendations to be inadequate and recommends much shorter exposure times. Hearing protection should be selected and worn correctly. However, for a musical environment, the need for hearing protection is a cue that SPL is too high and other remedies should be explored first to reduce the loudness level. The use of hearing protectors impairs intelligibility of music and is counter-productive to the creation of an enjoyable Human-Scale music experience, therefore SPL should be kept below 80dB. Power Scaling assists in this goal by allowing a "loud sound" to be attained at low-SPL.

Aural compression is invoked at all SPLs and to a greater extent as loudness increases. This is our internal physiological protection mechanism and it impairs accurate sensation of the sound. Even with hearing protection in place, aural compression will interfere with our judgement of tone and is a strong motivator to use lower SPLs. Our judgement of sound is much more accurate at low-SPL than at high-SPL, contrary to common prejudice.

REFER SERVICE TO QUALIFIED PERSONNEL
This equipment should be serviced only by qualified personnel with technical expertise in dealing with high-voltage circuitry, tube amplifiers and/or Power Scaling. To assist in serviceability, the Studio-KC25 is built in a U-frame. This allows removal of the top and bottom covers, providing access to main-board components on one side and solder points on the other.

WARNING (con't)

WARRANTY & LIMITED LIABILITY
The manufacturer warranties this equipment for Five Years from the date of shipment against defects of workmanship and electronic component failure, excluding tubes, and reverb delay lines, and excluding failure caused by abuse or misuse of the product. London Power will not be liable for damage to other equipment or property caused by negligent use of this product, by misinterpretation of this manual, or by component failure, or by use of the equipment in inappropriate environs (rain, damp, on unstable surfaces), by faulty wiring of signal or power paths, by faulty speaker loads causing damage to this unit, by ground faults causing damage to this or other equipment. For warranty repair, London Power will pay for parts and return shipping. Shipping to us is the responsibility of the owner. Assure that the unit is packed correctly. Damage during shipping is not covered by warranty.

FUSES
All fuses are internal and are slow-blow types. These are 5x20mm S506-series available world-wide. Fuses should be replaced with the same type and value.

Mains	630mA x2
Plate	400mA
Heaters	3A x2
Bias	100mA

Fuses can blow because the air inside the amplifier is too hot, due to poor ventilation or operating the power tubes at maximum current and maximum **Power Scale** setting. If a fuse blows it is best to determine the cause of the failure. Replacement with a similar fuse resulting in a second fuse failure suggests further investigation is required - that something may be damaged in the amplifier. Most often a tube replacement is required. Otherwise, refer servicing to a qualified tech.

Section-2: WIRING CONVENTIONS

The types of interconnections used between audio equipment and between that equipment and the mains is all very standard. The connection and cable requirements used by London Power products is described below.

Mains: The AC mains is connected through a male IEC chassis connector using a detachable power cord. The power cord is a 3-wire type carrying **Line**, **Neutral** and **Safety Ground** between the wall receptacle and the equipment. The wall-end of this cable has a male connector plug appropriate for the local region, and the equipment end is a female IEC connector. Replace the AC mains cable if it becomes worn, cut or pinched, or if the moulded connector ends are cracked.

DO NOT INTERFERE WITH OR DISABLE THE SAFETY GROUND !!

Speakers: Power amplifiers drive loudspeakers via heavy-wire interconnections using a 2-wire cable. This can be “lamp” or “zip” cord, or a pair of wires inside a sheathing. Loudspeaker current is high and the wire must be of sufficiently thick gauge to conduct this current without heating up. For amplifiers up to 100W, 18-gauge wire is sufficient but thicker wire (#16 or even #14) should be used if the distance between the power amplifier and the speaker is over 15m (46').

Speaker outputs on London Power equipment <100W use 1/4"-TS female connectors. The tip (T) carries the signal and the sleeve (S) is ground. Both ends of the cable should be wired identically, using male plug ends.

D.I.: “Direct-injection” outputs are typically male XLR jacks. This allows a 3-wire cable to the receiving equipment and the connection is most often “balanced”, meaning that the signal itself does not use a ground connection between the equipment, rather the signal “floats” so that ground levels become irrelevant.

At the sending end, London Power uses a male 3-pin XLR connector fed from either a transformer providing galvanic isolation, or a balanced drive circuit producing symmetrical signals. The receiving end uses a female 3-pin XLR and either a transformer or a differential amplifier.

The sending end of the D.I. cable is a female 3-pin XLR and the receiving end is a male 3-pin XLR, wired as follows: pin-1 is the equipment ground; pin-2 is the “hot” in-phase signal; pin-3 is the “cold” out-of-phase signal. The shield is tied to pin-1.

A less costly interconnection requiring less panel space on both pieces of equipment uses 1/4"-TRS connectors and a 3-wire cable. The tip (T) is “hot”, ring (R) is “cold”, and sleeve (S) is shield and chassis ground. Connector sex same as for XLRs above.

WIRING CONVENTIONS (cont'd)
Impedance-matched: Balanced connections do not require balanced signals to function, rather the more important parameter is to maintain balanced impedances of the two lines. This is easily attained and is less costly with respect to circuitry. The connector and cable types are the same as for the D.I. connections above.

Ground-compensated: Ground-compensated (GC) connections allow unbalanced signals to be passed between equipment without ground level difference impairment. The sending end requires a 3-wire male connector, either 1/4"-TRS or XLR. The receiving equipment can have an unbalanced 2-wire connector, such as female 1/4"-TS or female RCA phono input.

A 3-wire cable must be used for the ground compensation to be effective. At the sending end, the cable is wired the same as for the XLR or 1/4"-TRS above. At the receiving end, the "hot" goes to the tip (T) of the 1/4"-TS or of the RCA phono plug, while "cold" and the shield tie to the sleeve (S) of the connector.

GC outputs can be connected through a full 3-wire cable/connectors into a balanced XLR or 1/4"-TRS input and provide an impedance-matched source signal.

Unbalanced: Unbalanced connections are also called "single-ended" or "2-wire". Generally, one wire is signal and the other is ground, as for the speaker connections above. Note that some speaker connection might be floating, as when bridge-driven. The unbalanced output is either a female 1/4"-TS jack or female RCA phono. The receiving end is identical. Guitar cables are typically 2-wire with just a single inner conductor and a shield with male 1/4"-TS plugs for both ends. Hifi connections have historically been similar cable but with male RCA phono plugs for both ends. Phono plugs and mini-plugs (1/8"-TS and 1/8"-TRS) are common in semi-pro and home studios.

SIGNAL LEVELS: Note that the connector type used for any given input or output DOES NOT denote the nominal signal level, despite common usage of certain connector types for certain nominal signal levels. Neither does the application absolutely define the signal levels.
Instrument:-20dB = 77.5mVrms = 100mVpk
Semi-pro: -10dB = 210mVrms = 300mVpk
Line: 0dB = 775mVrms = 1V pk
"1-volt" Line: +4dB = 1.1Vrms = 1.6Vpk

Section-3: RACK MOUNTING

This equipment may be rack-mounted or used as a table-top device. Rubber feet are provided which bolt onto the bottom cover for table-top or shelf use. Note that the washer under the bolt-head has its round-side towards the rubber. Tighten the bolt just to the point where the rubber foot does not turn freely. DO NOT over-tighten.

For rack mounting, some units have a storage area on the rear panel for the rubber feet. If the unit does not have a storage position, such as on the 1U devices, place the rubber feet and their hardware in a ziplock bag and store in a safe place.

The rack-mount brackets bolt to the sides of the unit and are interchangeable from left to right. Start all four bolts before tightening any of them. The bolts should screw in freely without binding. Use appropriate bolts and washers to secure the unit to the rack rails.

Section-4: PRODUCT OVERVIEW

STUDIO and KC25 are integrated instrument amplifiers, comprised of a modest preamplifier and a sophisticated power amplifier, with interfacing for speakers and a line output. Both amplifiers are identical in their gain structure and features, with the only difference being the type of output tubes each can accommodate:

STUDIO uses octal-based output tubes of the standard pin-out (7AC), and can be fitted with one power tube or two, of the same type or as dissimilar pairs. Any of 6CA7, 6L6, 6V6, 5881, 6550, 7581, E34L, EL-34, KT-66, KT-77, KT-88, or any equivalents or variants.

KC25 uses 9-pin miniature output tubes of the standard pin-out (9CV), and can be fitted with one power tube or two, of the same type or as dissimilar pairs. Any of 6BQ5, 6CW5, 7189, EL-84, EL-844, N709, or any equivalents or variants.

Small-signal tubes are dual-triodes of the standard pin-out (9A), and can be any of 12AT7, 12AU7, 12AY7, 12AX7, 12BH7, 12BZ7, 12DF7, 12DM7, 12DT7, 12DW7, 5751, 5814, 5963, 5965, 6201, 6211, 6414, 6679, 6680, 6681, 6829, 6913, 7025, 7247, 7318, 7728, 7729, 7730, ECC-81, ECC-82, ECC-83, or any equivalents or variants. It is generally the case that types of the 12A_7 or ECC-8_ will be used, as these are what the circuit is optimised for. Others in the list above, particularly those with dissimilar sections, can provide interesting “in-between” gain levels compared to the identical-section types.

All tubes are external, mounted on the rear panel, as are bias adjustments and test points.

The cleanest output will be attained with a 12AT7 or equivalent in the V-PRE-2 position. A tube of similar mu-rating or lower in the V-PRE-1 position will provide very clean throughput at all gain settings, although the gain may be inadequate to achieve full power output with an instrument input. At the extreme of low-mu tube use, where both preamp positions are filled with 12AU7 or equivalent (mu=20), a quite high input signal level may be required to achieve full output. However, the low-mu tubes have a smoother, mellower sound than the high-mu types like 12AX7 (mu=100), which can sound a bit harsh.

For specific ranges of tone, the different mu levels provide an easy path. For example, a more “British” tone is attained using 12AX7s or ECC-83s in both positions, where a 12AX7 in V-PRE-1 and 12AT7 in V-PRE-2 may provide a more “North American” sound. Assisting these goals would be the use of at least one EL-34 output tube for the British tone and anything other than the EL-34 or KTs for the North American tone.

The power amplifier can produce up to 25W of audio power to drive various speaker loads. Through a typical musical instrument loudspeaker that produces 100dB of sound for 1Wrms input, the maximum loudness with the STUDIO or KC25 would be 114dB. This is over twice as loud as the 100dB sound, as the decibel scale is logarithmic. Any SPL over 70dB can damage hearing.

OVERVIEW (cont-d)
STUDIO & KC25 are nominally just power amplifiers, but they have a modest preamp to allow full output to be achieved from an instrument-level input. The preamp is comprised of two triode stages, one with variable gain and one with fixed gain.

The basic power amplifier circuit follows traditional lines with a front-end circuit providing gain and signal splitting, followed by a push-pull power stage loaded by a transformer. The speakers tie to the secondary side of the transformer. A line output after the output transformer provides a signal for recording or other purposes.

Looking at the front panel, the **Touch** control represents the division between the preamp and the power amplifier and can be considered as a part of either section. It is clear that there are more controls for the power amp, which is contrary to all other designs but a feature of the STUDIO range of products since its inception. This design approach allows the player or studio engineer to access parameters within the amplifier circuit which would normally be "pre-decided" by the amp designer, and thus give the operator freedom to voice the circuit as required at any given moment.

Versatility is one of the design goals for STUDIO, made possible through access to heretofore unknown parameters combined with explicit encouragement to experiment with many tube types and combinations thereof. As a studio tool, STUDIO can reveal new textures and tones for every session and for each new tonal requirement. For a single user, one tends to gravitate to an ultimate tone that is the signature of the player, at which point the amp is voiced for that tone and the player uses only a few of the controls on a daily basis. It is easy at that point to feel that one has "outgrown" the amplifier and desire to find one with just the controls being used daily. However, that endeavour may be fraught with frustration as the player now has to find an amp voiced exactly as STUDIO has been voiced by the player.

STUDIO has always used octal power tubes, as there are quite a few tube types with the same pin-out but quite different tones. This degree of freedom, together with its other unfamiliar controls, set STUDIO apart right at its introduction. The popularity of EL-84 output tubes led to the KC25, which accommodates these smaller tubes. The alternate tube types do not have quite as diverse a tone range as the octal range, but KC25 is nonetheless the most versatile "EL-84 guitar amp" available.

STUDIO-KC25 can be used with any type of electrified musical instrument, including guitar, bass, keyboard, or any acoustic instrument fitted with a dynamic or piezo-electric pickup. The amp can be part of the primary tone generation path or be used to re-amplify recorded signals. It is hoped that the versatility of STUDIO and KC25 encourages creative explorations by the studio personnel and by the player.

Section-5: CONNECTIONS
All connections are made via rear-panel jacks, except for an auxiliary input on the front panel. In a studio environment, it is common to use a patch bay for access to equipment inputs and outputs, as the jacks in the patch bay are designed for repeated insert-extract cycles. For a clean rack appearance it is preferred to have the wiring between the equipment and the patch bay at the rear, allowing clear access to all of the front-panel controls.

On STUDIO-KC25 the front-panel instrument input over-rides the rear-panel input.

Mains: AC Mains is connected via the female IEC connector at the left-hand end of the rear panel looking from the rear. Use only an approved and intact IEC power cable with the appropriate wall-plug end for your locale. Assure that the RANGE switch is set to the local mains voltage and that the front-panel Mains switch is 'off' (out) prior to connection of the power cable. Use only a properly grounded AC source.

100-120-240: This is the AC RANGE switch which matches the power transformer in STUDIO - KC25 to the nominal local mains voltage. Move the slider to the correct position for the local mains voltage prior to connecting the power cable to the amplifier or to the wall socket.
100 - Japan
120 - North America
240 - Everywhere else and parts of Japan

Input: This is the instrument signal input. Signals may also be tapped from line-level sources or even from another amplifier output, with appropriate setting of the front-panel Trim control. Use a standard guitar cable or similar fitted with 1/4"-TS male ends.

4R,8R,16R: These are the "direct-impedance" jacks allowing the speaker load to be matched to the output transformer tap. Connect the load to the jack of the same impedance value to achieve maximum power at the widest frequency response. For example, connect an 8Ω speaker to the **8R** jack.

The load can be "mismatched" to achieve subtle tone shifts. For example, tying the 8Ω speaker to the **4R** jack will provide a slightly brighter sound but at reduced power; tying the 8Ω speaker to the **16R** jack will provide a duller tone with reduced power.

Match: This speaker jack has a relay to connect it to one of two taps on the output transformer and provides a quick way to switch the tap-tone without unplugging-replugging the speaker cable. The relay is controlled by the front-panel **Match** switch.

Line Out: This is a transformer-isolated signal taken after the entire circuit including the output transformer. The signal is controlled by the front-panel **Line Level** and **Tone** controls. The signal can be balanced or unbalanced using a 1/4"-TRS 3-wire cable or 1/4"-TS 2-wire cable.

Section-6: FRONT PANEL
All of the user controls are on the front panel. There is also an auxiliary input for convenience in the control room.

Input: This is an unbalanced 1/4"-TS instrument input jack which over-rides the rear-panel jack. Any signal level between an instrument-level (-20dB, 100mVpk) to very-high line-level can be accommodated.

Trim: Trim varies the gain of the input stage and allows the input to accept signals as high as 20V peak (+26dB). High **Trim** settings will cause the later stages to distort more easily.

Drive: This control alters the signal level passed from the input stage to the second stage. High **Gain** settings will cause later stages to distort the signal.

Low: This control adjusts the amplitude of bass frequencies. Turn clockwise to increase and counter-clockwise to reduce bass emphasis. The 12-o'clock position is flat.

Mid: This control adjusts the level of mid-range frequencies. Turn clockwise to increase and counter-clockwise to decrease emphasis. The 12-o'clock position is flat.

High: This control adjusts the amplitude of treble frequencies. Turn clockwise to increase and counter-clockwise to reduce treble emphasis. The 12-o'clock position is flat.

Setting both **High, Mid** and **Low** controls to 12-o'clock creates a flat frequency response with no emphasis.

Touch: This control takes the signal from the EQ output and passes it to the power amp front-end. It can be considered to be both the preamp output level control and the power amp input level control. Setting **Trim** and **Drive** clockwise and **Touch** counter-clockwise but not to zero will create mild over-drive from the preamp without distorting the power amp.

Sparkle: Rotating this control clockwise provides mid- to high-frequency emphasis.

Shape: This control provides a low-frequency roll-off when rotated counter-clockwise.

Vibe: This control alters how "tight" bass will be and also changes the over-all gain of the power amp. Counter-clockwise settings provide low gain but tight bass; clockwise settings provide more gain and a "looser" feel. Its effect will be made subtle if **Sparkle** is set high.

Match: This switch sets the impedance tap matching for the rear panel **Match Out** jack. Set the switch to whatever sounds best.

FRONT PANEL (cont'd)

Loud: This control is similar to a master volume. A low **Loud** setting allows all of the preceding circuitry to be distorted even if the output tubes are operated cleanly. **Loud** also keeps the sound of the output tubes constant when used in concert with the **Power Scale** control, described below. A zero setting (fully counter-clockwise) results in no sound.

Power Scale: This control allows the output of the power amplifier to be varied from the full 25Wrms output down to less than 1µW (actual limit is zero). This provides a 74dB dynamic range and can reduce a 114db sound down to 40dB - a normal conversation level. Other control settings can effect further power reduction, down to whisper levels. The quietest levels will typically be unusable, but this gives the operator full control over the loudness of the performance.

To maintain, say, the "cusp of compression" or any other operating point for the output stage, **Power Scale** and **Loud** will generally be set similarly. Setting **Power Scale** lower than **Loud** will allow the output stage to be distorted even when the rest of the amplifier is running cleanly.

Each output tube has its own set of controls which can be set independent of the other tube. The tubes are called **Valve-1** and **Valve-2** on the front panel, and V-OUT-1 and V-OUT-2 on the rear panel. The switches are push-on/off types.

Level: This control dials in the sound of the designated output tube when set clockwise. Full-clockwise settings provide the cleanest push-pull sound. When **Valve-1 Level** is dialled counter-clockwise, the sound of output tube-2 will be heard only if **Valve-2** is dialled up from zero. When both **Valve-1** and **Valve-2 Level**s are set to zero (fully counter-clockwise) there will be no sound from the amplifier. When only **Valve-1** is dialled up, the single-ended sound of output tube-1 is heard. When only **Valve-2** is dialled up, the single-ended sound of output tube-2 is heard.

K1,K2: These switches select the bias method. Push **K** 'in' for cathode-bias; **K** 'out' for fixed-bias.

T1,T2: These switches select triode mode when pushed 'in'. Ultra-linear mode is selected when **T** is 'out'.

P1,P2: These switches select pentode mode when 'in' provided the related **T** switch is 'out'.

If both the **T** and **P** switches are pushed 'in', then triode mode is selected.
If both the **T** and **P** switches are pushed 'out', then ultra-linear mode is selected.

FRONT PANEL (cont'd)

Line Level: This control sets the signal level at the rear-panel **Line Out** jack. Set up the amp tone and loudness prior to setting the line level.

Tone: This control provides a high-frequency roll-off for the line output signal. Rotate Tone counter-clockwise for a less-bright sound.

Mains: This is a push-on/off switch to connect the AC mains to the power transformer. Power is 'on' when **Mains** is 'in'. **Mains** 'out' is power-off. The LED will illuminate when power is 'on'.

All of the controls and switches can be set in any combination that sounds good. Master-volume and non-master-volume sounds can be created at will. Single-ended sounds can be achieved with two tubes in place or with a single tube. You can operate the amplifier with a single power tube, or two tubes. With two tubes, you can use identical types or dissimilar types. Two 6V6s might be "too creamy", but a 6V6 and EL-34 working together may provide a richer sound that is both "fat" and "crisp". Tubes must be biased when installed; see BIASING TUBES.

Section-7: BIASING TUBES
Power tubes require a bias adjustment when in fixed-biased mode. The front-panel **K** switch should be 'out' for the related tube. When in cathode-bias (**K** 'in') the tubes are self-biased. Any tube extraction or insertion must be done with the power cord disconnected and **Mains** switch 'off' (out).

Power tube access is on the rear panel. To correctly align the tube, rotate the tube until you feel the key on the tube base engage the keyway in the socket. Gently rock the tube while pushing it to a seated position. Bias the tube according to the bias procedure below.

To extract a tube, gently rock the tube while pulling it free.

Preamp tubes do not require bias adjustment.

BIASING
Any time a power tube is installed or replaced, that tube must be "biased". Biasing sets the idle condition of the tube and changes the sound of the amplifier. Tubes can be operated hot or cold with corresponding tonality. Each tube type has a range of idle currents that it can handle. However, the idle current ranges for most tube types overlaps quite extensively.

Each tube has a corresponding bias pot and meter jack. The meter jacks are labelled **K1** for V-Out-1 and **K2** for V-Out-2. Between these jacks is a third labelled **K12** (common) that is a reference point. The bias adjusts are **Bias-1** and **Bias-2** for V-Out-1 and V-Out-2, respectively. Use a flat screwdriver to turn the recessed bias adjust pot shafts. Preset the bias pots fully counter-clockwise before installing tubes and powering the amp.

Bias Procedure
Install tubes with power cord disconnected and front panel **Mains** switch 'off'. The bias procedure is the same for both power tubes. Valve-1 is shown below.
Power Scale fully clockwise
Valve-1 Level fully counter-clockwise
K1 set 'out'
Rear panel bias pots set fully counter-clockwise

Other switch and control settings do not matter

Insert **RED** meter probe in **K1**
Insert **BLK** meter probe in **K12**
Set meter to DC millivolts >> each 10mV on the meter represents 1mA through the tube

Connect AC mains cord and turn the Mains switch up.
After a minute or two, you may see the meter reading rise. Otherwise, slowly rotate the rear panel **Valve-1 bias pot** clockwise. Adjust to the desired setting for the tube installed.

BIASING TUBES (cont'd)
If both tubes are being set for fixed-bias, as with a new amp set-up, then set both valve **Level** controls to zero (fully counter-clockwise) and make sure both **K1** and **K2** are out.

Bias V-Out-1 as above, then:
Move the **BLK** meter probe to **K2**.
The meter will display a reading similar to what you just set.
Slowly rotate the rear panel **Bias-2** clockwise for a zero reading.
The tube currents will be balanced.

When using dissimilar tubes, it is usual to adjust the bias for BOTH tubes to the capability of the lower-rated tube so that the hum-balance of the output stage will be reasonable. There is nothing harmful in setting the tubes to independent values, in which case the black meter probe stays in **K12** and the red probe is moved from **K1** to **K2** to set each tube separately.

Two tubes installed of any type or combination:

Tube#	DCmV MAXIMUM	DCmV typical
6CA7	625	50-500
6V6	300	50-250
6L6/GB	575	50-500
6L6GC	750	50-600
5881	575	50-500
6550	875	50-600
EL-34	625	50-500
KT-66	625	50-500
KT-77	625	50-500
KT-88	875	50-600

Note
Do not attempt to use an ammeter to measure idle currents. The meter jacks are designed specifically for use with volt meters

For KC25:

EL-84	300	50-250
EL-844	250	50-200

Section-8: EXAMPLE SET-UPS

CLEAN SOUND
Configuring the STUDIO-KC25 for maximum clean headroom is simple:
Power Scale fully clockwise
Valve-1 fully clockwise
Valve-2 fully clockwise
Touch fully clockwise
Loud fully clockwise
Shape fully clockwise
Trim fully counter-clockwise
Drive fully counter-clockwise
T out
P out or in
K1,2 to out
Low to 12-o'clock
High to 12-o'clock
Sparkle to 12-o'clock

Plug a guitar into the rear panel **Input** jack
Plug a speaker into the rear-panel **Match Out** jack
Dial up **Drive** for suitable loudness while playing

Manipulate the **Low**, **High**, **Sparkle**, **Shape** and **Vibe** controls to hear what each does individually.

While playing, flip the **T,P** switches through their positions to hear full **Triode** tone, full **Ultra**linear tone and full **Pentode** tone, then combinations of these. You may hear a click or pop if you switch the **T,P** while not playing.

Switch **Match** to hear the effects of the different taps of the output transformer working against the speaker. It is best to stop playing during the manipulation of the **Match** switch.

This is the basic setup to work from to derive other sounds.

Note: The **T,P** and **Match** switches all use electromechanical relays to control the circuit function. You may hear the relay click on and off when these switches are manipulated, and at power-up and power-down.

EXAMPLE SET-UPS (cont'd)

SINGLE-ENDED SOUND
STUDIO-KC25 can create single-ended amplifier sounds similar to those of, say, a Fender Champ. Amps like these have a single output tube and can only drive one end of the output transformer primary. Their sound generally gets more fat or distorted the louder they play.

1) Begin with the Clean setup, then:
Dial **Valve-1** fully counter-clockwise

The sound is now all that of valve-2. Whatever tube type is in this position will display its character. Flip the **K2** switch through its positions and hear the differences of single-ended sound with valve-2. Traditional single-ended amps conform to the **K2,P2** 'in' position.

You can hear the sound of valve-1 on its own by dialling **Valve-2** all the way counterclockwise, with **Valve-1** all the way clockwise. Push **K1,P1** 'in' to hear this tube in its traditional single-ended tone.

2) Begin with the Clean setup, then:
Dial **Valve-2** fully counter-clockwise

The sound is now all that of valve-1. Whatever tube type is in this position will display its character. Note that even with identical tubes, the SE sounds are slightly different, providing further flexibility of tone.

SINGLE-ENDED & PUSH-PULL COMPOSITE SOUND
The sounds between the single-ended and push-pull extremes can be dialled in freely using **Valve-1** and **Valve-2** controls. Dialling either control just a little bit back from fully clockwise will alter the harmonic balance of the output stage, warming the sound. If both controls are nominally pointing in the same direction, the sound is essentially balanced push-pull.

EXAMPLE SET-UPS (cont'd)

CATHODE-BIASED & FIXED-BIASED SOUNDS
The method used to control the output tube idle condition is either "cathode bias" or "fixed bias". Cathode biasing is also called "self bias", as the tube finds its own idle current working against a passive element. Fixed-biasing uses a negative control voltage on the control grid of the tube to set the idle current. Most modern amps are fixed-biassed, so this position is the default, i.e. where the **K** switch is 'out'. To select cathode-bias, push **K** 'in'.

Begin with the Clean setup, then:
Manipulate the **K1**,**K2** switch between its positions. Allow a minute or so for the sound to become more clearly the new sound influenced by the newly selected bias method.

OPEN-LOOP SOUND
Most modern amps have a feedback loop around the power amp and its front-end circuitry. This helps to stabilize the sound against tube and component variations and aging. It also helps make the inherently dark and woofy pentode operation of the power tubes be more balanced and listenable. Some older amps do not have this feedback loop and sound rounder when they distort.

Begin with the Clean setup, then:
Dial **Vibe** clockwise

The sound will become louder while becoming a bit looser. This is the sound of no feedback loop.

Push **P1**,**P2** 'in' for the lowest speaker damping possible and a slightly dark tone. Pentode mode has more distortion than either triode and ultralinear, and can sound bright by comparison.

Try all the combinations of **T**,**P** to hear their effect, which will be most pronounced with **Vibe** at its extreme.

PRESENCE
Adjust **Sparkle** to hear a boost in treble and mids. This control decouples the power amp feedback loop at high frequencies. **Sparkle** still has effect even when **Vibe** has dialled the feedback loop out.

EXAMPLE SET-UPS (cont'd)

DISTORTED SOUNDS
There are three basic distortion setups, with variations of each. Within some setups, an initial distortion mechanism is followed by a second or third with further signal drive.

Preamp Distortion
Clean setup, then:
Set **Touch** counter-clockwise
Dial **Trim** and **Drive** clockwise

Adjust **Touch** up slightly so the sound is controlled.
This is the sound of over-driving the second preamp stage.

Power Amp Front-end Distortion:
Clean setup, then:
Dial **Loud** counter-clockwise
Dial **Trim**, **Drive** and **Touch** clockwise

The initial distortion is the front-end of the power amp distorting. Dialling **Drive** further adds the preamp distortion.

Output Stage Distortion:
Clean setup, then:
Dial **Power Scale** counter-clockwise
Dial Drive clockwise

Initial distortion is the output stage power tubes over-loading. Secondary distortion when **Drive** is dialled further comes from the power amp front-end. Further **Drive** rotation brings in preamp distortion.

Note that when dialling **Power Scale** down, you will not hear a loudness change until you get the power level you are *actually* using. This is surprisingly much lower than most players expect.

Alternate Power Amp Front-end Distortion:
Clean setup, then:
Dial **Loud** counter-clockwise
Dial **Drive** about half way
Dial preamp **Touch** counter-clockwise

Rotation of **Touch** clockwise overloads the power amp front-end, while the preamp and power output stages are still operating clean.

Section-9: RECORDING SET-UPS
STUDIO-KC25 is designed to drive a loudspeaker, but to a controlled SPL using Power Scaling. The “cranked” sound is retained while stress in the environment due to excessive loudness is reduced or eliminated. The ideal recording setup is one where STUDIO-KC25 drives a speaker and the sound from the speaker is miked.

Effects Placement
STUDIO-KC25 is designed as a single tone-generator block, so delays, reverbs, or other time-based effects must be positioned ahead of the amp input, or added as a post-process effect in the mixing console, or in the line output path. “Early” position effects will require some adjustment after the amp has been set up. For example, if a reverb is placed between the guitar and the amp and adjusted prior to setting the **Power Scale** and other power amp controls, one will find that the reverb level rises as **Power Scale** is dialled down. The dry signal begins as being larger than the wet signal, so it will be the first to be limited or reduced in size by the decreasing amplifier head room. This has the sonic effect of reducing the amplitude difference between the dry and reverb sounds, effectively raising the reverb in the mix. The same happens with echoes and delays. These devices must be readjusted after the power amp controls are set. Tone-shaping devices such as multi-band equalizers used ahead of the amp will behave as usual.

Front-loaded effects can be used with STUDIO-KC25, just like any other guitar amplifier. Effects choice is not limited to tone shapers, rather any effect including time-based units can be used ahead of the **Input**. Here, instrument-level or line-level devices can be used interchangeably.

EQing Line Out
The **Line** output can be used in addition to miking the speaker, or even in lieu of miking the speaker. In either situation, it is assumed that a lower **Power Scale** setting will be used. The raw signal from the **Line** output will be as bright or distorted as the speaker output signal; however, it will not be filtered by a speaker. To account for this, the **Line** output will usually go to a multi-band EQ before heading to the recording console. Octave EQs or third-band EQs work best here. Parametric EQs may afford a usable frequency profile but are more difficult to set up.

To match the **Line** output sound to that of a speaker driven by STUDIO-KC25, the **Line** signal is equalized until its sound through the monitoring system is similar or identical to the acoustic sound from the STUDIO-KC25-driven speaker. At that point, if a silent recording is desired, the speaker can be removed from the STUDIO-KC25. A level shift may occur, but this is easily accommodated using either the **Power Scale** control, the **Line** control, or other controls in the monitoring system.

RECORDING SET-UPS (cont'd)

Two STUDIO-KC25s can be used in a stereo configuration. Stereo effects can be front-loaded or added post-process. Both amps can be set identically for a balanced acoustic output, or the amps can be set quite differently for a complex composite acoustic effect. The amps can be different models: for example, a STUDIO for one side and a KC25 for the other.

The STUDIO-KC25 is not just for guitar. It works extremely well with bass and keyboards as well.

STUDIO-KC25 is not sensitive to what impedance your cabinet is rated for; just set the **Match** switch to whatever position sounds best, or plug the speaker into whichever output jack sounds best.

Don't forget to try different types of output tubes and especially MIXES of output tubes.

Need a warmer sound? Just nudge one of the **Valve Level** controls back a bit from fully clockwise.

Use all of the controls. Keep notes about the setting combinations you like, including what guitar and cabinet was used and what type of sound was produced - and perhaps what kind of music the sound would be best for. There are lots of "safe" sounds and lots of "crazy" ones, too. Explore. Invent. Enjoy.