

LONDON POWER ERK, RLY & Q-series SWITCHING KITS SELECTION & APPLICATION

by Kevin O'Connor ©2013

1.0 - SWITCHING OVERVIEW

Control, selection and switching of features and circuits in audio amplifiers is very simple at its core, but most hobbyists and amp builders find switching circuits intimidating. Just as the name suggests, switching circuits “switch” and are either ‘on’ or ‘off’. There is no complex biasing requirement. It’s actually very simple, but the control possibilities are broad. Switching circuits impart no sonic effect of their own when implemented correctly.

From The Ultimate Tone (TUT) chapter 9, we know these terms:

mute: to reduce the audio signal level to zero, or to substantially reduce the amplitude to less than the normal operating level

muting element: the device used to cause the reduction of audio level

mute point: the place in the audio circuit where the muting element is tied

shunt switch: a switching element that has a connection to ground; a switch that causes a short to ground in one state and an open to ground in the opposite state

series switch: a switch element wired in series with the audio signal path; a break in the existing audio path is made and the switch is inserted; when the switch is closed, audio signal can pass through, when the switch is open, audio is blocked

DC path: an electrical path for leakage currents to ground; usually a high-value resistance

signal window: the peak-to-peak amplitude of the audio signal to be controlled

NO: normally-open; a mechanical contact on a switch or relay that is an open-circuit (high resistance) in the non-energised or non-actuated state; electronic components such as BJTs and mosfets behave like NO switch elements as they present a high resistance through their main high-current path (drain-to-source for mosfets, collector-to-emitter for BJTs)

NC: normally-closed: a mechanical switch or relay contact that is shorted (low resistance) when not energised or actuated; jfets behave like a NC switch as their natural (nonpowered) state presents a low resistance between their drain (D) and source (S)

voice: in a complete system, one combination of selectable features, options and/or presets

1.0 - SWITCHING OVERVIEW (cont'd)

latch: the ability to remain in a given state; push-on/push-off switches latch in each state being open then closed with each actuation; electronic circuits such as flip-flops latch in one of two states with each input stimulus

momentary: a non-latching mechanical device or electronic circuit; 'on' only as long as the actuating force is present

feature: any single attribute in a system that can be selected by means of a switch; usually an effect such as reverb, gain/volume boost, rectifier choice, triode/pentode/UL mode, fixed/cathode bias, or tremolo, etc; or an effects loop, or a preamp channel

preset: usually a feature that can be selected on the front panel of the amplifier, preamp, effect but cannot be directly accessed by independent remote selection

exclusive: selections that cannot be made at the same time; one choice excludes the other; mechanical switches and relays inherently provide exclusive selection

coincident: selections that can be made simultaneously and/or independently of each other

annunciation: system status indicator; on guitar amps and hifi equipment, annunciation is visual by means of LEDs or other visual displays

2.0 - LONDON POWER SWITCHING KITS

London Power's switching kits use widely available and generic components. This allows the circuits to be maintained indefinitely. "Programming" is of the simplest sort where applicable, achieved using handy DIP switches, or by soldering jumpers appropriate to create the function desired. Kits can be combined as recommended or used creatively to achieve the desired ergonomics or system switching performance.

Mechanical switches are the interface between the operator and the switching circuit. These switches can be front panel switches that are manipulated by hand, or larger sturdier types that can be used as foot switches.

Achievement of the function is indicated by LEDs on either/both the foot switch box and/or the amp front panel.

LEDs and switches are both aesthetic elements of the system, and the builder may choose types other than those offered by London Power. There are many styles of both switch and LED available from all the broad-line electronic component distributors.

The Q-system is based on option groups of four, thus Q = quad. Any number of voices less than this are accommodated with direct-random access. The system can be expanded sideways for more than 4-voices and 2-way communication between separate control stations is accommodated.

2.0 - LONDON POWER SWITCHING KITS (cont'd)

- 2.1 - RLY: Relay:** The simplest and most primitive switching option is the mechanical relay. It is universally applicable, and is therefore still a valid means to switch features. In some cases, a relay is the best or only means suitable. Relay contacts are fully isolated from the coil voltage and control input, so contacts can be wired for series or shunt switching. Requires the addition of a latching panel (PSW) or foot switch (FSW), or a latching electronic control circuit such as DFC, Q-RLY or Q-SR. Requires suitable voltage and current to support the relay coil; typically 12Vdc @ 12mA per RLY.
- 2.2 - ERK: Electronic Relay Kit:** Uses a latching panel switch (PSW) or remote foot switch (FSW) to control the non-latching electronic circuitry. The control circuit debounces the switch, produces complimentary control lines to control two sets of n-jfets wired as shunt switches, and ramps the control line change to avoid 'thumps' in the audio circuit. Any number of jfets per control line. Requires -12Vdc @ <1mA if no LED is used, or -12Vdc @ 10mA with a LED. Will provide single or dual annunciation (separate LED for each state). Can also operate from high-voltage AC if no LEDs are used. Plugging a cable into the foot switch jack disables the panel switch. LEDs supplied are standard-brightness round 3mm green.
- 2.3 - FSW:** Large-body push-on/push-off alternate-action switch with chrome actuator, suitable for use as foot switch with RLY or ERK. Can be wired for pulse operation for use with Q-LATCH and DFC. See TUT fig.9-77.
- 2.4 - PSW:** Subminiature SPDT toggle switch with chrome baton, suitable for use as panel switch with RLY or ERK.
- 2.5 - DFC: Dual Function Controller:** Interfaces non-latching NC switches to latching circuitry through switch debouncers for two independently controlled functions. Each output has a relay driver, shunt-jfet controller and series-jfet controller, plus its own function LEDs. Positive indication of both states of each output is provided. DFC is designed to allow aesthetic matching of its switches to those used by the Q-system. When shunt-jfet control is required, use -12Vdc. For series-jfet control, use -12Vdc and +12Vdc. Relay power is taken from the -12Vdc rail when either jfet output is used. If relays only are used, the circuit can be powered from either plus or minus 12Vdc. In the case of relay control only powered by +12Vdc, the jfet outputs can be used to control n-channel mosfet gates. When shunt-jfets are used (with or without relays), the series-jfet output can control n-mosfets that are ground referenced (S tied to ground). Requires 2x Q-FSW as a foot-switchable unit; or DFC-SW as a panel-controlled unit in the amp.
- 2.6 - DFC-SW: Dual Panel Switch:** Supplied with two switches but supports up to four push switches for a modern interface to DFC when DFC is mounted within the amplifier chassis for local control.

2.0 - LONDON POWER SWITCHING KITS (cont'd)

- 2.7 - Q-LATCH:** Latch for 1-of-4 Selection: Electronic circuitry provides direct random access for up to four voices. Includes switch debouncing for up to four NC momentary panel or foot switches, latches the selected voice, autocancels the previous selection, generates a continuous voice control line output, allows multiple LATCHes to be linked for more than four voices and/or to provide multiple control stations that communicate with each other (2-way communication). Can drive LEDs to indicate the voice selected. Requires 12Vdc @ <1mA without LEDs, or 12Vdc @ 10mA with LEDs. Voltage polarity should match that of Q-RLY and/or Q-SR if used. Use up to 4x Q-FSW for foot switch use. Use Q-SW for use in the amp.
- 2.8 - Q-SW: Quad Panel Switch:** Supports up to four momentary push switches for a modern interface to Q-LATCH when Q-LATCH is mounted within the amplifier chassis for local control.
- 2.9 - Q-FSW: Foot-switch:** High-quality Switchcraft push-button suitable for use as foot switch or as panel control. Use with Q-LATCH in foot switch box, or with 2x DFC in amp.
- 2.10 - Q-LED: Quad LED Carrier:** Support up to four LEDs for voice/feature indication on front of amp. Can be mounted independently or atop Q-SW.
- 2.11 - Q-LDV: Quad LED Driver:** Interface and driver for up to four LEDs ideally suited as voice LED indicator due to shared current limit resistor, i.e., one LED 'on' at a time.
- 2.12 - Q-MINI:** Package of Q-LATCH + Q-MNR for specific feature combination including BFX Effects Loop and one other exclusive choice, typical preamp channel selection.
- 2.13: Q-MNR:** 4-voice control interface where one feature is BFX with series-mix capability. Includes proper relay drive for loop control and preamp channel selection and LED drive.
- 2.14 - Q-RLY: Quad Relay Controller:** Provides interfacing and control for up to four groups of mechanical relays. Use RLY for the actual relay connection to the circuit being controlled. Four voice lines can be linked via DIP switches to each of the four blocks (add one Q-DIP per block), so that each block can have multiple or independent control. Each block controls a feature. Without the DIPs, programming is achieved by soldering in wire jumpers. Use cut-off resistor leads for the jumpers. LED drive circuitry is provided for both voice and feature indication. Voice LEDs are 'on' one at a time. Up to four feature LEDs can be 'on' while drawing only the current of a single LED. Expansion pads are provided to allow more than four voices to control each block. Requires voltage and current sufficient for the relay coils and LEDs (if fitted). Equivalent to four Q-SRs plus Q-LDV.
- 2.15 - Q-SR: Single Relay Controller:** Essentially one section of Q-RLY, and without the voice LED driver.

2.0 - LONDON POWER SWITCHING KITS (cont'd)

- 2.14 - Q-FET: Quad Fet Controller:** Provides interface for up to four groups of n-jfets, with each group having provision for shunt-wired and series-wired jfet elements. Each group produces two control lines: shunt output spans -12Vdc to zero; series output spans -12Vdc to +12Vdc. If only shunt wiring is needed, the series group can be wired shunt and the +12V input linked to ground resulting in complimentary drive outputs from each group. Any number of jfets per output line. With +/- 12Vdc, series output lines can control grounded-source power n-mosfets to switch high-power or high-voltage loads, such as cathodes of output tubes, Power Scale pots, etc. Four voice lines can be linked via DIP switches to each of the four blocks (install one Q-DIP per block), so that each block can have multiple or independent control. If no DIPs are used, programming is achieved by installing wire jumpers (cut-off resistor leads). Each block controls a feature. LED drive circuitry is provided for both voice and feature indication. Expansion pads allow more than four voices to control each block. Requires -12Vdc at 2mA without LEDs; add 10mA for voice LEDs, add a further 10mA per feature LED used; add +12Vdc at <1mA if series-jfets are controlled. Equivalent to four Q-SFs plus Q-LDV.
- 2.15 - Q-SF: Single Fet Controller:** Essentially one-quarter of Q-FET and without the voice LED driver.
- 2.16 - Q-VX: Quad Voice Expander:** Interfaces up to four more voices to Q-FET, Q-SF, Q-RLY or Q-SR. Use in the amplifier when Q-LATCH is remote, i.e., Q-LATCH is in a foot switch, and there is no Q-LATCH in the amplifier. Can drive voice LEDs. Add one Q-DIP per block that you wish to have easy expansion for. Otherwise, programming is achieved by soldering in wire jumpers (cut-off resistor leads).
- 2.17 - QRK-JFT: Jfet:** Series-connected jfet switches require a gate-blocking diode to function properly and to allow multiple jfets to be controlled by the same control line. Q-JFT has an n-jfet and its gate diode mounted on a small PCB.
- 2.18 - QRK-DIP:** Quad DIP switch used on Q-FET, Q-SF, Q-RLY, Q-SR and Q-VX. Can be retrofitted at a later date, as required.

3.0 - POWER SUPPLY NOTES

The DC power input connections on London Power's switching kits use these designations, with the related meanings:

VM: minus supply; -12Vdc; can be tied to ground when V0 is tied to +12Vdc; on ERK make no connection here if AC is used

V0: ground; zero Vdc; can be tied to +12V when VM is tied to ground

VP: plus supply; +12Vdc; on Q-SF, Q-FET and DFC VP can be tied to V0 when VM is tied to -12Vdc and only shunt-fets are being controlled by all outputs

AC: (ERK only) high-voltage AC input; VM not connected and no LEDs (R7 lifted, LNK in place)

The 12Vdc supplies can be unregulated for ERK and RLY and in general for the Q-system kits, but all switching kits benefit from the supply being regulated. Q-LATCH has its own regulator to assure reliable operation.

Regulated +/-12Vdc is readily attained from London Power's PM12-6, PM12-12 or from the AUX supply of PSU-TPA, PSU-10, PSU-25 or PSU-50.

4.0 - TYPICAL APPLICATIONS

The applications listed are for selecting commonly found features in guitar amps. The applications are not limited to these by any means. The location in the system where each switching component is placed is designated as follows:

amp: in the amplifier chassis

remote: as a remote foot switch

When a latching switch is indicated for the amp but a remote switch is also listed, it is assumed that a 1/4" TS jack with a closed-contact will be used at the amp allowing over-ride of the amp panel switch by the remote foot switch. This generally only applies to ERK and RLY applications.

Within the list of components, "+" separates the components. Between the + signs may be a choice of "item-A or item-B", for example, and this choice only applies to the components listed between the + signs.

For many of the applications, the actual quantity of audio muting elements, or circuit switching elements, is not specified. This quantity depends on the specifics of the circuit being switched. Typically, more than one point in an audio path must be switched to fully mute that sound. Other circuit points may be switched simultaneously.

4.0 - TYPICAL APPLICATIONS (cont'd)

4.1 - Reverb on/off

- or FX loop on/off
- or cathode-bypass cap on/off
- or gain boost on/off
- or volume boost on/off

4.1.1 - RLY

amp: RLY + latching switch; requires 12Vdc - 14mA

4.1.2 - RLY with remote

amp: RLY + latching switch; requires 12Vdc - 14mA
remote: latching foot switch (over-rides amp switch when cable plugged into amp)

4.1.3 - ERK

amp: ERK + latching switch + LED; requires 12Vdc - 14mA (<2mA w/o LED) or <350Vac - 2mA

4.1.4 - ERK with remote

amp: ERK + latching switch + LED; requires 12Vdc - 14mA (<2mA w/o LED) or <350Vac - 2mA
remote: latching foot switch

4.2 - Tremolo on/off

- or triode-pentode
- or fixed-bias / cathode-bias

Must be controlled directly by RLY, which in turn can be controlled independently by just a latching panel and/or foot switch, or by Q-SR, Q-RLY, or DFC.

4.3 - 2-ch Preamp

2-voices

LP-PRE is designed for shunt switching where D-PRE requires series switching.

D-PRE is not compatible with ERK

4.3.1 - RLY

amp: RLY + latching switch; requires 12Vdc - 14mA

4.3.2 - RLY with remote

amp: RLY + latching switch; requires 12Vdc - 14mA
remote: latching foot switch (over-rides amp switch when cable plugged into amp)

4.3.3 - ERK

amp: ERK + latching switch + LEDs; requires 12Vdc - 14mA (<2mA w/o LED) or <350Vac - 2mA

4.0 - TYPICAL APPLICATIONS (cont'd)

4.3 - 2-ch Preamp (cont'd)

4.3.4 - ERK with remote

amp: ERK + latching switch + LEDs; requires 12Vdc - 14mA (<2mA w/o LED) or <350Vac - 2mA
remote: latching foot switch

4.3.5 - DFC (only half used, other half can be for another function)

amp: DFC + momentary NC switch + several Q-JFT or 2x RLY; +12Vdc or -12Vdc

4.3.6 - DFC with remote (only half used, other half can be for another function)

amp: DFC + momentary NC switch + several Q-JFT or 2x RLY; +12Vdc or -12Vdc
remote: QRK-FSW (one for ch/select; second for another function)

4.3.7 - Q w/RLY

amp: Q-LATCH + momentary NC switch or Q-SW + Q-SR + 2x RLY; +12Vdc or -12Vdc

4.3.8 - Q w/RLY with remote

amp: Q-SR + 2x RLY; +12Vdc or -12Vdc
remote: Q-LATCH + 2x Q-FSW

4.3.9 -Q w/RLY with remote & 2-way communication

amp: Q-LATCH + momentary NC switch or Q-SW + Q-SR + 2x RLY; +12Vdc or -12Vdc
remote: Q-LATCH + 2x Q-FSW

4.3.10 - Q w/jfet

amp: Q-LATCH + momentary NC switch or Q-SW + Q-SF + several Q-JFT; -12Vdc (shunt only) or +/-
12Vdc shunt and/or series

4.3.11 - QRK w/jfet with remote

amp: Q-SF + several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series
remote: Q-LATCH + 2x Q-FSW

4.3.12 - QRK w/jfet with remote & 2-way communication

amp: Q-LATCH + momentary NC switch or Q-SW + Q-SF + several Q-JFT; -12Vdc (shunt only) or +/-
12Vdc shunt and/or series
remote: Q-LATCH + 2x Q-FSW

4.0 - TYPICAL APPLICATIONS (cont'd)

4.4 - 2-ch preamp + one feature

4 voices

depending on the feature, relay or jfet switching can be used or mixed

If the feature is an effects loop such as BFX, then the ideal control is Q-MINI, which is a package of Q-LATCH + Q-MNR. Q-MNR is specifically designed to control the preamp channel selection relays and switch the FX loop properly regardless of whether the loop is used in series-mode or mix-mode. The only extra components required are 3 or more RLY, Q-LED and Q-SW or 4x Q-FSW.

In the Q-MINI system, Q-LATCH can be mounted remotely using 4x Q-FSW. It is beneficial in this case to have annunciation on the amp panel by adding Q-LED. If all the circuitry is to be mounted in the amp, replace 4x Q-FS with Q-SW.

If full control on the amp face plus remote control with 2-way communication is desired, add Q-LATCH plus 4x Q-FSW to the Q-MINI system above.

4.4.1 - DFC (non-ergonomic selection)

amp: DFC + momentary NC switch + several Q-JFT or 2x RLY; +12Vdc or -12Vdc

4.4.2 - DFC with remote (non-ergonomic selection)

amp: DFC + momentary NC switch + several Q-JFT or 2x RLY; +12Vdc or -12Vdc

remote: 2x Q-FSW

4.4.3 - Q w/RLY

amp: Q-LATCH + 4x momentary NC switch or Q-SW + 2x Q-SR or Q-RLY + several RLY;
+12Vdc or -12Vdc

4.4.4 - Q w/RLY with remote

amp: 2x Q-SR or Q-RLY + several RLY; add Q-LDV with Q-SRs; +12Vdc or -12Vdc

remote: Q-LATCH + 4x Q-FSW

4.4.5 - Q w/RLY with remote & 2-way communication

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-SR + 2x RLY;
add Q-LDV with Q-SRs; +12Vdc or -12Vdc

remote: Q-LATCH + 4x Q-FSW

4.4.6 - Q w/jfet

amp: Q-LATCH + 4x momentary NC switch or Q-SW + 2x Q-SF or Q-FET
+ several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.4.7 - Q w/jfet with remote

amp: 2x Q-SF or Q-FET + several Q-JFT; add Q-LDV with Q-SFs;
-12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: Q-LATCH + 4x Q-FSW

4.4.8 - Q w/jfet with remote & 2-way communication

amp: Q-LATCH + 4x momentary NC switch or Q-SW + 2x Q-SF or Q-FET

+ several QRK-JFT; add Q-LDV with Q-SFs; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: Q-LATCH + 4x Q-FSW

4.4.9 - Q w/RLY + jfet

amp: Q-LATCH + 4x momentary NC switch or Q-SW + 2x Q-SR or Q-RLY + several RLY;

+12Vdc or -12Vdc

4.4.10 - Q w/RLY + jfet with remote

amp: Q-SR + Q-SF + several RLY + several Q-JFT + Q-LDV;

+12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: Q-LATCH + 4x Q-FSW

4.4.11 - Q w/RLY + jfet with remote & 2-way communication

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-SR + Q-SF + several RLY

+ several Q-JFT + Q-LDV; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: Q-LATCH + 4x Q-FSW

4.5 - 2-ch preamp + two features

8 voices

4.5.1 - Q w/RLY

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-RLY + several RLY

+ Q-VX; +12Vdc or -12Vdc

4.5.2 - Q w/RLY with remote

amp: Q-RLY + several RLY + Q-VX; +12Vdc or -12Vdc

remote: 2x Q-LATCH + 8x Q-FSW

4.5.3 - Q w/RLY with remote & 2-way communication

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-RLY + several RLY

+ Q-VX; +12Vdc or -12Vdc

remote: 2x Q-LATCH + 8x Q-FSW

4.5.4 - Q w/jfet

amp: 2x QRK-LATCH + 8x momentary NC switch or 2x Q-SW + Q-FET

+ several QRK-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.5.5 - Q w/jfet with remote

amp: Q-FET + several QRK-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 2x Q-LATCH + 8x Q-FSW

4.5.6 - Q w/jfet with remote & 2-way communication

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-FET

+ several Q-JFT + 2x Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 2x Q-LATCH + 8x Q-FSW

4.0 - TYPICAL APPLICATIONS (cont'd)

4.5 - 2-ch preamp + two features (cont'd)

4.5.7 - Q w/RLY + jfet **

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + (**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

4.5.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement
remote: 2x Q-LATCH + 8x Q-FSW

4.5.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + (**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement
remote: 2x Q-LATCH + 8x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SF, Q-SR, Q-FET and Q-RLY as required, and add Q-VXs to allow access into each controller board

4.6 - 3-ch preamp

3 voices

LP-PRE is designed for shunt switching where D-PRE requires series switching

D-PRE is not compatible with ERK

4.6.1 - Q w/RLY

amp: Q-LATCH + 3x momentary NC switch or Q-SW + Q-SR + 3x RLY; +12Vdc or -12Vdc

4.6.2 - Q w/RLY with remote

amp: Q-RLY + several RLY; +12Vdc or -12Vdc
remote: Q-LATCH + 3x Q-FSW

4.6.3 - Q w/RLY with remote & 2-way communication

amp: Q-LATCH + 3x momentary NC switch or Q-SW + Q-RLY + several RLY;
+12Vdc or -12Vdc
remote: Q-LATCH + 3x QRK-FSW

4.6.4 - Q w/jfet

amp: Q-LATCH + 3x momentary NC switch or Q-SW + Q-FET + several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.0 - TYPICAL APPLICATIONS (cont'd)

4.6 - 3-ch preamp (cont'd)

4.6.5 - Q w/jfet with remote

amp: Q-FET + several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series
remote: Q-LATCH + 3x Q-FSW

4.6.6 - Q w/jfet with remote & 2-way communication

amp: Q-LATCH + 3x momentary NC switch or Q-SW + Q-FET + several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series
remote: Q-LATCH + 3x Q-FSW

4.6.7 - Q w/RLY + jfet **

amp: Q-LATCH + 3x momentary NC switch or Q-SW + (**) + several RLY
+ several Q-JFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

4.6.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY + several Q-JFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement
remote: Q-LATCH + 3x Q-FSW

4.6.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: Q-LATCH + 3x momentary NC switch or Q-SW + (**) + several RLY
+ several Q-JFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement
remote: Q-LATCH + 3x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SFs and Q-SRs, and add Q-VXs to allow access into each controller board

4.7 - 3-ch preamp + one feature

6 voices

4.7.1 - Q w/RLY

amp: 2x Q-LATCH + 6x momentary NC switch or 2x Q-SW + Q-RLY + several RLY
+ Q-VX; +12Vdc or -12Vdc

4.7.2 - Q w/RLY with remote

amp: Q-RLY + several RLY + Q-VX; +12Vdc or -12Vdc
remote: 2x Q-LATCH + 6x Q-FSW

4.0 - TYPICAL APPLICATIONS (cont'd)

4.7 - 3-ch preamp + one feature (cont'd)

4.7.3 - Q w/RLY with remote & 2-way communication

amp: 2x Q-LATCH + 6x momentary NC switch or 2x Q-SW + Q-RLY + several RLY
+ 2x Q-VX; +12Vdc or -12Vdc

remote: 3x Q-LATCH + 12x Q-FSW

4.7.4 - Q w/jfet

amp: 2x Q-LATCH + 6x momentary NC switch or 2x Q-SW + Q-FET
+ several Q-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.7.5 - Q w/jfet with remote

amp: Q-FET + several Q-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 3x Q-LATCH + 12x Q-FSW

4.7.6 - Q w/jfet with remote & 2-way communication

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + Q-FET
+ several Q-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 3x Q-LATCH + 12x Q-FSW

4.7.7 - Q w/RLY + jfet **

amp: 2x Q-LATCH + 12x momentary NC switch or 2x Q-SW + (**) + several RLY
+ several Q-JFT + Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement

4.7.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY
+ several Q-JFT + Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement

remote: 2x Q-LATCH + 6x Q-FSW

4.7.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: 2x Q-LATCH + 6x momentary NC switch or 2x Q-SW + (**) + several RLY
+ several Q-JFT + Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement

remote: 2x Q-LATCH + 6x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SF, Q-SR, Q-FET and Q-RLY as required, and add Q-VXs to allow access into each controller board

4.0 - TYPICAL APPLICATIONS (cont'd)

4.8 - 3-ch preamp + two features

12 voices

4.8.1 - Q w/RLY

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + Q-RLY + several RLY
+ 2x Q-VX; +12Vdc or -12Vdc

4.8.2 - QK w/RLY with remote

amp: QK-RLY + several RLY + 2x Q-VX; +12Vdc or -12Vdc
remote: 3x Q-LATCH + 12x Q-FSW

4.8.3 - Q w/RLY with remote & 2-way communication

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + Q-RLY + several RLY
+ 2x Q-VX; +12Vdc or -12Vdc
remote: 3x Q-LATCH + 12x Q-FSW

4.8.4 - Q w/jfet

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + Q-FET
+ several Q-JFT + 2x Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.8.5 - Q w/jfet with remote

amp: Q-FET + several Q-JFT + 2x Q-VX;
-12Vdc (shunt only) or +/-12Vdc shunt and/or series
remote: 3x Q-LATCH + 12x Q-FSW

4.8.6 - Q w/jfet with remote & 2-way communication

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + Q-FET
+ several Q-JFT + 2x Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series
remote: 3x Q-LATCH + 12x Q-FSW

4.8.7 - Q w/RLY + jfet **

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + (**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement

4.8.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement
remote: 3x Q-LATCH + 12x Q-FSW

4.0 - TYPICAL APPLICATIONS (cont'd)

4.8 - 3-ch preamp + two features (cont'd)

4.8.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: 3x Q-LATCH + 12x momentary NC switch or 3x Q-SW + (**) + several RLY
+ several Q-JFT+ 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet
requirement

remote: 3x Q-LATCH + 12x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SF, Q-SR, Q-FET and Q-RLY as
required, and add Q-VXs to allow access into each controller board

4.9 - 4-ch preamp

4 voices

4.9.1 - Q w/RLY

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-RLY + several RLY;
+12Vdc or -12Vdc

4.9.2 - Q w/RLY with remote

amp: Q-RLY + several RLY; +12Vdc or -12Vdc

remote: Q-LATCH +4x Q-FSW

4.9.3 - Q w/RLY with remote & 2-way communication

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-RLY + several RLY;
add Q-LDV with Q-SRs; +12Vdc or -12Vdc

remote: Q-LATCH + 4x Q-FSW

4.9.4 - Q w/jfet

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-FET
+ several Q-JFT; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.9.5 - Q w/jfet with remote

amp: Q-FET + several Q-JFT;-12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: Q-LATCH + 4x Q-FSW

4.9.6 - Q w/jfet with remote & 2-way communication

amp: Q-LATCH + 4x momentary NC switch or Q-SW + Q-FET + several Q-JFT;
-12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: Q-LATCH + 4x Q-FSW

4.0 - TYPICAL APPLICATIONS (cont'd)

4.9 - 4-ch preamp (cont'd)

4.9.7 - Q w/RLY + jfet **

amp: Q-LATCH + 4x momentary NC switch or Q-SW + (**) + several RLY
+ several Q-JFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

4.9.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY + several QJFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: Q-LATCH + 4x Q-FSW

4.9.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: Q-LATCH + 4x momentary NC switch or Q-SW + (**) + several RLY
+ several Q-JFT; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: Q-LATCH + 4x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SF, Q-SR, Q-FET and Q-RLY as required, and add Q-VXs to allow access into each controller board

4.10 - 4-ch preamp + one feature

8 voices

4.10.1 - Q w/RLY

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-RLY + several RLY
+ Q-VX; +12Vdc or -12Vdc

4.10.2 - Q w/RLY with remote

amp: Q-RLY + several RLY + Q-VX; +12Vdc or -12Vdc

remote: 2x Q-LATCH + 8x Q-FSW

4.10.3 - Q w/RLY with remote & 2-way communication

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-RLY + several RLY
+ Q-VX; +12Vdc or -12Vdc

remote: 2x Q-LATCH + 8x Q-FSW

4.10.4 - Q w/jfet

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-FET
+ several Q-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

4.0 - TYPICAL APPLICATIONS (cont'd)

4.10 - 4-ch preamp + one feature (cont'd)

4.10.5 - Q w/jfet with remote

amp: Q-FET + several Q-JFT + Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 2x Q-LATCH + 8x Q-FSW

4.10.6 - Q w/jfet with remote & 2-way communication

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + Q-FET

+ several Q-JFT + 2x Q-VX; -12Vdc (shunt only) or +/-12Vdc shunt and/or series

remote: 2x Q-LATCH + 8x Q-FSW

4.10.7 - Q w/RLY + jfet **

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + (**) + several RLY

+ several Q-JFT + 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

4.10.8 - Q w/RLY + jfet with remote **

amp:(**) + several RLY + several Q-JFT + 2x Q-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: 2x Q-LATCH + 8x Q-FSW

4.10.9 - Q w/RLY + jfet with remote & 2-way communication **

amp: 2x Q-LATCH + 8x momentary NC switch or 2x Q-SW + (**) + several RLY

+ several QRK-JFT + 2x QRK-VX; +12Vdc or -12Vdc or +/-12Vdc depending on series/shunt jfet requirement

remote: 2x Q-LATCH + 8x Q-FSW

(**) - depending on the requirement for relay and jfet control, mix Q-SF, Q-SR, Q-FET and Q-RLY as required, and add Q-VXs to allow access into each controller board

5.0 - EXPANDING BEYOND

The number of voices and features is unlimited in a guitar tone creation system. It is up to each designer or player to figure out how many voices is “enough” and which are truly useful. Most players cannot determine this without trying the combinations first and hearing for themselves what each does. Typically players will keep coming back to a small number of core sounds - these represent the most useful voices.

Even the simplest London Power switching kits expand beyond the usual mass-production offerings by providing proper signal control with player ergonomics. The Q-system takes this beyond what computer-driven controllers offer.

5.0 - EXPANDING BEYOND (cont'd)

5.1 - DETERMINING THE NUMBER OF VOICES

In general, the number of voices the system has is based on the number of channels and the number of features. The total number of features is always "+1" as the choice of preamp channel is itself a "feature". So, the "2-ch preamp + one feature" application multiplies out as

$2 \text{ channels} \times (1 + 1) \text{ features} = 4 \text{ voices}$

For 4 preamp channels and 3 features:

$4 \text{ channels} \times (3 + 1) \text{ features} = 16 \text{ voices}$

And so on.

5.2 - HOW MANY Q-LATCHes?

The number of Q-LATCHes required is equal to the number of system voices divided by 4, then round up if there is a fractional result. For example, suppose there are 12 voices. This works out neatly to $12 \div 4 = 3$. If we have 18 voices, we get $18 \div 4 = 4.5$, which we then round up to 5 as we cannot cut the Q-LATCH in half, even though we can use just half of one as required.

5.3 - WHEN TO USE Q-VX

When there is just a single Q-LATCH mounted in the amp or mounted remotely as a foot switch, then we do not need Q-VX. If there is more than one Q-LATCH, then we might have to add one Q-VX for each extra Q-LATCH if we have to provide expanded access to a given relay or jfet control function. The number of Q-VXs is always one less than the quantity of Q-LATCHes with respect to controlling one controller board. This assumes the Q-LATCHes are at the amp end.

For example, suppose there are 8 voices, and thus 2x Q-LATCH. If there is a single Q-RLY, Q-FET, Q-SR or Q-SF, then we need only one Q-VX. This allows the second Q-LATCH to tie into the controller board. Note that because Q-VX allows for tying into up to four control blocks, it can mate with a single Q-FET or Q-RLY, but alternately can tie to up to four Q-SR/SF combinations.

On the other hand, if we are using multiple controller boards, say a Q-RLY and a Q-SF - this can be any combination of boards, even same-type - then we must add a Q-VX for each controller board. In this case, one Q-VX to expand the function access for Q-RLY and another to expand access into Q-SF.

5.0 - EXPANDING BEYOND (cont'd)

5.4 - VOICE LEDs

Voice annunciation for an amplifier configuration where each preamp channel represents a voice in its entirety, i.e., no other switched features, is very simple: Q-LATCH will drive the voice LEDs on the foot switch and/or the amp panel if fitted there. If Q-LATCH is remote, then the amp voice LEDs can be driven by Q-LDV, Q-RLY or Q-FET.

In more complex systems, what is a voice LED may become questionable. Although the system has a given number of voices, and one may be accessing all of them, the actual number of voice LEDs on the amp may not be exactly what is required, nor will it match what is mounted on the foot switch.

If our simple 2-channel preamp now has an FX loop added, we have four voices but only two (or three) things being switched. Two of the voices engage ch-1, while the other two voices engage ch-2. So, we only need two “voice” LEDs to indicate the preamp portion of the selection, and then a third LED to show that the FX function is engaged. In this situation we have two options to assure that the channel LEDs light when they are supposed to.

The first option is universal and uses Q-VX to interface the Q-LDV. We do not use any of the voice LED drive capabilities of any other board so fitted. Instead, we use the programming offered by Q-VX to allow, say, LED-1 to light for voice-1 and voice-2. LED-1 will indicate ch-1 is engaged. We program LED-2 to be engaged by voices 3&4 to indicate that ch-2 is ‘on’. For the FX indication, we can use a further section of Q-VX and Q-LDV as a function LED driver programmed to light with voices 2&4. Alternatively, we can use the function LED drive capability of the controller board itself for FX indication.

The second option requires the installation of only two of the voice LEDs on whatever controller board is used, and the addition of two jumpers. Each of the voice LEDs on the given controller has its dedicated driver transistor. If, as in the example above, we use LED-1 for ch-1 and LED-3 for ch-2, we then leave out LEDs 2&4. We add a jumper from the cathode of LED1 to the cathode of LED2, and another jumper from the cathode of LED3 to the cathode of LED4. The BJTs act as an OR gate and allow voice lines 1&2 to light LED1, while voice lines 3&4 light LED3. We have chosen this particular LED orientation simply because the LED driver BJTs are hardwired to specific voice lines.

5.5 - FUNCTION LEDs

Each of the control blocks of Q-FET, Q-RLY, Q-SF and Q-SR have LED drivers. These can be used to indicate that the given function is active. This is straightforward with non-preamp channel features, where, say, an FX loop might be active for half of the system voices.

5.0 - EXPANDING BEYOND (cont'd)

5.5 - FUNCTION LEDs (cont'd)

One section of Q-RLY might execute the switching between two channels of a two-channel preamp, taking advantage of the fact that relays themselves have two states. The default might be to ch-1 with relays 'off', with the powered relays selecting ch-2. In this case, the function LED indicates that ch-2 is selected but there is otherwise no indication that ch-1 is selected when it is active. Of course, in the Q-system, you cannot turn off a function without selecting something else, making that other voice the indicator of ch-1.

On the other hand, DFC provides positive indication of both states of its outputs. Used to switch channels, one section of DFC drives its two LEDs which then indicate ch-1 and ch-2 status.

5.6 - LEDs OR NO LEDs

It behooves each builder to take the time to look at the switch system components carefully to determine which should be fitted with LEDs and which should not. There can be quite a cost savings here, especially when fitting your own LEDs. For initial set-up of the system and to verify that the boards function, tack-soldering the LEDs in place provides easy monitoring of the switching action even before the boards are mounted into an amp.

The builder can then use any colour and size of LED. The LEDs that come with the kits are standard-brightness 3mm round green LEDs. Note that the Q-LED mounting for the LEDs does not have to be used; rather, the LEDs can be positioned wherever is appropriate on the front panel using standard LED holders.

Remember that LEDs are an aesthetic element on the front panel of the amp, and on the foot switch box. You can make a statement with them or not.

5.7 - PROGRAMMING

As described above, many of the voices will share features of the system. To achieve this overlap of control requires thoughtful consideration on the part of the switch system installer. Because of the many options possible, many people get lost or confused and may even give up on configuring a truly good and ergonomic control system. That is sad.

To ease matters, the Q function controller boards come with space for DIP switches. These are arranged in groups of four to correspond with the four incoming voice lines. Any or all of the voice lines can then engage a given function. The DIP switches are added by ordering Q-DIP, one per function block, and are a high-reliability type with a life expectancy 5-10 times that of less expensive types. Having the DIP switches in place allows the builder and/or player to try different voicing options any time after the initial installation. As an alternative, where the DIPs would be, the installer adds a wire jumper for each voice that should engage the function. The jumpers are just the cut-off leads of resistors or diodes used to make the kit. Reprogramming is achieved by removing and/or adding jumpers.

5.0 - EXPANDING BEYOND (cont'd)

5.8 - POWER SUPPLY REQUIREMENTS

When series-jfets are used, +/-12Vdc is required.

When shunt-jfets are used, -12Vdc is required.

When shunt-jfets and series jfets are used, +/-12Vdc is required.

When relays are used along with shunt-jfets, -12Vdc is required.

When relays and series-jfets are used, +/-12Vdc is required, with relays powered by the -12V.

When relays, shunt-jfets and series-jfets are used, +/-12Vdc is required with the relays powered from the -12V.

N-ch mosfets can be combined with series-jfet control provided the source (S) of the mosfet is tied to ground. The mosfet can then switch tube cathodes, Power Scale pots, large relays, or other elements where high-voltage might be present.

When only relays are used +12Vdc or -12Vdc can be used.

London Power's power supplies for tube amps based on the PSU-TPA board, PSU-10, PSU-25 and PSU-50, all have +/-12Vdc regulated auxiliary voltages which are ideally suited to switching circuit support. If one is not using any of the above PSUs, then PM12-6 or PM12-12 Plus-Minus-12V kits provide regulated voltages at either 175mA or 350mA, respectively.

5.9 - MECHANICAL SWITCHES

The human interface to all the switching circuits is the mechanical switch. ERK and RLY both require a latching switch, where the DFC and Q-system require momentary switches with a normally closed contact that opens when pushed.

Latching switches for the front panel of the amp can be toggles, rockers or push-on/push-off alternate-action types. The voltage across the switch is low, as is the current through the switch. Even when directly controlling relay coils, switch current is about 12mA per RLY and only 12Vdc. This low power environment provides a wide latitude of size and style.

Latching switches for foot switch use are most popularly a large-body chromed-actuator type. This is the type shipped with ERK in the past, and now are an option as FSW. FSW can be wired as a momentary switch, if one requires the appearance or feel of that switch type for use with Q-LATCH or DFC. See TUT fig.9-77.

5.0 - EXPANDING BEYOND (cont'd)

5.9 - MECHANICAL SWITCHES (cont'd)

Panel switches for DFC and Q-LATCH are a PCB-mounted push button wired as NC, opening when depressed. The Q-FSW can also be used as a panel switch, requiring a much larger hole for mounting.

Foot switches for DFC and Q-LATCH are a momentary push-button with a large actuator. These are a Switchcraft type providing both a NC and NO contact, designated Q-FSW. Only the NC connection is used for the kits listed.

5.10 - FX LOOP CONTROL

Sophisticated effects loops like London Power's BFX Best All-Tube effects Loop can be used in series-mode or mixing mode with the flick of a switch. This is used as a preset. Some players like to turn the loop on/off and the switching for this should accommodate the operating mode of the loop. Q-MNR is designed specifically to deal with this situation correctly, while also handling preamp selection and annunciation of all these changes. Relay drivers are built into Q-MNR and 2x RLY is required to control the loop, with two or more RLY to control the preamp selection.

Q-MNR is available in a discount package with Q-LATCH as Q-MINI as an economical yet ergonomic way to control the most common amp configuration of a 2-channel preamp with effects loop.