

Recording Studio Consoles and Film Production, Part II

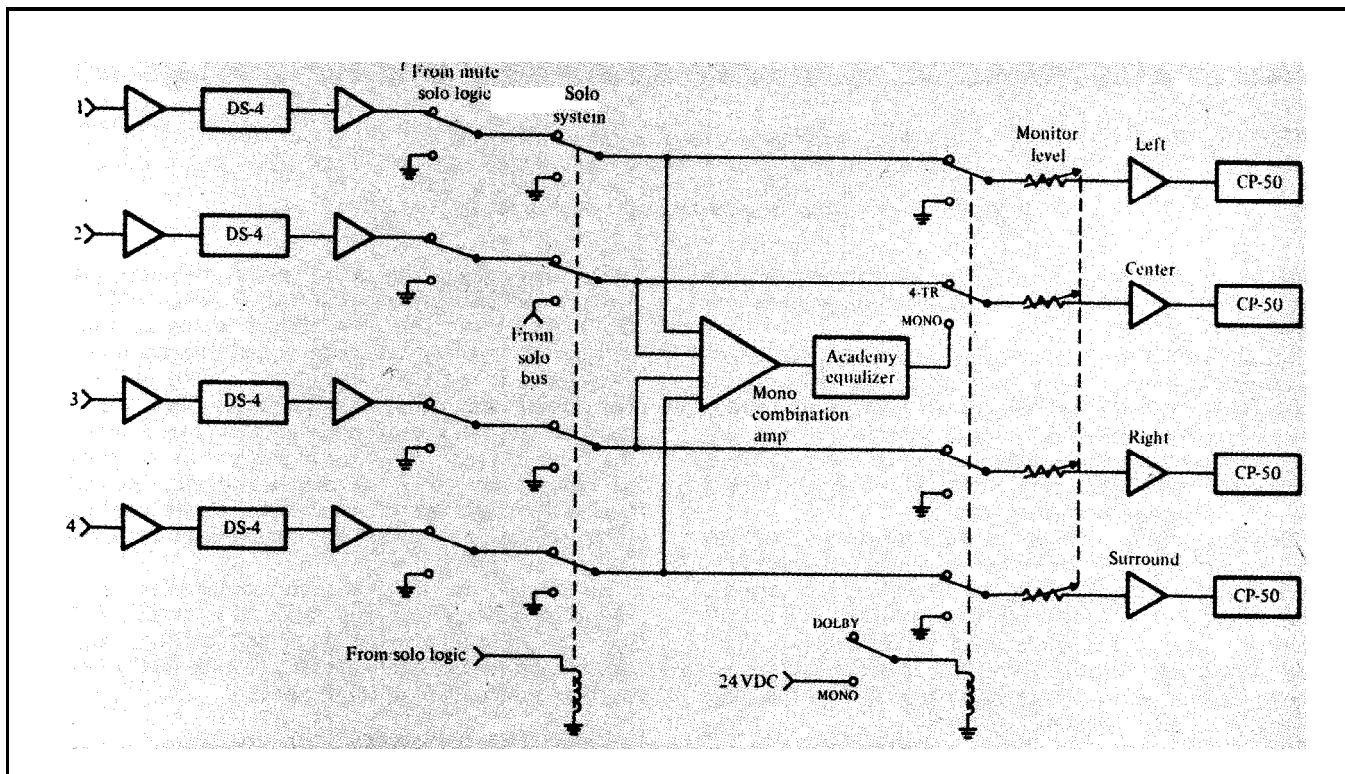
The following article offers a step-by-step description of the changes made to an MCI 428 B and Neve A665 in converting them for use in film mixing.

THIS IS THE second of a series dedicated to the art of film mixing, an understanding of the tools used, and ways to utilize some equipment that was never intended for film studio use! Part 2 will feature a case study of the modification of two different consoles that are currently in use in a very busy film studio. In Part 1 (September, '83) we touched briefly on the console requirements. Now we will discuss some of the auxiliary requirements in a little more depth.

Film mixing is a complex task involving a large number of steps that require many movements, and they should all be easily repeatable. What this means is that the commonly used controls should be within easy reach, and automatically identified by function. For these reasons the monitor controls are most often grouped with the machine remotes and the record controls.

The first console that we will examine is an MCI 428 B

series console. This was the first time that this author had ever been involved in anything associated with actual re-recording technology. When we were approached, our impression of what was involved consisted of the simple wiring of an M24 rack. When we got down to discussing the actual details of the work, we found we had to block out three months instead of the three days that we had scheduled for the work! The first step of the construction process was the gleaning of the information presented in the two parts of this article. The next part of the process was to determine how to make a pre-existing MCI console conform to the requirements outlined by the Dolby stereo film format while retaining the ability to do mono film work at other times. Upon examination, it was determined that the vast majority of change to be made to the board would be done in three major areas. These were: The I/O module in the panning area, the Monitor module, which is where the majority of the work



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Ed. note. This monitor system detail drawing appeared in incomplete form in Part I of this series (Sept. '83). Our apologies to our readers and author Greg Hanks for any confusion this may have caused.

occurred, and the Patch bay, which also required extensive modification. The details of the work performed are as follows.

I/O MODULES

We determined that the console would work in one of the three modes that were part of its original design. The chosen mode is "mix." When doing Dolby stereo mixing, the monitor buses are, in fact, the output buses. This is a common situation in any in-line console. The quad buses of the console are used for this purpose, and the pan pots access this bus. The sends in this mode are post EQ and pre-pan driver. For mono work, the first four assignable buses are used, with the bus outputs patched to the DS-4 inputs in the patch bay (to be detailed later). The output assign drivers are accessible in the mix mode with no modification. The only changes required in the I/O module for the use described above are:

1) the addition of a Mic/Line switch across contact pair 'D' of the Remix relay (K2) (see FIGURE 1A). This was done because the room is also used for Live Mixing as well. Otherwise, the mic preamps could simply be removed and the line inputs hard wired to the fader inputs. We also included a line trim in between each line input and mic/line switch (see FIGURE 1B).

2) the rewiring of the pan network so as to pan from the "Left/Right" pan pair to either "Center" or "Surround" (which is switch selected) as shown in FIGURE 1C. It was also necessary to change the swamping resistors for a -3-dB center. The only real custom work required for this task was the fabrication of dress plates of the appropriate color to identify the added functions, and the inclusion of the selector switch and mode identifying LED.

MONITOR MODULE

Because of the vast difference in functional requirements between record and film recording, the monitor module was the subject of the majority of the changes required in the console. When the decision was made to add mag motion and record controls to the console, we figured it made sense to incorporate the monitor control as part of the same package and completely isolate it from the board. The fabrication effort involved building and mounting a box of the same shape and size as an MCI Autolocator. This was done so as to enable the mounting of the whole package on a Glide Mount assembly under the front bolster of the console. Within this framework, we designed and built a system that contained a motion controller with record function control, and a bus/mag selector system integrated with a monitor solo function of our own devising. The design goal was to keep the controlling electronics outside of the console, while maintaining all of the audio circuitry on the monitor module itself. All of the lines to and from the remote control were to remain isolated from the audio signal and grounds. This was done primarily because the record control and motion control circuits were referenced to a common signal that was over 200 feet away from the console. (We were concerned with minimizing the number of changes that had to be made to the mother board of the console.) We also worked with the philosophy that a chassis connection is a screen or shield connection that is brought to ground at one point only. In keeping the audio out of the remote control box, we were also able to keep RF interference to an absolute minimum (as well as minimizing the number of wires that we had to run from the monitor module itself). We decided to use the quad bus monitor and quad tape return monitor positions as our main insert points. We rewired the selector switch so as to allow selection between bus and mag, using four SPDT reed relays. Reed relays perform all of the added audio switching in the monitor circuit. These are driven by a transistor that is driven by a logic low from the monitor box. The bus/mag outputs are then taken to the input of the monitor circuit through a four-pole double-throw selector switch. The other

input of the switch is the output of the original monitor selector switch. This was done to accommodate all the other monitor selections that come with the console. The output is then buffered by four op-amps and taken to the patch bay to drive the input of the DS-4. The DS-4 outputs are then returned through the patch bay, back down to the monitor PCB, and brought back into the monitor circuit via four differential op-amps. The outputs of the four differential amps then feed the remaining monitor circuitry. Following these monitor selector buffer amplifiers are another four reed relays to be used for our monitor solo system. Again these are driven by a transistor that is driven by the remote control box with a logic low (open collector).

At this point in the original circuit, we encountered the mono switch. This function required in our current design scheme. However, the original operation was a bit different than what we now needed. Originally, the switch inter-tied all of the summing junctions with a mono combine of the quad bus. What was now required was a mono signal composed of the quad buses, feeding only channel two (the hard center) and muting the other three monitors. Also to be included in this mode of operation was an academy equalizer inserted in series with the output. The equalizer may be bypassed with a switch, but is only accessible in the mono monitor mode. A warning indicator is incorporated to indicate the use of this mode. These functions were accomplished by rewiring the switch and including another four reed relays in the input circuit of the line output buffer. The academy equalizer was realized using an op amp with an appropriate R-C-L input network. FIGURE 2 illustrates in block form the changes that we made.

PATCH BAY

The changes made in the patch bay were primarily those of addition. We added four rows of patching to allow access to an M24 Rack (remember the M24 discussed earlier!). We had to include additional monitor patching to allow for the inclusion of the Dolby DS-4, and for four mag recorders—one of them six track, and the other three four tracks each. We also had to bring out the monitor input patches to allow patch bay access to the monitor selector.

OTHER CHANGES

Highly desirable (read necessary) features soon to be added to the console to facilitate efficient use in film production include: the inclusion of four linear faders inserted between the output of the channel combining amplifier(s) on the I/O module and the output transformer so as to accommodate fades in the mono mode, and the addition of switch-selectable low pass and high pass filters in series with the abovementioned faders so as to easily record mono tracks with academy equalization. In addition, two quad panning joysticks that are accessed in the patch bay, buffered, and fed directly to the quad buses have been added to the console.

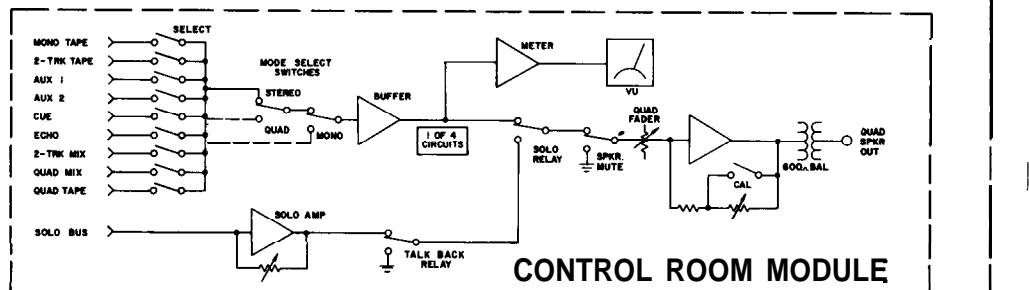
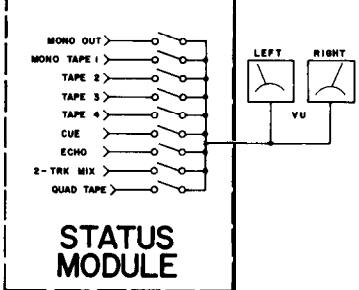
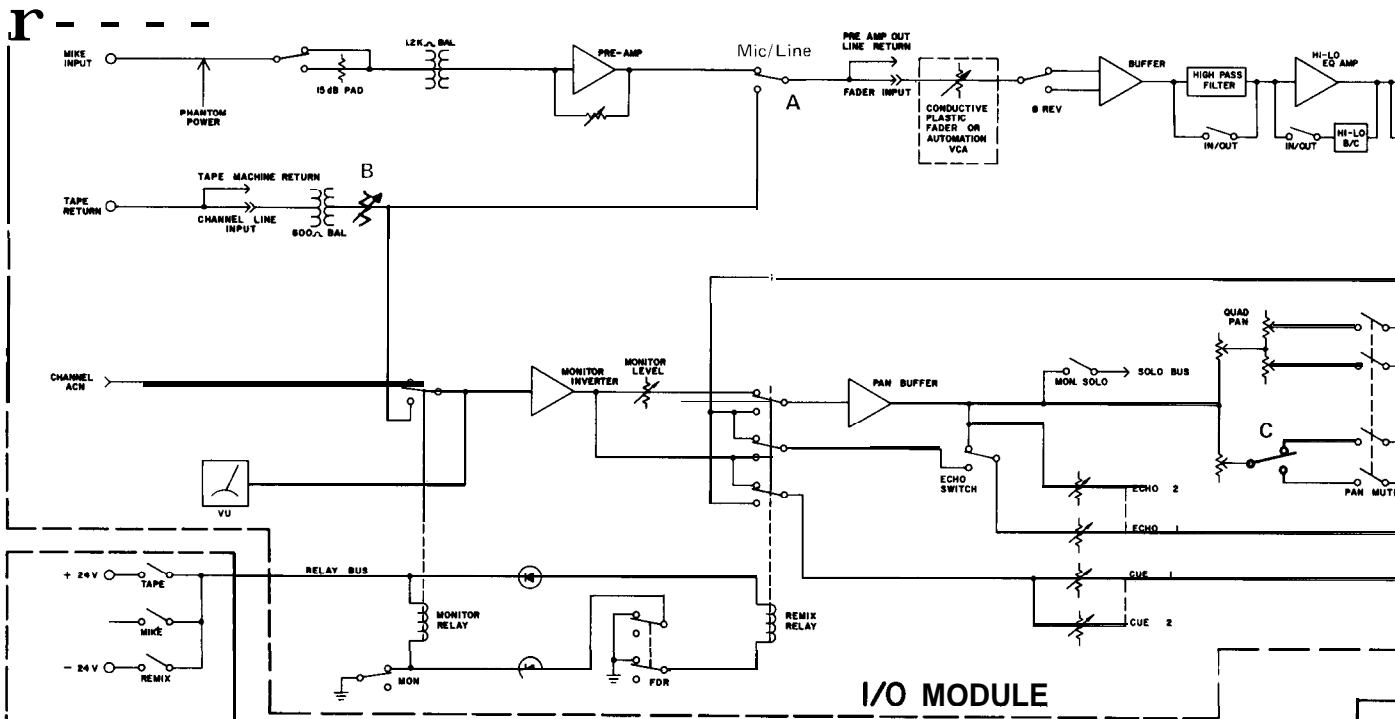
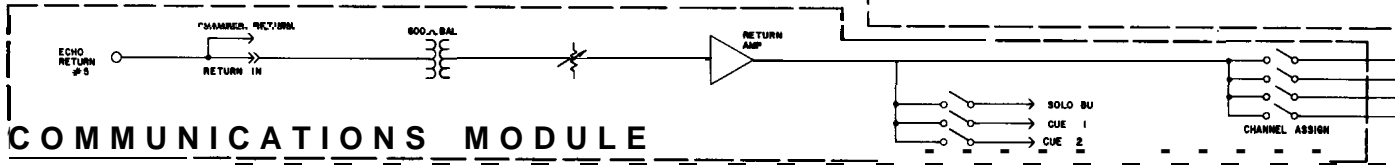
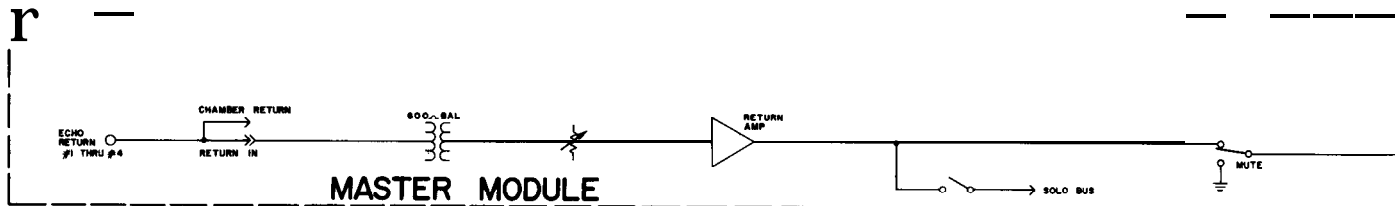
The following is a summary of the changes that were made to the MCI JH428-B to allow it to function in the world of Dolby Film Re-recording:

I/O MODULES

- 1) Add Mic/Line switch.
- 2) Add Panning selector switch.
- 3) Rewire panning network.
- 4) Add dress escutcheon to identify the above!

MONITOR MODULE

- 1) Remove quad tape return switch and wiring.
- 2) Install Bus/Mag select relays in the Quad Bus monitor position.
- 3) Insert buffer amp(s) on output of monitor selector switch (post relays).
- 4) Take output(s) of buffer to patch bay.
- 5) Install four differential input amp buffers (fed from the patch bay).



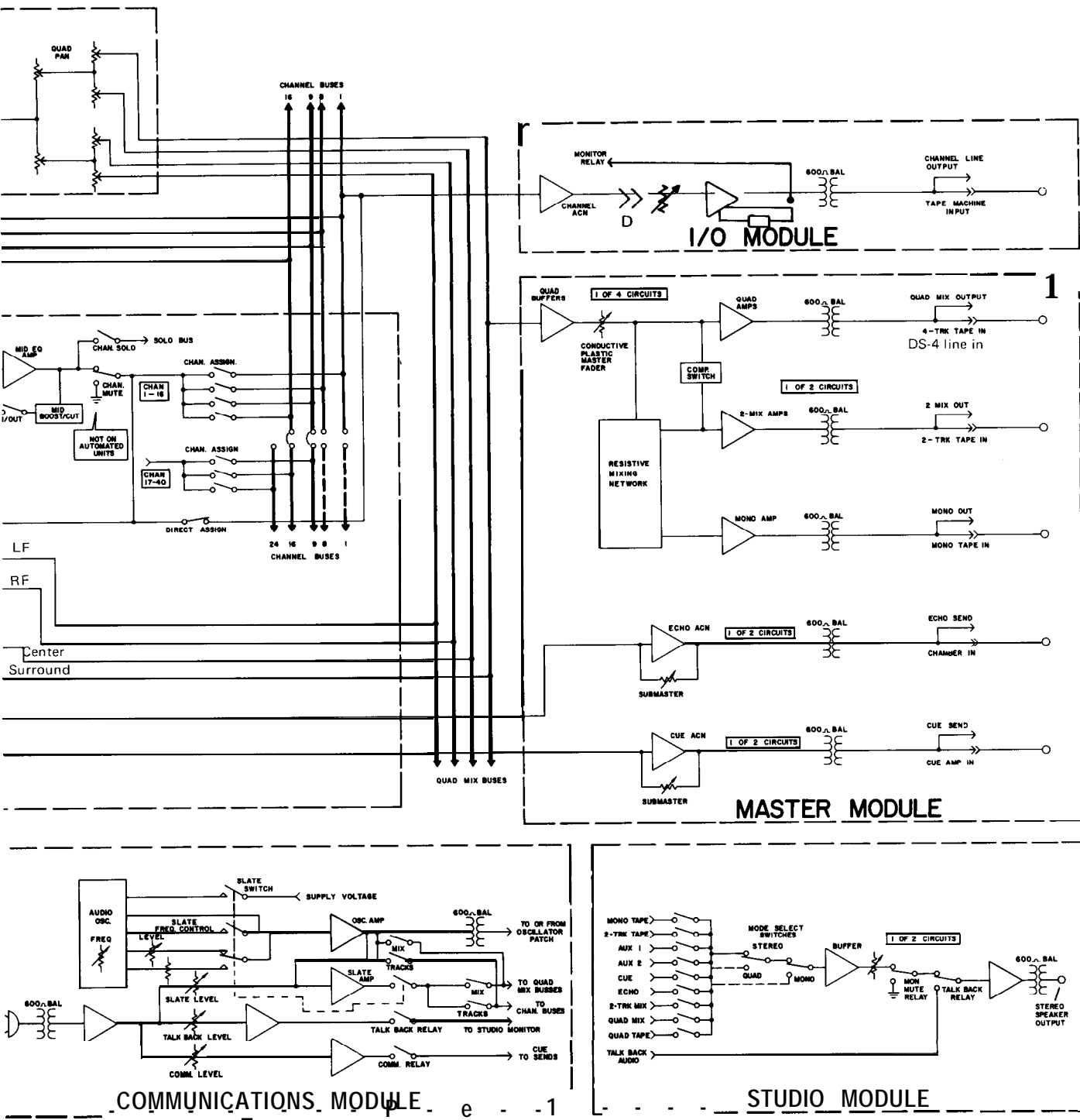


Figure 1. Signal flow diagram of the MCI JH-400t3 console, with modifications.

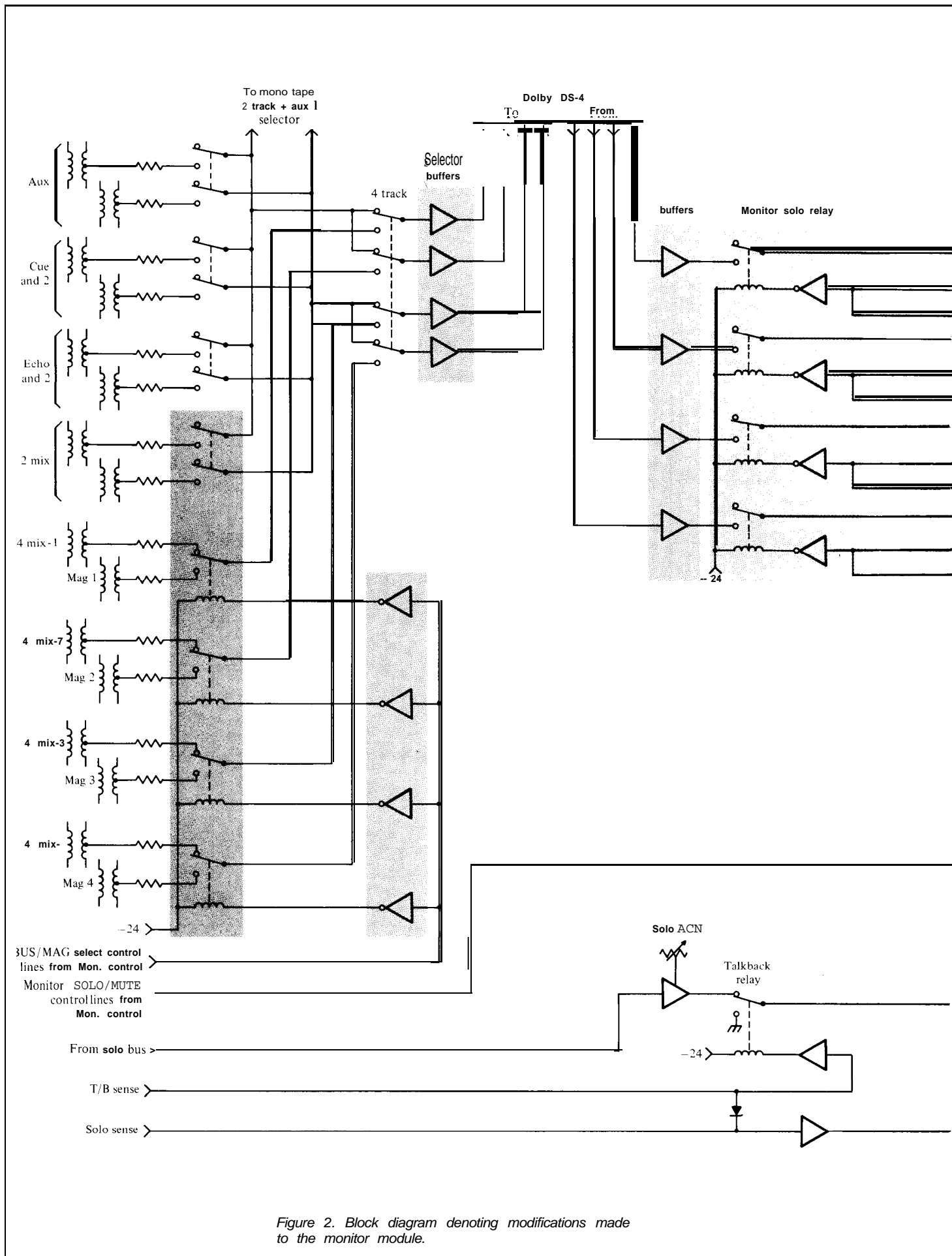
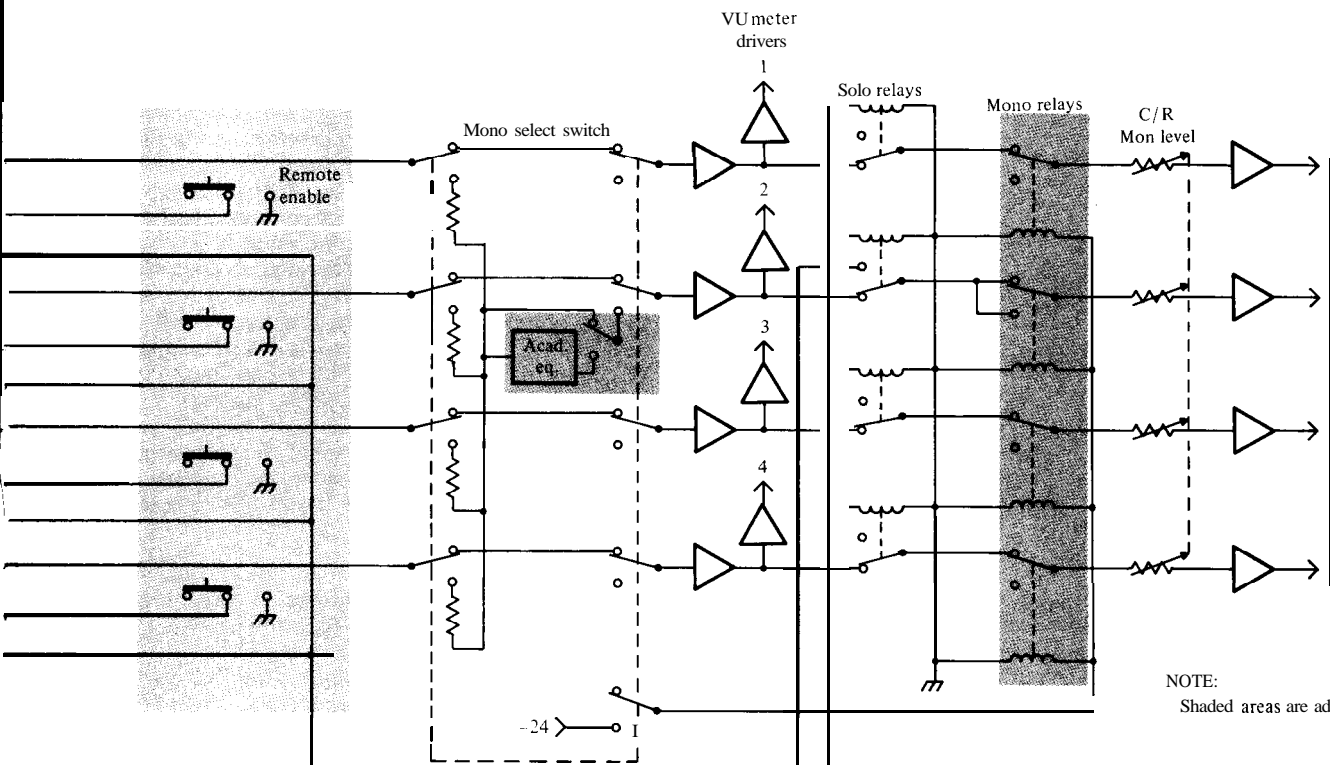


Figure 2. Block diagram denoting modifications made to the monitor module.



NOTE:
Shaded areas are added circuitry.

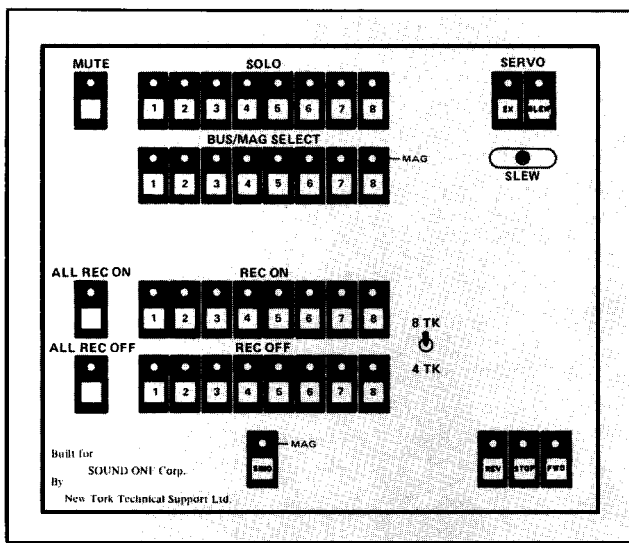


Figure 3. Monitor selector/mute/solo assembly utilized in modification of the Neve A665 console.

- 6) Install monitor Solo/Mute relay circuitry. (This was installed using the already present mute switches on the module, through the normally "on" contacts.)
- 7) Rewire Mono switch.
- 8) Install mono select relays.
- 9) Install academy equalizer in mono side chain.

PATCH BAY

- 1) Install DS-4 patch points within the monitor circuit.
- 2) Add monitor input patching (with appropriate corresponding normals).
- 3) Add required additional rows of patching for outboard equipment.

Changing the JH428 over to a film console was a very rewarding project in terms of both economy (a standard film console usually costs over \$150,000) and flexibility.

THE NEVE A665

Modifying this older custom console for operation in the film realm was in some ways an easier task, yet in others much more difficult. Originally, this board was a 32 in by 16 out by 24 monitor. Based around the older class A 1073 channel amplifier, this console offers some of the finest examples of Neve custom hand work anywhere. Part of the original design included four limiters, which could be inserted in the middle of any of the 16 output group amps. Concurrent with this were two sets of re-routing switch banks allowing for any output to be sub-grouped into any other group. These facilities came from some far-sighted thinking for use in a standard recording facility, and are almost essential to the desires of the film format. This console was to serve many more purposes than the MCI. The studio management intended to have a room wherein it would be possible to work in some of the more non-standard multitrack film formats that are currently in use. Some of these formats would be: four channel Dolby; six channel Dolby; six channel Discrete; eight track Discrete; eight channel Dolby with low frequency side fills; six and eight channel 'IMAX'; client designed multitrack. These possibilities necessitate having up to eight separate monitors throughout the studio. The capability of assigning various buses to these monitor channels while controlling Bus/Mag selection and maintaining a single monitor fader was essential. This situation led to the decision to construct a separately enclosed monitor selector/mute/solo assembly that utilized the eight-track monitor position on the presently available monitor matrix assembly (see FIGURE 3). Once again we decided to put the monitor and recorder controls in a common chassis mounted on a Glide Mount assembly. As before, the main work necessary was in the monitor section.

The older Neve consoles are built on a building block concept. The input channels consist of two separate modules—an input module that incorporates the preamplifier, fader, and equalizer in one chassis, and the output assignment module, which consists of an output assignment switch bank and a buffer amplifier. The channel amplifiers are of the modular 1272 type. The monitor circuit (for the multitrack section) consists of, a mixer and a group of relay contacts that select the source desired. In the film environment this translates to a situation whereby the configuration that you desire is achieved by simply reconnecting the wires that constitute the system. Some of the advantages afforded us were based upon the fact that the pan pot was switched in or out of circuit by the original design. Therefore, if the studio was being utilized in the Dolby stereo mode, the pan pot was engaged to pan between any two buses. If the console was being used in the mono mode, the pan pot was simply not engaged, and the first four buses were used as in any mono film console. Bus faders were also provided as part of the original design. In the time that Rupert Neve Ltd. constructed this monument to the custom art, -3 dB pan centers were standard design. Originally, -3 dB pan pots were used so that mono information did not build up in the mono playback mode. Later, high fidelity systems in the home presented a much greater coherency so that mono information played back on a two-channel system proved to add in 4½ to 5 dB increments, which has prompted the adaptation of the 4½ dB pan center norm. The necessary modifications included:

- 1) Removing the 24 track monitor section, and converting it to an auxiliary 24 by 4 mixer with separate sends.
- 2) Removing the 24 track monitor selector position.
- 3) Rewiring the patch bay to accommodate the Dolby DS-4 Network. It was also necessary to provide patch points for the monitor inputs and outputs so that the various monitoring environments could be accommodated.
- 4) Designing and fabrication new monitor and control circuitry for an eight track monitoring environment that would allow mixing in 6-track mag and 8 track 'IMAX' formats, as well as the more conventional Dolby 4 track format. (Mono mixing must also be accommodated.)
- 5) Rewiring the monitor selector relay matrix to accommodate the new monitor assembly.
- 6) Designing and constructing a new mono combine network that would allow for the use of the monitor solo network while allowing for single speaker monitor.
- 7) Rewiring the re-assign network so as to allow re-assignment to buses 1 through 4.
- 8) Modifying the internal intercom facilities so as to interface with our custom monitor system.

With the sub-system modular design of this console we were freed from the constraints of placing our additional circuitry on a pre-existing printed circuit board (as with the MCI 428 discussed earlier).

The additional monitor circuitry is shown in FIGURE 4. The monitor system conversion of existing circuitry consisted of re-routing wire and removing what had become unnecessary functions. With our modifications to the monitor, we constructed an additional sub-rack of amplifiers that embodied the additional circuitry in the forms of a 10-channel VCA group, nine transformer-coupled line drivers for the monitor outputs, and many buffer amplifiers to drive the mono and solo circuitry. We chose to use VCAs for the monitor so as to maintain very close tracking on all eight monitor channels at different attenuator settings. A benefit that was realized by using VCAs was the ability to perform mutes with a single DC line rather than a collection of relays. This benefit was used in the monitor solo system by driving the mutes directly with TTL level logic. We used optoisolators throughout the interface between logic controls and audio circuitry so as to eliminate any ground loops in the system.

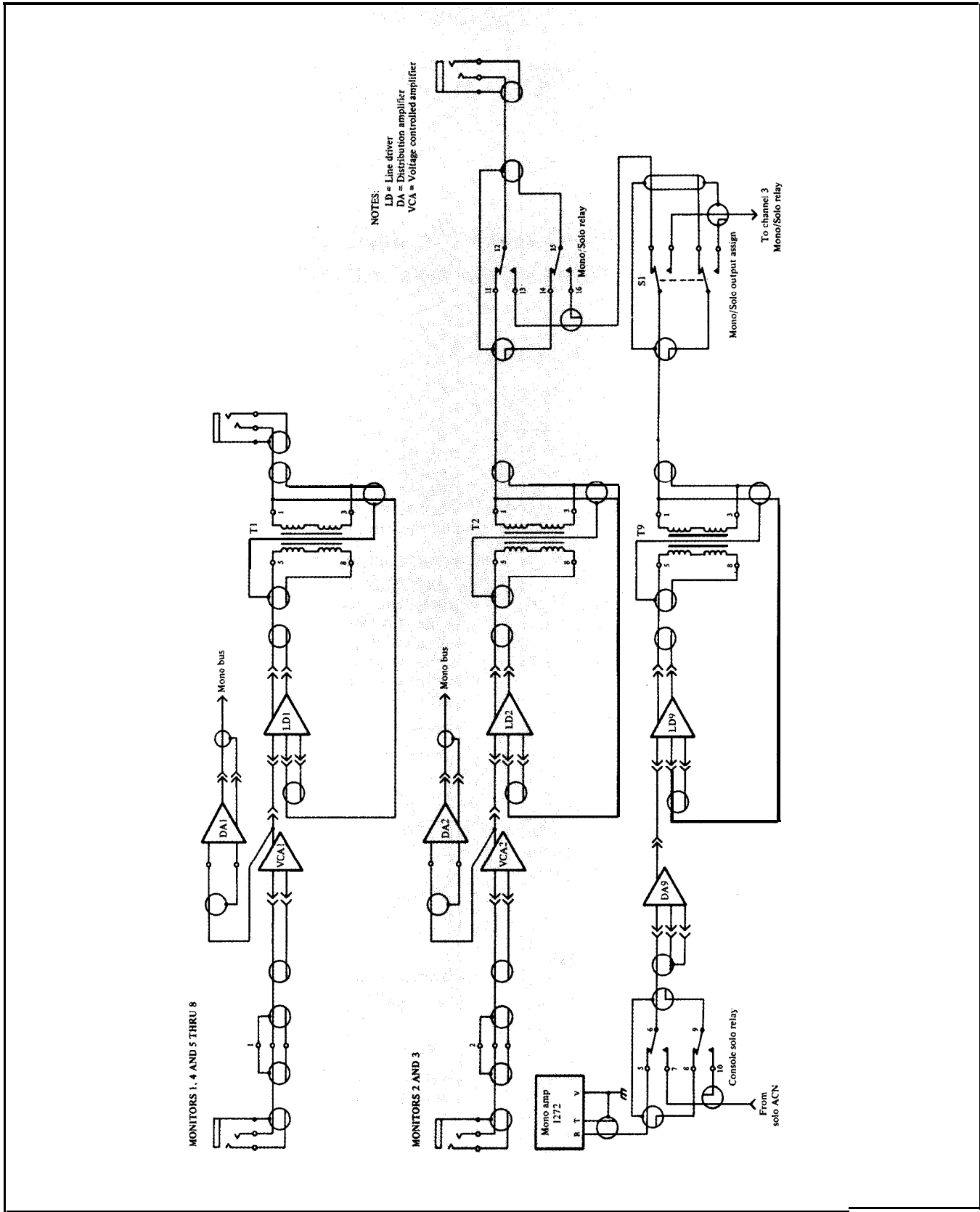


Figure 4. Additional monitor circuitry for the A665.

IN CONCLUSION

It was deemed desirable to maintain the original design concepts as much as possible in the modification procedure. To this end we solicited the assistance of Rupert Neve of England. They provided us with the very able assistance of one of their servicemen, David Close. He proved very helpful in divining the intentions of the original engineer when

reading the drawings that were provided with the console and interpreting them so as to identify the individual wires inside the console. The time scheduled for this project made all of Neve's assistance invaluable. In addition, the author wishes to acknowledge Mel Zelniker, whose assistance in the preparation of this article proved invaluable. ■