Planning a Studio Installation

J. D. COLVIN*

PART II—This is the second of a series covering broadcast studio installations. The methods outlined are also suited to large public-address projects.

As A START toward laying out the console, a list of all the items that are to be mounted either on the panel or in the cabinet should be prepared. The source of this list is the block diagram. Checking off on the block diagram the items already planned to be mounted in the equipment rack leaves those that belong in the console (microphones, loudspeakers and over-the-door on-air lights excepted). All controls, switches, indicating lights and meters should be mounted on the panel while such things as transformers, resistors, non-variable or non-indicating items are to be mounted either behind the panel or somewhere inside the cabinet.

Making the actual panel layout is another job that starts with pencil and erasures on cross-section paper and ends up with "T" square and triangle. The object is to arrange the parts to be mounted on the panel in such a way as to provide the greatest convenience to the operator. An effort should be made to group together those controls that are functionally related. For example, a switch with a pilot light to indicate its operation should be grouped together. A switch in a mike circuit should be located over the attenuator of that circuit, or if for other reasons the switch is located on the announcer's control panel in the studio, a light should be located over the attenuator to indicate when the distant switch is operated and that the attenuator is hot. Until someone conceives of a better arrangement, the panel sketch begins by laying out the variable attenuators for microphones, turntables and nemo inputs across the bottom. The VI meter goes at the top center of the panel. What is left in the way of switches and lights are located functionally in the remaining space.

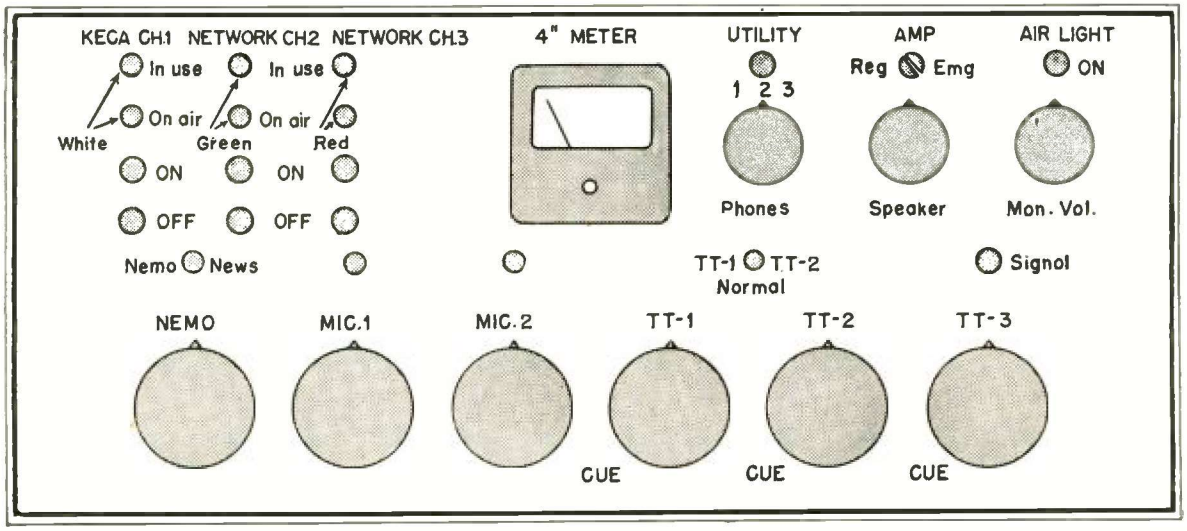
*Audio Facilities Engineer, American Broadcasting Co.

Panel Layout

Figure 1 shows the panel layout that was finally arrived at for the studio being used as an example. The upper left-hand section contains the group of lights and push keys that control the master switching relays. This arrangement is uniform with other control panels of the same station. Indicating lights that show when either *Mic 1* or *Mic 2* are on are located immediately over their respective *mic* faders. The switch described as providing a rapid transfer between *turntable 1* and *2* is located over and between the faders for these turntables. Headphones and monitor speaker selector switches and the monitor speaker volume control are within easy reach but far enough removed from the turntable attenuators so as not to be confusing. Least used are the utility and the regular-emergency amplifier keys and naturally take the spot of lesser operating convenience at the top of the panel. The key for turning on the "on-the-air" sign is also at the top of the panel but more readily found by habit since it is on the extreme right side of the panel.

Console panels should be as low as is possible to make them without undue crowding of parts or excessive sloping. Eight inches is a good height to strive for but very difficult to obtain with a flat panel. Off-set panels as shown in *Fig. 2* are necessary to obtain the minimum of height but are costly to manufacture and require a more expensive cabinet. When operated on a table 28 inches in height, a console panel can be eleven inches high and not make it necessary for the operator to stretch to look into the studio. Most comfortable operation of the faders is had when mounted on a panel that slopes 10 to 15 degrees off the vertical with their center line between 2¾ and 3¼ inches above the table top. This slope of panel

Fig. 1. Panel layout for the studio installation discussed in this article.



also puts the VI meter at an angle of best visibility to the operator. Thus, after having laid out the panel on cross-section paper until a satisfactory arrangement is obtained, the next step is to draw the panel layout accurately and to dimension all the mounting holes. Attention must be given to clearance between each part to make sure there is sufficient room for wiring.

Finish

Finish specified for a panel should be one not having a high gloss to avoid troublesome light reflection. A very high resistance to wear is necessary because of the invariable habit operators have of rubbing the tips of their fingers on the panel while riding gain. An electrolytic finish known as alumilite is probably one of the best from the wear standpoint. It can be had in black, natural aluminum and some pastel shades. This finish can only be applied to an aluminum panel and for best results must be reflector sheet aluminum. Run-of-the-mill aluminum sheets have a tendency to finish streaked. Alumilite finish can be engraved through without any danger of chipping as occurs with most lacquer finishes.

Factors that determine cabinet design are such things as: the panel size and the depth to which equipment mounted on the panel extends toward the rear; other pieces of equipment that are to be mounted on the base of the console as terminal blocks, transformers, etc.; the point at which interconnecting cables between the console and other equipment enter the console; sufficient space to clear apparatus mounted near the top of the panel when the panel is swung outward on its hinge. Cabinets must also be designed for appearance as well as function. A well-appearing studio installation always creates a good impression on a client.

For normal servicing of the equipment on the panel, particularly the faders, the panel should be arranged on a hinge out from the top of the cabinet. For installation of the console it is desirable to have access to the terminal blocks through the rear of the cabinet, or better still have the entire cabinet top removable. The base of the cabinet with terminal blocks and panel attached remain fastened to the table.

Preliminary preparation of the conduit layout was listed as the next step in planning a studio layout on the basis of probability. In the author's experience, by the time the equipment layouts have been completed and before running sheets and interconnecting diagrams can be started, actual construction work on the studio plant is under way. And, since the contractor will start to pour concrete for the control room floor the day after tomorrow, the electrician has to have a conduit layout by yesterday! Since it has happened so frequently in the past it is probable that it will happen again in the future and the only solution is to whip out a preliminary conduit layout.

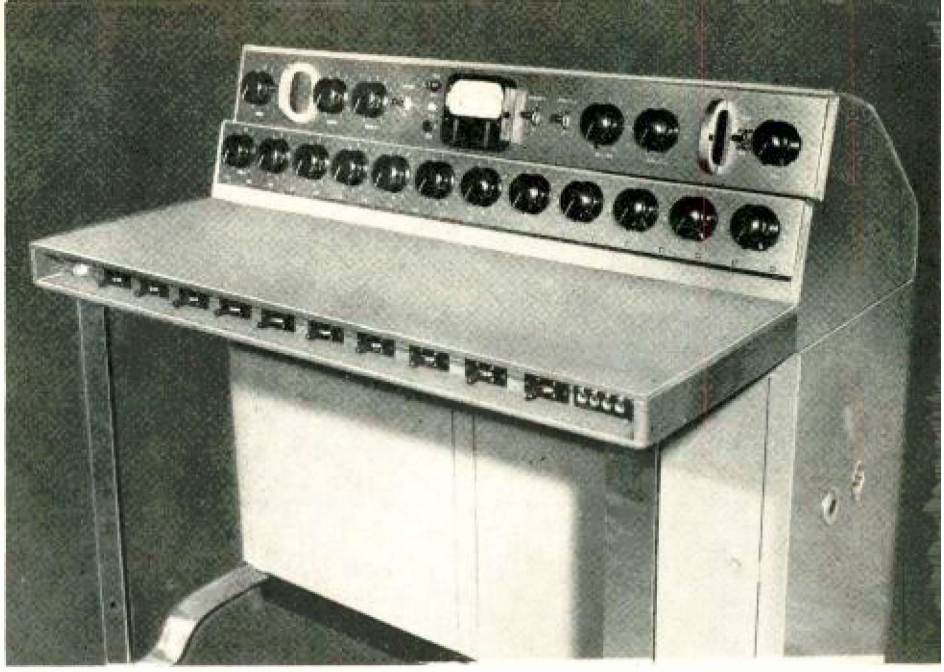


Fig 2. Typical console with off-set panel designed for most convenient operation

Conduit Layout

To start the layout, a plan view drawing of the studio and control room is necessary. On this are drawn, in the proper locations and dimensions, plan views of the equipment rack and console. With the block diagram as a source of requirements, appropriate indications are marked on the plan view drawing where each microphone and turntable receptacle box is to be located. Turntables require a-c power for their operation so it is necessary to indicate a-c outlets convenient to their location. Outlets for loudspeaker and over-the-door on-air light signs must be accounted for and indicated. When all such equipment terminations are accounted for that are shown on the block diagram one is quite safe to assume that nothing has been overlooked.

Conduits, metal duct or troughs in the floor must now be decided upon as a means of carrying the inter-connecting wiring between all terminal points that are indicated on the plan view. The use of conduits and troughs in the floor should be considered only on new installations when they can be located as required. Metal ducts running along base boards are useful in those cases where additions to existing equipment are being made and it is either impossible or impractical to make conduit runs in the floor. Troughs are most useful where there are a great many wires running between two points as is usually the case between a rack and console. Its use makes easy the running of the many pairs and the segregation of these into cables of safe level difference. Troughs also provide a convenient terminating point for individual conduit runs which might otherwise have to be much longer and make extra bends if run direct to their final termination point. The rack end of a trough can run directly underneath the rack thereby providing an easy means of running the cables up to the terminal blocks. At the console end the trough usually ends underneath a wall type cabinet mounted at floor level. The box provides a means of anchoring flexible conduit running up to the console and to bring cable from the trough to the console terminal blocks. The main use of conduits is for runs of but one or a few pairs of wires to isolated points such as mike receptacle, speaker outlets, the main program line to master control etc. Conduits are best suited where runs must be made through walls or from one floor to another.

Circuit Levels

A very definite rule must be observed as to the separation of cables into circuit level groups when run in conduits and troughs. Wire pairs having a level difference of more than 30 db should not to be run in the same circuit or cabled together in a trough. Failure to observe this precaution is likely to cause cross-talk between circuits of greater differences. A level group classification found useful in broadcast installations are *Low, Medium, Zero, Control* and *Power. Low* is for circuits from —60 to —30 VU, medium, from —30 to 0 VU. Zero from 0 to +30 VU and High covers any value above +30 VU. *Control* is composed of battery, relay and light circuits. *Power*, as its name im-

[*Continued on page* 41]

Planning a Studio

[*from page 31*]

plies, covers 115 volt a.c. Observance of these level groups determines in many cases how many conduits must be run from between any two points or how many separate cable groups must be made in a trough. An example would be a mike receptacle mounted in the base board and a monitor speaker outlet on the wall immediately above. It would be necessary to run two separate conduits from the rack to the location due to the level difference between the two circuits. Cables grouped into the above classification should be separated by at least three inches when run in troughs. Compromises can sometimes be made in short runs, such as running control circuits with high-level circuits.

Having all equipment indicated on the plan layout of the studio and control room, the actual location and position of troughs and conduits are drawn. Assuming a trough is to be used between the rack and the console this should be drawn first. Conduits are then drawn from all terminal points to the position of their connection. For example, according to the block diagram, the microphones connect first to a jack which is located in the rack. Thus the conduit or conduits running from mike outlets must go first to the rack. If the shortest length of conduit can be had by running direct to the opening under the rack, it should be shown that way. If the shortest path is to run the conduit to some point along the trough, this would be the logical point for it to terminate. The mike cable can then finish its run to the rack in the trough. A neater job of fanning out the wires to the rack terminal blocks can be done if all the pairs come out of the trough, rather than a number of conduits converging from various directions.

Checking off the circuits on the block diagram as each conduit is drawn will assure that none will be overlooked. If any doubt exists as to whether or not a conduit is needed, always put it in. In cases where there are three or more conduits between two points it is always good insurance to run a spare.

With all the conduits required shown on the layout it become necessary to determine what the trough dimensions should be and the size of each conduit. Since the trough will carry all circuit levels except power, there will be five cables in all. Separating these cables by three inches will require a total trough width of approximately 18 inches. The depth of the trough need not be more than three inches although it can be more if a greater depth fits in better with the floor construction. The following table gives a conservative number of pairs that may be pulled through various sizes of conduit.

Type of Wire	Number of Conductors per Conduit				
	½	¾	1	1½	2
Rubber Covered Mic Cable	1	2	3	6	9
Twisted Pair Shielded	2	4	8	15	30

Each conduit on the layout should now be numbered and a table made up that consists of the conduit number, its size, the number of pairs of wire and the kind of wire. To determine the size of the conduits a careful estimate of the number of pairs to be run in each will have to be made. A fairly accurate count of audio pairs can be made by using the block diagram as a guide. It is helpful to mark each circuit indicated on the block with the conduit number through which it is to run. Control circuits are more difficult to estimate at this time unless a complete wiring schematic of the relay interlock and lights has been made. If there is any doubt always assume on the greater side. From the number of pairs the size of conduit can be selected from the table given previously. The exact number of pairs to be run in each conduit or trough will have to be determined after the cross connection sheets are made. When these sheets are compiled the number of pairs to be pulled in each conduit can be added to the table. As to the kind of wire, all microphone leads should carry a rubber insulation over the shield. Audio and control circuits are wired with twisted pair shielded. 18 or 20 ga. conductors are sufficiently large. Power circuits should conform to the local electrical code.

[*To be concluded*]