

A new color coding and wiring scheme will make it easier for a craftsman to determine what kinds of equipment (telephones, PBX's, key, etc.) are interconnected and where they are terminated when he enters the equipment closet on a customer's premises.

Connective System For Customer Premises

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THE DEGREE OF COMPLEXITY in connecting telephone facilities within large buildings, such as office buildings or apartments, depends on the number of telephones, the variety of services, and the nature of the building. Connecting one phone in a single-family residence is simple compared to the work involved in connecting facilities in a skyscraper for thousands of phones and various kinds of complex services.

According to a Bell System survey conducted in 1968, techniques for connecting key telephones and private branch exchanges (PBX's) in large office buildings required new approaches. Congestion and confusion often prevailed at locations where cables and equipment were interconnected. Much of the confusion resulted from the great numbers of key telephone systems in use; a six-button key telephone set, for example, uses cables with 25 pairs of wires, and a 30-button call director uses as many as 100 pairs. By contrast, only one pair is generally needed for residential telephone service. In effect, the variety of cabling, wires, and connections had outstripped the hardware and methods of installation devised to supply the service.

Wiring becomes cluttered (see figure on page 218), when a large number of cables enter the

connecting field randomly with only a small number of the pairs in each cable actually connected. Most of the pairs are tied into bundles and draped on the side for possible use in the future. Good housekeeping is very difficult. Craftsmen are hindered while making wiring additions, changes, or repairs. And a maze of wiring adds to the difficulty of tracing any particular wire or cable for more than a few inches at a time.

Moreover, the task of interconnecting complex systems is time-consuming because craftsmen shift back and forth between several locations in an area. For example, to add key features to an ordinary PBX line, some of the changes must be made on the connecting blocks in one room while others, to complete the job, are made in the PBX cabinet.

After studying the problem, Bell Laboratories people devised a system that simplifies the whole wiring arrangement. One principal feature is a color-coding scheme (the colors are depicted in the design on the front cover) that, if consistently applied at every installation, will produce uniform connective systems. Thus, a craftsman called to install equipment on a customer's premises can more easily identify the kinds of equipment that are interconnected by the wiring facility and the

locations of their terminations.

The new approach uses a series of connecting blocks mounted on color-coded backboards. The backboards, based on a 17-by-20 inch modular size, accommodate five basic items of equipment that must be interconnected. (The colors incidentally, are pastel shades because bright colors lose their identity more readily in subdued light.) The five items and their corresponding colors are:

- Lines toward the central office—green
- Lines toward customer telephone sets—blue
- Terminations to PBX equipment—purple
- Terminations to key equipment—red
- Terminations to special (other than PBX and key) equipment—yellow

Facilities requiring shielded pairs or coaxial cables are excluded from the system.

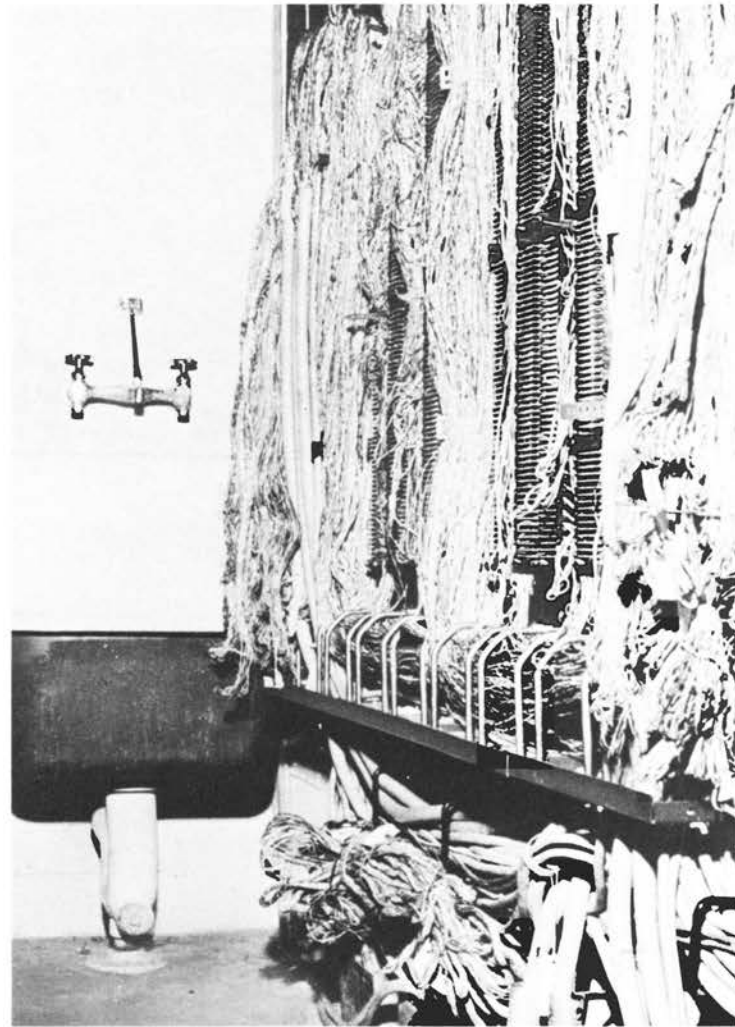
The modular arrangement of the backboards helps in keeping facilities neat and orderly. The compact layout of the terminals conserves wall space and shortens the length of interconnecting wires. Since every cable pair is terminated, which initially may mean some extra work for the craftsman, unused wires cannot accumulate, thus eliminating clutter and causing less difficulty for the craftsman over the long run.

The plan also outlines an organization of locations where connective arrangements can occur. These locations are terminal rooms, apparatus closets, equipment rooms, and satellites.

A terminal room, usually in a basement, receives the entrance cable from the central office. In large buildings several thousand pairs of wires from the central office may be terminated and interconnected to thousands of other pairs that spread to other locations throughout the building.

Apparatus closets are locations which terminate cables containing the input and output pairs associated with small manual PBX's, key equipment, and special equipment. When switching systems are involved, these locations are called equipment rooms. Satellite locations receive inputs from terminal rooms, apparatus closets, equipment rooms, and other satellites.

Several kinds of backboards were initially designed for apparatus closets and satellite locations associated with key equipment. One kind of backboard, furnished in either green or blue, is equipped with brackets on which connecting blocks, specially designed for the purpose, snap into place. The brackets form a tunnel through which the cables are passed, and enable the cable paths to be completely separated from the cross-



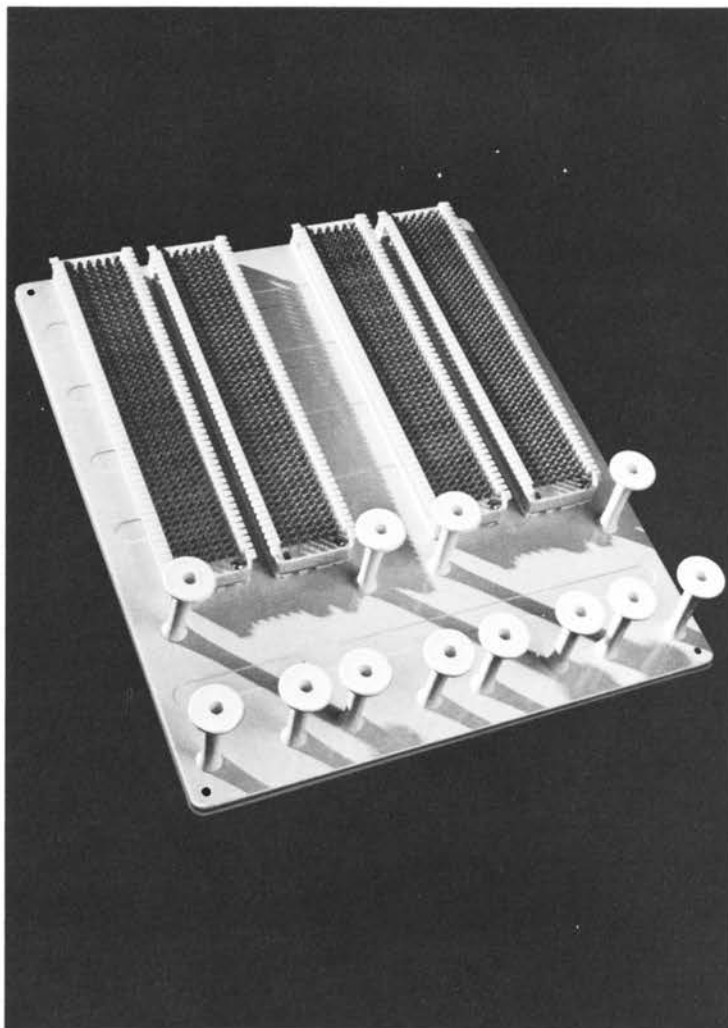
connecting wire paths. Open slots on the sides of the brackets are intended to ease the installation of cables for the craftsman. After the cabling has been installed, the connecting blocks are mounted on the brackets.

The connecting blocks are 10 inches long and approximately 2½ inches wide. Each block contains an array of quick-clip connectors (see *Quick-Connect Clip Terminal*, RECORD, June 1962) which allow each one of the 100 wires to be terminated and cross-connected to one other point.

The blue 17-inch by 20-inch backboard handles up to sixteen cables of 25 pairs each that may run to sixteen six-button key telephone sets. The green backboard terminates up to 400 pairs from the



Installing equipment on a customer's premises where the wiring looks like this (left) can be a difficult job. Much of the difficulty will be eliminated, however, using connecting blocks mounted on backboards (right) to simplify installing and wiring equipment. The pegs on the backboard guide the interconnecting wires. The wiring facility then should look as neat as the arrangement shown above. Here, John Roio of New Jersey Bell wires a terminal incorporating the new standardized wiring arrangement in an office building in downtown Newark. This particular location contains 170 key telephones and 40 call directors.



central office. A smaller one ($8\frac{1}{2} \times 20$ inches), also color-coded green, can be installed in apparatus closets served by 200 or fewer central office pairs. Similarly, a small blue backboard handles situations where a full-sized board will not fit.

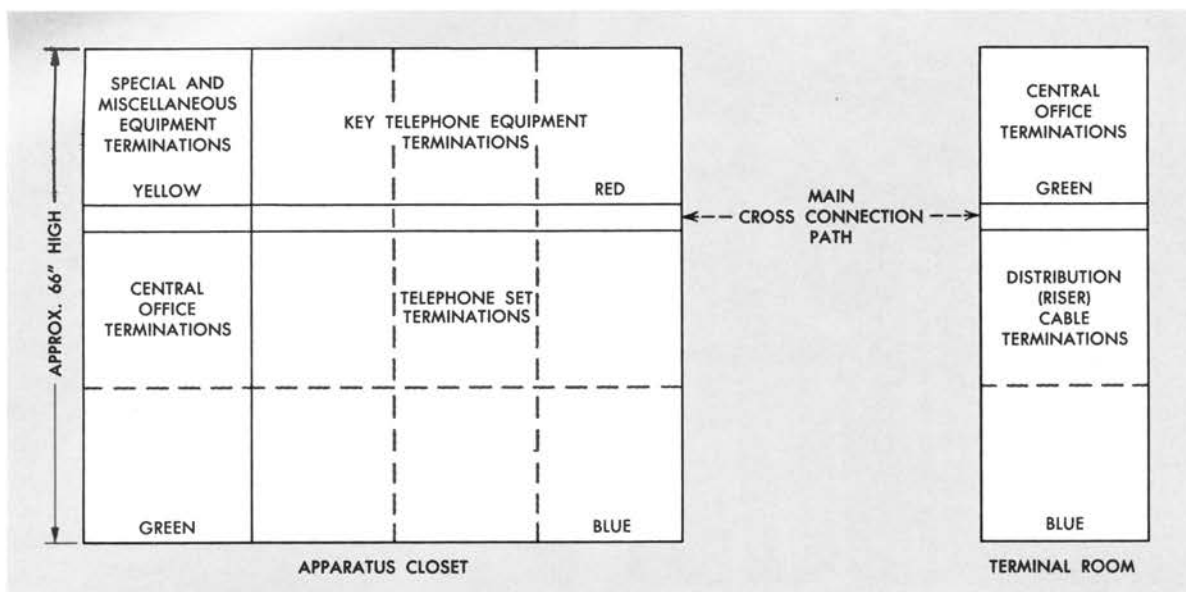
Another kind of backboard is red. It is used to terminate cables from key equipment, and its four connecting blocks supply five other points of connection for each cable wire terminated. The blocks can accommodate the input and output connections for up to twenty key telephone line circuits.

Recently, three more backboards have been developed to add more flexibility to wiring arrangements. They are exactly like the original green and blue ones, except they are colored purple,

yellow, and red. And another type of connecting block has been added for use with the new red backboards. They are used with telephone lines that serve three or fewer key telephone sets.

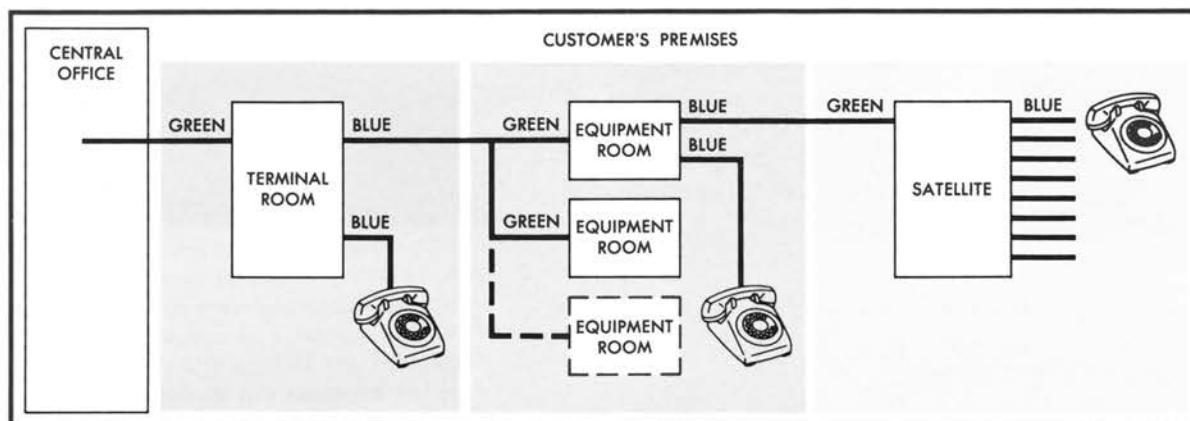
One of the outstanding features of the connecting arrangements is the modular building-block nature of the backboards. The concept simplifies the planning, layout, and installation of almost every job. It also permits more efficient use of wall and rack space and allows more orderly growth.

Standard layouts of the color-coded backboards have been devised for all combinations of key, switching, and special equipment for any arrangement of the customer's premises. The layouts are based on the length of the jumper wires required



The schematic diagram shows the recommended physical layout of the standardized modular backboards for an apparatus closet and a terminal room. The strip dividing the upper and lower sec-

tions represents the horizontal run provided for the interconnecting wires. The total size of the connective wiring system and the relative size of the differently colored sections can vary widely.



The wiring arrangement between locations on a customer's premises is simplified by a color-coding scheme, which typically looks like the one shown

above. The same wiring arrangement applies to apparatus closets in place of equipment rooms when key equipment and small PBX's are installed.

for cross-connections. The intent is to keep their length to a minimum, to avoid a large concentration of wires at any one point in the run, and to be able to trace jumper wires easily.

In a typical terminal room wiring arrangement, incoming cables from the central office approach and fan out at the top of a green field. All other cables leave from the bottom of a blue field (see the lower figure on this page). Some of these

wires may run vertically to other floors via riser cables, whereas others may run to remote locations on the same floor.

As an example of a wiring arrangement, three green and six blue modules can accommodate 1200 incoming pairs (green) and 2400 outgoing pairs (blue) in only 51 inches of horizontal width on a wall. This 2-to-1 ratio of in-to-out wire pairs occurs frequently. Other ratios can be obtained by



The cabinet, which houses the key telephone circuit equipment for the Newark, N. J., office building, is located in the same room as the wiring facility with the circuit terminals.

changing the size of either the green or blue field.

The plan for apparatus closets with key equipment requires a similar arrangement using the red field. The number of inward pairs terminated seldom exceeds 200 for an apparatus closet. This includes some spares. In apparatus closets, cables from small manual PBX's, key equipment, and special equipment approach the appropriate modules from the top. Cables to the blue and green modules

approach from the bottom.

Generally, the doctrine described here has met with excellent acceptance in the field. The simplicity of the standardized arrangement appeals to the craftsman and permits him to be immediately familiar with the facilities involved at each location. Facilities in office and apartment buildings throughout the country are being wired with these new techniques.