



A Modern Crossbar PBX

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Special Systems Engineering I

Private Branch Exchange (PBX) customers differ widely in their telephone requirements — some have only a few extensions and others have thousands of extensions in hotels, department stores, and large industrial establishments. Most businesses, however, require less than sixty extensions, and demand has been increasing for a modern dial PBX system to serve such customers. The new 756A PBX is a small “packaged” design that matches the decor of modern offices. In addition to the conventional PBX services, the 756A provides a “camp-on” feature to permit automatic connection when a line becomes free.

To most people, a PBX is a telephone switchboard, frequently located in or near the reception room of a business establishment and used for servicing calls over the company's telephone extensions. In a dial PBX, however, the switchboard is only one part of the total equipment; much of the work of interconnecting telephones is done automatically by electromechanical switches. The switchboard in a dial installation might thus be considered as a sort of “control panel,” with the relays, switches, and other equipment out of sight.

In small manual PBX systems, much or even all of the “behind-the-scenes” equipment can be mounted within the switchboard itself. On the other hand, even a small dial system requires switching equipment and power equipment mounted in additional cabinets. As a consequence, the installation of present-day systems occasionally offers difficulties because a particular building may have narrow doors, too small an elevator, or insufficient floor bracing. These problems have been solved by the new 756A crossbar dial PBX developed at the Laboratories.

Many telephone customers requiring dial PBX service have between 20 and 60 extension lines and

10 or fewer central-office trunks, and the most economical arrangement for serving this field is to provide only one or two “packaged” systems. The 756A is a small packaged design supplied in capacities of either 40 or 60 lines and equipped for 6 central-office trunks. Four additional central-office trunks can be added as desired. The basic switching components are crossbar switches and wire-spring relays. The 756A is also the first equipment to use the recently-developed “2-in-1” wire-spring relay that provides two relays in the space normally required for one.

Physically, the entire PBX is housed in two modular cabinets of steel and aluminum (Figure 1). The depth and height are similar to those of standard office filing cabinets, and all maintenance is done from the front. Each module contains three small relay racks arranged so that they can be pulled forward out of the module like vertical file drawers. Each rack mounts on ball-bearing telescoping slides. Interlocking latches prevent more than one rack being pulled out at a time and, since each weighs about the same, the combined weight of the other two racks is sufficient to keep the cabinet steady. For this reason there is no

need for floor bolts when installing this system.

The PBX cabinets are designed for mounting in regular office space, along with file cabinets or other office furniture. Since an extended rack projects no further than a standard file drawer, the aisles do not need to be widened. The cabinets are of modern styling, finished in a shade of beige-gray that has become popular in office furniture. Sound-absorbing material reduces the noise of the switching equipment. The PBX is connected to the office wiring by plugs and pre-arranged jacks.

A total of three equipment modules are provided, from which the twin-module 40-line or 60-line 756A may be constructed. One module is common to both 40 and 60 lines, and the second contains additional equipment for either the 40-line or the 60-line system. A new modern attendant's console, shown in the illustration at the head of this article, has sufficient capacity to handle all ordinary calls requiring the assistance of an attendant. This console features push-button keys and simplified operation. Since it is assumed that the attendant will have other duties as a secretary or receptionist, the console is small enough for table- or desk-top mounting.

Smaller systems may use a six-button telephone set instead of the console. With some installations a switchboard may be more desirable than either the console or the six-button set. In such cases the

60-line system can be used with a switchboard.

The power supply is completely self-contained, and is mounted in the first or basic module. Commercial 115-volt, 60-cycle ac is stepped down in voltage, rectified, and filtered to produce 48 volts dc for use in the PBX. The filter contains a large capacitor that stores sufficient electrical energy to maintain the voltage during momentary interruptions of the commercial supply. Where interruptions are apt to be of appreciable length, an additional modular cabinet can be supplied. This cabinet contains storage batteries as a reserve power source, and a rectifier keeps the batteries charged. Ringing current, signaling tones, and flashing interruptions are generated by equipment in the power-supply unit regularly furnished.

While most present-day dial PBX's use step-by-step switches, the 756A achieves small size and faster operation by using crossbar switches and common-control principles. It operates essentially as a small crossbar office; register circuits connect to calling lines and trunks to supply dial tone and receive called numbers. The called numbers are passed to a marker which determines the busy and idle state of called points, performs an idle-hunting function for grouped lines and trunks, and controls the establishment of talking connections. The crossbar switches establish all connections.

Although only one marker is supplied, it actually contains two independent marker channels, used alternately on successive calls. Should trouble be encountered, the marker "times out" and makes a second trial using the other channel. The two registers are also used alternately unless one is busy. Busy tone is normally supplied by a busy-tone trunk but, should this trunk itself be busy, the marker operates a relay in the appropriate register, and the register supplies busy tone. Troubles are indicated by lamp displays.

All conventional PBX services are available with the 756A. Calls to extensions are placed by dialing two digits; with two to seven as the number in the initial digit. Calls requiring the attendant are placed by dialing zero. Dialing an initial 9 causes connection to an idle central-office trunk and the calling station line receives a second dial tone from the central office. Where certain extensions are restricted from direct outside dialing, users must dial 0 for the attendant and ask her to get the number. If they dial 9, they will be intercepted and transferred to the attendant. Also, certain extensions, while not restricted from dialing local outside calls, will also be intercepted if used to dial

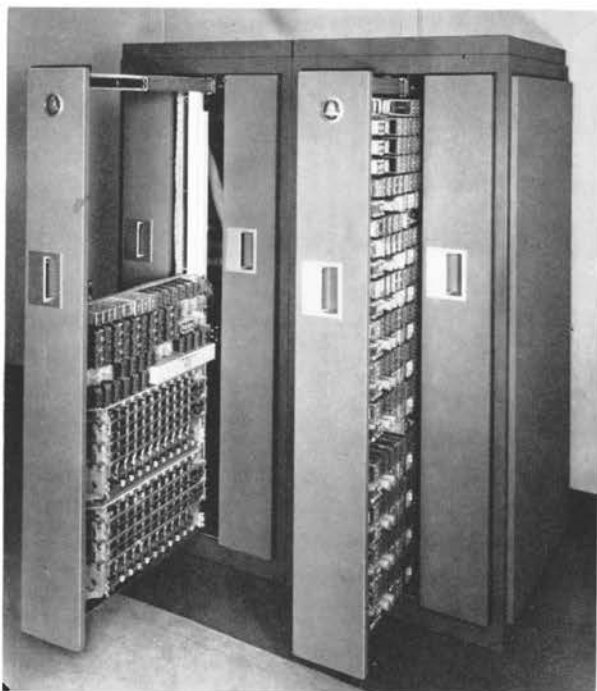


Fig. 1 — The 756A crossbar PBX dial equipment.

the code reserved for long-distance telephone calls.

Inward calls from a central office first cause the attendant to be signaled. She answers a trunk by its key appearance on the console and asks for the desired called party. She then operates a key to summon a register which furnishes dial tone, and then either keys or dials the desired extension number into the PBX equipment. The trunk is connected to the desired station which receives ringing current, and subsequent talking battery from the central office. The attendant may split the connection when desired until after conversation with the called party begins. After the attendant releases her keys, she may be recalled by the called party operating his switch-hook momentarily. Disconnects take place automatically without involving the attendant.

A "camp-on" feature has been included in the 756A for inward calls from a central office. If the called station is busy, the attendant is so notified and can advise the calling party that he may wait if he wishes. After the attendant releases from the call, the trunk will "camp-on" until the line is free. As soon as the first call disconnects, the trunk is automatically cut through to the called line and applies ringing current. No further assistance is required from the attendant. This feature reduces waiting time for inward calls to busy lines and frees the attendant for other duties.

The central office provides talking current for both inward and outward calls, and also provides current to ring the PBX attendant on inward calls. For intra-PBX calls — those between two extensions — ringing and talking current are supplied by the PBX. An additional circuit, called an "intercom"

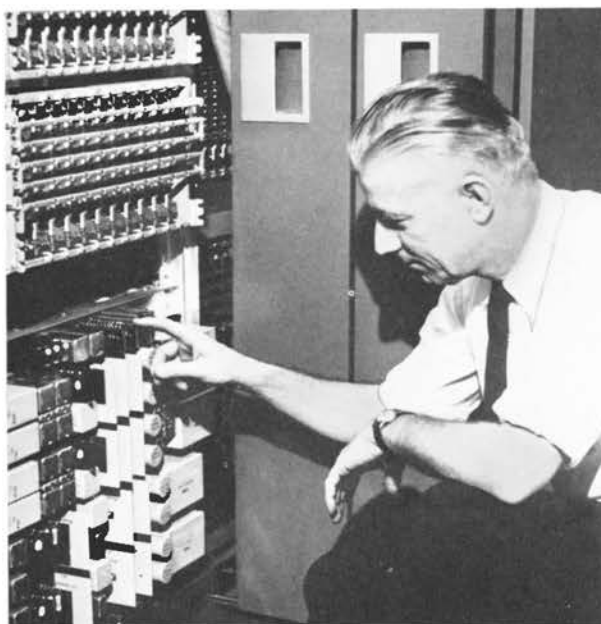


Fig. 2 — The 756A PBX circuitry being inspected at the Cleveland, Ohio, trial installation.

trunk, or junctor, is brought in on this type of call to supply the necessary currents and signals. Outward trunks to other PBX's are reached by dialing 8, and calls over these trunks are handled in the same manner as outgoing calls.

This new PBX, modern in design and appearance, should fill the telephone needs of today's smaller businesses. The ease of installation and maintenance, the adaptability of its size and modular construction to the requirements of modern offices, and the new features offered should make the 756A system attractive both to customers and to the Operating Telephone Companies.

THE AUTHOR



O. H. WILLIFORD, whose home town is Greenwood, Miss., joined the Laboratories in 1920 and initially engaged in laboratory and field testing of step-by-step, panel, manual and No. 1 crossbar systems. During World War II, he was associated with various military projects, and at the close of the war he became concerned with the development of the No. 5 crossbar system, particularly in the design of the maintenance facilities. He was an active member of the group representing the Laboratories during the installation and cutover of the first No. 5 system in Media, Pa. Transferring to the Systems Engineering Department, he prepared engineering information on the No. 5 system for the use of Operating Company engineers in planning central offices. He was active in the Englewood DDD trial and thereafter in engineering studies related to the expansion of the customer dialing network. He is now in charge of a Special Systems Engineering group studying requirements for new PBX features and systems.