



Small system. The Com Key 718 system has 7 lines and 18 phones. At the right is the optional direct-station-selection console with station-busy indication.



Medium-size system. The larger Com Key 1434 system has additional buttons for up to 14 lines, as well as 34 direct-station-selection codes.



COM KEY* telephone systems— flexibility for small, growing businesses

The Com-Key 718, 1434, and 2152 key-telephone systems meet today's business-communications needs and can be expanded easily for tomorrow's.

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ALMOST FIVE DECADES AGO, the Bell System developed the first key telephone service so that customers could receive and hold several calls simultaneously. Today, key-telephone systems function as communications centers for millions of businesses.

In the late 1920s there were no key-telephone *systems*, so telephone companies supplied key-telephone *service* by designing stations, relays, and wiring plans for each customer. Some of these plans were later standardized, but they lacked flexibility, making installations and changes difficult and expensive. In 1938 Bell Labs developed the first standard key-telephone system—the 1A—using building blocks called key-telephone units. These are individual relay-circuit assemblies for such functions as holding calls, and supplying visual and audible signals. The installer assembled each 1A system on-site, using a different key-telephone unit for each function.

As the communications needs of growing businesses became more sophisticated, the 1A1 and 1A2 key-telephone systems were developed and introduced in 1952 and 1964

respectively. The 1A2 key-telephone system, which still provides most of the key-telephone service to business customers today, has become larger, more complex, and increasingly versatile. However, it has become increasingly expensive to add features and expand the capacity of larger key systems (with over four lines) in the field because of rising costs.

To hold down costs, Bell Labs engineers in 1972 began developing a low-priced, factory-wired and tested key-telephone system that could be installed and maintained with less effort than previous systems.

The Com Key* 718 system

The Com Key 718 system, which made its debut in 1973, can handle up to 7 incoming lines and 18 stations. (For businesses needing only up to 4 lines and 16 stations, the Com Key 416 system was introduced in 1975.)

Optional features for the Com Key 718 can be added with plug-in modules, thus eliminating the need for wiring changes. The Com Key 718 system and its descendants consist of one or more attendant consoles, wall or desk telephones, wall-mounted paging speakers, and cabinets containing control equipment.

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Big system. This large Com Key 2152 system is equipped with a 21-line attendant console at the left, and a direct-

station-selection/message-waiting console at the right. The attendant may use either a headset or a handset.

Each telephone of the Com Key 718 system (see left photo, page 78) uses a 25-pair cord; has ten buttons for incoming lines, intercom lines, and hold; and is available with a TOUCH-TONE® or rotary dial. To simplify system installation and growth, each incoming line appears in the same button position on all 18 phones. This makes life easier for craftspeople because complicated cross connections for custom installations are unnecessary, and conventional color-coded wiring patterns can be followed during the system's installation.

The attendant's telephone can be augmented by two optional consoles. With a message-waiting console, the attendant just pushes a button and the selected station's hold lamp lights, signifying there's a message to be picked up at the front desk. With the direct-station-selection console, the attendant pushes a button, assigned to a specific station, then tells someone there's a call. The attendant's voice will be preceded by a short burst of tone.

The Com Key 718 system's standard features include:

- *Voice signaling*—allows the attendant to speak to someone via the system's intercom without the called party having to pick up the handset.

- *Tone signaling*—supplies two different tones to identify outside or inside calls.
- *Automatic button restoration*—restores buttons on a telephone when the handset is hung up, preventing accidental break-in on a conversation if the handset is lifted again.
- *Intercom*—provides two independent paths, each selected by its own button, to all stations.

The system's optional features include:

- *Music on hold*—furnishes music (supplied by the customer) to waiting callers put on hold.
- *Paging*—lets the attendant page, via the handset and wall speakers, persons away from their desks.
- *Privacy*—prevents persons from listening in on a conversation from another phone.
- *Privacy release*—permits a person talking on one phone to allow someone at another phone to join in on a call.
- *Power-failure transfer*—maintains basic but limited service during a commercial power failure. Incoming lines are connected to conventional ringers, outside the phones, because the phones' internal speakers will not sound without commercial power.

These standard and optional features, plus the added conveniences of the direct station-selection and message-waiting consoles, have been able to satisfy practically all the communications requirements of small businesses.

The Com Key 1434 system

For larger businesses needing more lines the Com Key 1434 system was introduced in 1974. A bigger version of the Com Key 718 system, the 1434 uses 14-line telephone sets with 50-pair cords. (Recently, another version of the 1434 system was introduced; it uses 7-line, 25-pair-cord sets. This version is being marketed as the Com Key 734 system.) The 1434 handles up to 14 incoming lines and 34 stations (see illustration, page 78), and has three intercom paths—one more than the Com Key 718 system.

Both the Com Key 718 and 1434 systems stimulated customers to ask for even more features. Since the systems had little available internal space they couldn't be modified or expanded.

The Com Key 2152 system

Responding to the demand for more new key-telephone features, Bell Labs developed another generation of packaged key-telephone systems, the Com Key 2152 (see photo, opposite page). This system also can grow right along with the customer, handling up to 21 lines, 52 stations, and three intercom paths. The Com Key 2152 system has all the features of both its predecessors and an even greater variety of optional features that include:

- *Hands-free answer-on-intercom*—allows a person to answer intercom calls without pushing buttons. The person just talks into a microphone unit.
- *Do-not-disturb*—permits a person to turn off the phone's speaker (when the hands-free-answer-on-intercom feature is included). The caller hears a do-not-disturb tone and the attendant sees a flashing lamp on the direct-station-selection console.
- *Multipurpose buttons*—permits calls on lines, automatic-signaling intercoms, or a third intercom path to be answered on a group of phones within the system.
- *Automatic-signaling intercom*—furnishes an automatic intercom path at the push of a multipurpose button; for example, between boss and secretary. When either person lifts the handset and presses the automatic-signaling intercom button, the other person is sig-

naled automatically with a tone—or the caller's voice.

- *Dedicated-path direct-station-selection console*—provides an intercom path, available only to the attendant, to each phone. The attendants can't be blocked from making a call to a station.

The 2152 system is a blend of the early key-telephone systems, such as the 1A, 1A1, and 1A2, which could supply almost any number and variety of custom-installed features, and the prepackaged Com Key 718 and 1434 systems which have a fixed number of features and fixed capacities. Yet with all its versatility and growth potential, the Com Key 2152 system requires only slightly more work to install than the 718 and the 1434 systems. The Com Key 2152 system has greater flexibility than the 718 and 1434 systems because it incorporates additional and newly designed plug-in modules. And it uses new connector-equipped, modular key-telephone panels (in which the modules are installed), connecting units and power supplies. Flexibility is further enhanced because two multipurpose buttons on the system's phones can be used for several functions. For example, the buttons could be used for incoming lines, an automatic-signaling intercom, or for a button-per-path intercom—with the ability to set up conference calls.

The telephones

For telephones to be used with the Com Key 718 and 1434 systems, Bell Labs engineers found that with reasonable modifications, 10- and 20-button telephones of existing key-telephone systems could do the job nicely. (These phones also are used with the Com Key 2152 system.) The sets' buttons can be used for many functions, the circuitry is adaptable to a wide range of feature options, and the styling is modern. Because they used modified existing telephones, the Com Key systems could be made available sooner and capital expenditures would be minimized. The modifications required to add new features entailed making several electrical and mechanical changes.

A major modification was for the multiline conferencing feature. This lets the user set up conference calls on several lines by pushing two or more buttons which connect the lines in the telephone. To make the feature possible, the phones' interlock mechanisms (which normally prevent two buttons from being

depressed at the same time) were modified, allowing several buttons to be pressed at once.

So that this means of conferencing would not cause lines to remain connected after the handset was replaced, a connection was made between the handset's line-switch actuator and all line buttons. Now, when the handset is replaced, all depressed line buttons are restored, breaking the conference connection and preventing interference between calls at all phones. Automatic button restoration eliminates inadvertent interruptions of calls in progress.

So the customer can recall the attendant or access custom-calling features, a special button was dedicated to recall. The button was needed because flashing the switchhook would cause line buttons to pop up and disconnect the lines. Pressing the recall button momentarily interrupts the line current without restoring the buttons. To let the user preselect a line—by pushing a button—before picking up the handset, further modifications were made to the mechanical linkage between the handset and line buttons.

Mechanical interaction among all automatic button restoration components was carefully adjusted. This was necessary to take into account wide operating tolerances of lightweight handsets as well as rough handling—which could cause a line to be released inadvertently.

Voice and tone signaling as well as paging features made it necessary to remove the phone's bell and add a small loudspeaker, an amplifier and volume control. And acoustic "tune up" was needed to get good sound from a bottom-facing speaker in a tiny enclosure.

Two other Com Key system features are privacy and night transfer (which allows the attendant to switch after-hours calls to any telephone on the premises).

The parts needed for the privacy feature, an electronic assembly and privacy-release switch, are built into some phones, and can be added easily to unequipped sets in the field. The night-transfer feature was made available using an existing button in most sets, but in some minimum-feature phones, an installer adds the button with a kit of parts.

All telephones were modified to accommodate standard adjuncts, such as a speaker-phone, headset adapters, and the recently developed transmitter adjunct needed for the hands-free-answer-on-intercom feature. These required new mounting cords, terminal

boards, provision for parts installation, factory testing, and field servicing.

Outwardly the phones still resembled 10- and 20-button phones, but with a difference. Customers were given a greater choice of colors to blend with office decor. This was done with ivory-colored housings, handsets, and cords, and a choice of nine snap-in faceplates in decorator colors or wood-grain finishes. The faceplates, which are made by laminating a textured vinyl sheet to a steel backing, are durable and inexpensive. Decals for dial markings and other lettering are applied with a hot-transfer process. This gives customers more color choices and saves money because now Operating Companies need only maintain inventories of faceplates, not complete phones. Replacement plastic parts are all the same neutral color.

The Com Key 2152 system's added flexibility makes it possible for a customer to have a telephone with only intercom lines and no central-office lines. As the demand for such a set was expected to be low, a standard six-button phone was modified for cost control.

Key-circuit modifications for up to three intercom lines and multiline conferencing were simple. The phone's bell was replaced with a small loudspeaker and associated circuitry. Feature options were limited to a message-waiting light as well as an external hands-free-answer-on-intercom transmitter and control module. The six-button phone does not have a recall button. To complement the Com Key 2152 system's line of phones, a wall phone with all the desk-phone's features was needed. The handset and line-switch actuating linkages of the basic sets, therefore, were redesigned for vertical operation so the phones could be wall mounted using a skirt-like adapter. The adapter also permits concealed or surface connections to the cabling system, and may be used for mounting the hands-free-answer-on-intercom transmitter and controls.

The consoles

Ten consoles are now available for all Com Key systems (an eleventh, for the 2152 system, is now under development). Four consoles, for the 718 and 1434 systems, use basic parts from 10- and 20-button phones. Seven were designed especially for the Com Key 2152 system and have added features to make attendant operation simpler and more versatile. The consoles fit into three groups: attendant, message waiting, and direct-station selection.

The features are listed in the table below.

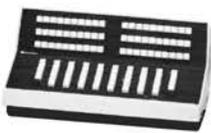
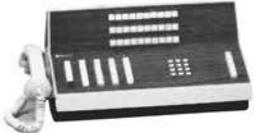
The Com Key 2152 attendant consoles may be equipped to allow the user to set up conference calls on central-office and intercom lines, or to transfer ringing to any station, or to an external ringer. The consoles may be used with handsets or headsets.

Direct-station-selection consoles for the Com Key 718 and 1434 systems use nonlocking buttons for station selection. This makes it necessary for the attendant to select an intercom path on the attendant console before

using the direct-station-selection console—a two-step operation. The 2152 system attendant has a dedicated intercom path to each station and doesn't have to push an intercom-path button before selecting a station. In a full-size Com Key 2152 system the message-waiting and direct-station-selection features are combined in one console.

Depending on the size of the business, systems may be equipped with a wide range of phone sizes and console options. There could be 10-button phones only for a small business

Com Key Systems' Consoles and Telephones

	Console Code	Used With	Features
	6A	718	18-station direct-station selection with station-busy indication. No dedicated intercom path.
	6C	2152	As above but with dedicated intercom path.
	6B	718,2152	18-station message-waiting with station-busy indication.
	7A	1434	34-station direct-station selection with station-busy indication. No dedicated intercom path.
	7C	2152	As above but with dedicated intercom path.
	7B	1434,2152	34-station message-waiting with station-busy indication.
	128A6Y	2152	52-station direct-station selection with station-busy indication and dedicated attendant intercom path.
	138A6Y	2152	52-station direct-station selection with station-busy indication, dedicated attendant intercom path, and 52-station message-waiting field.
	832,2832 telephone set	718 2152	Seven-line answering set. Also available with TOUCH TONE® dial.
	833,2833 telephone set	1434 2152	Fourteen-line answering set. Also available with TOUCH TONE dial.
	128A4T (R)	2152	21-line answering set. Also available with rotary dial.
	138A4T (R)	2152	21-line answering set with intercom/central-office-line conferencing field. Also available with rotary dial.

using a 718 system. A sizeable business with the largest Com Key 2152 system could have up to three attendants, operating independently, using 21-line consoles with 52-station direct-station-selection and message-waiting features.

Attendant positions equipped with direct-station-selection consoles have private (dedicated) intercom paths and calling priority. If a station is called simultaneously by the attendant and someone else, the attendant has automatic priority and is connected. The other caller hears a distinctive preemption tone. Lamps under the direct-station-selection buttons also show the attendant whether a phone is off hook or if the person doesn't want to be disturbed.

All Com Key systems have a one-button-per-path voice-signaling dial intercom requiring no station equipment. Lamps for each intercom path are connected in all stations, and when a path is in use, all lamps light. To make an intercom call, a person simply pushes a dark button for an idle path and dials a two-digit code for the desired station. At the called phone, there's a burst of tone followed by the caller's voice. To reply, the person lifts the handset, presses the lit intercom button, and talks.

At a Com Key 2152 phone equipped with hands-free-answer-on-intercom, the called person doesn't have to lift the handset to answer an intercom call. For privacy, a person can turn off the intercom's microphone by pushing the microphone-off button. At the push of the do-not-disturb button, a caller then hears a do-not-disturb signal.

In the Com Key 2152 system, the optional automatic-signaling intercom provides tone and voice paths between two phones—for example, between boss and secretary. When either person presses one of the multipurpose buttons and picks up the handset, a tone signal is sent to the other phone automatically. The feature also can be arranged for an office where one secretary works with several persons.

Up to three paging zones can be dialed from all stations or called directly with the push of a button on the direct-station-selection console. Lamps under the console's paging buttons show other attendants that paging is underway.

Behind-the-scenes equipment

Key-service units for the Com Key 718 and 1434 systems use 66-type connecting blocks

for station connections and require few or no cross connections. To give the Com Key 2152 system its flexibility, four major groups of common equipment were developed: connecting units, key-telephone units, panels, and mounting hardware.

Connecting units (see photo 3, opposite page) consist of 66-type connector blocks assembled and wired together. They are used for connecting telephone cables and central-office lines, and for assigning features for the phones and lines. Two connecting units can handle the largest installation.

Most of the Com Key systems' components are mounted on 4-inch and 8-inch printed wiring boards called *key-telephone* units. (Twelve new ones were developed for all Com Key systems, and four are carryovers from the 1A2 system.) In the Com Key 718 and 1434 systems, the key-telephone units plug into connectors that are installed in *key-service* units.

Panels are used for mounting and wiring Com Key 2152 key-telephone units (see photo 3, opposite page). The panel for a 7-line, 34-station system has connectors for seven 8-inch key-telephone units, and for up to fourteen 4-inch key-telephone units. A supplementary panel holds 22 additional 4-inch key-telephone units and two 8-inch key-telephone units. A system equipped with basic and supplementary panels provides service for up to 21 lines and 52 stations.

Four power-supply panels are available to operate any of the systems. The panels contain various combinations of three power supplies and interruptors, and fuse boards. They can be changed easily for system expansion. A 7-line, 18-telephone system would use the smallest power panel with one power supply. The largest 21-line, 52-station system would use a combination of panels containing three power supplies.

The key-telephone-unit panels, power panels, and connecting units for a large Com Key 2152 system are plugged together and mounted in two cabinets, each about 26 inches wide, 40 inches high, and 16 inches deep. Or they could be installed in a 23-inch wide rack, depending on the office facilities available. The common equipment for a large Com Key 2152 system is shown mounted in a rack on the opposite page.

The Bell System expects a long life for the Com Key systems—especially for the 2152 system, which can be expanded easily to keep up with the continuously growing communications needs of businesses. □

Behind the scenes. Pictured in a laboratory are the Com Key systems' key-service units and common apparatus with their covers removed.

(1) In the wall-mounted key-service unit for the Com Key 718 system, the power supply is at the left and the plug-in key-telephone units are under it and at the right. (2) In the Com Key 1434 system's floor-mounted key-service unit, 66-type connecting blocks are at the top, the power panel is at the bottom, and above it are two key-telephone unit panels. (3) The Com Key 2152 system's common apparatus is mounted in a rack in the lab. The power-supply panel is at the top and underneath it are two key-telephone unit panels. Steve Miller, a Bell Labs engineer, is attaching a wire to one of the system's 66-type connecting blocks.

