SS1 SELECTIVE SIGNALING SYSTEM
GENERAL DESCRIPTIVE INFORMATION
PRIVATE LINE TELEPHONE SERVICE

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1. GENERAL

A. Scope

1.01 This section describes the equipment and operating principles of the SS1 selective signaling system, which signals stations associated with 4-wire private line telephone circuits. Such private line telephone circuits are used by airlines, utilities, trucking concerns, and other companies whose operations require frequent communication between separate facilities. The SS1 equipment is also used for telephone company order-wire service.

1.02 This section is reissued to describe privacy, central office access, and PBX access features. It also incorporates information formerly presented in Section 310-425-100. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

B. General Operation

1.03 The SS1 equipment permits personnel at telephone stations of a waystation to selectively signal other telephone stations, or to signal a number of such stations simultaneously. A waystation is an assembly of SS1 signaling equipment and associated telephone stations at one of a customer's locations. Each waystation has at least one telephone set, and the use of a number of telephone sets at one waystation is quite common. A separate 2-digit code is assigned to each station so that it can be individually signaled. When a signal is sent from one telephone set, it is received and decoded at all the waystations of the SS1 system. However, only the telephone set (or sets) assigned the code involved is rung. The assignment of one or more codes to which a number of telephone sets respond simultaneously can be used to establish automatic conference calls.

1.04 Two pulls of a standard rotary dial are used to generate each 2-digit code. The digit 1 is not used in any station code since it is reserved as a means of canceling a misdialed initial digit. A total of 81 codes may be assigned within any one SS1 system. The dc pulses of the dial are converted to frequency-shifted tone pulses for transmission over the 4-wire private line facility. The tone pulses are restored to dc pulses by standard single frequency (SF) units and are used at the receiving points to initiate ringing of the proper telephone set.

1.05 A feature of the system termed interarea switching allows a station of one SS1 system to dial into an adjoining SS1 system.

1.06 SS1 privacy arrangements are available which prevent the intrusion of another station into a conversation established between two stations. Additional stations may be dialed into a privacy call by one of the stations already engaged in the call. Certain stations equipped with an override key can temporarily void a privacy call to request permission to pass priority or emergency traffic.

1.07 By the use of access circuits, stations of the SS1 system may dial into central offices or into PBX systems; and PBX stations can dial into the SS1 system when so arranged. Communication with stations of a manual PBX is also possible.

C. Descriptive Terms

1.08 Certain terms used in this section to refer to parts of the SS1 selective signaling system or its operation may not be familiar or express the same meaning to everyone; therefore, these terms are defined in the following list.

(a) ***Backbone:*** That part of the 4-wire private line facility used by the SS1 system which extends from central office to central office, sometimes referred to as a main-line circuit — bridges at the central offices permit loops from waystations to be tied to the backbone so that intercommunication between waystations can be established.

(b) ***Busy Tone:*** A 2600-cps tone which is locally applied or a 2400-cps tone from an interarea switch to signify that dialing is in progress or that a private communication has been established.

(c) ***Code:*** The two digit number assigned to a telephone set for identification and signaling purposes.

(d) ***Common Control:*** Equipment of the SS1 system that allows private conversation (see ***Privacy***) to be carried on between two or more stations — also required for CO and PBX access operation.

(e) ***Decoder:*** Equipment of the SS1 system which counts and registers the 2-digit dial pulse codes, then causes associated equipment to signal the called station.

(f) ***High Guard:*** Condition of the SF unit when SF pulsing is not present on the line — prevents the SF unit from spuriously responding to speech components of the same frequency as the signaling frequency (2600 cps).

(g) ***Interarea Switching:*** An arrangement for interconnecting two SS1 systems so that stations in one system may signal and communicate with stations in the second system.

(h) ***Keyer:*** Device for converting dc dial pulses into 2600- and 2400-cycle, frequency-shifted, tone pulses for transmission to the decoders of the SS1 system.

(i) ***Low Guard:*** Condition of the SF unit when SF pulsing is present on the line.

(j) ***Packaged Unit:*** A factory-wired assembly of individual SS1 units into a configuration which provides desirable waystation features.

(k) ***PBX Access:*** A feature of the SS1 system which allows stations of the system and stations of a PBX to communicate — can also provide access to central office subscriber lines.

(l) ***Privacy:*** The feature of an SS1 system equipped with common control that allows two or more stations to communicate in private.

(m) ***Waystation:*** The location of SS1 equipment on a customer's premises, consisting of one or more telephone sets and associated signaling equipment.

(n) ***3-Digit Interarea Switching:*** A method of providing interarea switching in which stations in an adjacent SS1 system may be signaled without also signaling a station in the home SS1 system, even though the stations have the same station code.

(o) ***44-Type Bridge:*** A 4-way, 4-wire bridge which provides for the interconnection of four 4-wire loops — used for connecting waystation facilities to the backbone of an SS1 system.

2. SYSTEM PLAN

A. General Description

2.01 The SS1 system operates over a 4-wire multistation private line to signal remotely located stations. Several stations are often located at one waystation as shown in Fig. 1. Signaling on the backbone of the system is always done by means of tone. Signaling between the central offices and waystations may be carried on by tone or by dc signals, depending upon the location of the signaling equipment. Three possible arrangements are shown in Fig. 1.

2.02 All the signaling equipment associated with waystation A is located at the waystation itself. Therefore, tone signals are fed to and from the waystation and its central office as well as along the backbone of the system. Outgoing signals are converted from dc dial pulses to tone by the keyer, incoming signals are converted from tone to dc pulses by the SF unit. The reconstructed dc pulses are used by the decoder and station signaling equipment to summon the proper station.

2.03 Signaling equipment of waystation B is divided between the waystation and its central office. The keyer and SF unit are located at

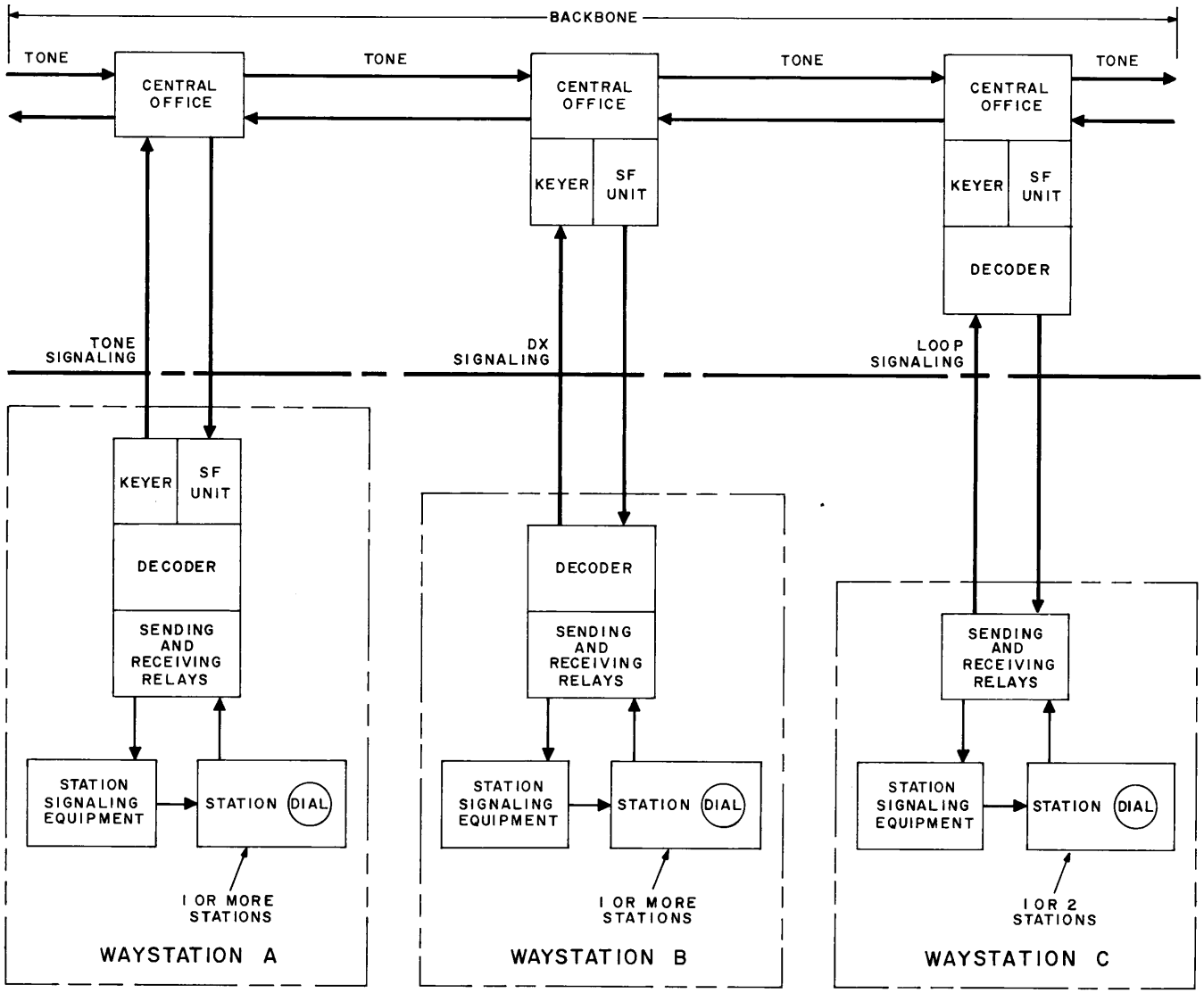

Fig. 1 — Typical System Arrangements

the central office; the decoder, at the waystation. DX (duplex) signaling is used between the locations to carry the dc signals. The decoder is located at the waystation, since it will most likely be required to signal more than two telephone sets at the waystation.

2.04 Waystation C of Fig. 1 illustrates another possible equipment grouping. This time all the signaling equipment, except the sending and receiving relays of the waystation, is located in the central office. Loop signaling is used between the waystation and the central office. This limits the number of stations that can be signaled to two.

2.05 Codes are sent over the backbone by means of frequency-shifted tone pulses. The SS1 method uses 2600-cps tone bursts to represent the pulses and transmits a 2400-cps tone between the 2600-cps pulses. The 2400-cps tone ensures that the SF unit will release after each pulse and guards against the echo effects of a long line. Tone is present on the circuit only during the signaling interval whereas in normal toll circuit single-frequency operation, tone is present during an on-hook condition.

2.06 The system is ready for dialing as soon as the handset is removed from the switchhook or an equivalent action is performed by use of a key. Dialing is blocked, however, if another handset of the same waystation is off-hook at the same time. Before dialing, the station operator must monitor the line to prevent interference with other users. Speech will be present if a nonprivate conversation is in progress. Tone will be present if a privacy conversation is in progress or another station is dialing. If the line is free for use, the code of the desired station of the SS1 system may be dialed by two pulls on a standard dial.

2.07 The dc dial pulses actuate a keyer which converts the dc pulses to 2600- and 2400-cycle tone pulses and sends them to all the SF units. The SF units are part of the SS1 equipment associated with each receiving waystation. They convert the tone pulses back into dc pulses. The reconstructed dc pulses operate decoders. All decoders respond to the pulses transmitted over the system. The code originated by the sending telephone set causes the decoders to produce a momentary output. This output is used at waystations to actuate other signaling or control equipment which rings the called telephone sets. The closure lead is connected to station signaling equipment that provides its own lock-up and release features, as required.

2.08 If the sending or receiving stations are located in a central office, as they would be for order-wire use, loop or DX signaling links may not be required. In other applications, where all the signaling equipment is located at the waystation, loop or DX signaling links again may not be required, since the tone pulses can be extended to the waystation SF equipment.

2.09 Upon receiving the first pulse of any digit, the equipment at all locations, except that of the sending station, opens the loops between the telephone sets and the backbone. A 2600-cps tone is sent to the telephone sets as a busy tone. This prevents inadvertent interference with signaling by other users going off-hook at the same time. This condition exists until two digits have been dialed or until 6 seconds (the time allowed for dialing the second digit) have elapsed. The outgoing speech paths and signaling paths from the various telephone sets are open during this dialing interval. Therefore, if an operator at another waystation picks up a telephone set while dialing is in progress, a busy tone will be heard. The signaling already in progress cannot be interrupted by talking or attempting to dial from the second telephone set.

2.10 If the first digit is dialed in error, the digit may be canceled by dialing the digit 1. This cancels the digit in all the decoders of the system. The user may then immediately dial the correct digit. Alternatively, the system may be allowed to time out. Then at the end of the 6-second, time-out period; the first digit dialed in error is automatically canceled and the system is ready to accept another code.

2.11 Dialing into another SS1 system is provided by the use of one of two types of area-linking circuits. The first type permits interarea calls to be initiated by dialing a 2-digit connect code to tie the originating system to a second SS1 system. Once the two systems are connected, the desired station of the adjacent system can be dialed. However, station codes in the two systems cannot be duplicated, or both stations with the same code in the originating and the adjacent sys-

tem will be simultaneously signaled. A more complex link, called a 3-digit interarea switching circuit, signals only the station in the second system by use of a 3-digit code, even though duplicate codes are assigned in the two systems. The 3-digit code consists of the normal 2-digit code of the desired station with the digit 1 inserted between the first and last digits. For example, if the code of a station in the adjacent system is 27 when dialed from its own system, its code becomes 217 when dialed through the 3-digit interarea switching circuit. The inserted digit 1 is used to prevent the signaling of the similarly coded station in the SS1 system of the call originator.

2.12 Dialing a central office subscriber line number or a PBX station number is accomplished in a similar manner. A 2-digit code is dialed to gain access to the central office or PBX, then further digits are dialed to complete the call. Calls may be completed through a manual PBX with the assistance of the PBX operator. Incoming calls can be placed from a PBX (but not a central office) into the SS1 system. The lockout feature of the common control unit is used with central-office and PBX access to control access and to prevent the decoder from ringing SS1 stations when digits of the subscriber line or PBX station are dialed.

2.13 Privacy of SS1 conversations may be desired. Privacy can be provided on an automatic basis so that any two stations engaged in conversation are guarded against intrusion; or the system can be arranged so that privacy is on a manual basis controlled by only a few selected stations. In either case, a privacy override circuit may be employed to allow priority or emergency traffic to break in on privacy conversations when necessary.

B. Tone Circuit

2.14 The tone circuits of the SS1 system are comprised of keyers and standard SF units. Usually one keyer and one SF unit are associated with each waystation. The keyer generates the 2600- and 2400-cycle pulsing tones from the dc dial pulses; the SF unit restores the tone pulses to dc pulses at the receiving end. Some waystations may be equipped to receive only or to send only. In such cases, the keyer or the SF unit is omitted from the waystation equipment.

2.15 Since the SS1 system puts tone signals on the line only when actively signaling, the signaling system is in the same condition when the circuit is idle as it is when there are speech signals on the line. This means that the SF units must be in a high guard condition when speech is present to avoid talkoff (the response of an SF unit to high-frequency speech components). The SF units will also be in the high guard condition when the line is idle and awaiting dial pulses.

2.16 The first pulse of a digit might be lost when dialing begins if the pulse is a normal length spurt (60 to 70 milliseconds) of 2600-cps tone and the SF receivers are in the high guard condition. Therefore, the first pulse of a digit is deliberately elongated to at least 100 milliseconds in the keyer. This long burst of tone forces the SF receiver to shift to low guard, where it remains for the rest of the digit. Once the SF unit is shifted to low guard, it remains in this condition until a complete digit (or two, if so arranged) is received.

2.17 The keyer unit consists of a 2600- and 2400-cycle transistor oscillator and control circuits. Normal dc dial pulses are used to key the oscillator, but the output is frequency-shifted, tone keying with an extra long first pulse. Lengthening the first pulse to at least 100 milliseconds is accomplished by using a delay circuit which delays all pulses but fills in most of the space in front of the first pulse with a 2600-cps tone. The delay time, plus the normal break time of the dial mechanism, results in a long initial pulse. Input and output pulses of the keyer are shown in Fig. 2. The elongated initial pulse is evident. Only the initial pulse

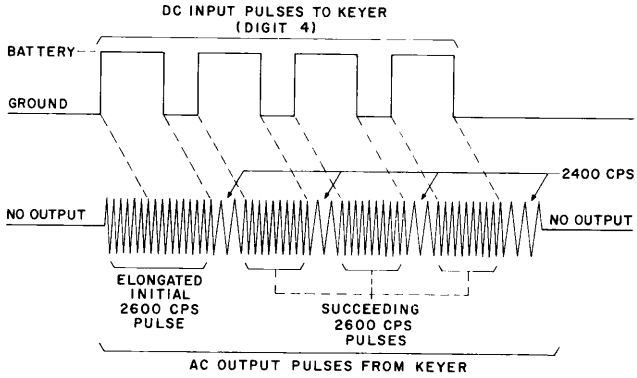

Fig. 2 — Keyer Input and Output Pulses

need be lengthened, since the SF units will be held in the low guard condition as succeeding pulses of a digit arrive.

2.18 A guard tone of 2400 cps is inserted between pulses and at the end of the last pulse to ensure that the SF units release at the end of each 2600-cps pulse. The 2400-cps tone, which enters the guard channel of the SF units, forces them to release at the end of each pulse despite the possible presence of 2600-cps echo that might tend to hold the SF units operated.

2.19 The keyer incorporates a fail-safe feature which prevents continuous tone from being fed to the line. This prevents a keying fault at one waystation from disabling the complete SS1 system.

C. Loop and DX Signaling Circuits

2.20 When the tone equipment associated with a waystation is located in a central office, either loop or DX signaling may be used between the two locations. Loop signaling may be used if only one or two stations are located at the waystation. In this case, the decoder can be located with the tone equipment in the central office, and the stations can be alerted by signals sent over the loop. If more than two stations are used at the waystation, or if it is desirable to locate the decoder at the waystation for some other reason, DX signaling is used between the tone equipment in the central office and the decoder at the waystation.

2.21 Loop signaling is shown in Fig. 3. The waystation may contain one or, at most, two telephone sets to be signaled. The output of the SF receiver in the central office is connected to the decoder. DC pulses from the SF unit are registered in the decoder. A short output pulse is produced by the decoder when the proper 2-digit code is received. The output pulse of the decoder energizes one of two dc sending relays. Battery of one polarity or the other will be sent through the 4-wire loop terminations to the receiving relay circuit of the waystation. The receiving relay circuit will contain one or two receiving relays. If only one telephone set is to be signaled, only one receiving relay will be used. Then battery of either polarity sent from the dc sending relays circuit will operate the receiving relay. If two telephone sets are to be selectively signaled, two relays and two poling diodes comprise the receiving relay circuit. One telephone set or the other will be signaled, depending on the battery polarity applied from the dc sending relays circuit and the corresponding operation of a receiving relay. Codes are transmitted in the other direction from a telephone set dial in the waystation to the keyer in the central office on the second pair of the 4-wire loop. The sending relay circuit, located between the dial and the keyer, performs dial pulse repeating and off-normal functions and shorts the station end of the transmitting loop to prevent room noises from interfering with signaling.

2.22 When a waystation associated with a particular central office has three or more telephone sets, the decoder will be located at the waystation and DX signaling will be used between tone equipment in the central office and the signaling equipment in the waystation. This arrangement is illustrated in Fig. 4. The SF unit operates the decoder over the pair which transmits speech to the waystation. During incoming dialing, the guard transfer and busy tone circuit opens the transmitting loop to the backbone and transmits busy tone to the waystation. On outgoing calls, dial pulses are repeated by the sending relay in the waystation and the signal lead extension circuit to cause the keyer in the central office to pulse the code over the backbone circuit. As shown in Fig. 4, the outgoing call may be originated from a No. 300 switching system, used at air route traffic control centers, rather than by a dial of the SS1 system. The No. 300 switching system is briefly discussed in Part 7.

2.23 As mentioned earlier, special signaling arrangements are not required if the tone equipment is located with the decoder in the waystation. The equipment arrangement may then be provided as shown in Fig. 5, a block diagram of a typical waystation which contains all the signaling equipment. Tone signals from the backbone are extended on a 4-wire loop from the central office to the waystation. An amplifier will be optionally inserted in the signaling receiving leg, when required. Incoming codes are registered in the decoder and are used to trigger the station signaling equipment. Outgoing codes are originated by a standard dial or by a No. 300 switching system.

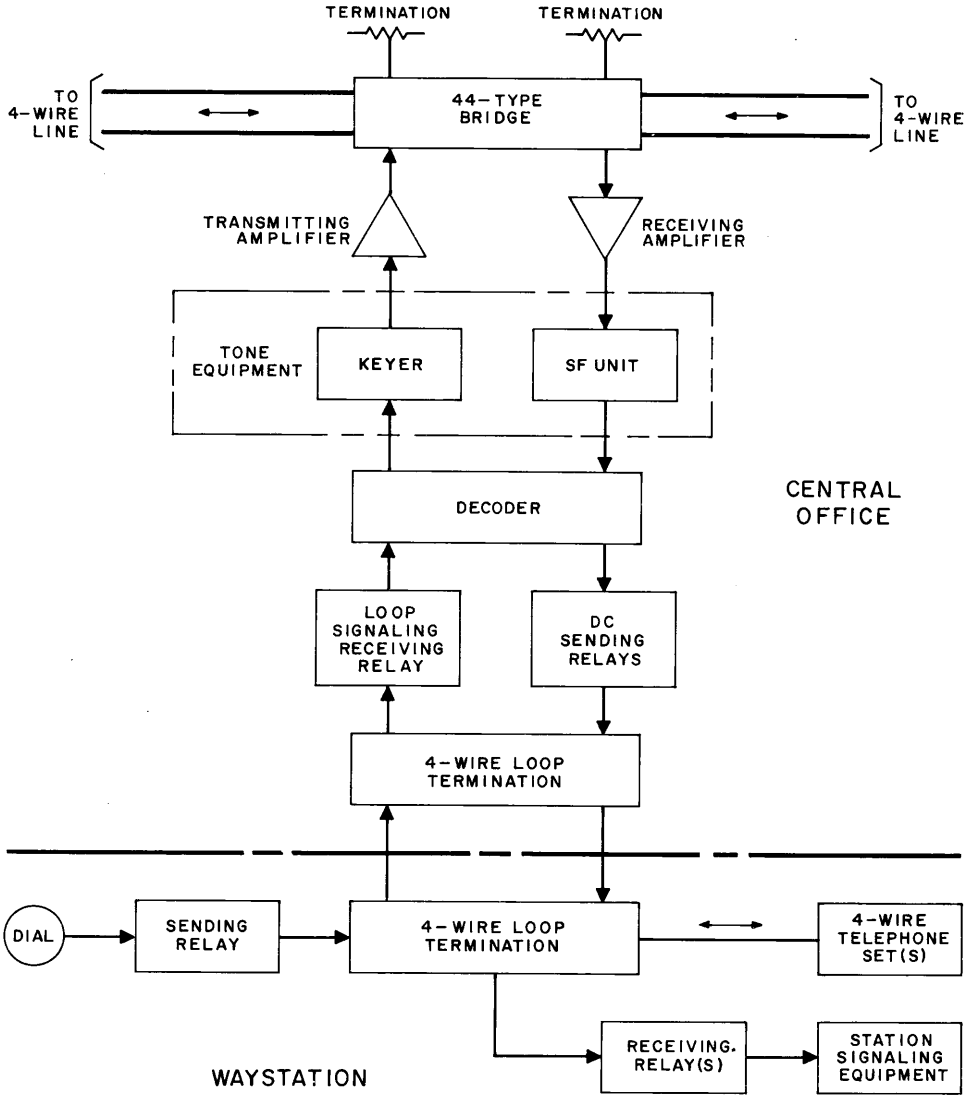

Fig. 3 — Loop Signaling

D. Decoder

2.24 The decoder counts incoming dial pulses, determines the digits dialed, and provides an input to the station signaling equipment when the incoming code corresponds to one of the waystation telephone set codes. The basic decoder can recognize all nine codes of one tens group (the number of codes is nine since the digit 1 is not used) or it can recognize up to four codes in each of two separate tens groups (a total of eight in this case). By use of additional relays to recognize and store additional tens group information, the capacity of the decoder can be enlarged to include all 81 available codes. This subject is further discussed in Part 3.

2.25 The decoder is seized by the first digit of a code and is normally released when the second digit of the code is received. However, only six seconds (interdigital time) are allowed for dialing the second digit of a code after the first digit has been dialed. This is done to prevent a tie-up of the system caused by a dialing error wherein only one digit is dialed.

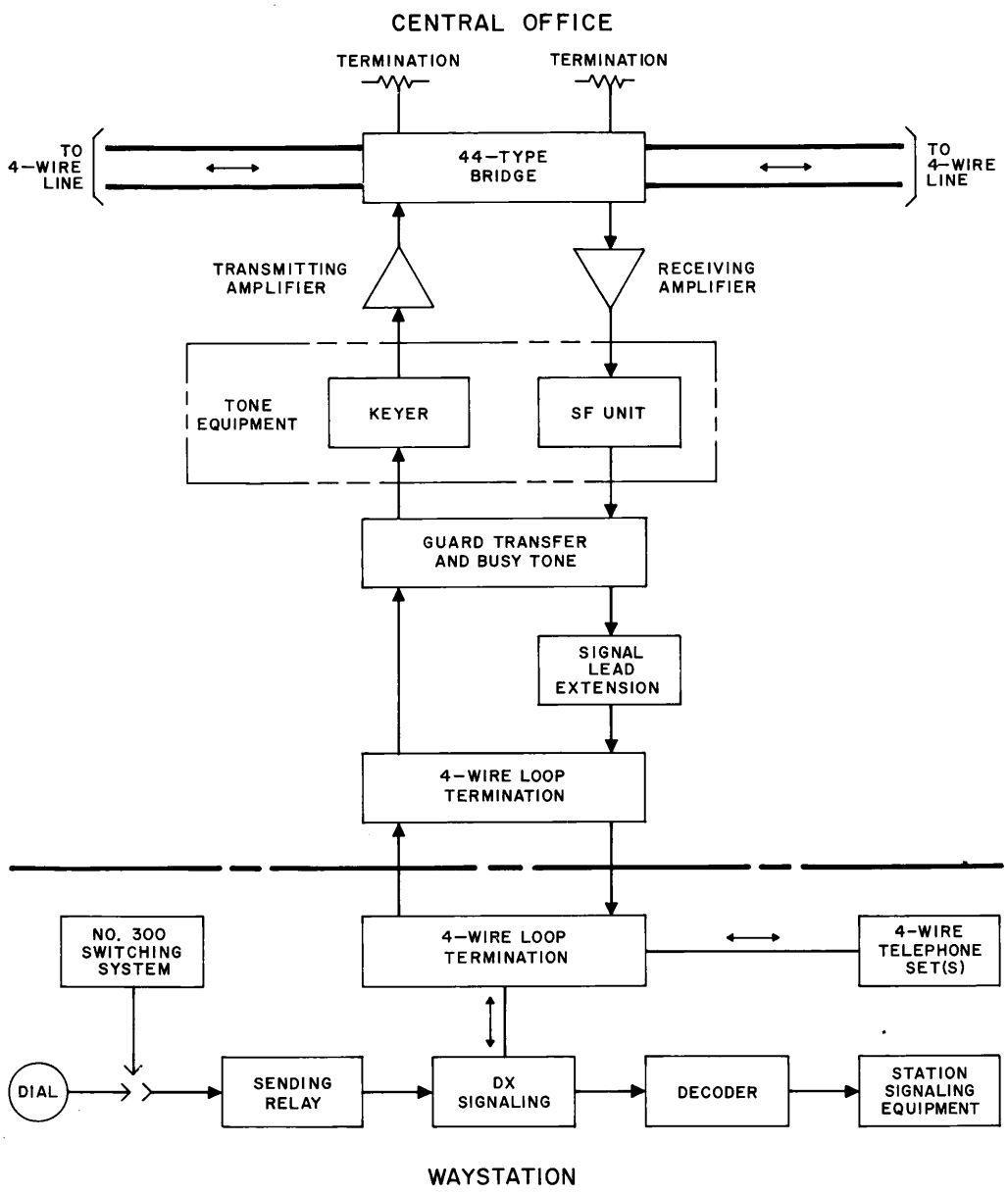

Fig. 4 — DX Signaling

2.26 If the digit 1 is dialed after the initial digit, the first digit stored in the decoder will be canceled and the dialing of a new code may commence. This procedure is used to cancel a digit, which has been dialed in error, without waiting for the 6-second time-out period to expire. The digit 1 is also used when dialing a station when 3-digit interarea switching is used to interconnect two SS1 systems. This prevents the signaling of the same-coded station in the area where the dialing originates when the desired station is signaled.

E. Loop Bridging Arrangements

2.27 If two or more waystations are in close proximity to a common central office, the tone equipment (keyer and SF unit) may be mounted in the central office and shared by the

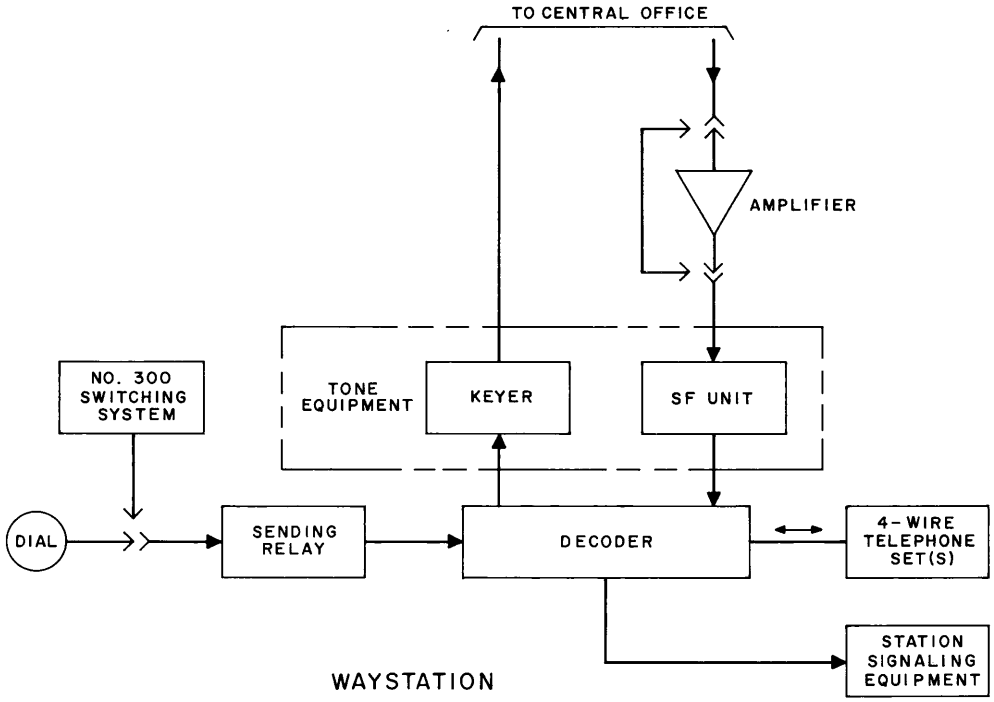

Fig. 5 — Signaling Equipment at Waystation

waystations. Such an arrangement involving two waystations is shown in Fig. 6.

2.28 A decoder is used with the SF unit to decode incoming signals and operate the correct waystation signaling equipment. If more than two codes are required at a waystation, a second decoder is provided at the waystation and the dc pulses are repeated at the central office for transmission over a DX signaling loop to the waystation. A waystation loop will be connected for DX signaling (if more than two stations must be signaled at the waystation) or for loop signaling if only one or two stations are located at the waystation. As shown in Fig. 6, loop signaling is employed between waystation A and the central office. DX signaling is used with waystation B.

2.29 If a third waystation is to share the tone equipment located at one central office, another pulse repeating and busy tone circuit must be installed. Additional sending and receiving relays (or a signal lead extension circuit) must also be used to exchange dc pulses with the waystation.

F. Dialing Stations of Adjoining SS1 System

2.30 Provision has been made for dialing from one private line SS1 system into a second SS1 system. Dialing into an adjoining system can be accomplished in two ways. One method is called interarea switching; the second method is called 3-digit interarea switching. These two arrangements are discussed in the following paragraphs.

2.31 Interarea switching involves two adjoining SS1 systems which normally carry their own traffic and operate independently of each other. If a special access code is dialed, however, the two systems are tied together. The originating station in the first system can now dial any station located in either system by dialing another 2-digit code, the second code being that of the desired station in the second system. As can be seen, coordination in the assignment of codes in the two SS1 systems is essential if the alerting of two stations (one in each system) by dialing one code is to be avoided. That is, the same code cannot be assigned to individual stations in both systems.

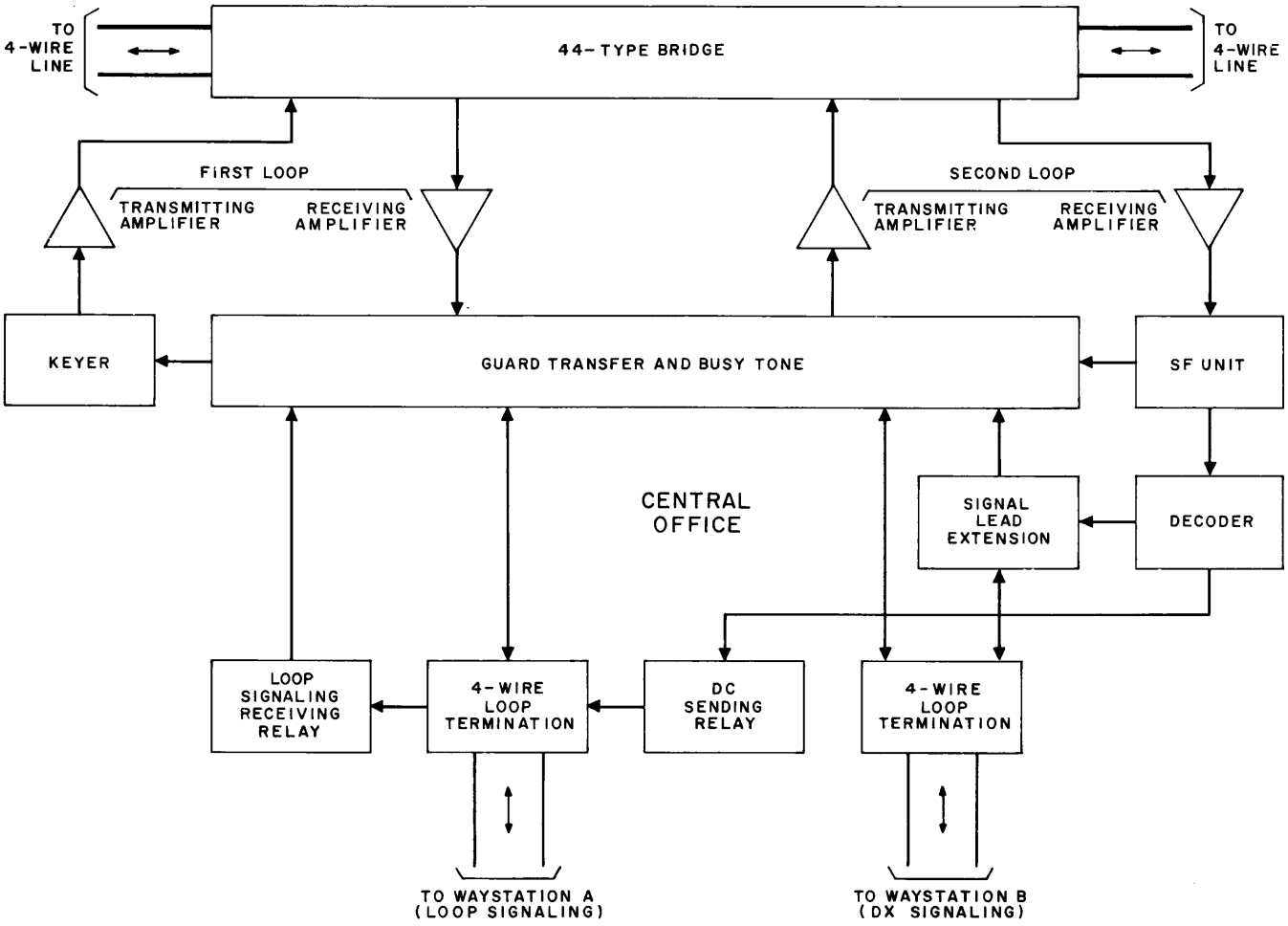

Fig. 6 — Loop Bridging Arrangement

Upon completion of the call from one SS1 system to another, a special code must be dialed to disconnect the two systems.

2.32 Signaling in two adjoining SS1 systems joined by the 3-digit interarea switching circuit occurs only in the called-station system when 3-digit dialing is used. Thus station codes may be assigned in one SS1 system without concern about possible duplication of code assignments in another system. Access into the second system is gained by dialing the 2-digit access code as discussed for the simpler interarea switching circuit. The 3-digit switching circuit will return a busy signal if the adjacent system is in the process of dialing or if it is engaged in a private conversation. When the two systems are linked, the desired station in the second system is signaled by use of the 3-digit code which was discussed in 2.11. Stations in the first system may be added by dialing their codes in the normal 2-digit form. The 3-digit codes are processed in the following manner. The first digit of the called code is registered in all the decoders of both SS1 systems. As a result, both decoders in the waystation which provides the 3-digit interarea switching circuit will be off-normal. The circuit is so arranged that when both decoders are off-normal, the talking path between the two systems is temporarily opened. This prevents the decoders of the second system from registering the upcoming digit. The digit already registered in the decoders of the second system is retained, however. When the second digit (a 1) is dialed, the decoders of the originating system recognize this as the cancellation signal and restore to normal. Now only the

decoders of the second SS1 system have a registered digit and are off-normal. This closes the talking path between the two systems again. The third digit of the 3-digit code is now dialed. This digit is registered in all the decoders of the second system as the last part of a station code. The affected station is signaled. The decoders in the first system register the third digit of the 3-digit code as the first digit of a new code, because the original first digit has been canceled. Immediately after the called station in the second system has been signaled, a simulated digit 1 is automatically sent to all decoders so that the decoders of the first system will be immediately normalized and the conversation can begin. At the end of the conversation, the link between the two systems is broken down by dialing a disconnect code if the originating station is not equipped with common control (privacy). The link is automatically disconnected when the originating station goes on-hook if it is equipped with common control.

G. Loop Cutoff

2.33 If an excessively noisy loop must be employed as part of the SS1 system, the connection of this loop to the backbone circuit may be controlled by the waystation switchhook or an equivalent key. This arrangement permits incoming signaling even though the voice path is disconnected from the backbone circuit until the switchhook is operated.

H. Common Control

2.34 The common control circuit provides the privacy feature of the SS1 system. This circuit is connected with the keyer, decoder, and sending relay circuits on an optional basis. The common control circuit provides a termination for one telephone set at a waystation and also provides for use of an override key for stations which are allowed to break into existing privacy conversations. The connection of additional telephone sets to the common control circuit at a waystation can be accomplished by installation of individual station control circuits and a gate circuit to provide preference lockout for the dial leads.

2.35 With automatic privacy wiring of the common control circuit, all stations except the calling and called stations are locked out of the system whenever any station makes a call. A 2600-cps busy tone is applied locally at all locked-out stations if they go off-hook during a privacy call. Common control circuits wired for manual privacy operation cause privacy to be effective only when a controlling exclusion key is operated. Upon operation of the key, all stations except those already in on the call will be locked out. Additional stations may be dialed into a privacy call by one station of each waystation already involved in the call.

2.36 Privacy ends when the station that originated the call hangs up or an override key is operated. The stations that do not hang up can continue to talk but without benefit of privacy.

2.37 Certain stations may be equipped with a local override key which can be used to enter a privacy call. The intruding station can then request that the line be made available for emergency use. During override, a 2400-cps warning tone is applied to the line. The overriding station is not provided with dialing capability until the originating station of the privacy call goes on-hook.

2.38 Certain other stations may be provided with a master override key. With master override, privacy is completely disrupted, and the overriding station has the ability to dial without waiting for a termination of the call in progress.

I. Central Office and PBX Access

2.39 Circuits to permit access to central offices or PBXs may be added to an SS1 system equipped with common control. These circuits permit dialing from any SS1 station to a central office station or to a dial PBX station. They also permit dialing from PBX stations or the PBX operator position to SS1 stations.

2.40 A waystation lockout circuit must be used in conjunction with central office and PBX access. The lockout circuit, required at all waystations, recognizes all central office and PBX access codes assigned to the SS1 system. The lockout circuit provides control of the access circuit located at the waystation and prevents the waystation decoder from ringing SS1 stations when codes intended for the central office or PBX are transmitted over the line.

3. ASSIGNMENT OF CODES

A. Code Grouping

3.01 The SS1 system has a capacity of 81 codes. This means that up to 81 different stations in the system may be assigned individual codes. When a station is dialed, only the called station is signaled. These stations may all be at separate locations or a number of them may be grouped at a common location and be served by a common loop from the central office. Such a waystation group might be, for example, various stations of an airline at an airport. This waystation group could include operations, reservations, radio room, and PBX access. The SS1 system provides ready communications between stations at this airport and stations of the airline located at other cities.

3.02 The code relay in the decoder is one which can be wired to decode nine codes in any one ***tens*** digit or four codes in each of two ***tens*** digits. If more than nine codes are used at one waystation, if the assignments fall within more than two ***tens*** digits, or if more than four codes are assigned in one ***tens*** digit and at least one code in another ***tens*** digit; additional code relays must be used. Many waystations will not require any additional code relays to recognize all the codes assigned to the waystation, if the codes are grouped economically.

3.03 As an example of economical grouping, consider the central office installation with three loops running to separate waystations, each having one or two codes assigned. A single decoder will be located in the central office. If all the codes of the three waystations fall within one or two ***tens*** digits, the basic code relay complement of the decoder will be sufficient to recognize all of the codes. Or consider a larger waystation with 15 codes. If these codes are carefully chosen to be confined to only two or three ***tens*** digits, just one additional code relay need be added to the basic code relay complement to recognize all of the required codes. If, on the other hand, the codes are indiscriminately assigned; as many as eight additional code relays might be required to do the job.

B. Multiple Usage of Codes

3.04 Under some conditions it is possible to obtain more than 81 individual station selections within the same SS1 system. Sometimes the waystations are arranged so that on-premises dialing (signaling between stations of the same waystation) is not allowed. This is to prevent personnel from using the SS1 system for local communications when other equipment is available for this purpose. Since a number of codes will be assigned to this loop, none of which can signal the others, these same codes could be duplicated in another waystation of the system. When a station of one waystation dials a particular duplicated code, only the station at an outside waystation will be signaled. This arrangement is practical only in an SS1 system consisting of two waystations.

3.05 Consider an extreme example of two air route traffic control centers which are the only waystations of an SS1 system. Each station of one waystation can signal a maximum of 81 codes in the second waystation and vice versa. Thus, 162 stations could be located in the same SS1 system and signaled individually. Of course, this maximum number would be greatly reduced if on-premises dialing were allowed, interarea switching were involved, or some codes provided central office or PBX access.

4. DESCRIPTION OF EQUIPMENT

4.01 Equipment at both central offices and waystations varies with each particular type of installation. The equipment is provided on a building-block basis, as required. However, a number of common configurations are supplied as preassembled and prewired packages which are ready for installation into mounting bays. The amount of interunit wiring to be done at installation is thereby greatly reduced.

4.02 Packaged units are available which incorporate one or more of the following capabilities in various combinations:

(a) To send codes, to receive codes, or to send and receive codes.

(b) To receive one or two codes or to receive up to 81 codes.

(c) To incorporate privacy, either automatic or manual.

(d) To incorporate interarea switching using 2-digit or 3-digit codes.

(e) To have access to central office or PBX.

(f) To have on-premise dialing or lock-out of on-premise stations (during dialing only).

4.03 A typical waystation packaged unit is shown in Fig. 7. This waystation is equipped to send all codes and receive up to about 18 codes. The restriction on the number of codes that can be received is dependent upon the number of D- relays installed on the sending and code relay unit, the second horizontal panel. Since only one relay is installed (although others can be added at a later date), a maximum of 18 codes can be recognized by operation of the code relays of the decoder unit at the top of the assembly and the code relay of the sending and code relay unit. This packaged unit is comprised of four separate SS1 units: a decoder unit, a sending and code relay unit, a keyer unit, and a fuse indicator unit. In addition, there are positions for four standard plug-in units. One is the SF unit (single-frequency signaling circuit) which is mounted vertically on the left side of the assembly. The other three plug-in units become part of the decoder. They are: an amplifier, a pad, and a 6-second time delay relay.

4.04 The components of most individual SS1 units are mounted on 19-inch plates. The completed 19-inch units are placed alongside the vertical SF unit mounting plate which forms a mounting surface for one end of the 19-inch units as shown in Fig. 7. The overall width of the assembled package is then 23 inches and mounts in a 23-inch bay drilled or adapted for 2-inch mounting centers. If more than 14 inches of vertical room (the height of the SF unit mounting plate) is required to mount the 19-inch panels, the remainder are mounted below the SF unit with adapters to extend them to 23 inches. A few of the SS1 units, for example, the common control unit, are already 23 inches wide and usually are placed above the SF unit. Standard E-type SF units,

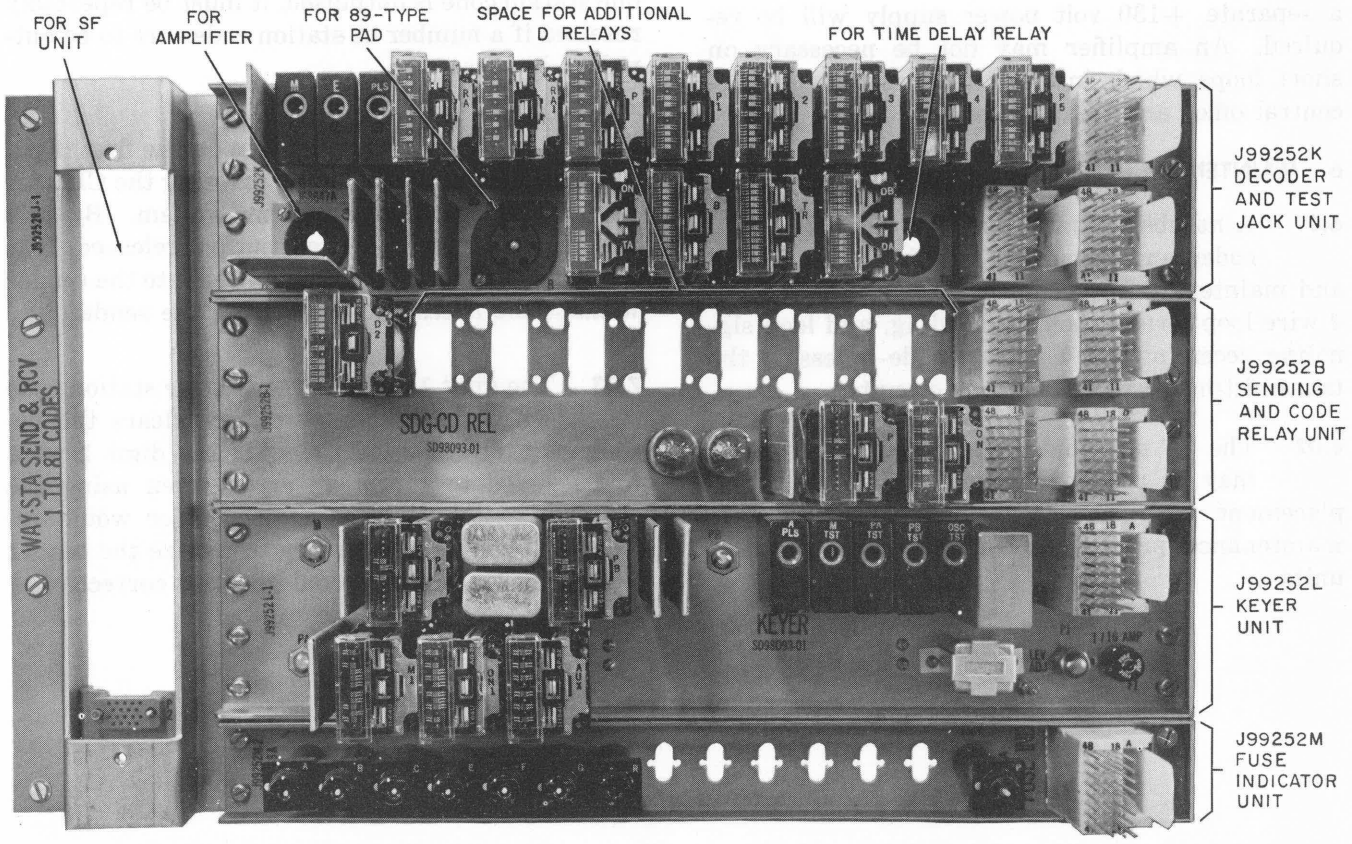

Fig. 7 — Typical Waystation Packaged Unit

DX signaling circuits, and signal lead extension circuits, as required, plus a combination of individual SS1 units comprise the waystations.

5. POWER REQUIREMENTS

5.01 If signaling equipment is located at the central office, it is arranged for —48 volt battery operation. The sending equipment located at the waystation may be wired for —48 or —24 volt battery operation. When the decoder is also located at the waystation, —48 volt battery must be available for its operation. A separate —48 volt rectifier may be installed if the decoder is located at a waystation not already equipped with —48 volt battery.

5.02 If all the signaling equipment associated with one waystation (including the SF unit) is located at the waystation, an amplifier may be required to raise incoming tone signals to the proper level for SF unit operation. Battery of +130 volts is required, in addition to a —48 volt source, to power a tube-type amplifier. If this power is not already available at the waystation, a separate +130 volt power supply will be required. An amplifier may not be necessary on short loops which insert little loss between the central office and the waystation.

6. MAINTENANCE FEATURES

6.01 A number of jacks are mounted on the decoder and keyer units to facilitate line-up and maintenance procedures. Other jacks on the 4-wire loop termination, dc sending, and loop signaling receiving relay unit provide access to the transmitting and receiving loop circuits.

6.02 The SF unit and the amplifier, when used, may be readily checked by temporary replacement with service tested, units. Separate maintenance procedures are provided for these units.

6.03 The pulsing break time of the keyer may be tested and adjusted using the 2B signaling test set. The 2400- and 2600-cps frequencies of the keyer oscillator and its output level may be checked and adjusted by use of standard test equipment. All other units of the SS1 system use standard relay equipment and require standard Bell System relay adjustment procedures.

7. USE WITH NO. 300 SWITCHING SYSTEM

7.01 The SS1 selective signaling system is used with the No. 300 switching system at air route traffic control centers of the FAA. Dialing is accomplished in a slightly different manner when the No. 300 switching system is involved. Before dialing, the station operator seizes a 300 system register sender. Two digits, the desired station code, are key pulsed into the register sender. The register sender outpulses the digit 1, sends the two station digits inserted by the station operator, then drops off the line. Since the register sender drops off the line automatically as soon as one station code is outpulsed, it must be repeatedly reseized if a number of station codes are to be outpulsed in succession.

7.02 If a dialing error is made on the first digit, it may be corrected by pressing the CLEAR key on the No. 300 switching system. By this action, the sender is cleared, but not released. The correct code may then be key pulsed into the sender without the necessity of reseizing the sender.

7.03 The digit 1, which precedes the station code when the sender outpulses, clears the decoders at all other locations. If the digit 1 were to be keyed to cancel an error when using the No. 300 switching system, the sender would release. It would be necessary to reseize the sender before the station code could be sent correctly.