

SWITCHING SYSTEM NO. 300

METHOD OF OPERATION

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1. GENERAL

1.01 This section provides a description of the key operations that attendants may be expected to perform at the control consoles, or positions, in the Federal Aviation Agency (FAA) air route traffic control centers (ARTCCs). Portions of this information may be used to conduct operational tests supplementing tests conducted with the test set as outlined in Section 480-710-501. For a general description of the No. 300 Switching System, refer to Section 981-205-100.

1.02 This section is reissued to include information on the J53026HK position equipment installed in the central computer complex console and to generally update the section.

1.03 The No. 300 Switching System (300 SS) is designed specifically to provide voice communication facilities as may be required by

the FAA. These facilities provide (a) communications among personnel within an ARTCC, (b) communications between ARTCC personnel and personnel in other allied agencies over regular telephone lines, and (c) for a connecting link between the attendant position and customer-owned radio equipment.

1.04 The switching functions of this system are controlled by nonlocking pushbutton keys at the attendant positions. The keys are mounted in units of six and may be placed in various arrangements in the customer-provided console, depending upon the requirements at that particular position. Key units associated with land-lines have an indicator lamp for each key. Key units associated with a radio line or a combination of lines require, in addition to the indicator lamp, a syllabic lamp to indicate the presence of incoming speech on the optional radio line. The keys that are associated with land-line operations available at an attendant position and the functions of these keys are tabulated in Table A. The keys associated with radio lines and radio line combining when used with the 300 SS are tabulated in Table B under their respective combining usage.

1.05 Most of the key operations that an attendant is expected to perform are self-explanatory from the key designations or from the functions listed in Tables A and B. The procedures necessary when a sequence of action by the attendant is required in order to establish a condition are described in Part 2 of this section. It is expected that at each ARTCC some selected attendant positions will have access to keys that are not a functional part of the 300 SS; such keys are usually installed and maintained by the customer. This section does not attempt to describe these keys or their functions.

1.06 Since the FAA requirements at the various ARTCCs vary, *all* the operational functions described in this section may not be presently installed at *any* of the centers but are available as a part of the 300 SS.

TABLE A
KEYS ASSOCIATED WITH LAND LINE OPERATIONS

KEY DESIGNATION	MEANING	FUNCTION
BR CONT	Brightness control (used in dark environment areas only)	In the OFF position, disables the DIM regulator and extinguishes all idle signal lamps. In the ON position, provides dim lighting on all line lamps in the no-signal condition to aid in line identification. (Locking turnbutton key.)
CH	Chime cutoff	Disables chime. (Locking turnbutton key.)
CK	Control key	Located at the supervisor position <i>only</i> . Maintains control over the restricted lines in the ARTCC. When momentarily operated, permits <i>one</i> outgoing call on the restricted line. When turned to the ON position and left in that position, allows unlimited access to the restricted line. One key and one lamp are provided for each restricted line. When ON, the lamp indicates that the line is accessible.
DA	Direct access	Directly seizes, without dialing, an interphone line for either answering or originating a call.
DIM	Dim regulator (used in conjunction with BR CONT)	Regulates the brightness of active signal lamps.
HLD	Hold	Establishes a hold condition on PBX extension and central office lines.
HS-LS	Headset-loudspeaker	Transfers the override receiving capability between the headset and the loudspeaker.
IA	Indirect access (or override)	Used in conjunction with the PB dial to establish connections to lines not terminated by DA at an attendant position.
LD-CO	Lamp display cutoff	Where auxiliary lamp panels are provided, used to activate or deactivate the panel.
LLCA	Long lines common answering	Used to answer incoming calls on circuits using SS-1 dialing signals.
PCA	Primary common answering	Used for receiving incoming calls on local dial lines or PBX tie lines. Has three call storage lamps associated with the indicator lamp. Incoming calls cause the storage lamps to flash, and operation of the PCA key connects the attendant to the stored calls in order of their arrival.

TABLE A (Cont)

KEY DESIGNATION	MEANING	FUNCTION
R&FL	Ring and flash	Takes the place of a switchhook on CO and PBX lines and provides manual ringing on ringdown or automatic ringdown lines.
SCA	Secondary common answering	Parallels the PCA feature at another selected position when the SEC LPS key at the PCA position is activated.
SEC LPS	Secondary lamps transfer	Allows PCA calls directed to one position to be answered at another selected position.
SIG RST	Signal restore	Used to disable the position signal-blanking feature and restore the blanked-out indicator lamps at the position so that the status of a line may be observed prior to initiating a call. (Locking turn-button key.)
SR	Short ring <i>Note:</i> Not to be associated with SR key on key shelf of telephone sets.	Provides an automatically timed short ringing signal to an interphone line.
—	Circuit cutoff	Enables an attendant to cut off (from his position loudspeaker) "hot" line voice calls which are also arranged for multiple appearance at other positions. (This key is a pushbutton/turnkey and may be mounted in a DA key position.)
JK TRAN	Jack transfer	Provides the capability for an exchange of position control. This arrangement permits the manual D controller to operate his position and the radar position without an exchange of telephone instruments.
PTR	Position transfer	Diverts incoming calls selectively directed to a position to another position that is assuming the operation of the first position when it is to be unmanned during light load periods.
MON	Monitor (associated with the coordinator position)	Enables another position, usually a coordinator, to monitor on an individual basis, from his overhead position, the attendant telephone circuits of up to nine manual D controllers. The monitored position is unaware of being monitored. The coordinator selects the desired telephone circuit through the IA circuitry.

TABLE B

KEYS ASSOCIATED WITH RADIO LINES AND RADIO LINE COMBINING

METHOD OF COMBINING	KEY DESIGNATION	MEANING	FUNCTION
Fixed	DA	Direct access	Connects a fixed combination of radio lines or a single radio line to the attendant position.
Attendant Dial-Controlled	RT	Receive-transmit	Connects the transmit and receive channels of a radio line to a combination.
	RO	Receive only	Connects only the receive channel of a radio line to a combination.
	ER	Erase	Releases all radio lines in a particular combination.
	SCO	Status lamp cutoff	Extinguishes the status lamps.
Central	POS	Position	Selects a particular attendant position for access to a radio combination.
	RT	Receive-transmit	Selects receive and transmit channels of a radio line that is to be placed in a combination.
	RO	Receive only	Selects only the receive channel of a radio line that is to be placed in a combination.
	ER	Erase	In conjunction with the POS key, releases all radio lines in a particular attendant combination.
	PB	Pushbutton dial	Used to dial the IA code numbers of radio lines to be placed in a combination. (A maximum of six radio lines may be grouped in the same combination.)
	RD	Read out	Used with the POS key and readout lamps to identify radio lines grouped in a combination for a particular attendant position. A flashing lamp indicates transmit and receive channels have been grouped in a combination, while a steady on lamp indicates that only the receive channel has been placed in a combination.

TABLE B (Cont)

METHOD OF COMBINING	KEY DESIGNATION	MEANING	FUNCTION
Miscellaneous	RAD ON-OFF	Radio on-off (associated with radar controller positions)	Disables the automatic radio headset-loudspeaker transfer at the manual D controller position when adjacent radar position is manned. Effectively cuts off the manual D controller customer-owned radio loudspeaker when the radar position is manned and connected to radio.
	RLS	Release	Releases headset interphone connections and restores radio connection when operated. This key is generally associated with customer-owned radio circuits available to a radio position.

1.07 Certain lamp signals are used to indicate the status of associated lines. These are as follows:

- (a) **OFF (or dimly lighted):** Line is idle. No position is connected.
- (b) **Steadily (and brightly) lighted:** Connection to the line has been made busy at some other position.
- (c) **Flashing (1/2 sec on, 1/2 sec off):** Call incoming on the associated line.
- (d) **Winking (60 ipm, 97:3 on-off ratio):** PBX or central office line is being held.
- (e) **Fluttering (12 pps or 720 ipm, 80:20 on-off ratio):** Feature key associated with line indicator is the last one depressed.

Additional lamp indications are as follows. A position override lamp, when lighted, indicates that one or more positions have joined this position via the override feature. A position pilot lamp, when flashing, indicates incoming calls directed to this position. A steady on pilot lamp indicates the position has been disabled for test purposes. Where lamp indications other than those given in this paragraph are expected, those indications will be explained where mentioned in the text.

1.08 The attendant position is connected to the 300 SS by a telephone headset or handset plugged into the jacks of a position console. Removing the headset or handset disables the position and releases all existing connections. Lamp signals and the land-line loudspeaker continue to function. The secondary lamps transfer (SEC-LPS) key circuit can be activated even though the position is disabled. During the discussions in this section, it is assumed that proper connections are made at the position.

1.09 When the attendant has originated or answered a radio call, communication is on a push-to-talk basis. The push-to-talk switch may be either a hand-operated switch in the headset cord or a foot-operated switch.

2. METHOD OF OPERATION

A. Originating a Call

Direct Access Method

2.01 The direct access (DA) feature is provided at all attendant positions having access to interphone lines. The DA feature allows the attendant to seize directly, without dialing, an interphone line that is either wired directly or multiplied to his position. Each DA line has an associated nonlocking pushbutton key and line status lamp. When the DA key is momentarily operated,

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the DA circuitry disconnects any previously connected interphone or radio line and connects the position instrument jacks to the newly selected circuit. The DA lamp associated with the operated DA key will flutter. The DA lamp associated with the same DA line at multiple positions will light steadily. Signaling on outgoing calls may now be made by dialing, voice paging, or ringing, depending upon the type of line circuit used.

Indirect Access Method

2.02 The indirect access (IA) feature allows the attendant to dial-select interphone lines. The IA feature consists of a nonlocking pushbutton with an associated status indicator lamp and is used in conjunction with a pushbutton (PB) dial. Momentary operation of the IA button disconnects the position instrument jacks from any previously selected interphone line or radio circuit and activates the position PB dial. The appropriate code is then dialed on the PB dial; when the connection has been completed, the associated IA indicator lamp flutters. For outgoing calls, signaling may be made by further dialing, voice paging, or ringing, depending upon the type of line circuit selected.

Note: If the IA code is improperly dialed, the PB dial ready (RL) lamp flashes. The CLEAR button on the PB dial panel should be operated and the IA code redialed.

At end of conversation, attendant operates any other line key or RLS key to release connection.

B. Signaling on Outgoing Calls

2.03 After an attendant has selected an outgoing line circuit, further signaling may be required. This will depend upon the type of equipment at the distant end. Line types and methods of signaling are as follows.

- (a) Automatic signaling lines require no further attendant action.
- (b) When the selected line requires ringdown signaling, the attendant operates the ring and flash (R&FL) key.
- (c) When a manual line is selected that requires selective ringing, the attendant momentarily depresses the R&FL key for a long ring and the (SR) key for a short ring.

- (d) A code must be dialed when 2400/2600 Hz SS-1 selective signaling lines are selected.
- (e) Central office lines, PBX extensions, or PBX tie lines require that a number be dialed.
- (f) Voice signaling is required on certain types of lines.

2.04 The attendant uses the PB dial to dial a number on central office lines, PBX tie trunks, or PBX extensions. When the CO or PBX equipment is ready to receive dial pulses, a dial tone is heard in the attendant position headset. While dialing is in progress, the attendant should hear the guard tone. When the dialing is completed, the END key on the PB dial is manually operated, guard tone stops, the PB dial RL lamp is extinguished, and the ringing tone should be heard.

2.05 The outward signaling dial code required by SS-1 selective signaling lines may be either a 2-digit or a 3-digit code.

2.06 Simultaneous connections to two or more stations in the SS-1 system are accomplished in the following manner:

- (a) After dialing the first station code, the attendant operates the START key on the PB dial to re seize a register sender.
- (b) When the RL lamp lights steadily and a guard tone is heard, the attendant dials the second station code.
- (c) The guard tone stops and the RL lamp is extinguished when the second station code is outpulsed. The attendant then repeats (a) and (b) for each additional station desired.

Note: The END key on the PB dial is not used during this sequence because end information is automatically outpulsed after each station code is dialed.

C. Answering Incoming Calls

2.07 Incoming calls are indicated by signals on the DA, PCA, SCA, or LLCA line lamps associated with the type of call being received. If the incoming call is directed to a particular position, the position pilot lamp flashes at that position. An

attendant position handling radio calls observes a flashing DA lamp associated with single radio lines, or, if the radio line is a part of a combination, the incoming radio call causes a DA lamp associated with the combination to flash.

2.08 An attendant may answer an incoming DA call by operating the DA key associated with the flashing DA lamp. The attendant may answer an incoming DA call through the IA circuitry if the attendant knows the code of the line to be answered. When the incoming call is DA and the proper pushbutton has been operated, the line lamp signal changes from flashing to fluttering at the answering position, and changes from flashing to steady at all multiple appearances. The position pilot lamp is extinguished. Incoming calls on voice signaling lines may or may not be associated with a flashing signal lamp.

2.09 Primary common answering (PCA) calls directed to a particular position may be diverted to another preassigned position as secondary common answering (SCA) calls when the attendant at the PCA position operates the SEC LPS key. As many as three PCA calls may be in storage at any one time awaiting answering in sequence of receipt. PCA lamps at the primary position indicate calls in storage, and SCA lamps at the secondary position serve the same purpose. When more than one call is in storage, the flashing lamp signal advances one position as each preceding call is answered. For example, the number two call in storage advances to number one as the previous number one is answered, and the number three call advances to number two. The position pilot lamp continues to flash until the last call is answered. Long Lines (LL) calls, which are usually SS-1 type, may be stored, but only one lamp is provided to indicate the calls. The LL lamp continues to flash as long as calls are waiting. The attendant releases connection to a line and extinguishes the lamp signal at all appearances when all calls have been answered by operating another line key or the RLS key.

D. Override (Intercommunications)

2.10 The override feature permits an attendant to connect, through DA or IA circuitry, to any other position served by the 300 SS, even though the other position may be busy. An override lamp at the overridden position lights steadily, thus indicating to the attendant that he is being overridden.

No action is required at the overridden position. Incoming override speech is received through the loudspeaker or headset, determined by the operation of the headset-loudspeaker (HS-LS) key, if provided. If the HS-LS key is not provided, the attendant receives incoming override speech over the telephone headset.

2.11 An attendant may intrude on any busy line via DA or IA. A busy DA line is indicated to the attendant by a steady light. When the associated DA pushbutton is operated, the lamp changes to flashing. No visual indication is observed on busy lines selected by the IA circuitry.

2.12 If an attendant intercepts an incoming call directed to a particular position, the line lamp at the intruding position flutters and a change from flashing to steady is observed at the overridden position. The intruding position attendant should alert the attendant at the overridden position of the interception.

2.13 A coordinator position attendant may monitor, on an individual basis, any of the manual D controller positions over which he has supervisory control. From his overhead position, by operating the MON key and then dialing an appropriate 2- or 3-digit code, the coordinator may bridge his receiving capabilities to an attendant position. The attendant is then monitored without his knowledge. In this manner, the coordinator remains aware of the operational details of his sector without directly questioning the attendant. Override calls directed to the coordinator are received in the normal manner; but, to answer, the coordinator must first release the monitor condition.

2.14 The coordinator has a coordinator and conference circuit available that allows up to 15 coordinators and attendants to communicate under conference conditions. Attendant access to the conference circuit may be via DA or IA in the normal manner. A group of line keys and lamps located near the coordinator telephone set jacks provides a pickup key and lamp for each conference circuit available to the coordinator.

E. Supervisor Position Operation

2.15 Each 300 SS requires at least one supervisor position. This type of position may connect, one at a time, to all lines available to the system. Each line available to the system has a DA nonlocking

pushbutton key and a line lamp at the supervisor position. Some of these keys and lamps will remain in service although the system common control equipment is disabled. Indirect access circuitry is available for establishing connections to long line common answering and local line common answering features as well as to the override channels of other positions for intercommunications.

2.16 When incoming selective signaling of the supervisor position is required, position pilot, chime, and blanking equipment is provided and operated in the normal manner.

2.17 An access control key may be available at the supervisor console to limit the use of certain lines, usually central office lines. Momentary operation of the key to the OFF position permits one IA call on the restricted line. Leaving the key in the ON position allows unlimited access to the line. A lamp associated with the control key lights to indicate that the line is available for IA.

F. Central Computer Complex Console Position

2.18 The central computer complex console position J53026HK provides voice communication access to ARTCC positions, associated peripheral facilities, and local PBX lines. The console position includes six DA keys and a pushbutton dial for IA. Operation of the J53026HK position is similar to that of any other type of position used in the ARTCC.

G. Radio Line Operation

2.19 The 300 SS provides on an optional basis (to be locally engineered) the facilities for selecting and connecting to single radio lines or a combination of radio lines. An attendant may have the following features available at his position through DA or IA circuits: single radio lines, fixed combinations of radio lines, combinations of radio lines preselected by a central combiner and assigned to his position, or facilities to establish dial-controlled combinations from his position. The assignment of radio lines or combinations of radio lines to a particular position, in all cases except dial-controlled combinations, is determined by operational requirements. The position attendant cannot alter these combinations. Dial-controlled combining, however, allows the attendant to select up to six radio lines and the modes of operation for these lines such as receive only, or transmit and receive.

A separate PB dial is required at all positions having dial-controlled combining facilities.

Selection of Single Radio Line

2.20 Single radio lines may appear at a position as a direct access line. Attendant may select the line on an indirect access basis. Single radio lines may appear at a position as part of a combination and on a direct access basis.

Attendant Dial-Controlled Combining

2.21 To establish a dial-controlled combination, the attendant operates the RO or RT key and then dials the IA code of each line to be added to the combination. The receive only (RO) key, when operated, establishes only the receive channel, while the receive-transmit (RT) key establishes the receive and transmit channels of a radio line to the combination. A group of combiner status lamps is provided (maximum of six) to indicate the number of lines in a combination. A cutoff key may be provided to control these lamps.

2.22 Operation of the erase (ER) key releases all lines from a combination that an attendant may have established.

Central Combining

2.23 Central combining permits the establishment of combinations of radio lines for attendant positions from a central combiner position. The central combiner has nonlocking position (POS) keys. Each POS key corresponds to an attendant position having access to the central combiner. Attendant operates POS key corresponding to desired position. Associated POS lamp lights. The central combiner position has an RO key, an RT key, an ER key, a PB dial, and a group of status lamps (maximum of six), which perform functions comparable to those at the attendant positions.

2.24 To establish a combination from the central combiner position, a central combiner attendant operates the RT key to the ON position if both receive and transmit channels are desired, or the RO key to the ON position if only the receive channel is desired. The attendant then operates the position selecting key(s) corresponding to the attendant positions that are to have access to the combination. The associated position lamp(s) is lighted, and the attendant releases the nonlocking

position-selecting key(s). When the PB dial RL lamp is lighted, the desired code may be dialed to establish the first radio line in the combination. Additional lines may be added to the combination by reoperating the position selecting key(s) and by dialing the desired code for each line to be included in the combination. The RT or RO key must remain in the ON position or be restored to the ON position before setting up the next line.

2.25 Once a combination has been established by the central combiner, the operating position attendant seizes the combination by operating the DA key associated with the combination. The receive channel of the combination is transferred from the loudspeaker to the attendant headset. The attendant may then transmit over the transmit channel if that capability is included in the combination.

2.26 Operation of another line key or the RLS key releases the combination and reconnects the receive channel to the loudspeaker set.

▶Attendant Key-Controlled Combining

2.27 The key combiner consists of a group of keys and lamps located at an attendant position and a group of control relays in the radio line combiner circuit. With this circuit, an attendant can place from 1 to 12 radio lines in a combination. Receive channel only may be placed in the combination when monitoring only is desired. Both receive and transmit channels can be placed in the combination when talking out on the line is required.

2.28 An associated direct access key must be depressed to seize the combination after it has been set up.

2.29 Each radio line appearing at the key combiner has one each of the following connected to it:

- REC key
- REC lamp
- TRS key
- TRS lamp
- SY (syllabic) lamp

2.30 The REC key is a 3-position, locking key: OFF, LS, and HS. Operation of this key to the LS position places the receive channel in a combination that can be monitored over the radio loudspeaker. When the key is operated to the HS position, the receive channel is placed in combination to be monitored by headset. However, before monitoring by headset, the combination must first be seized by operating the direct access key associated with the key combiner. The REC lamp, when on, indicates its associated receive channel has been placed in combination.

2.31 The TRS key is a 2-position On-Off locking key. Operation of this key to the ON position, places both the receive and transmit channels in the combination. The TRS lamp, when on, indicates both the receive and transmit channels have been placed in the combination. The attendant must operate the direct access key to seize the combination.

2.32 A syllabic lamp is connected to the receive channel of each radio line. This lamp lights on incoming voice currents to indicate an incoming call.

2.33 If the REC key is operated to LS position and its associated TRS key is operated to the ON position, the receive channel of the radio line will be connected to both loudspeaker and headset when the combination is seized.♦

Fixed Combining

2.34 Fixed combining enables a position attendant to gain access to a combination of radio lines through DA or IA circuitry in the normal manner. A fixed combination is usually wired semipermanently in an equipment room, and the attendant has no control over the selection of the radio lines in the combination. Each combination is associated with a single DA key, line lamp, and SY lamp at attendant position. A line lamp and an SY lamp is associated with each line at positions where line is available as direct access.

2.35 This circuit does not provide for eliminating the transmit channel of a radio line from attendant telephone set. When the attendant operates the DA key associated with combination, he is able to transmit simultaneously to all lines in the combination. When the attendant releases combination by operating RLS key or any other

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line key, receive channel leads are transferred from telephone headset to loudspeaker set for monitoring purposes.

Automatic Radio Transfer

2.36 An attendant position, equipped with the automatic radio transfer feature, has access to both radio lines and land-lines. Each attendant position is equipped with a set of radio jacks and a set of telephone jacks. These sets of jacks may be used individually or simultaneously.

2.37 When a headset or handset is plugged into radio jacks only, and when no line key has been operated, the attendant position is connected to a radio line. The push-to-talk switch on the headset or handset remotely controls the radio line. Operation of a line key automatically transfers the attendant position from radio to land-line operation. After completing land-line call, the release key is operated. This automatically transfers the attendant position back to radio operation.

2.38 When a headset or handset is plugged into telephone jacks only, the attendant position operates as a normal land-line position.

2.39 When one headset or handset is plugged into the radio jacks, and another into the telephone jacks, the attendant position operates as a radio position and a land-line position simultaneously. The attendant who is plugged into the radio jacks may talk and listen on the radio line. At the same time, the attendant position plugged into the telephone jacks may operate as a normal land-line position. Under these conditions, the transfer feature is locked out.

2.40 A customer-owned loudspeaker is provided for incoming radio calls. This loudspeaker is **connected** when radio jacks are **not connected** to the radio line. It is **disconnected** when radio jacks **are connected** to a radio line.

2.41 An override call, directed to an automatic radio transfer position, will be connected as follows:

- To radio jacks when position is using **radio jacks only**, whether attendant is engaged in radio call or land-line call. Overrider cannot transmit over radio line but can hear both sides of radio conversation.
- To telephone jacks when position is using **telephone jacks** only.
- To telephone jacks when position is using both **radio jacks** and **telephone jacks**.

H. Equipment Frame Key Operation—Lamp Signal Circuit

2.42 The transistor flash circuit and the transistor flutter circuit are both free-running multivibrators. When voltage is applied initially, or after a **power interruption**, both transistors may conduct simultaneously. This results in a steady output from the circuit. Momentary operation of STA key will restore multivibrator action to flash circuit. Momentary operation of STB key will restore multivibrator action to flutter circuit. STA and STB keys are located adjacent to signal circuit on equipment frame.◆