

SWITCHING SYSTEM NO. 400

IDENTIFICATION

1.00 GENERAL

This section covers the identification of a 2-digit dial crossbar-type system designed primarily to provide dial inter-communication for up to 40 stations.

2.00 INTRODUCTION

2.01 Switching System No. 400 is a packaged unit with 6 talking paths and 20 station lines in the basic unit. It is expandable to 30 or 40 station lines by adding plug-in, 10-line supplementary units. Basic package also contains equipment for two central office lines arranged with an add-on feature.

2.02 Need for an attendant position is eliminated. Key telephone sets or THE CALL DIRECTOR sets are used instead (see Fig. 1).

2.03 The numbering plan provides for station line numbers from 20 through 39 for 20-line system, 20 through 49 for 30-line system, and 20 through 59 for 40-line system. Unassigned lines must be cross-connected to reach busy-tone trunk. Line 39 is wired as a test line but may be used as a regular station line.

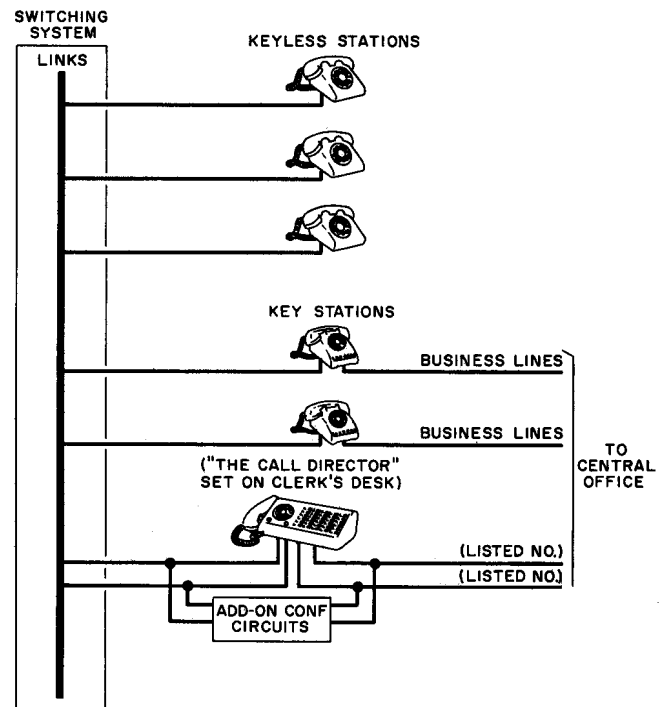
2.04 A batteryless power plant is self-contained. It operates on 115 volts ac and supplies +48 volts, -48 volts, and 10 volts ac. Also dial tone, busy tone, automatic ringing, and audible ringing are supplied. Through the use of large capacitors, the system is capable of holding circuits during momentary commercial power interruptions.

2.05 Three universal line circuits are provided which may be used for 2-way tie trunks, telephone dictation trunks, connections to loudspeaker paging trunks, 3A code call, or regular station lines. Appropriate trunk circuits must be located in an external equipment cabinet. (See Fig. 2.)

Note: Two universal line circuits are required for 3A code call.

2.06 There is space within the cabinet for mounting additional Direct Station Selection (DSS) units, future touch-tone calling circuits, additional add-on line, and/or central office line circuits.

2.07 Group hunting is available in any group of lines having the same tens digit by a simple strapping arrangement. Hunting can be sequential or nonsequential and in ascending or descending order. For one-way sequential hunting, a diode must be used instead of a strap. Two 426A diodes are furnished with each line, link, and connector unit. They are wired to a



NOTE 1: KEYLESS STATIONS INTERCOMMUNICATE ON 2-DIGIT BASIS VIA SWITCHING SYSTEM, AS DO KEY STATIONS AND "THE CALL DIRECTOR" SETS.

NOTE 2: OUTSIDE CALLS ARE PLACED DIRECT BY KEY STATIONS. KEYLESS STATIONS HAVE ACCESS TO CENTRAL OFFICE VIA "THE CALL DIRECTOR" SET WITH ADD-ON CONFERENCE CIRCUITS.

Fig. 1 - Switching System No. 400 Diagram

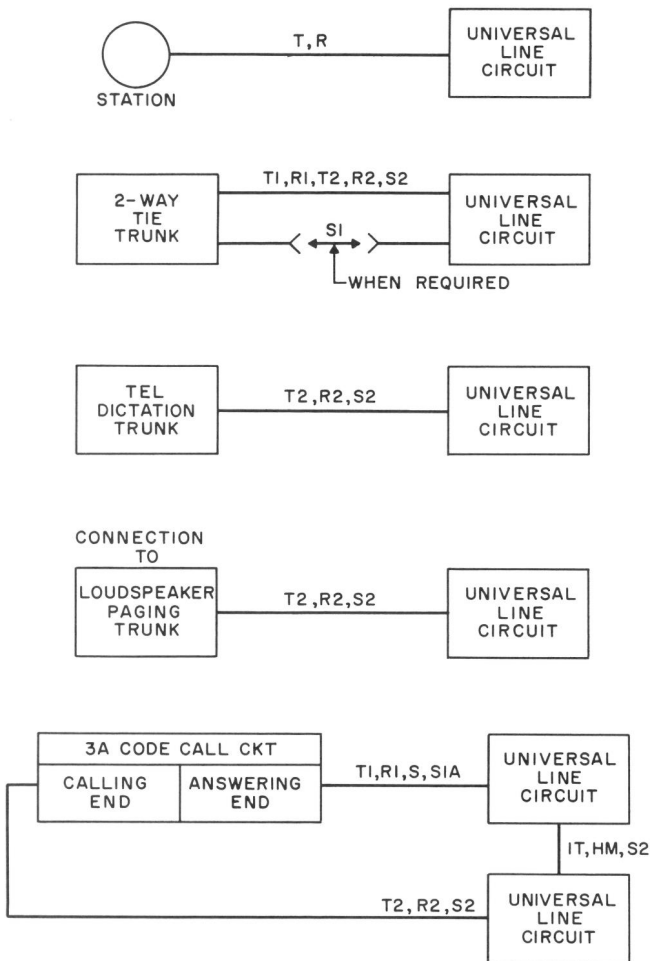


Fig. 2 - Universal Line Applications

plug-in assembly on the unit for ease of installation. Additional 426A diodes must be ordered separately as required.

2.08 Three jacks at the top of slide No. 2 are provided (see Fig. 3). A test box called call progress indicator set may be plugged into these jacks. See section entitled Call Progress Indicator Set, Operating Methods.

### 3.00 STATION OPERATION

3.01 Any type of common battery, bridged ringing telephone set may be used with the Switching System No. 400. Intercommunicating between stations is accomplished by dialing the called station's two digits. Connection to a universal line is completed by dialing only one digit, 6, 7, or 8.

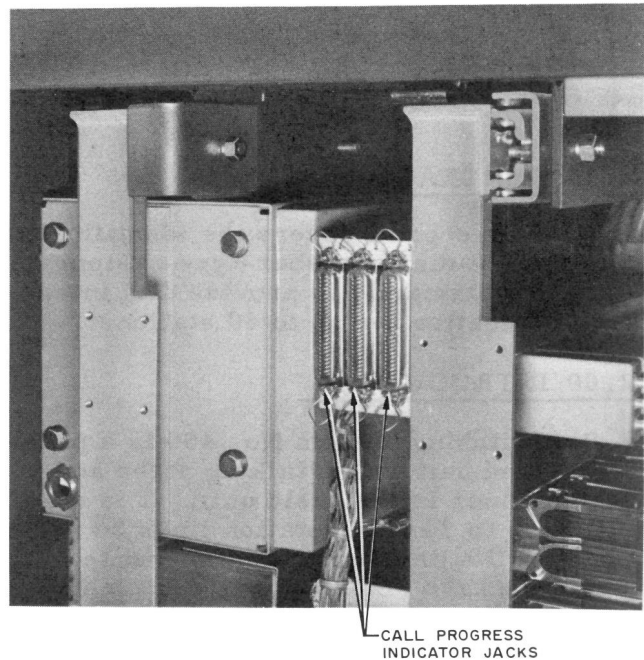


Fig. 3 - Call Progress Indicator Jacks on Slide No. 2

3.02 Key telephone or THE CALL DIRECTOR sets are used for receiving or originating central office add-on calls. This is shown in Fig. 4 and 5. An associated station line is required for each central office line with add-on feature.

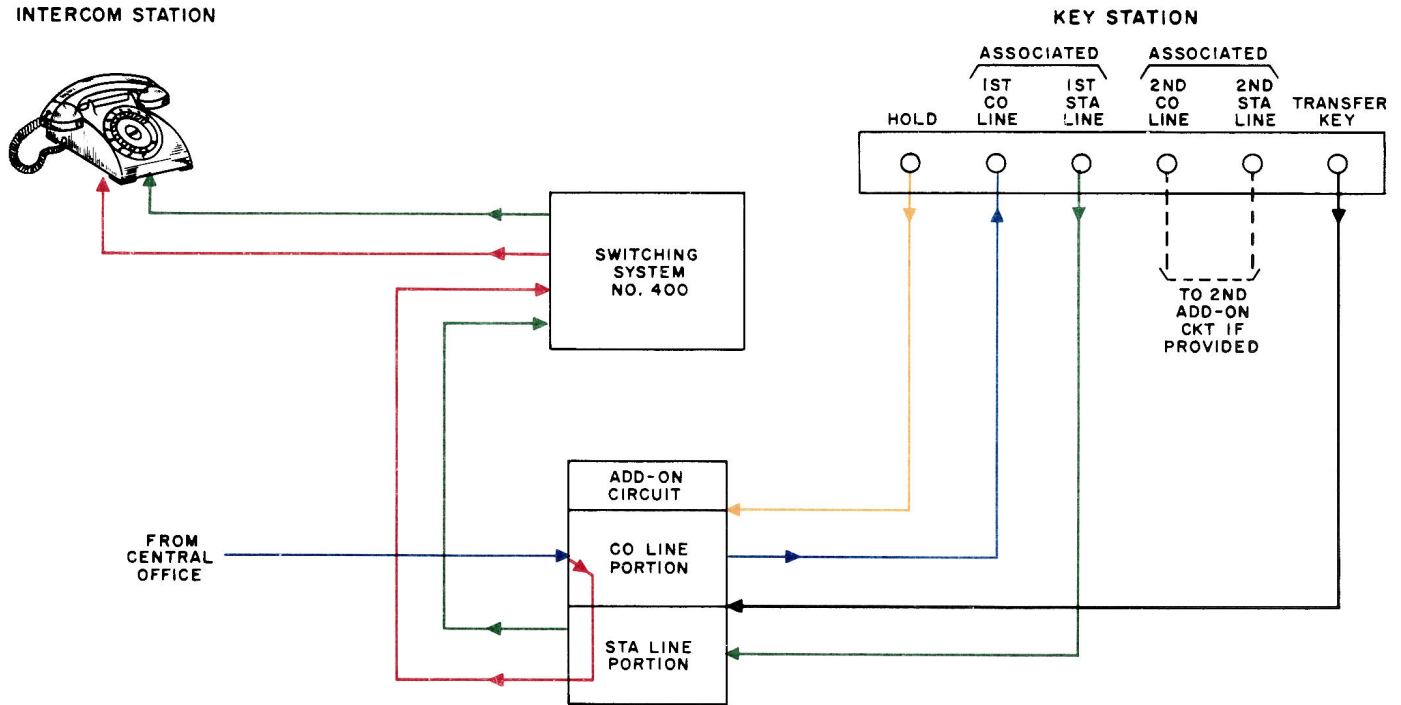
3.03 Separate central office lines without add-on feature may also be terminated in the same key sets. The service features are the same as those of the 1A1 key telephone system, pickup, hold, line and busy lamp, etc.

3.04 Telephone sets connected to the system require only two conductors (tip and ring). Extensions may be used for multiple appearances of lines.

3.05 DSS, if provided, allows a station to place a call by the use of a signaling key instead of dialing. Keyless as well as key stations may be equipped with DSS signaling keys. For keyless telephone sets, 551, 549, or equivalent keys may be used. Keys in key telephone sets or THE CALL DIRECTOR sets must be converted to nonlocking when used for DSS signaling. Each signaling key should be designated with the number or initials of the called station that is to be signaled.

**STEPS:**

1. INCOMING CALL RINGS AT KEY STATION.
2. KEY STATION ANSWERS AND HOLDS.
3. KEY STATION DIALS INTERCOM STATION.
4. KEY STATION OPERATES TRANSFER KEY.
5. CENTRAL OFFICE LINE CONNECTED TO INTERCOM STATION.



NOTE: KEY STATION RESTORES HANDSET, AND DISCONNECT IS UNDER CONTROL OF INTERCOM STATION.

Fig. 4 - Block Diagram of Add-on Feature  
(Incoming Call to Intercom Station  
Via Key Station with Add-on)

#### 4.00 EQUIPMENT (See Fig. 6, 7, and 8.)

4.01 Switching System No. 400 is contained in a single cabinet of the 756 PBX-type (see Fig. 9). The equipment is mounted on three pull-out slides. An interlock arrangement permits pulling out only one slide at a time, thus eliminating the need for anchoring the cabinet to prevent tipping.

4.02 The equipment cabinet is 27-1/4 inches wide, 30-1/8 inches deep, 63-5/8 inches high, and with the top raised, 92-1/2 inches high. The 20-line cabinet weighs 740 pounds. The 40-line cabinet

weighs 820 pounds. See Fig. 10 for floor space requirements.

4.03 The same type of cabinet is supplied with a list 1 or list 2 basic unit. Either list may be enlarged in the field by adding equipment to the maximum capacities shown in Table A.

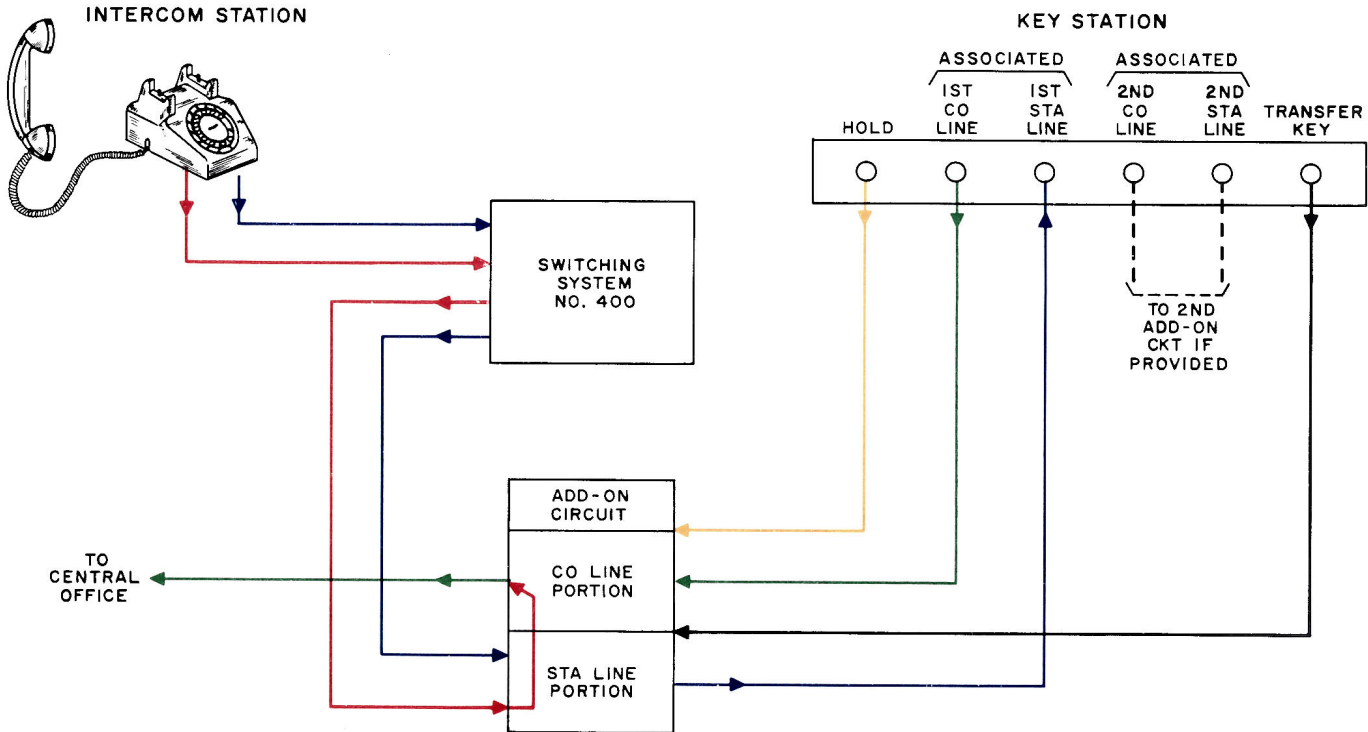
4.04 The equipment is subdivided as follows:

J53035A-1, List 1 Cabinet Assembly

- The basic 20-line, 6-junctor system equipped with two add-on line units.

## STEPS:

1. INTERCOM STATION DIALS KEY STATION.
2. KEY STATION ANSWERS AND HOLDS.
3. KEY STATION DIALS ON CENTRAL OFFICE LINE
4. KEY STATION OPERATES TRANSFER KEY.
5. INTERCOM STATION CONNECTED TO CENTRAL OFFICE LINE.



NOTE: KEY STATION RESTORES HANDSET, AND DISCONNECT IS UNDER CONTROL OF INTERCOM STATION.

Fig. 5 - Block Diagram of Add-on Feature  
(Outgoing Call from Intercom  
Station Via Key Station with Add-on)

Slide No. 2, the center slide, contains the marker and registers. The marker is similar to the marker of the 756A PBX, except virtually all of the duality has been removed. In addition, all CO trunk and attendant facilities have been eliminated. There is space on this slide for four additional mounting plates. See Table A and Note 2. Slide No. 3, the right-hand slide contains the line, link, and connector units for lines 20 through 29 and 30 through 39 and the three universal line circuits. This slide also contains the junctor

and dial pulse register units. Slide No. 1, the left-hand slide, contains the power supply, interrupter, and fuse panel. There is space available on this slide for adding two line, link, and connector units for lines 40 through 49 and 50 through 59 (see Fig. 11 and 12). Plug-ended cables are in place on this slide for connecting these 10-line supplementary units into the system and extending necessary T and R leads to the crown (see Fig. 13). The crown of the cabinet contains a number of quick connect-type connecting blocks (see

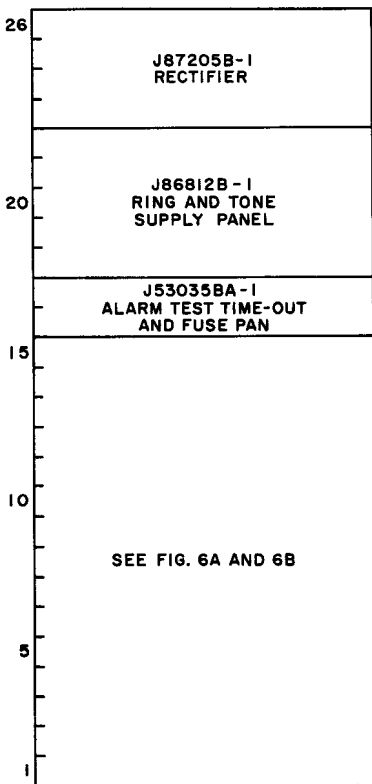


Fig. 6 - Slide No. 1

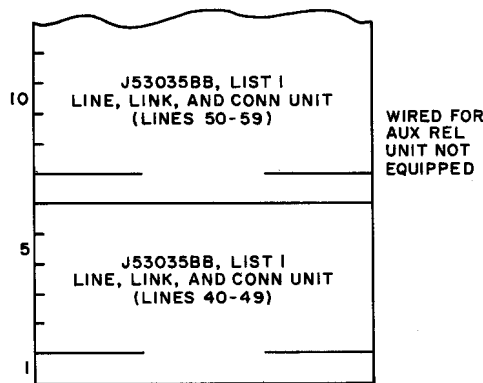


Fig. 6A - Slide No. 1, Equipped for Lines 40-59

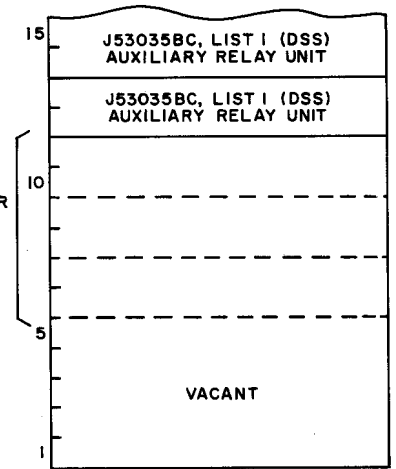


Fig. 6B - Slide No. 1, Equipped per J53035A, List 2

Fig. 14). Station wire or cable terminates directly inside the cabinet. There is no provision made for bridging on these blocks. Three capacitors located in the crown will carry the system dc load for approximately 1/4 second during a momentary interruption of commercial power. Lift-off panels on the sides and front of the cabinet are removable for installation and maintenance operations.

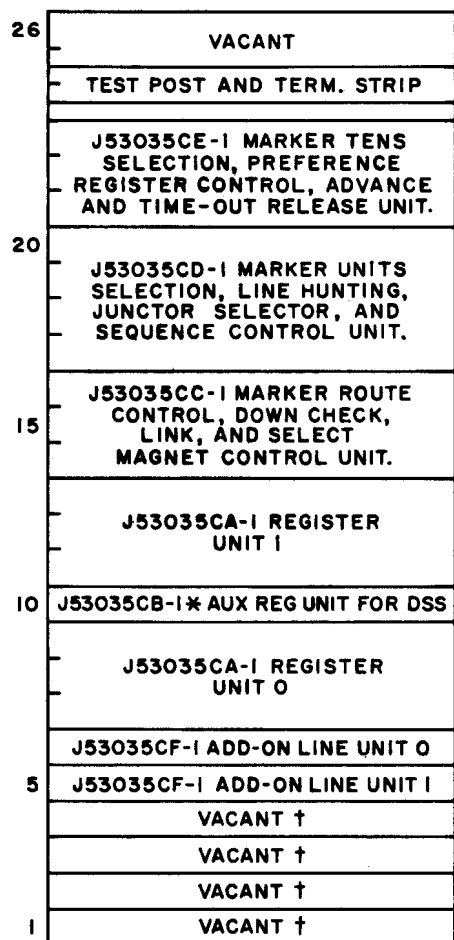
J53035A-1, List 2 Cabinet Assembly

- In addition to the above, the list 2 cabinet assembly is factory equipped with two DSS units mounted in slide No. 1 and an auxiliary register unit

mounted in slide No. 2. This equipment is sufficient for eight stations. Wiring for up to 20 stations is furnished. Connections for DSS stations are made on connecting blocks within the crown.

J53035BB-1, List 1 Line, Link, and Connector Unit.

- The 10-line supplementary unit required to expand the 20-line system to 30 and 40 lines. It consists of a crossbar switch and a number of relays wired to three 50-point connectors on the rear of the unit. All that is required to install this unit is to mount it on the slide using four screws,



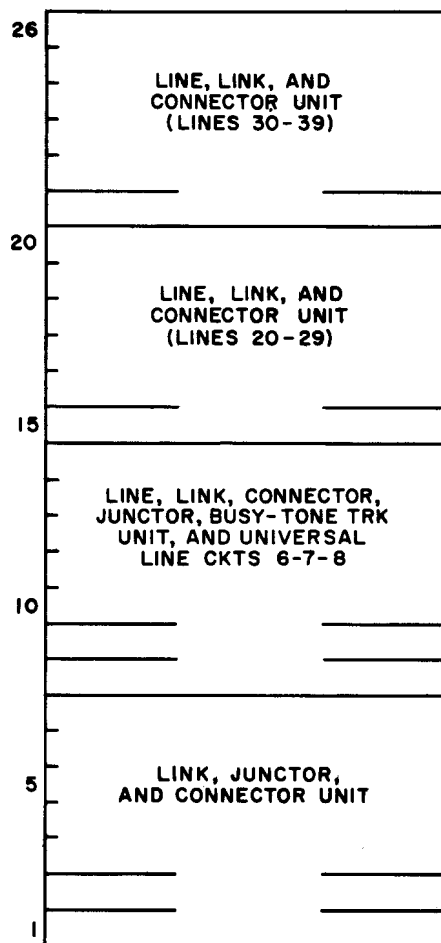
\* FURNISHED ONLY WITH J53035A, LIST 2.  
 † SEE TABLE A AND NOTE 2.

Fig. 7 - Slide No. 2

and plug in the connector-ended cable provided on the slide.

J53035CF-1, List 1 Add-on Line Unit

- A single mounting plate unit, 2 inches by 23 inches, containing all the apparatus required to provide the add-on feature on one CO or PBX line. The unit is made up of three parts; a CO or PBX line circuit, a bridging circuit, and a station line circuit. The CO or PBX line and the station line circuits are functionally the same as the line circuit units of the 1A1 key telephone system (202-, 230-, 238-, and 239-type key telephone units), and as such, provide for pick-



NOTE: EQUIPMENT FOR SLIDE 3 PER J53035D-1 (NO OPTIONAL EQUIPMENT).

Fig. 8 - Slide No. 3

up and hold with illumination. The bridging circuit is functionally similar to the PBX bridging circuit (237-type KTU) of the 1A1 key telephone system. The major differences are that the add-on line unit operates on 48 volts dc rather than 24 volts dc, and the apparatus is mounted on 2-inch mounting plate rather than panel-type mounting plate.

J53035CG-1, List 1 Key Telephone Unit

- A single mounting plate unit, 2 inches by 23 inches, containing three line circuits. These circuits are identical in service and features to the above mentioned 1A1 key telephone

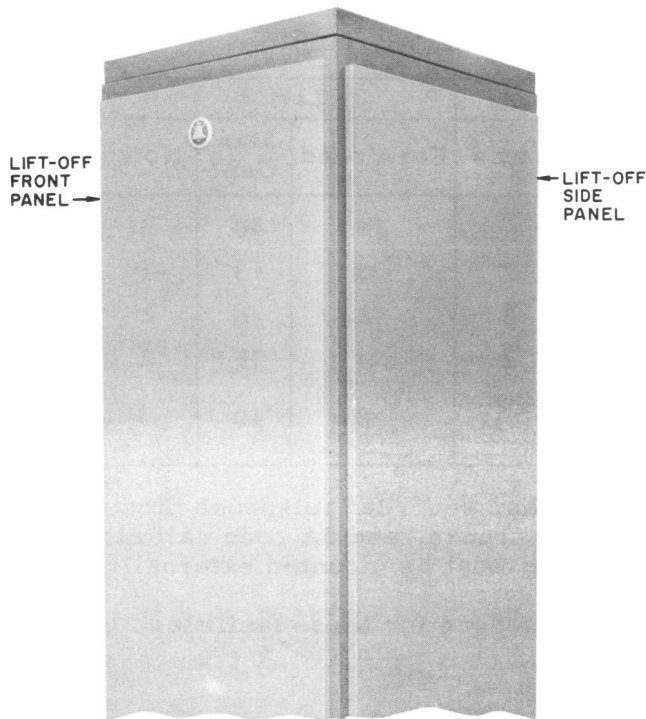
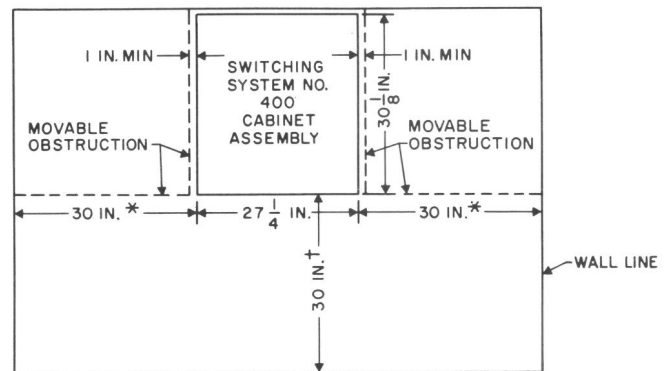


Fig. 9 - Switching System No. 400 Cabinet

system line circuits, the only difference being 48 volts dc operation rather than 24 volts dc. The unit can be used to terminate auxiliary CO or PBX Switching System No. 400 lines where the add-on feature is not required.

J53035BC-1, List 1 DSS Auxiliary Station Relay Unit

- A double mounting plate unit, 4 inches by 23 inches, containing equipment for four stations. Each station equipped with DSS can originate a call to any one of ten other stations associated with the system. One nonlocking key per called station is required at the calling station. All stations may be equipped with this feature by ordering the proper number of units (one unit per four calling stations). The four calling stations using the same unit are not limited to calling the same ten stations. Two of these units are furnished when J53035A-1, List 2 cabinet assembly is specified.



\* SPACE REQUIRED ON SIDES AS MAINTENANCE AREA.

† SPACE REQUIRED FOR WITHDRAWING SLIDES (MAY BE AISLE SPACE).

Fig. 10 - Floor Space Requirements

J53035BC-1, List 2 Diode Assembly for DSS

- A separate plug-in diode assembly (one for each calling station) consisting of twenty 400J diodes (10 tens and 10 units). Strapping between these diodes determines which ten stations are called. Eight assemblies are furnished with the two DSS auxiliary relay units when J53035A-1, List 2 cabinet assembly is specified. Order one diode assembly for each station when ordering additional DSS auxiliary relay units.

J53035CB-1, List 1 Auxiliary Register Unit for DSS

- Contains relay equipment designed to supplement the dial pulse register circuits. It operates in conjunction with DSS auxiliary relay units and DSS signaling keys, and allows dial pulse registers to operate to select called station number without using pulsing relays. This unit is shop-mounted when J53035A-1, List 2 cabinet assembly is specified and must be ordered separately and be field-mounted when adding DSS to list 1 cabinet assembly.

4.05 The list 2 cabinet assembly equipped for twenty lines provides mounting space for up to five DSS relay units in

TABLE A  
CAPACITY OF SWITCHING SYSTEM NO. 400

Feature	List 1			List 2		
	Furnished	Max Cap.	Notes	Furnished	Max Cap.	Notes
Station Lines	20	40		20	40	3
Universal Lines	3	3	1	3	3	1
Add-on Lines	2	6	2	2	6	2
Key Telephone Lines	-	12	2	-	12	2
DSS Stations, Maximum Ten Keys Per Station	-	40	3(c)	8	40	3

Note 1: Optional items such as 2-way tie trunks, recorded telephone dictation trunks, connections to loudspeaker paging trunks, and 3A code call circuit may be associated with universal lines but must be mounted externally.

Note 2: Slide No. 2, mounting spaces 1-4, reserved for these facilities may be equipped as follows:

- (a) 4 add-on lines (four 1-circuit units), or
- (b) 12 key telephone lines (four 3-circuit units), or
- (c) Any combination of (a) and (b) totaling 4 units.

Note 3: May be expanded to provide total combinations as follows:

- (a) 20-station lines - 0 to 19 DSS stations,
- (b) 30-station lines - 0 to 15 DSS stations, or
- (c) 40-station lines - 0 to 39 DSS stations, but DSS equipment is all mounted externally.

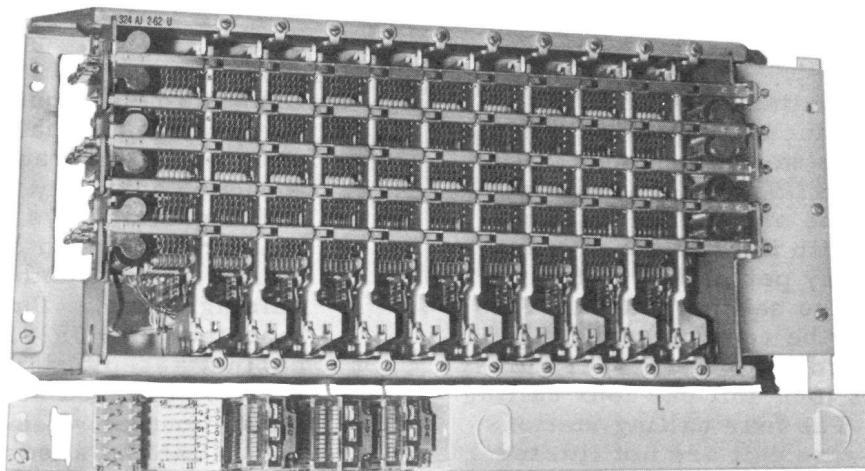


Fig. 11 - Line, Link, and Connector Unit for Lines 40-49  
or 50-59, Front View



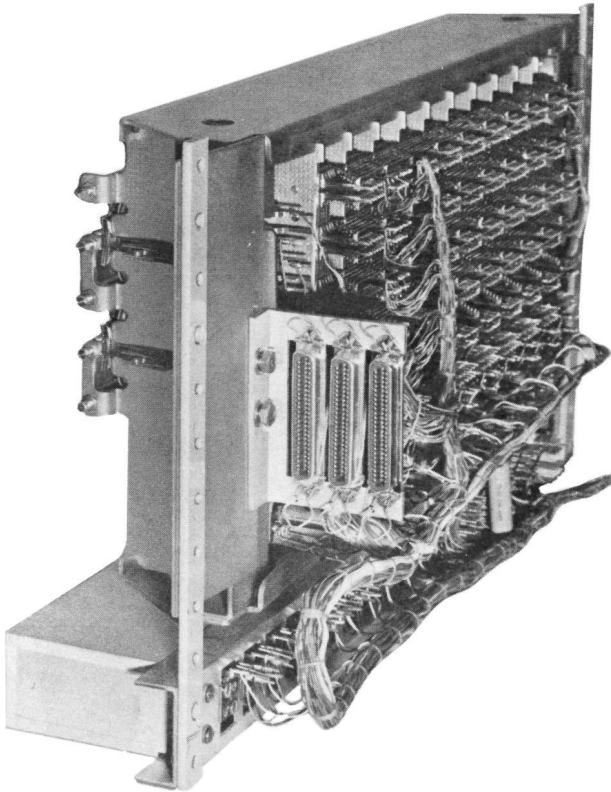


Fig. 12 - Line, Link, and Connector Unit for Lines 40-49 or 50-59, Rear View

slide No. 1 (see Fig. 6). When equipped for thirty lines, space is available for only four DSS relay units. When equipped for forty lines, there is no space within the cabinet and all DSS relay units must be mounted in an external equipment cabinet.

4.06 Ten DSS relay units are required in an external equipment cabinet to equip all forty stations for DSS service.

4.07 The J53035A-1, List 1 system does not contain any DSS relay equipment. It does have the DSS register connecting block in the crown. Cable pairs from the crown go to the DSS register unit location in slide No. 2. Also, leads that are needed from dial pulse register circuits appear at this location. If DSS is to be added, the DSS register unit is installed in slide No. 2, and all the DSS relay units are installed in an external equipment cabinet.

4.08 The 7-inch panel-type key telephone units coded 249A and 250A will be

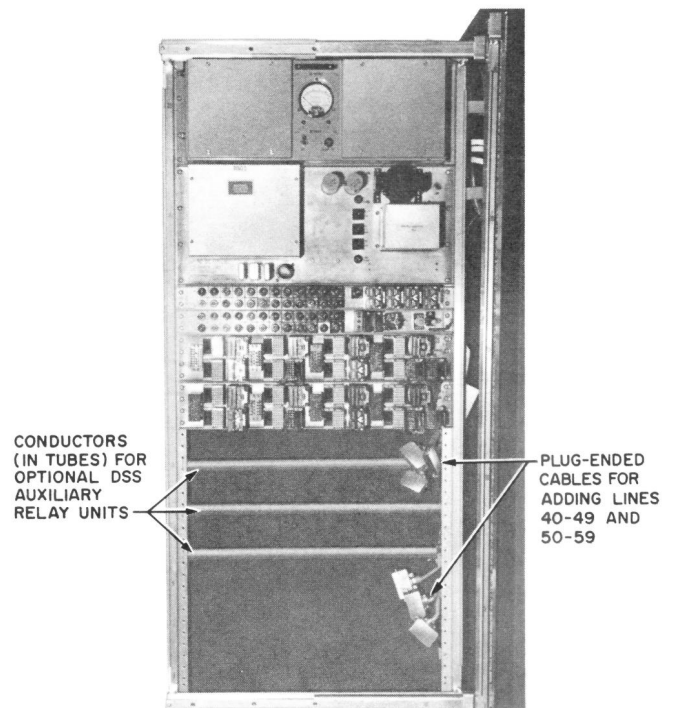


Fig. 13 - Slide No. 1

available as soon as manufacturing facilities permit. These units (two 249A and one 250A key telephone units) will be functionally the same as the J53035CF-1, List 1 add-on line unit but arranged for 24-volt dc operation. They are designed to be used in those systems where the CO line with add-on requirement exceeds the available space within the cabinet. Any standard equipment cabinet capable of handling 200-type key telephone units may be used. A separate power plant will be required.

4.09 A set of schematic drawings and circuit description sheets is furnished in a binder and stored in the cabinet crown. Drawings for other features which may be provided on an optional basis, such as tie trunks and recorded telephone dictation trunks, must be ordered separately.

4.10 Circuits and equipment of Switching System No. 400 are covered in the following drawings:

SD- and CD-69463-01 - Cabling Diagram  
SD- and CD-69464-01 - Junctor Circuit  
SD- and CD-69465-01 - Busy-Tone Trunk

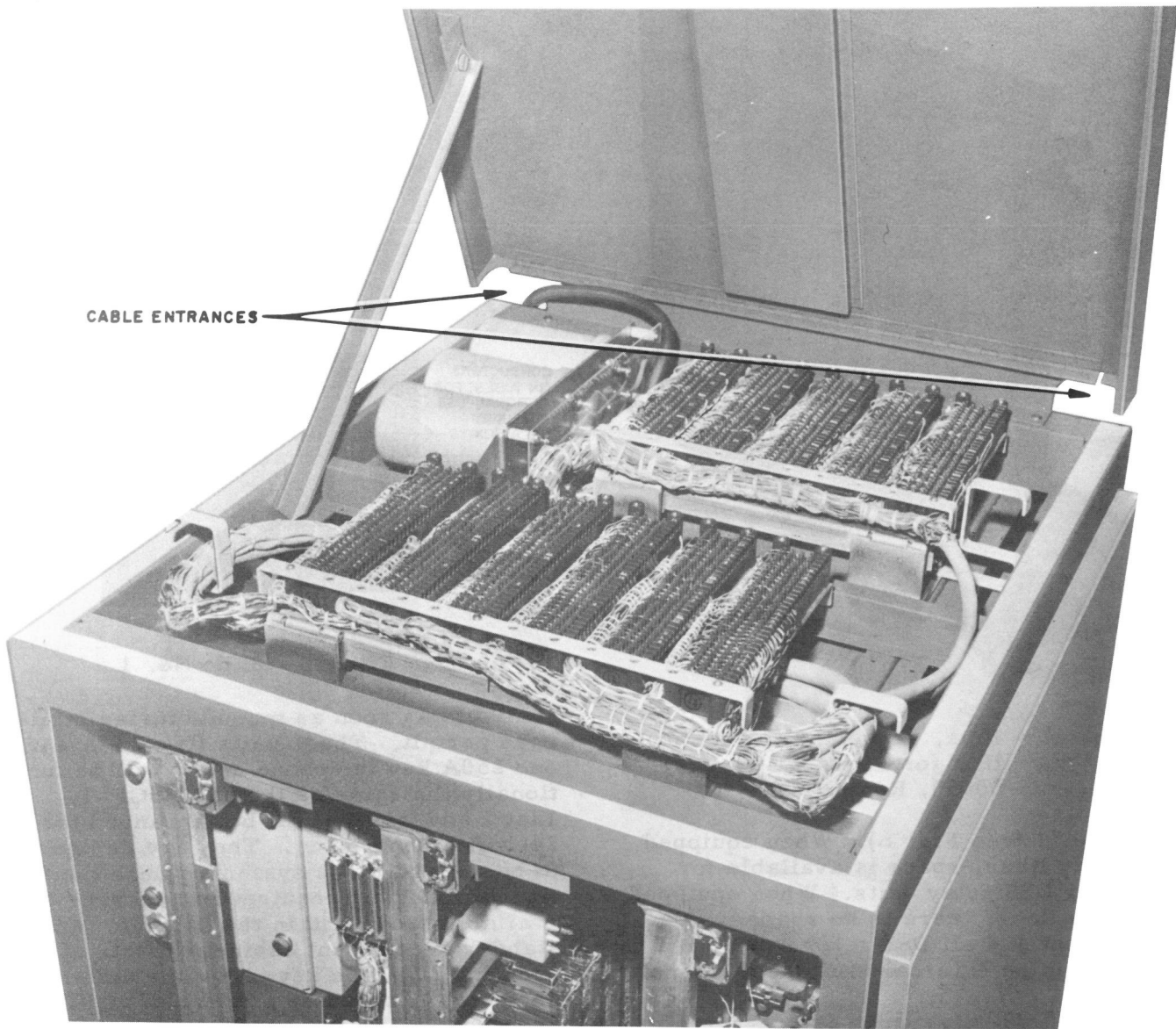


Fig. 14 - Cabinet Crown

- SD - and CD-69466-01 - Key Telephone Line, an Add-on Circuit
- SD- and CD-69467-01 - Auxiliary Relay Circuit for DSS
- SD- and CD-69468-01 - Marker Circuit
- SD- and CD-69469-01 - Line, Link, and Connector Circuit
- SD- and CD-69470-01 - Dial Pulse Register Circuit
- SD- and CD-69471-01 - Alarm and Test Circuit

- SD- and CD-69473-01 - Key Sheet
- SD- and CD-81577-01 - Power Supply Circuit
- ED-69479-10 - Equipment Diagram and Index

- 4.11 Ordering information is as follows:
- J53035A-1, List 1 Cabinet Assembly
  - J53035A-1, List 2 Cabinet Assembly
  - J53035BC-1, List 1 Auxiliary Relay Unit (DSS)
  - J53035CB-1, List 1 Auxiliary Register Unit (DSS)

J53035BB-1, List 1 Line, Link, and Connector Unit (Lines 40-49 or 50-59)  
 J53035CF-1, List 1 Add-on Line Unit  
 J53035CG-1, List 1 Key Telephone Line Unit  
 J53035BC-1, List 2 Diode Assembly (for DSS)

249A Key Telephone Unit CO or Line Circuit  
 250A Key Telephone Unit Add-on Circuit

### 5.00 FUNCTIONAL DESIGNATIONS

The functional measuring and B sheet locations on SD drawings for relays are given in Tables B and C.

TABLE B  
 MARKER RELAYS

Relay	Sh*	Functional Meaning	Relay	Sh*	Functional Meaning
AC	2	Abandoned call	RPAO, RPA1	2	Register preference aux
ALB	9	All links busy	RUC	2	Register units connector
ARB	1	All registers busy	S 0-9	5	Sleeve
BSY, BSYA	4	Circuits busy	SA	11	Second trial auxiliary
BTC	8	Busy-tone trk connector	SE	4	Sleeve end
BTT	8	Busy tone	SMR, SMRA	8	Select magnet register
BY	4	Busy test	SMT	10	Select magnet timing
DCK	11	Down check	SOA	8	Sleeve operate
HC	4	Hunt connector	ST	11	Second trial
HMK	4	Hold magnet check	STR	11	Second trial register
HMT, HMTA	8	Hold magnet timing	T 1-5	1	Line tens
JRO-5	7	Junctor register	TA	11	Time-out auxiliary
JRE	7	Junctor register end	TA 1-5	1	Line tens auxiliary
JTA, JTAA	7	Junctor terminating	TAC	2	Tens auxiliary connector
JTB	7	Junctor terminating	TEO, TE1	1	Tens end
LB	9	Link busy	TM	11	Tens magnet
LE	9	Link end	TO	11	Time-out
LS, LSA	9	Link start	TOK	11	Time-out check
LSH	9	Link shift	TOL	11	Time-out lock
LT2-9	9	Link test	TP1-5	1	Tens preference
LTC	9	Link test connector	TR	11	Trunk tens
LUC	2	Line units connector	TRC	7	Trunk class
MTA, MTB	11	Marker timing	TRCA	7	Terminating route complete
NA	11	No connection auxiliary	TRK, TRKA	7	Terminating route check
NC	11	No connection	TRL	9	Transfer links
RO, R1	1	Register	UO-8	3	Units
RAO, RA1	8	Register allotter	U9	4	Units
RCK	11	Release check	UE	2	Units end
RCT, RCTA	7	Register cut through	UL	2	Units lock
RG	8	Register group	WIL, WL	10	Link sequence
RHK	8	Register hold magnet check	WLG, WLGA	9	Link sequence
RL	8	Release	WU	4	Units sequence
RLA	8	Release alarm	ZIL, ZL	10	Link sequence
RLS, RLSA	11	Trouble release	ZLG	9	Link sequence
RPO, RP1	1	Register preference	ZU	4	Units sequence

\* Reference SD-69468-01.

TABLE C

LINE, LINK, AND CONNECTOR, DIAL PULSE  
REGISTER, ALARM AND TEST, BUSY-TONE TRUNK,  
JUNCTOR, AND DSS RELAYS

Circuit	Relay	Sh	Functional Meaning
Line, Link, and Connector Circuit, SD-69469-01	IN 6-8	4	In
	L 6-8	4	Universal line
	OT 6-8	4	Out
	SL 6-8	4	Sleeve
	SMC 0-5	6	Select magnet connector
	TC 1-5	6	Tens count
	TCA 1-5	6	Tens count auxiliary
Dial Pulse Register Circuit, SD-69470-01	BY	1	Busy
	DC	3	Dial completion
	KRA	3	Key pulsing register advance
	L	1	Line
	ON	1	Off normal
	OT	3	Only tens
	P 1-5	2	Pulse counter
	P2A	2	Pulse counter auxiliary
	PU	1	Pickup
	RA	1	Register advance
	RC	5	Register connector
	RCA	5	Register conn auxiliary
	RLL	1	Register release
	RT	1	Register test
	SR	1	Supervisory
	STR	3	Steering
	SW	3	Switching
TD 0-9	3	Tens digit register	
TMO	1	Time-out	
TR	3	2-digit trunk	
UD	3	Units digit	
UD 0-9	4	Units digit register	
Alarm and Test Circuit SD-69471-01	AL	2	Alarm
	FAC	2	Fuse alarm ac
	FAN	2	Fuse alarm neg
	FAP	2	Fuse alarm pos
	PU	2	Pickup
	TMO	2	Time-out
TR	2	Trouble	
Busy-Tone Trk, SD-69465-01	A	2	
	RA	2	
Junctor Ckt, SD-69464-01	A	2	
	B	2	
	D	2	
	TP	2	Tripping
DSS Auxiliary Register and Relay Circuits, SD-69467-01	DSC 0-1	4	DSS connector
	PR 0-1	4	Priority
	K	3	Key
	RC 0-1	3	Register control
	SC	3	Station connector