1P2 KEY TELEPHONE SYSTEM

TESTS AND MAINTENANCE

1. GENERAL

1.01 This section provides tests and maintenance information in the form of Trouble Locating Tables and functional schematics for the following 1P2 Key Telephone System arrangements:

(a) Single group, two (CO, Centrex, or PBX) audio/video lines.

(b) Single group, one (CO, Centrex, or PBX) audio/video line and single link, dial selective (6-station) audio/video intercom.

(c) Single link dial selective (10-station) audio/video intercom.

(d) Multigroup, one (CO, Centrex, or PBX) audio/video line.

1.02 No attempt should be made to repair or modify key telephone units. When necessary, replace them. Since the 607A KTU (control equalizer) requires complete realignment, replace it only when absolutely necessary. Section 518-800-510 outlines video loop alignment procedures; Section 518-800-512 outlines video loop trouble locating procedures.

1.03 Refer to Section 518-800-105 for 600 series key telephone unit (KTU) functional schematics and 518-215-125 for 400 series KTU functional schematics. Refer to the appropriate 1P2 KTS connection section for optional wiring information and designations.

1.04 For additional information on the 1P2 Key Telephone System, refer to:

- CD- and SD-69605-01, SD-69621-01, and SD-69628-01 — Single Group CO or PBX Line Circuit
- CD- and SD-69606-01, SD-69621-01, SD-69622-01, SD-69628-01, and SD-69629-01 — Single Link Intercom
- CD- and SD-69607-01, SD-69623-01, and SD-69630-01 — Multigroup CO or PBX Line Circuit

2. TESTS

2.01 Before making specific tests of 1P2 Key Telephone Equipment associated with central office lines, have the test desk place a video call over the line under test without ringing, to make certain the video loop is satisfactory. In addition, tests should be completed on the 2C Video Station Equipment as outlined in Section 518-800-501.

2.02 In all of the following trouble locating tables, it is assumed that the system was functioning properly before the trouble occurred.

TROUBLE LOCATING TABLE INDEX

Table L — Video Signal Troubles

Table M — System Busy Tone Troubles

Table N — Miscellaneous Troubles

Single Group (CO, Centrex, or PBX) Line Service Visual Signal Troubles

2.03 Have a regular audio (nonvideo) call placed on the line under test. Three observations as listed in the following (consisting of a letter and subnumber) should be ***made*** and ***noted*** while the call is in progress.

Audio Call

A. Ringing on Line

1. Flashing white lamp
2. Flashing red lamp
3. Steady white lamp
4. No lamp signal

B. Called Station Answers (Off-Hook)

1. Steady white lamp
2. Steady red lamp
3. Flashing white lamp for duration of time-out; then, no lamp signal (answering incoming call only)
4. No lamp signal

C. Hold

1. Winking white lamp
2. Winking red lamp
3. Steady white lamp
4. No lamp signal

2.04 After completion of the observations on an audio call, have a video call placed on the line under test and again ***observe*** and ***note*** the call progress as follows:

Video Call

D. Ringing On Line

1. Flashing red lamp
2. Flashing white lamp
3. Steady red lamp
4. No lamp signal

E. Called Station Answers (Off-Hook)

1. Steady red lamp (Note)
2. Flashing red lamp for duration of time-out; then, no lamp signal (answering incoming call only)
3. Steady white lamp
4. No lamp signal

F. Hold

1. Winking red lamp
2. Winking white lamp
3. Steady red lamp
4. No lamp signal

Note: On outgoing video calls, a steady white lamp is normal until the complete telephone number has been dialed. Video Sync Signal (VSS) is then returned to the 606A KTU, at which time a steady red lamp should appear.

2.05 The six lamp observations made in 2.03 and 2.04 should be used in conjunction with Table A and the appropriate functional circuits provided in this section, to analyze probable causes of trouble. The suggested corrective action should then be followed when applicable. For instance, if the letter-number combinations recorded were A1, B1, C4, D1, E1, and F4, Table A indicates:

- A blown fuse in lamp wink supply
- Defective contact "A" relay (600A KTU)
- "C" relay (600A KTU) not operating.

Where more than one possible trouble is indicated, the most probable trouble is listed first.

2.06 Table B lists the possible causes and corrective action required when trouble is encountered with the audible signal at a primary or secondary station on a video or nonvideo call. When trouble is encountered with the tone

ringer at a primary station, the tests outlined in Section 518-800-501 should be used as an aid in determining whether the trouble is in the key equipment or in the station equipment.

2.07 Certain key equipment troubles may result in no video signal being received from the CO at the display unit. Table C lists these possible troubles and the corrective action required. Before making these tests, the video loop under test should have been checked from the test desk and the station equipment checked to eliminate the possibility of trouble in those areas.

TABLE A

VISUAL SIGNAL TROUBLES (CO, CENTREX, OR PBX LINE, SINGLE GROUP)

LAMP INDICATIONS						PROBABLE TROUBLE(S) *	CORRECTIVE ACTIONS
A	B	C	D	E	F		
1	1	1	1	1	1	None	None
1	1	1	2	2	2	Sync Detector in 606A KTU S or P Relay in 600A KTU No Sync from CO or PBX	Check for battery on the SYC lead of 600A KTU (B21) Is battery present? YES → Replace the 600A KTU NO Replace the 606A KTU NO Trouble is in CO or PBX
1	1	1	4	4	4	Red half of lamp burned out Series diode in red lamp open Blown fuse in +10V supply P relay in 600A KTU not operating	Check for +10V on lamp lead of 600A KTU (A8) during video call Is +10V present? YES → Replace Lamp NO Check fuse in power supply and replace if open. If fuse is OK, replace 606A KTU

* Wiring may cause all of the troubles listed.

TABLE A (Cont)

LAMP INDICATIONS						PROBABLE TROUBLE(S) *	CORRECTIVE ACTIONS
A	B	C	D	E	F		
4	4	4	1	1	1	White half of lamp burned out Series diode in white lamp open Blown fuse in −10V supply	Check for −10V on lamp lead of 600A KTU (A8) while off-hook IS −10V present? YES → Replace lamp NO → Check fuse in power supply and replace if open. If fuse is OK, check wiring
4	1	1	4	1	1	Blown fuse in lamp flash circuit R relay not operating in 600A KTU	Check for −10V (at flash rate) at LF contact on 600A KTU (A7) with incoming audio call Is −10V present? YES → Replace 600A KTU NO → Replace fuse
1	1	1	4	1	1	Blown fuse in PLF circuit Bad P relay contact in 600A KTU	Check for +10V (at flash rate) at PLF contact on 600A KTU (B7) Is +10V present? NO → Replace fuse YES → Replace 600A KTU
1	1	4	1	1	4	Blown fuse in LW supply Bad contact in A relay in 600A KTU C relay in 600A KTU not operating	Check LW contact (A2) on 600A KTU for presence of −10V (at wink rate) with held audio call Is −10V present? NO → Replace fuse YES → Replace 600A KTU

* Wiring may cause all of the troubles listed.

TABLE A (Cont)

LAMP INDICATIONS						PROBABLE TROUBLE(S) *	CORRECTIVE ACTIONS
A	B	C	D	E	F		
1	1	1	1	1	4	Blown fuse in PLW supply Bad P relay contact in 600A KTU	Check PLW contact (B2) on 600A KTU for presence of +10V (at wink rate) Is +10V present? — NO → Replace fuse YES → Replace 600A KTU
1	4	1	1	1	1	Blown fuse in −10V supply	Check −10V contact (A4) on 600A KTU for steady −10V with station off-hook −10V present — NO → Replace fuse
1	1	1	1	4	1	Blown fuse in +10V supply Bad P relay contact in 600A KTU	Check +10V contact (B4) on 600A KTU for steady +10V with circuit in PICTUREPHONE mode +10V present — NO → Replace fuse YES → Replace 600A KTU
1	4	1	1	4	1	Relay A make contact open in 600A KTU	Replace 600A KTU
1	3	4	1	3	4	Relay A break contact closed in 600A KTU	Replace 600A KTU
1	4	4	1	4	4	Relay C contact open in 600A KTU	Replace 600A KTU
2	2	2	2	2	2	Lamp reversed	Reverse lamp

* Wiring may cause all of the troubles listed.

TABLE A (Cont)

LAMP INDICATIONS						PROBABLE TROUBLE(S) *	CORRECTIVE ACTIONS
A	B	C	D	E	F		
3	1	3	3	1	3	Blown fuse in interrupter circuit Relay B in 600A KTU not operating or open contact Defective motor in interrupter	Check +10V contact (1) on interrupter for 10V AC with circuit in incoming audio call mode +10V present? NO → Replace fuse YES Check ST contact (2) on interrupter for ground with circuit in incoming audio call mode Ground present? NO → Replace 600A KTU YES Replace interrupter
4	4	4	4	4	4	Power supply inoperative Blown fuses in −10V and +10V supplies	Measure AC input to primary of power supply 117V AC present? NO → Check to see if line cord is plugged in YES Check −10V and +10V outputs of power supply Cord plugged in? NO → Plug in cord YES −10V and +10V output present? Check power supply primary fuse NO Check fuses Fuse OK? NO → Replace fuse YES Check 117V AC input at wall receptacle Fuses OK? NO → Replace fuses YES → Replace power supply 117V AC present? NO → Restore AC input

* Wiring may cause all of the troubles listed.

TABLE B

AUDIBLE SIGNAL TROUBLES (CO, CENTREX, OR PBX LINE, SINGLE GROUP)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No audible signal on non-video call (primary or secondary station) or No audible signal on video call (secondary station only)	Option strap wrong or missing in 600A KTU	Correct strapping
	Open or incorrect wiring in signal circuit	Correct wiring
	Defective audible signal	Replace signal
	L, B, or R relays not operating (Common audible only)	Replace associated 600A KTU
	Wrong voltage supply for signal device	Check power supply
No tone ringer on video call (primary station only)	Defective tone ringer	Replace tone ringer
	Defective 1A service unit	Replace 1A service unit
	S or P relay not operating	Replace associated 600A KTU
	RLB relay not operated	Check for power failure at 600A KTU, 606A KTU, or 1A Service Unit. Replace associated 600A KTU
	Option strap wrong or missing in 600A KTU	Correct strapping
	Defective common audible circuit	Repair or replace common audible circuit

* Wiring may cause all of the troubles listed.

TABLE C

VIDEO SIGNAL TROUBLES (CO, CENTREX, OR PBX LINE, SINGLE GROUP)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No video in either direction	Video switch not operated	Replace 601A KTU
	S or P relay not operated	Replace 600A KTU
	Loopback not removed, RLB relay not released	Replace 606A KTU
	Defective cable equalizer	Replace 606A and/or 607A KTU
Outgoing but no incoming video	Defective cable equalizer	Replace 607A KTU
Incoming but no outgoing video	Defective common half of cable equalizer	Replace 606A KTU
	S or P relay not operated	Replace 600A KTU
Display unit not turned on	Defective video switch (S and P relays operated)	Replace 601A KTU
	Power failure in 1A Display Unit	Check display unit
	Defective sync detector in cable equalizer	Replace 606A KTU

* Wiring may cause all of troubles listed.

Single Link Intercom Service
Visual Signal Troubles

2.08 Have a regular audio (nonvideo) call placed to the station under test. Two observations as listed in the following (consisting of a letter and subnumber) should be ***made*** and ***noted*** while the call is in progress.

Audio Call

A. Ringing on Line

1. Flashing white lamp
2. Flashing red lamp
3. Steady lamp
4. No lamp

B. Called Station Answered (Off-Hook)

1. Steady white lamp
2. Steady red lamp
3. Flashing lamp
4. No lamp

2.09 After completion of the observations on an audio call, have a ***video*** call placed to the station under test and again ***observe*** and ***note*** the call progress as follows:

Video Call

C. Ringing on Line

1. Flashing red lamp
2. Flashing white lamp
3. Steady lamp
4. No lamp

D. Called Station Answered (Off-Hook)

1. Steady red lamp
2. Steady white lamp
3. Flashing lamp
4. No lamp

2.10 The four lamp observations made in 2.08 and 2.09 should be used in conjunction with Table D and the appropriate functional circuits (Figs. 9 through 25) provided in this section, to analyze probable causes of trouble. The suggested corrective action should then be followed when applicable. For instance, if the letter-number combinations recorded were A4, B4, C1 and D1, Table D indicates:

- The −10V fuse blown
- Lamp filament open.
- PLF fuse blown

Where more than one possible trouble is indicated, the most probable trouble is listed first.

2.11 Table E lists the possible causes and corrective action required when trouble is encountered with the audible signal at a primary or secondary station on a video or nonvideo call. When trouble is encountered with the tone ringer at a primary station, the tests outlined in Section 518-800-501 should be used as an aid in determining whether the trouble is in the key equipment or in the station equipment.

2.12 Certain key telephone system troubles may result in no video signal being received at the display unit. Table F lists these possible troubles and the corrective action required. Before making these tests the station equipment should have been checked to eliminate the possibility of trouble.

2.13 No PICTUREPHONE intercom service beyond the capability of the 877-type networks will be provided initially.

TABLE D

VISUAL SIGNAL TROUBLES (SINGLE LINK INTERCOM)

(Notes 2 and 3)

OBSERVATION				PROBABLE CAUSE	CORRECTIVE ACTION
A	B	C	D		
1	1	1	1	NONE	NONE
2	2	2	2	Lamp reversed in socket	Reverse lamp
				Blown LF fuse	Replace fuse
4	1	1	1	Relay P (604A KTU) contact failure	Replace 604A KTU
				Interrupter contact failure	Replace interrupter
4	4	1	1	−10V fuse blown	Replace fuse
				Lamp filament open	Replace lamp
				PLF fuse blown	Replace fuse
1	1	4	1	Relay P (604A KTU) contact failure	Replace 604A KTU
				Interrupter contact failure	Replace interrupter
1	1	4	4	+10V fuse blown	Replace fuse
				Lamp filament open	Replace lamp
				PLS fuse blown	Replace fuse
1	1	1	4	Relay P (604A KTU) contact failure	Replace 604A KTU
1	4	1	1	LS fuse blown	Replace fuse
				Relay P (604 KTU) contact failure	Replace 604A KTU
4	1 (Note 1)	4 (Note 1)	1	Blown interrupter fuse	Replace fuse
				Interrupter not running	Check for ground at terminal 2 of interrupter—if present replace interrupter. If ground is not present, replace 425B KTU
3	1 (All stations)	3 (All stations)	1	Blown interrupter fuse	Replace fuse
				Interrupter not running	Check for GRD at terminal 2 of interrupter. If present, replace interrupter. If GRD is not present, replace 425B KTU
				Relay R (407B KTU) failure	Replace 407B KTU
3	1 (One station) (Note 4)	3 (One station) (Note 4)	1	425B KTU relay contact failure	Replace 425B KTU

TABLE D (Cont)

OBSERVATION				PROBABLE CAUSES	CORRECTIVE ACTION
A	B	C	D		
3	1	3	1 (Several stations) (Note 4)	407B KTU relay contact failure	Replace 407B KTU
				425B KTU relay contact failure	Replace 425B KTU
3	1	3	1 (See Note 1)	Blown interrupter fuse	Replace fuse
				Interrupter not running	Check for ground at terminal 2 of the interrupter—If present replace interrupter—If ground is not present, replace 425B KTU
1	4	1	4	(At one station only) Defective 425B KTU	Replace 425B KTU
				(At all stations) Defective 407B KTU	Replace 407B KTU
1	1	2	2	Relay contact failure (604A KTU)	Replace 604A KTU
1	3	1	3 (Called station unable to seize audio link) (One station)	605A KTU relay or diode failure	Replace 605A KTU
				422B KTU relay contact failure	Replace 422B KTU
1	3	1	3 (Called station unable to seize audio link) (Several stations)	422B KTU Y relay coil or contact failure	Replace 422B KTU
1	3	1	3 (Called station unable to seize audio link) (All stations)	422B KTU LT relay coil or contact failure	Replace 422B KTU
1	1	2	1	Relay P 604A KTU contact failure	Replace 604A KTU
1	1	1	2	Relay P 604A KTU contact failure	Replace 604A KTU

Notes:

1. This observation at all intercom stations simultaneously can be due to F3, interrupter motor, L relay (425B KTU), or R relay (407B KTU). This observation at a group of stations is most likely due to a "Y" relay contact in either the 407B KTU or the 425B KTU, and cannot be due to interrupter fuse or motor. This observation at a single station is most likely due to relay failure of either relay LT1 or LT2 in the 425B KTU.
2. If one of the diodes in the lamp base shorts out, red and white lamps will both come on at the same time for one type of call but not the other.
3. If white and red lamps burn simultaneously on both audio and video calls, the lamp is improperly seated.
4. If ringing is applied to the correct station and steady lamp is observed during ringing, replace the 425B KTU. If ringing is applied to the wrong station and steady lamp is observed during ringing, replace the 407B KTU.

TABLE E
AUDIBLE SIGNAL TROUBLES
(SINGLE LINK INTERCOM)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No audible signal at telephone set of called station on a video call and all stations have this trouble	Failure of P relay (604A KTU)	Replace 604A KTU
	Failure of 427C KTU	Replace 427C KTU
No audible signal at telephone set of called station on a video call to a particular station	Failure of V relay (605A KTU)	Replace 605A KTU associated with this station
Audible signal to wrong telephone set on a video or audio call	Failure of 407B KTU	Replace 407B KTU
No audible signal at telephone set on an audio call to a particular station	Failure of V relay (605A KTU)	Replace the 605A KTU associated with this station
	Failure of 407B KTU	Replace the 407B KTU
No audible signal at tone ringer on a video call to a particular station	Failure of V relay (605A	Replace 605A KTU associated with this station
	Failure of 407B KTU	Replace 407B KTU
No ringing in the system	Fuse F21 open	Replace fuse F21
	Fuse F3 open	Replace fuse F3
	Interrupter not running	Check for ground at terminal 2 of the interrupter. If present, replace the interrupter. If ground is not present, replace 425B KTU
Steady ringing to any called station	Fuse F3 open	Replace fuse F3
	Interrupter not running	Check for ground at terminal 2 of the interrupter. If present, replace the interrupter. If ground is not present, replace 425B KTU
A primary station connected for bridged hunting for one station is rung on an intercom call while busy on another line	Failure of 421A KTU associated with this feature	Replace 421A KTU
A primary station connected for bridged hunting for more than one station is rung on an intercom call while busy on another line	Failure of 421A KTU associated with this feature	Replace 421A KTU
	Failure of 422B KTU associated with this feature	Replace 422B KTU

* Wiring may cause all of the troubles listed.

TABLE F
VIDEO SIGNAL TROUBLES
(SINGLE LINK INTERCOM)

TROUBLE INDICATION*	PROBABLE CAUSE	CORRECTIVE ACTION
Display unit not turned on at a particular station	Relay L of the 605A KTU associated with that station	Replace 605A KTU
No display units in the system turn on	Relay P of 604A KTU	Replace 604A KTU
	Failure of the 427C KTU	Replace 427C KTU
Display units turned on but no video at one or both video stations on a completed connection	Relay V or LS of 605A KTU of either station	If both station relay LS and V are on the same 605A KTU replace that 605A KTU. If not, isolate the faulty relay by calling a third station from the first calling station, or call first called station from the third station. Replace the 605A KTU as appropriate

* Wiring may cause all of the troubles listed.

TABLE G

AUDIBLE TONE TROUBLES

(SINGLE LINK INTERCOM)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No dial tone on one or more stations	Relay L of 605A KTU associated with this station	Replace the 605A KTU
	Failure of 604A KTU	Replace 604A KTU
No dial tone in the system	No system power	Restore power
	Failure of 423A KTU	Replace 423A KTU
	Relay K of 604A KTU	Replace 604A KTU
	Failure of 407B KTU	Replace 407B KTU
No audible ringback in the system	Failure of 423A KTU	Replace the 423A KTU
	Fuse F3 open	Replace fuse F3
	Interrupter not running	Check for ground at terminal 2 of the interrupter. If present, replace the interrupter. If ground is not present, replace the 425B KTU
No audible ringback at a particular station	Relay L of 605A KTU associated with this station	Replace the 605A KTU
Steady uninterrupted audible ringback in the system	Fuse F3 open	Replace fuse F3
	Interrupter not running	Replace interrupter
No system busy tone at a particular station	Relay L of 605A KTU associated with this station	Replace the 605A KTU
No station busy tone in the system	Failure of the 423A KTU	Replace 423A KTU
	Interrupter not running	Check for ground at terminal 2 of the interrupter. If not present, replace the 604A KTU. If present, replace the interrupter.
	Relay K of 604A KTU	Replace 604 KTU
Uninterrupted system busy tone	Fuse F3 open	Replace fuse F3
	Interrupter not running	Replace interrupter
No station busy tone	Defective 422B KTU associated with station busy tone	Replace the 422B KTU
	Relay K of 604A KTU	Replace 604A KTU
	Failure of the 423A KTU	Replace 423A KTU

* Wiring may cause all of the troubles listed.

TABLE H
PRESET CONFERENCE TROUBLES
(SINGLE LINK INTERCOM)

TROUBLE INDICATION*	PROBABLE CAUSE	CORRECTIVE ACTION
None of the stations to be conferenced can be visually signaled on a conference call	Relay T of 421A KTU associated with conference station lamps	Replace this 421A KTU
	No output from the 425B KTU on the conference code L lead.	See CORRECTIVE ACTION for absence of flashing lamps on incoming audio calls (Table D)
A station to be conferenced cannot be visually signaled on a conference call only	Relay T of 421A KTU associated with conference station lamps	Replace this 421A KTU
A station to be conferenced never receives a steady lamp signal	Relay T of 421A KTU associated with conference station lamps	Replace this 421A KTU
One or more of the stations to be conferenced can't access the audio link on a conference call	Relay T of 421A KTU associated with the LK leads	Replace this 421A KTU
A station to be conferenced cannot be audibly signaled on a conference call	An open diode between the conference code ringing lead and the station	Replace that diode
None of the stations to be conferenced can be audibly signaled on a conference call	No output from a 605A KTU on the conference TRC lead	See CORRECTIVE ACTION for absence of audible signaling on an incoming audio call (Table E)
One or more of the stations to be conferenced on a signal key preset conference call do not receive audible or visual signals	Relay T of 421A KTU associated with the signal key	Replace this 421A KTU
None of the stations to be conferenced on a dial selected preset conference call receive audible or visual signals	No output from a 605A KTU on the conference TRC lead	See CORRECTIVE ACTION for absence of audible signaling on an incoming audio call (Table E)
	Defective 413A KTU	Replace 413A KTU

* Wiring may cause all of the troubles listed.

Multigroup (CO, Centrex, or PBX) Line Service

TABLE I

VISUAL SIGNAL TROUBLES (MULTIGROUP)*

Note: Use Single Group Visual Troubles (2.03, 2.04, and Table A) except for the following on flash and wink trouble indications.

TROUBLE INDICATION*	PROBABLE CAUSE	CORRECTIVE ACTION
Attended operation — Flashing at all stations on incoming call.	R relay not operating (602A KTU).	Check for ground at pin B38 of 602A KTU. If present, replace 602A KTU. If not present, replace the 600A KTU.
Nonattended or night service operation—No flashing lamps on incoming call or winking lamps on held call at any group.	Defective contact on R or BSY relay (602A KTU)	Replace 602A KTU.
Nonattended or night service key operation—Flashing lamps on incoming call and winking lamps on held call at Groups 2 through 9. No flashing lamps at Group 1.	Defective contact on R relay (602A KTU).	Replace 602A KTU
Audio call—No steady lamp at any group after pickup or at Groups 2 through 9 on an incoming call in attendant mode.	Blown −10V fuse.	Replace fuse.
	Defective contact on VT1 relay (602A KTU).	Replace 602A KTU.
Audio call—No steady lamp at Groups 2 through 9 on incoming call when connected in attendant mode.	Relay R open (602A KTU).	Replace 602A KTU.
Audio call after pickup — Steady lamps at Group 1, but not at Groups 2 through 9, or steady lamps at Groups 2 through 9, but not at Group 1.	Defective contacts on BSY relay.	Replace 602A KTU.
Audio call after pickup—No steady lamps at any groups.	Blown −10 volt fuse. Defective VT1 relay contact (602A KTU). Relay BSY not operating or defective BSY relay contact (602A KTU).	Replace fuse. Replace 602A KTU.
Video call—No steady lamp at any groups after pickup.	Blown +10 volt fuse. Defective contact on VT1 relay (602A KTU). Defective contact on BSY relay (602A KTU).	Replace fuse. Replace 602A KTU.
Attendant operation—No flashing lamps at attendant station on incoming call or winking lamp at that station on a held call.	Defective contact on R or BSY relays (602A KTU).	Replace 602A KTU.

* Wiring may cause all of the troubles listed.

Note: If none of the trouble indications listed in Table I are present, and lamp trouble indications are still present at Group 1 (monitored station regardless of which of the three circuit configurations is used) **USE TABLE A.**

TABLE J

AUDIBLE SIGNAL TROUBLES (MULTIGROUP, CO, CENTREX, OR PBX LINES) (See Notes)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No audible signal on non-video call (primary or secondary station) or No audible signal on video call (secondary station only)	Option strap wrong or missing in 600A KTU.	Correct strapping.
	Open or incorrect wiring in signal circuit.	Correct wiring.
	Defective audible signal.	Replace signal device.
	L, B, or R relays not operating. (Common audible only)	Replace associated 600A KTU.
	Wrong voltage supply for signal device.	Check power supply.
No tone ringer on video call (primary station only)	Defective tone ringer.	Replace tone ringer.
	Defective 1A service unit.	Replace service unit.
	S or P relay not operating.	Replace associated 600A KTU.
	RLB relay not operated.	Check for power failure at 600A KTU, 606A KTU, or 1A Service Unit. Replace associated 600A KTU.
	Option strap wrong or missing in 600A KTU.	Correct strapping.
	Defective common audible circuit.	Repair or replace common audible circuit.

* Wiring may cause all of the troubles listed.

Notes:

1. With attendant service this table applies to the attendant station only.
2. With nonattended service this table applies only to those stations selected to be rung in this arrangement.
3. With night service key arrangement, Table J applies, however: If the attendant station receives an audible signal and those stations selected for night service do not, the trouble is in the attendant night service key.

TABLE K

DIRECTED TRANSFER CALLS

AUDIBLE AND VISUAL SIGNAL TROUBLES

(See Note)

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No ringing or flashing lamps at selected telephone set with the line circuit in the hold condition.	Relay T (421A KTU) not operating.	Check for ground at pin 9 of this 421A KTU with the signal key operated. If ground is not present, check the signal key. If present, check for ground at pin 8 of this 421A KTU. If present, replace the 421A KTU. If not present, replace the 602A KTU.
No ringing (audio or video).	Defective contact in interrupter.	Replace interrupter.
Ringing on audio-only or video-only call.	Defective contact in 421A KTU. Defective VT1 relay contact in 602A KTU.	Replace 421A KTU. Replace 602A KTU.
No flashing visual signal on video call at more than one station.†	Blown PLF fuse.	Replace PLF fuse.
	Defective relay contact in 412A KTU.	Replace 412A KTU.
	Defective VT1 relay in 602A KTU.	Replace 602A KTU.
No flashing visual on video call at one station only.†	Defective relay contact in 421A KTU.	Replace 421A KTU.
No flashing visual on audio call at more than one station.†	Blown LF fuse.	Replace LF fuse.
	Defective relay contact in 412A KTU.	Replace 412A KTU.
	Defective VT1 relay in 602A KTU.	Replace 602A KTU.
No flashing visual signal on audio call at one station only.	Defective relay contact in 421A KTU.	Replace 421A KTU.

* Wiring may cause all of the troubles listed.

† Trouble could also be defective lamps in telephone set.

Note: The trouble indications in Table K would occur after the incoming call has been placed on hold and the signal key is operated.

TABLE L

VIDEO SIGNAL TROUBLES

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
Display unit does not turn on at a particular station.	Defective relay contact on VS1 relay in the 602A, 603A, or 601A KTU associated with or in series with this station.	Replace 602A, 603A, or 601A KTU.
	Defective A1 relay contact on 602A or 603A KTU associated with or in series with this station.	Replace 602A or 603A KTU.
No display units in system turn on.	S or P relay failure.	Replace 600A KTU.
	Defective sync detector in cable equalizer.	Replace 606A KTU.
No video in either direction at a particular station.	Defective relay contact on VS1 relay in the 602A, 603A, or 610A KTU associated with, or in series with this station.	Replace 602A, 603A, or 601A KTU.
No video in either direction in the system.	S or P relay failure.	Replace 600A KTU.
	Defective cable equalizer.	Replace 606A or 607A KTU.
Incoming video signal or outgoing video signal but not both at a particular station.	Defective contact on VS1 relay of the 603A, 602A, or 601A KTU associated with or in series with that station.	Replace 602A, 603A, or 601A KTU.
Outgoing but no incoming video in the system.	Defective control half of cable equalizer.	Replace 607A KTU.
Incoming but no outgoing video in the system.	Defective common half of cable equalizer.	Replace 606A KTU.

* Wiring may cause all of the troubles listed.

TABLE M

SYSTEM BUSY TONE TROUBLES

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
No system busy tone to ***any station*** going off-hook over the busy lamp indication.	Failure of tone generator in 602A KTU.	Replace 602A KTU.
No system busy tone to a ***particular group*** of stations going off-hook over the busy lamp indication.	Defective contact on A or B relay (602A or 603A KTU) associated with this group.	Replace 602A KTU.

* Wiring may cause all of the troubles listed.

TABLE N

MISCELLANEOUS TROUBLES

TROUBLE INDICATION *	PROBABLE CAUSE	CORRECTIVE ACTION
Line cannot be held — line lamp goes out immediately.	Defective 600A KTU. Defective hold circuit in telephone set.	Replace 600A KTU. Replace telephone set.
No group can seize the line.	No enabling signal for A relays and/or B relays due to defective BSY relay (602A KTU).	Replace 600A KTU.
	Defective 600A KTU.	Replace 600A KTU.
All groups starting with Group 1 and proceeding to a particular group can seize the line. No groups higher than that particular group can seize the line.	Open chained ground. (CH, CH1 leads)	Determine where chained ground is open and replace defective 602A or 603A KTU.

* Wiring may cause all of the troubles listed.

3. MAINTENANCE

FUNCTIONAL SCHEMATIC INDEX

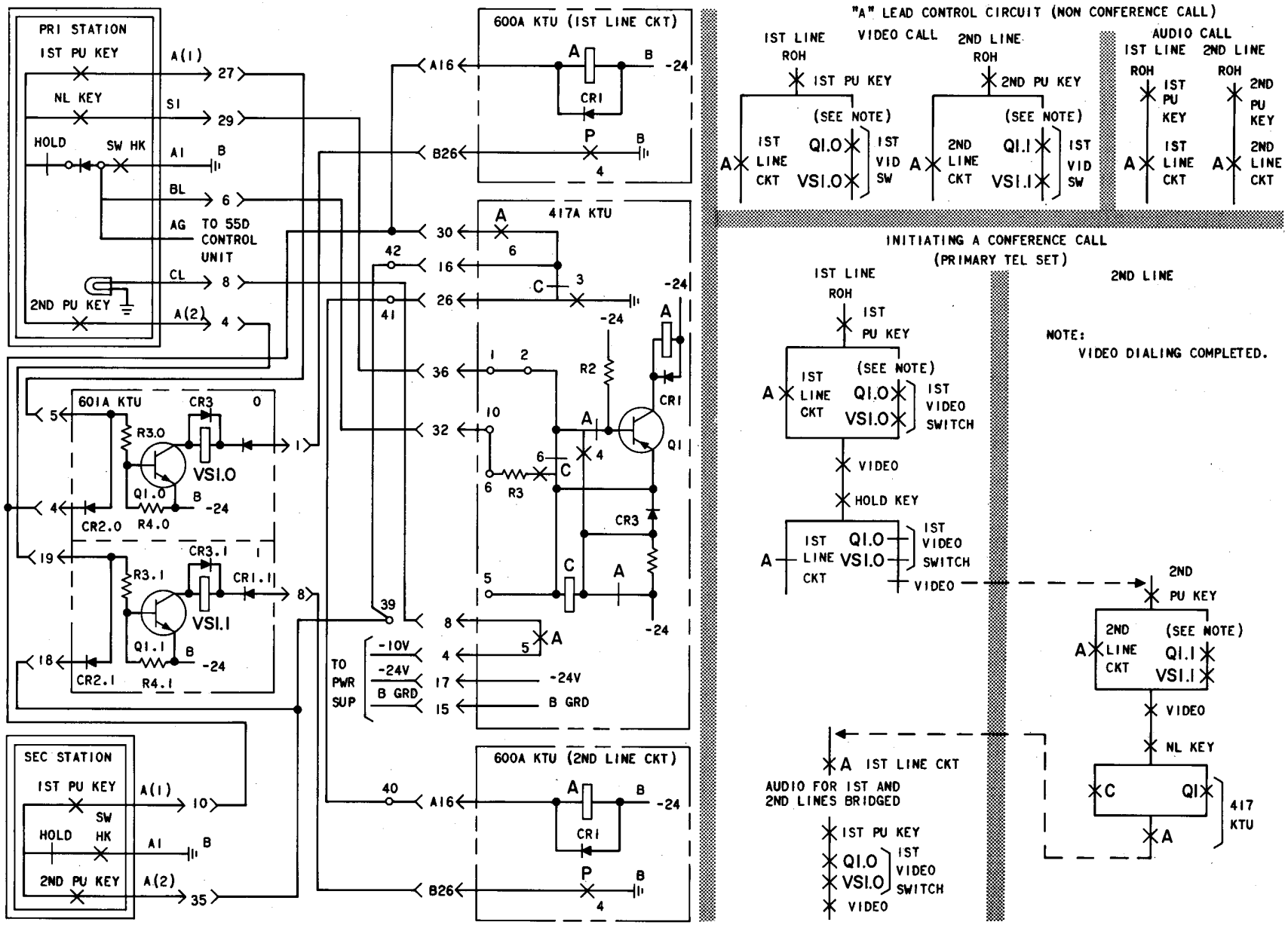


Fig. 1 — Single Group, *A* Lead and Add-on Conference Control

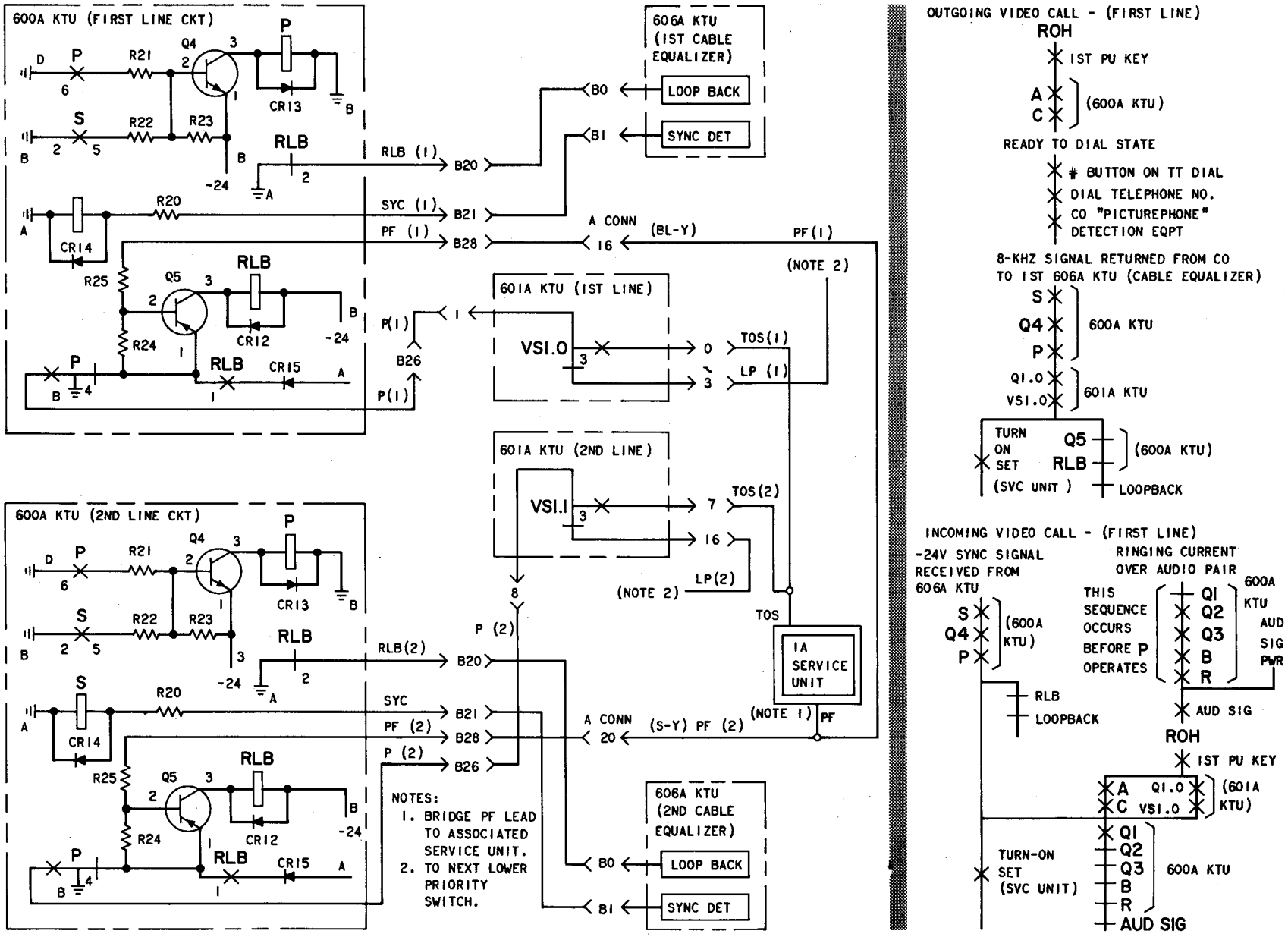
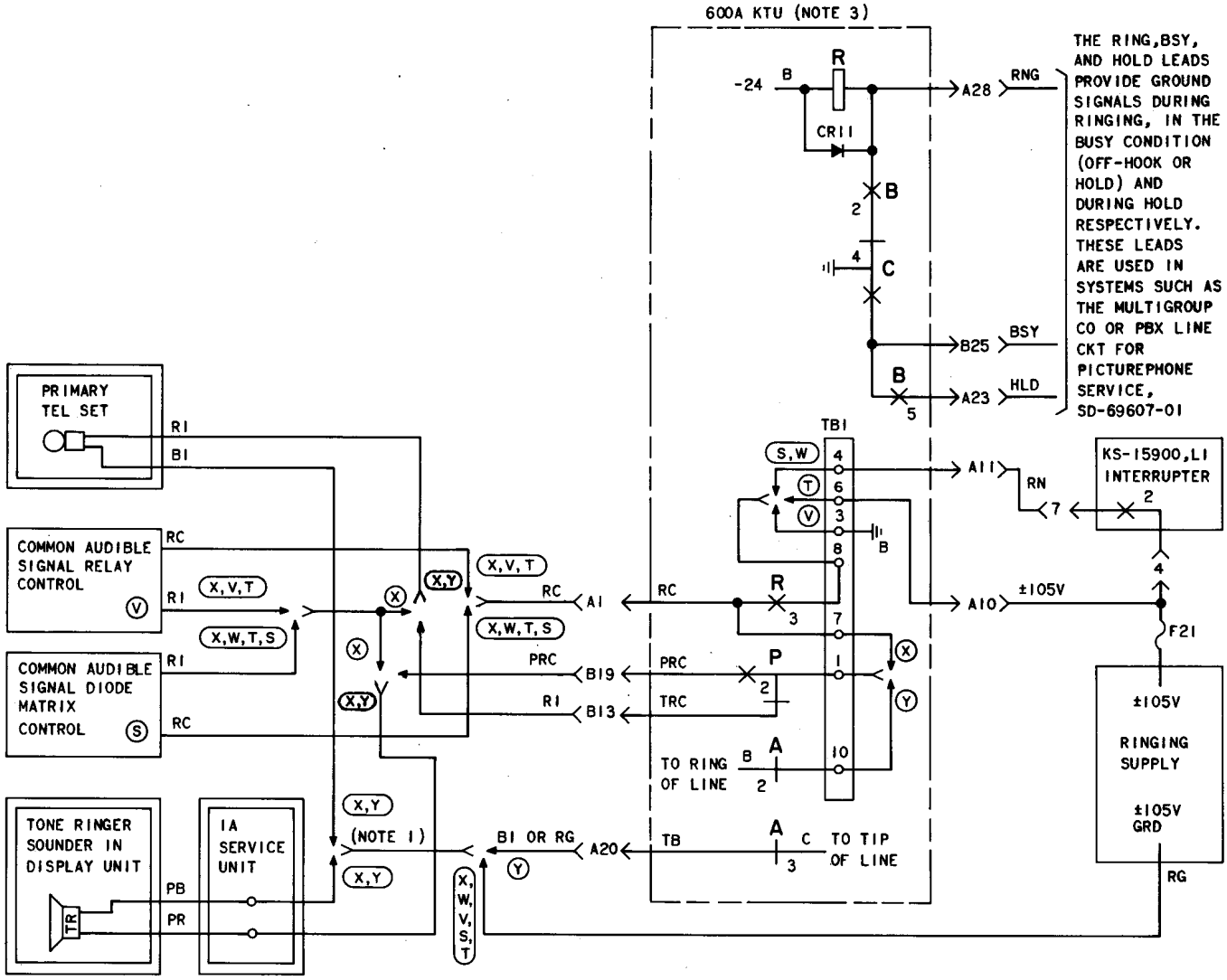


Fig. 2 — Single Group, Power Failure, Sync, Remove Loopback, and Turn-on-Set Control



NOTES:
1. OPTIONS X OR Y PROVIDE FOR LINE RINGING ON EITHER TONE RINGER OR TEL SET RINGER OR BOTH.
2. REFER TO APPROPRIATE CONNECTION SECTION FOR OPTION STRAPPING TERMINAL ASSIGNMENTS ON CONNECTING BLOCK.
3. AUDIBLE SIGNAL OPTION STRAPS ON 600A KTU MUST BE PROVIDED BY INSTALLER.

AUDIBLE SIGNALING OPTIONS		
FEATURE OR OPTIONS		WIRING
LINE RINGING		Y
LOCAL RINGING		X
INTERRUPTED RINGING		W
COMMON AUDIBLE SIGNAL	RELAY CONTROL	V
	DIODE MATRIX CONTROL	S
STEADY RINGING		T

Fig. 3 — Single Group, Ringing Control

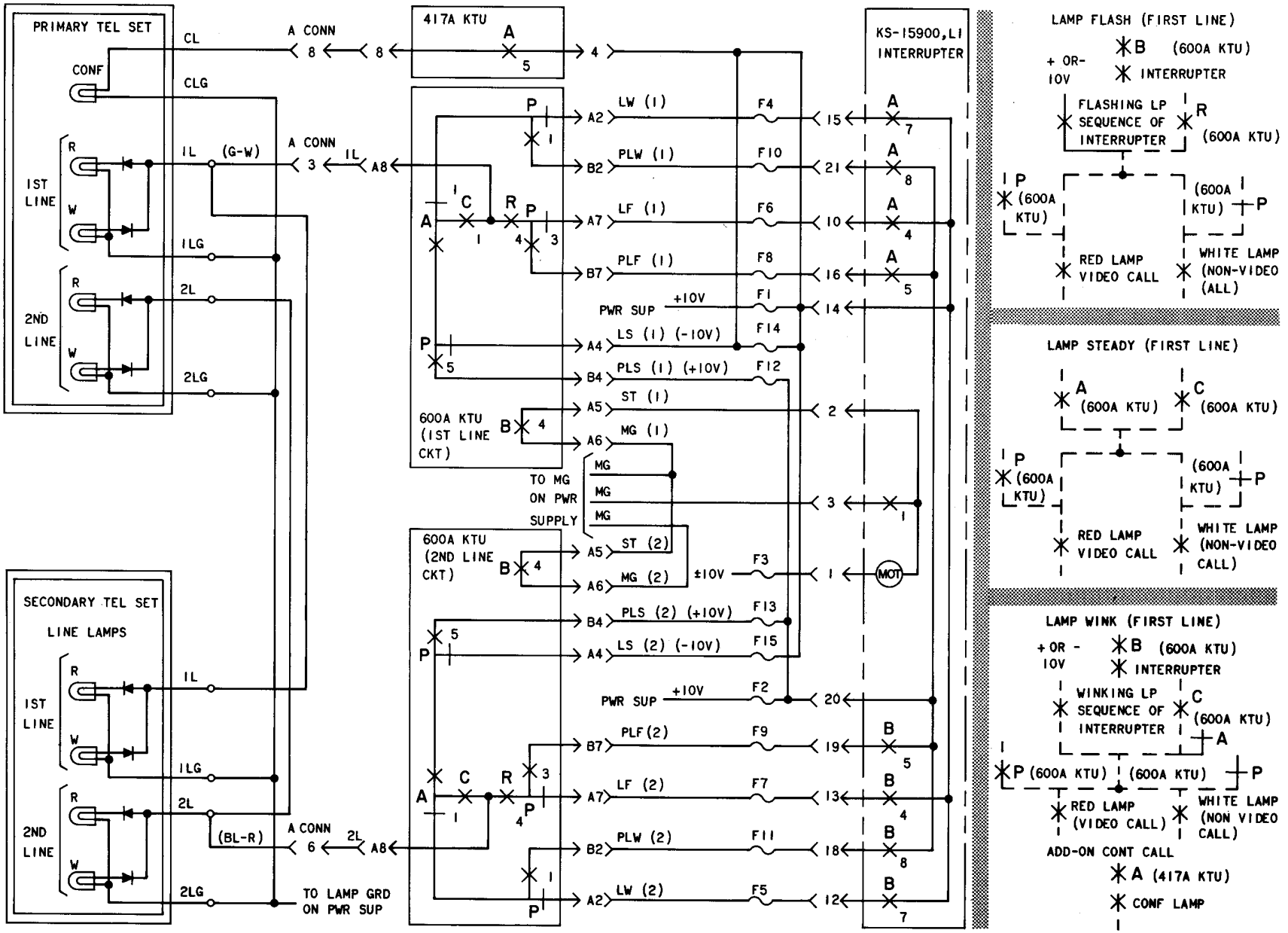


Fig. 4 — Single Group, Lamp Control

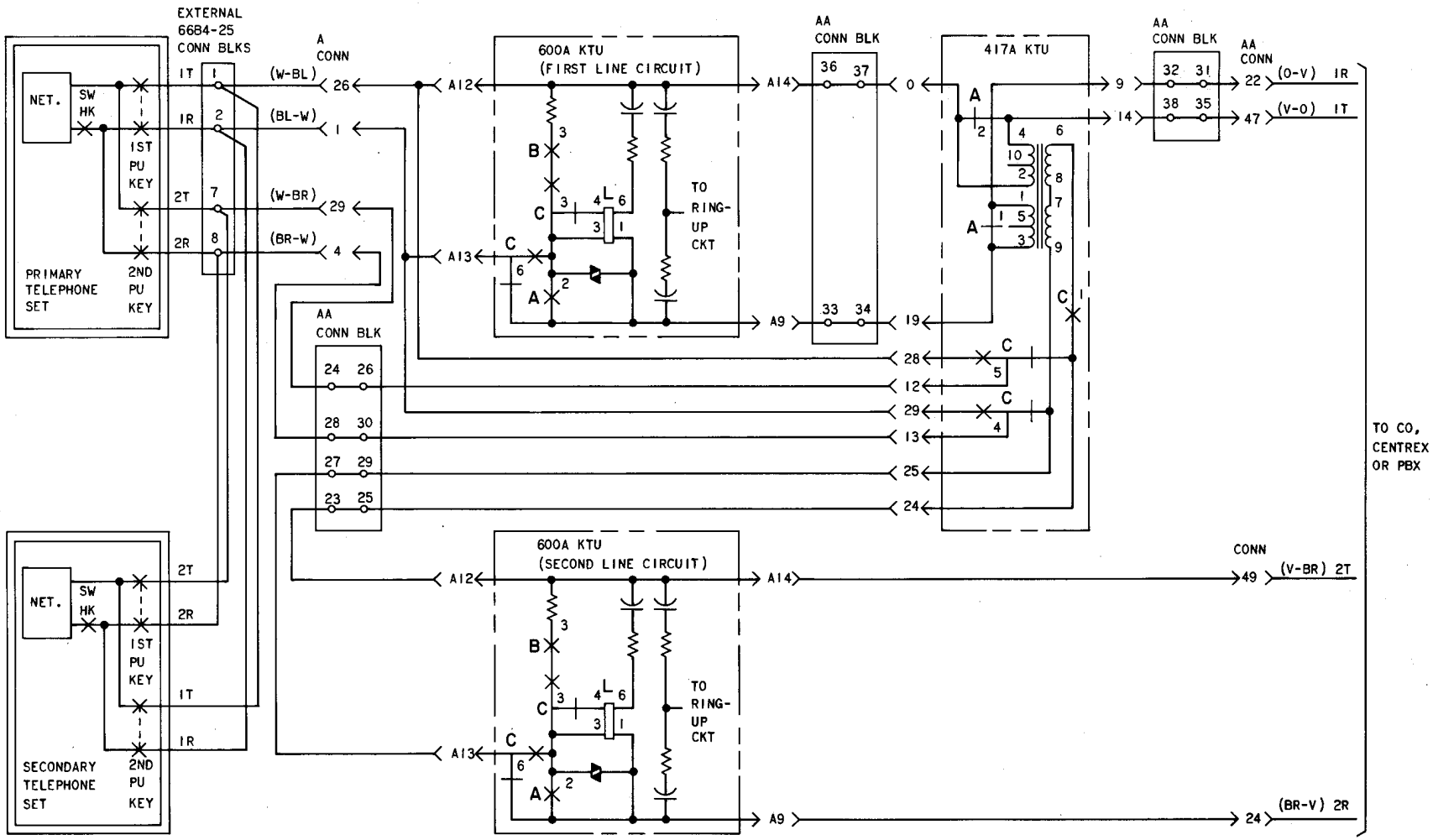


Fig. 5 — Single Group, Audio Transmission Path (With Add-on-Conference)

NOTES:
1. SPACE IS PROVIDED FOR ONLY ONE 601A KTU, ALL OTHERS MUST BE EXTERNALLY MOUNTED IN 69-TYPE ADAPTERS.
2. A 607A KTU MUST BE PROVIDED IN THE OUTGOING VIDEO PAIR (VOT, VOR) OF THE PICTUREPHONE STATION SERVICE UNIT WHEN IT IS FURTHER THAN:
   A. 500' WITH 252A SWITCHBOARD CABLE (24GA),
   B. 425' WITH D TYPE INSIDE WIRING CABLE (24GA),
   C. 615' WITH D TYPE INSIDE WIRING CABLE (22GA).

601A KTU-OPTIONS
(N) SINGLE STATION
(M) LOWEST PRIORITY MULTIPLE STATION

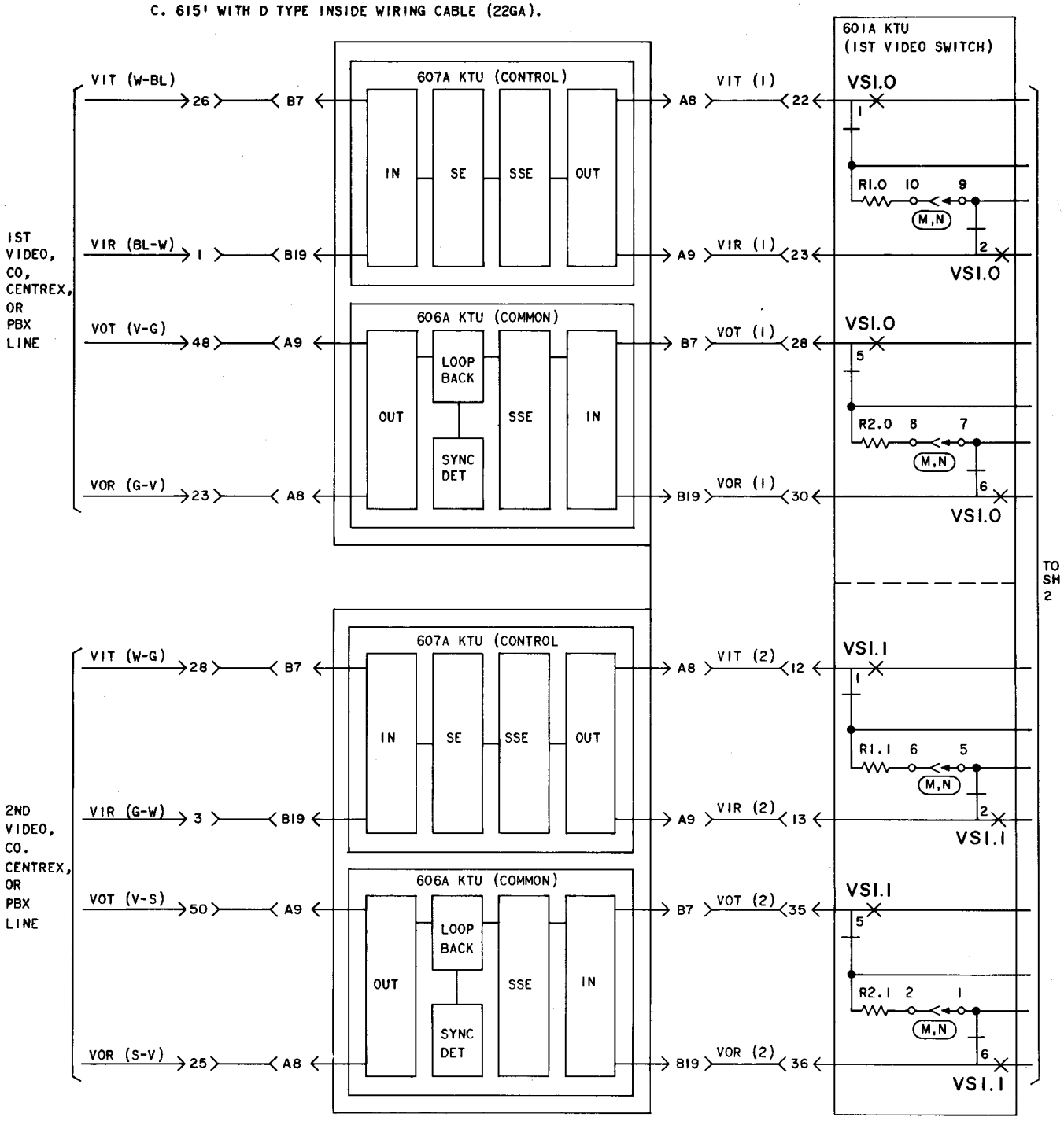


Fig. 6 — Single Group, Video Transmission Path (Sheet 1)

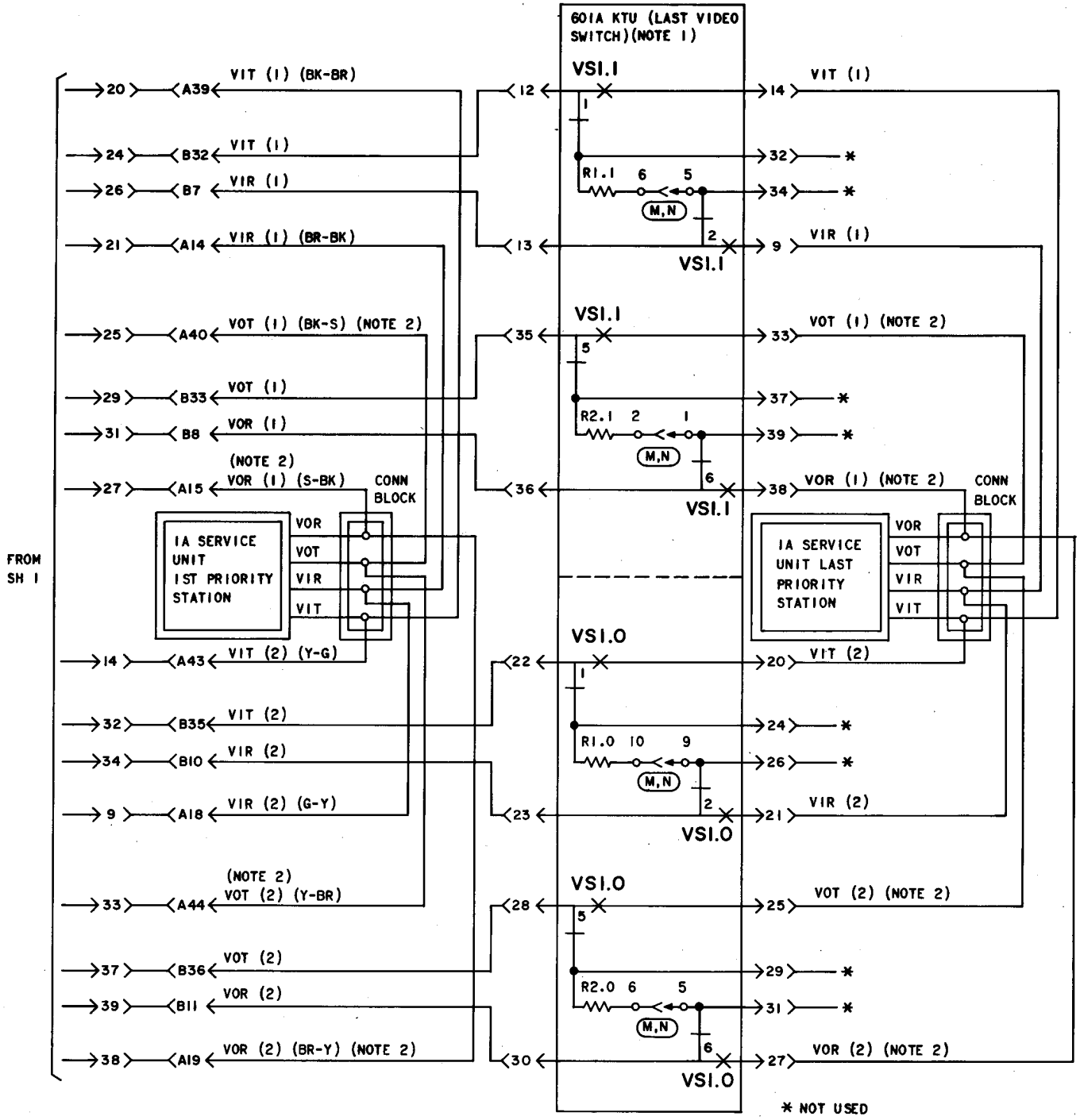
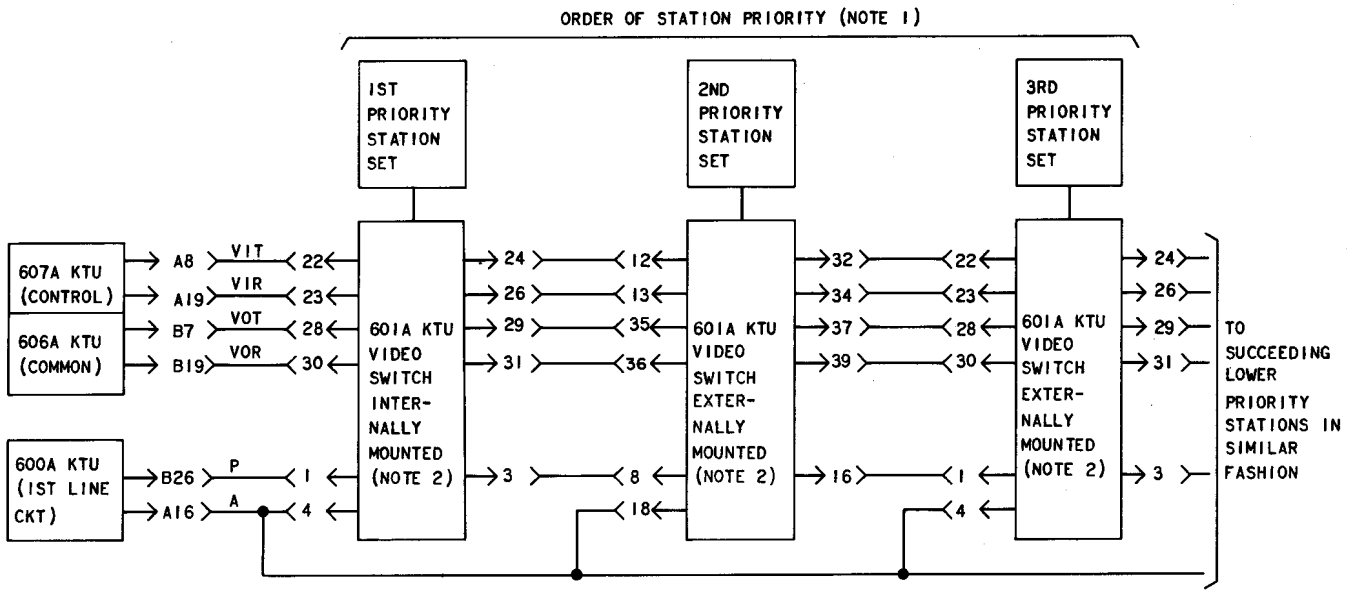


Fig. 6 — Single Group, Video Transmission Path (Sheet 2)



NOTES:
1. THE CASCADING OF VIDEO SWITCH CIRCUITS TO PROVIDE MULTI-STATION ACCESS UTILIZES A SEPARATE VIDEO SWITCH PER PICTUREPHONE STATION. THIS BLOCK DIAGRAM INDICATES THE WIRING ARRANGEMENT OF THE VIDEO TRANSMISSION PATHS ON A PRIORITY BASIS.
2. REFER TO FIG. 6 FOR SIMPLIFIED SCHEMATIC OF THE VIDEO TRANSMISSION PATH THROUGH THE VIDEO SWITCH.

Fig. 7 — Single Group, Connections to Provide Typical Station Priority

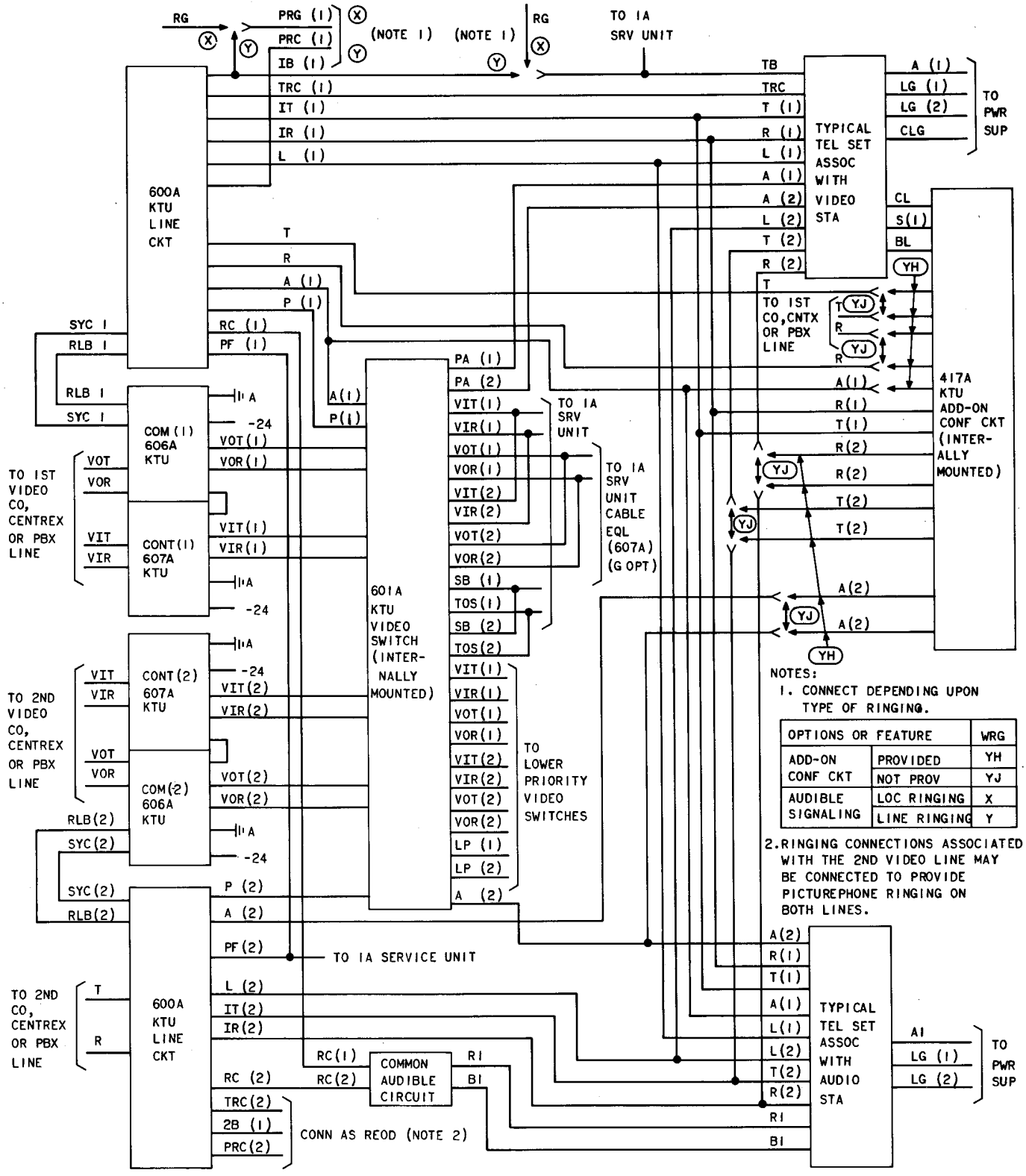
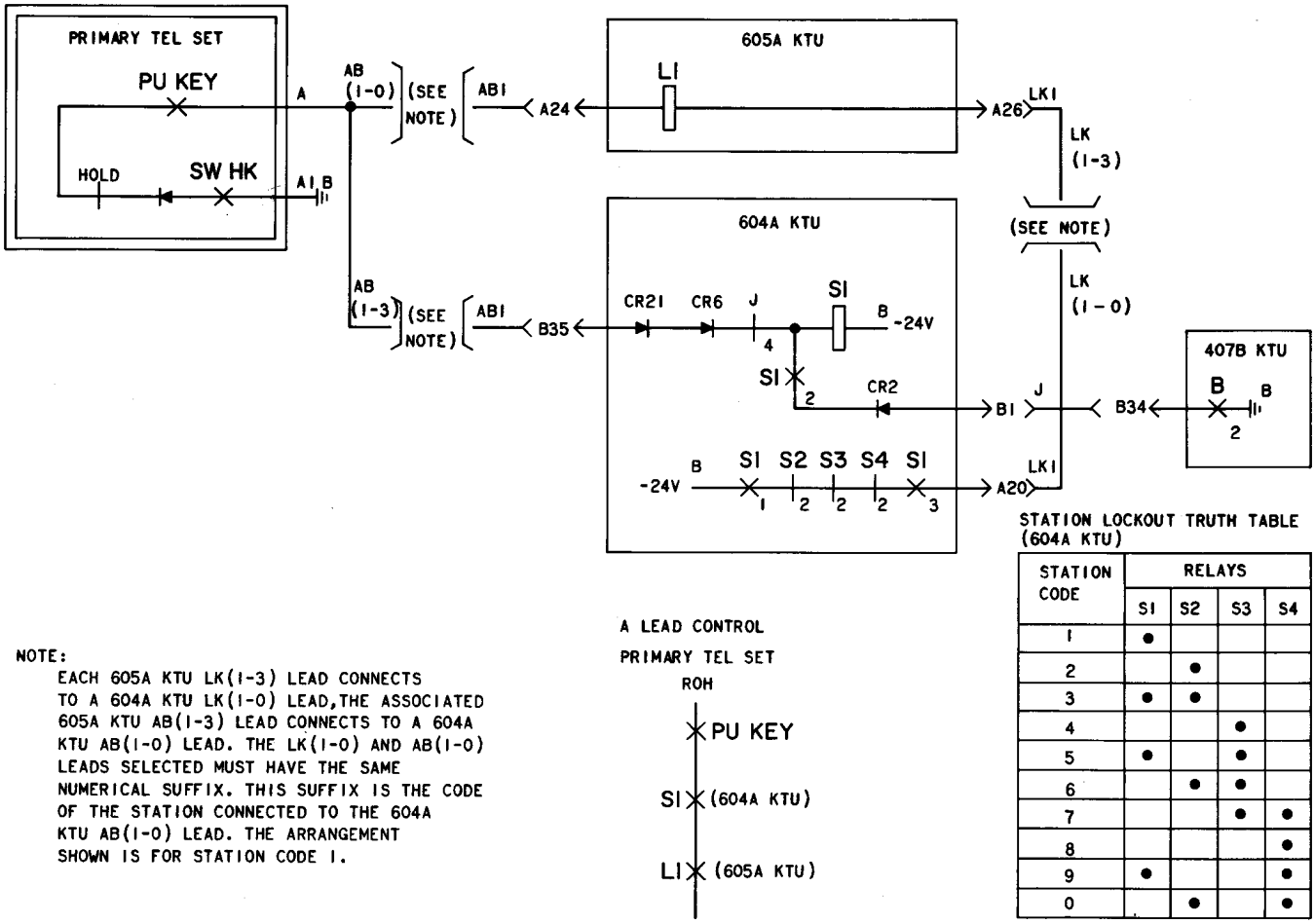


Fig. 8 — Single Group, CO, Centrex, or PBX Primary-Secondary Arrangement (With Add-on Conference) Block Diagram



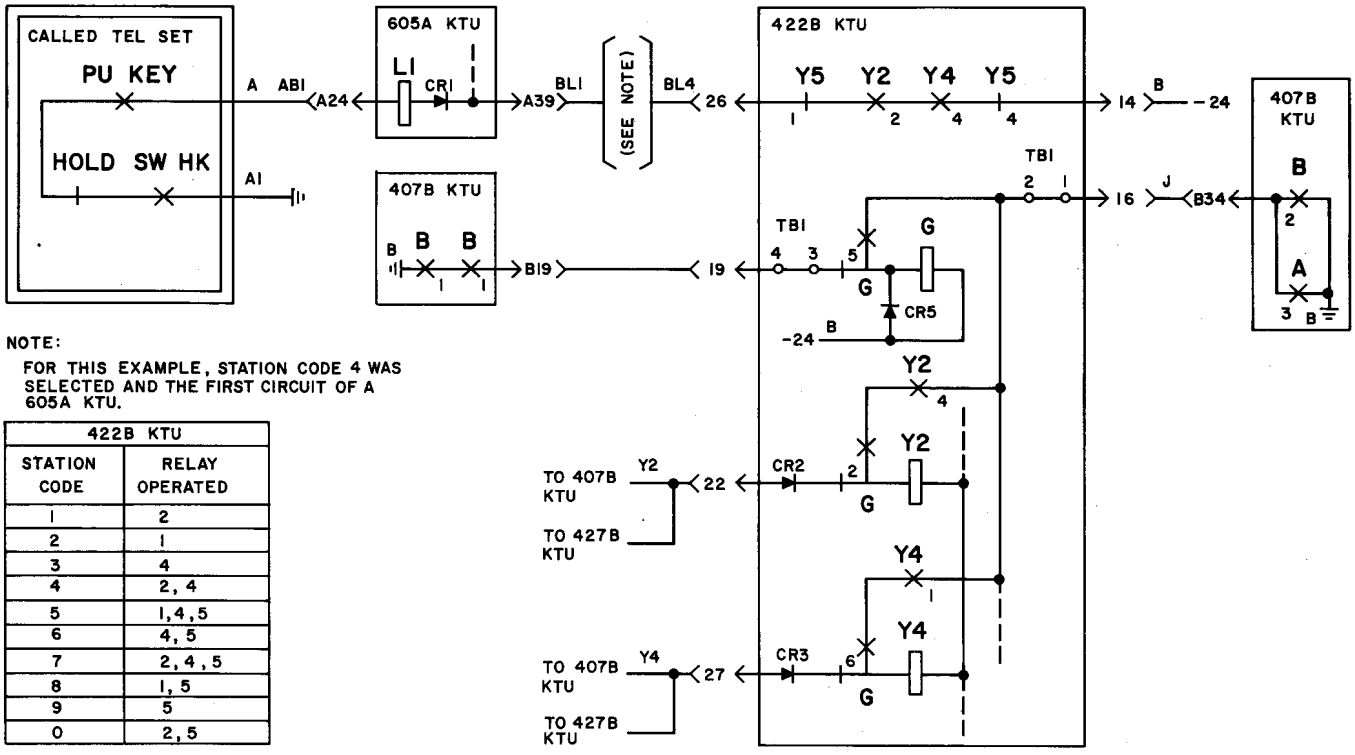
NOTE:
EACH 605A KTU LK(1-3) LEAD CONNECTS TO A 604A KTU LK(1-0) LEAD, THE ASSOCIATED 605A KTU AB(1-3) LEAD CONNECTS TO A 604A KTU AB(1-0) LEAD. THE LK(1-0) AND AB(1-0) LEADS SELECTED MUST HAVE THE SAME NUMERICAL SUFFIX. THIS SUFFIX IS THE CODE OF THE STATION CONNECTED TO THE 604A KTU AB(1-0) LEAD. THE ARRANGEMENT SHOWN IS FOR STATION CODE 1.

A LEAD CONTROL
PRIMARY TEL SET
ROH

STATION LOCKOUT TRUTH TABLE (604A KTU)

STATION CODE	RELAYS			
	S1	S2	S3	S4
1	●			
2		●		
3	●	●		
4			●	
5	●		●	
6		●	●	
7			●	●
8				●
9	●			●
0		●		●

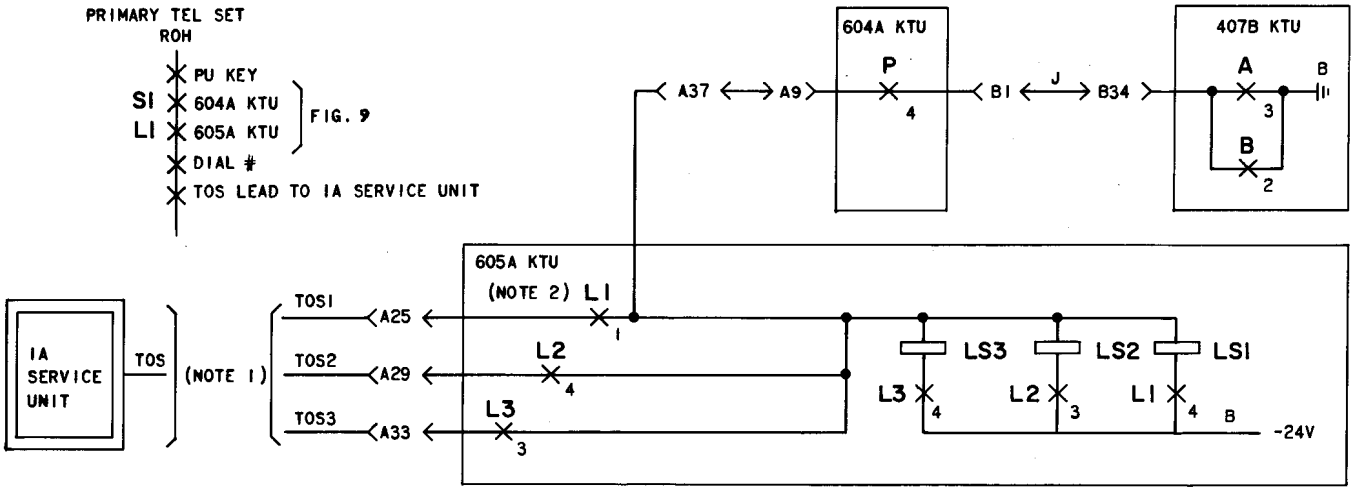
Fig. 9 — Single Link Intercom, *A* Lead Control (Primary Station)



NOTE:
FOR THIS EXAMPLE, STATION CODE 4 WAS SELECTED AND THE FIRST CIRCUIT OF A 605A KTU.

422B KTU	
STATION CODE	RELAY OPERATED
1	2
2	1
3	4
4	2, 4
5	1, 4, 5
6	4, 5
7	2, 4, 5
8	1, 5
9	5
0	2, 5

Fig. 10 — Single Link Intercom, Called Station Link Enable Circuit



NOTES:

1. THE 605A KTU CONSISTS OF 3 IDENTICAL CIRCUITS. THE CIRCUITS SELECTED FOR CONNECTION TO A STATION SHOULD BE USED ONLY WITH THAT PARTICULAR STATION. THE 605A KTU TOS (1-3) LEAD MUST HAVE THE SAME NUMERICAL SUFFIX AS THE LK (1-3) AND AB (1-3) LEADS SELECTED FOR USE WITH THIS STATION.
2. SEE FIGURE ENTITLED "A LEAD CONTROL CIRCUIT FOR OPERATE PATH OF L(1-3) RELAYS.

Fig. 11 — Single Link Intercom, Turn-on Set (TOS)

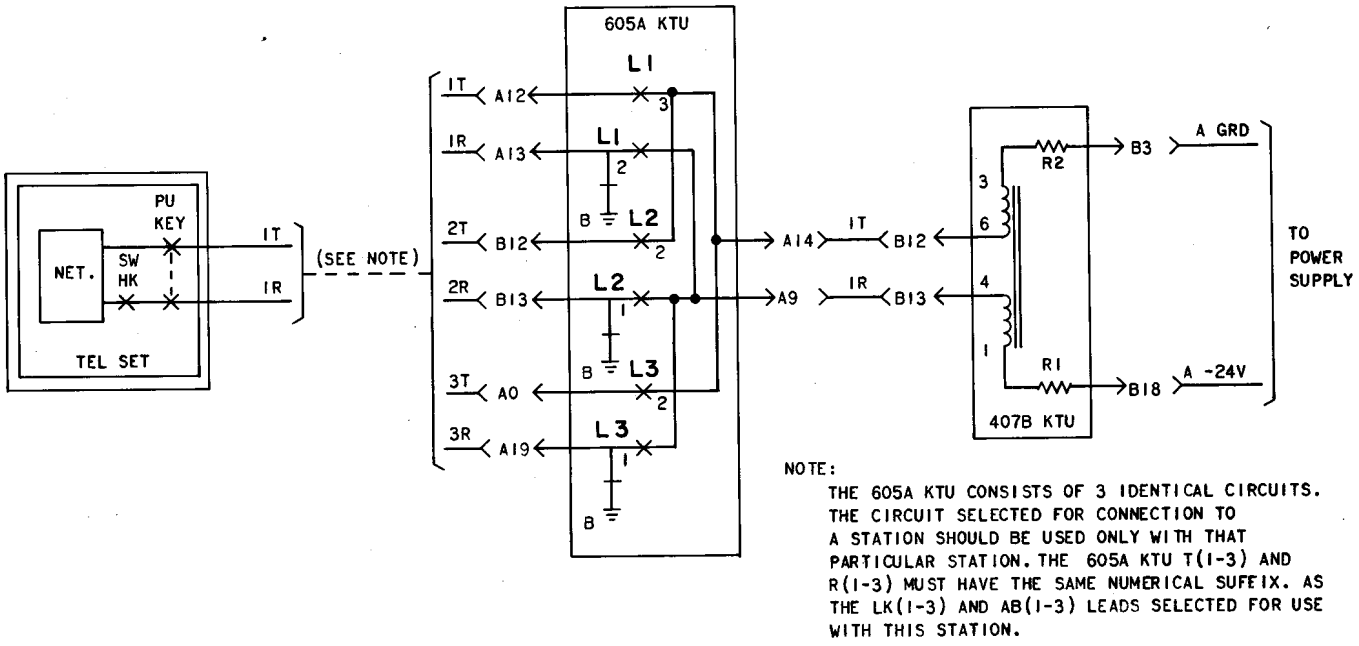
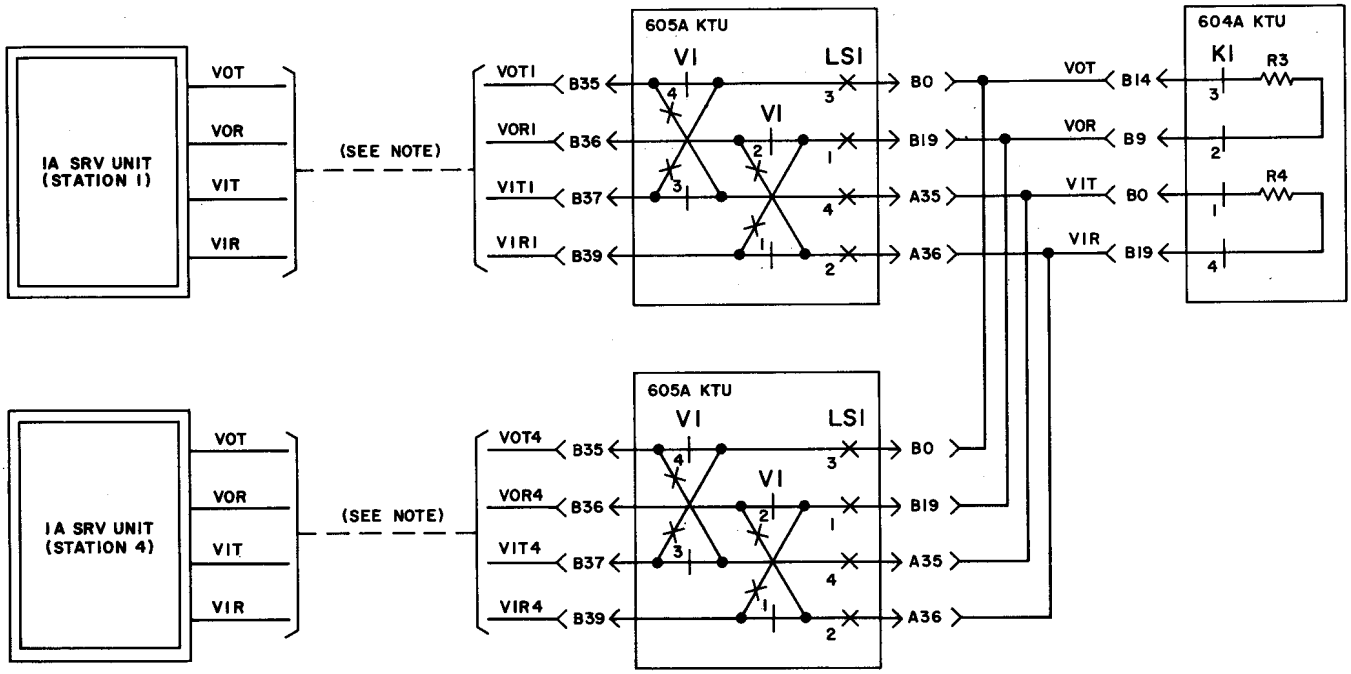
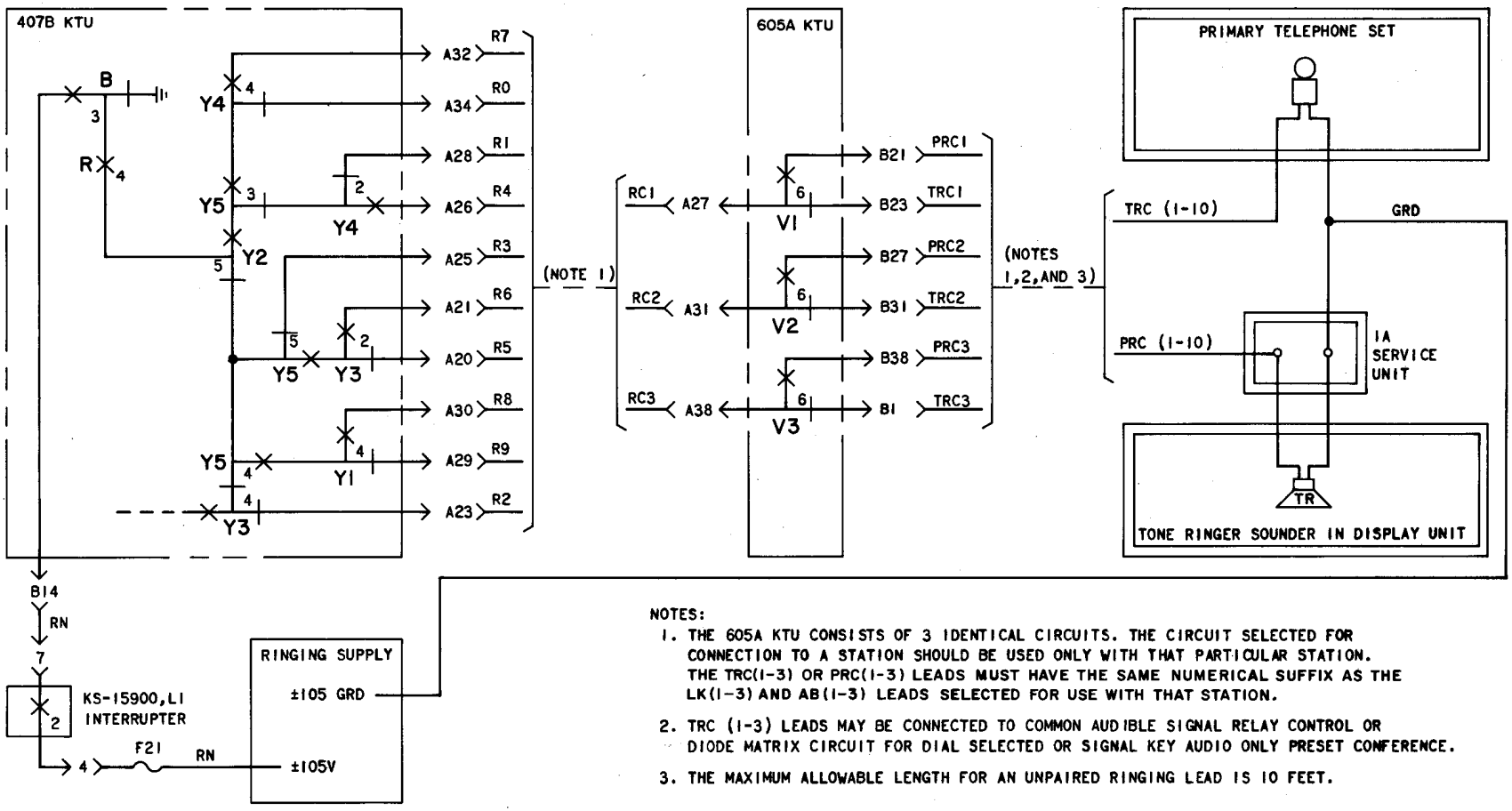


Fig. 12 — Single Link Intercom, Audio Transmission Path



NOTE:
THE 605A KTU CONSISTS OF 3 IDENTICAL CIRCUITS. THE CIRCUIT SELECTED FOR CONNECTION TO A STATION SHOULD BE USED ONLY WITH THAT PARTICULAR STATION. THE 605A KTU VOT(1-3), VOR(1-3), VIT (1-3) AND VIR (1-3) LEADS MUST HAVE THE SAME NUMERICAL SUFFIX AS THE LK(1-3) AND AB(1-3) LEADS SELECTED FOR USE WITH THIS STATION. IN THIS EXAMPLE,THE 1ST CIRCUIT IN TWO DIFFERENT 605A KTU'S WAS SELECTED.

Fig. 13 — Single Link Intercom, Video Transmission Path



NOTES:

1. THE 605A KTU CONSISTS OF 3 IDENTICAL CIRCUITS. THE CIRCUIT SELECTED FOR CONNECTION TO A STATION SHOULD BE USED ONLY WITH THAT PARTICULAR STATION. THE TRC(1-3) OR PRC(1-3) LEADS MUST HAVE THE SAME NUMERICAL SUFFIX AS THE LK(1-3) AND AB(1-3) LEADS SELECTED FOR USE WITH THAT STATION.
2. TRC (1-3) LEADS MAY BE CONNECTED TO COMMON AUDIBLE SIGNAL RELAY CONTROL OR DIODE MATRIX CIRCUIT FOR DIAL SELECTED OR SIGNAL KEY AUDIO ONLY PRESET CONFERENCE.
3. THE MAXIMUM ALLOWABLE LENGTH FOR AN UNPAIRED RINGING LEAD IS 10 FEET.

Fig. 14 — Snigle Link Intercom, Ringing Control

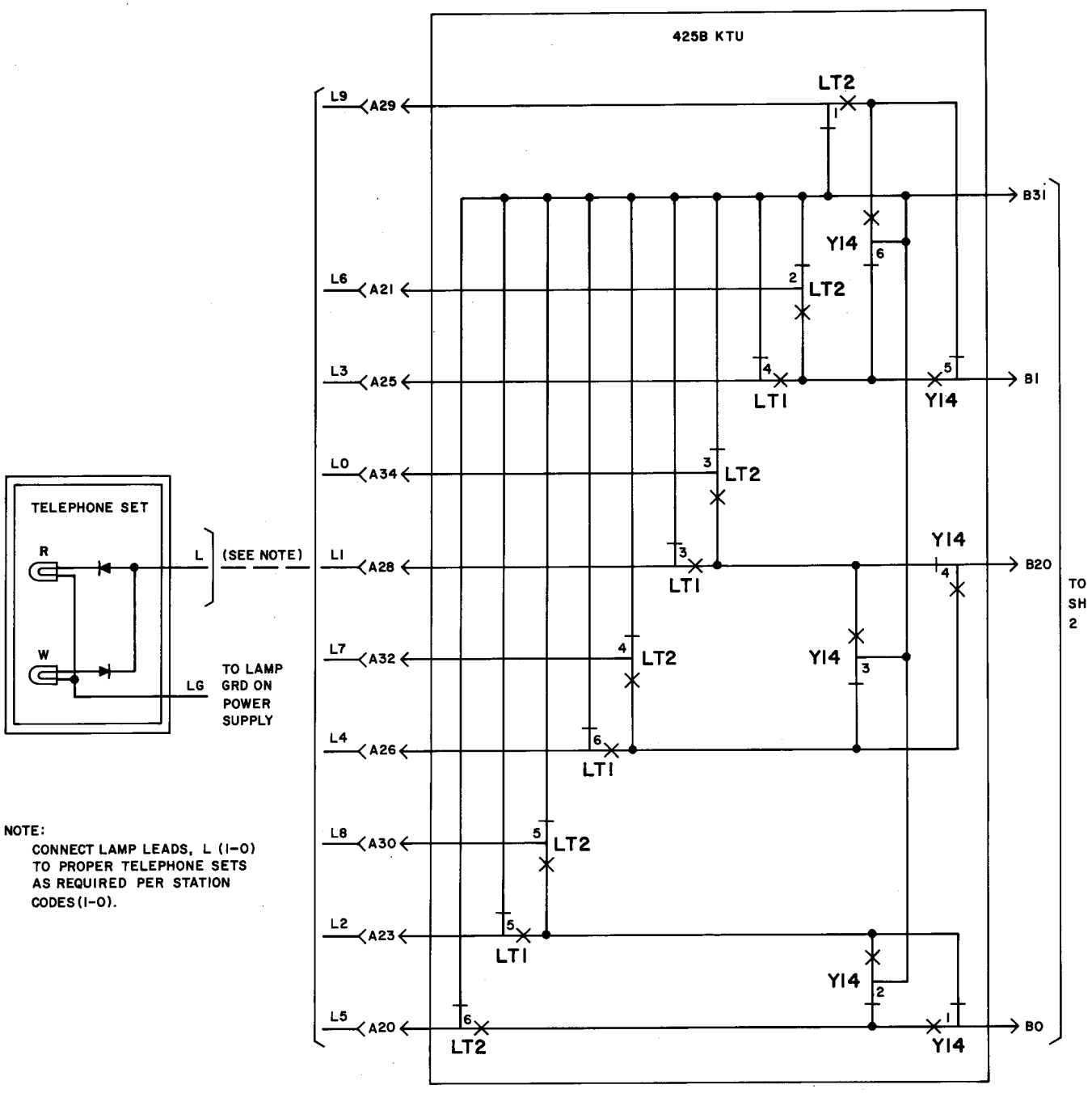


Fig. 15 — Single Link Intercom, Lamp Control (Sheet 1)

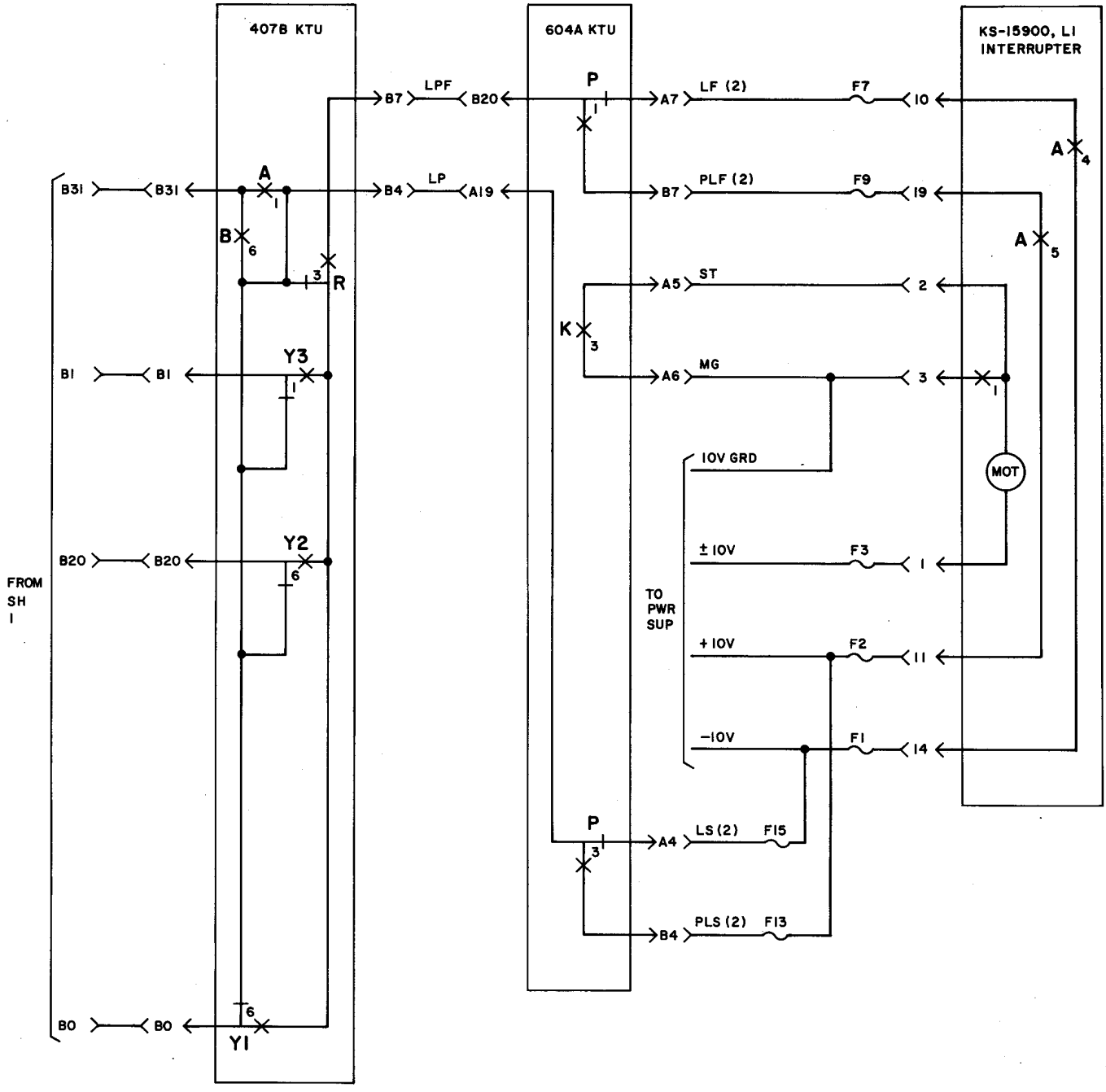
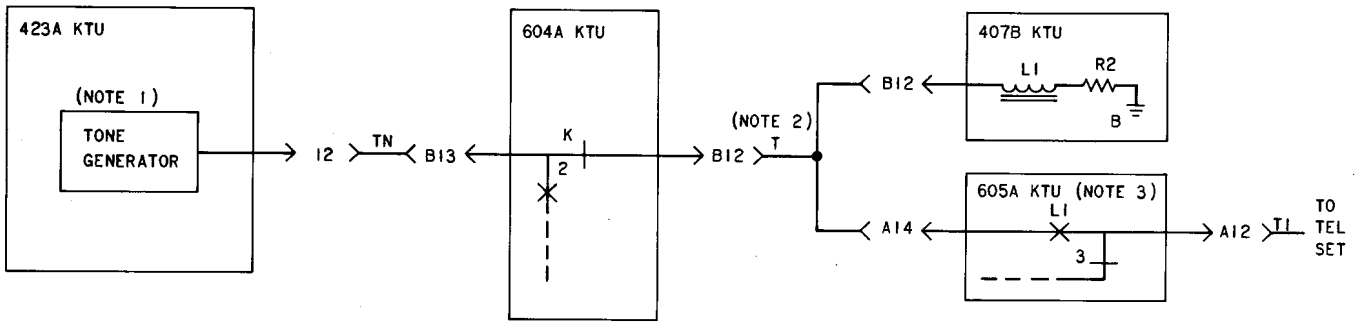
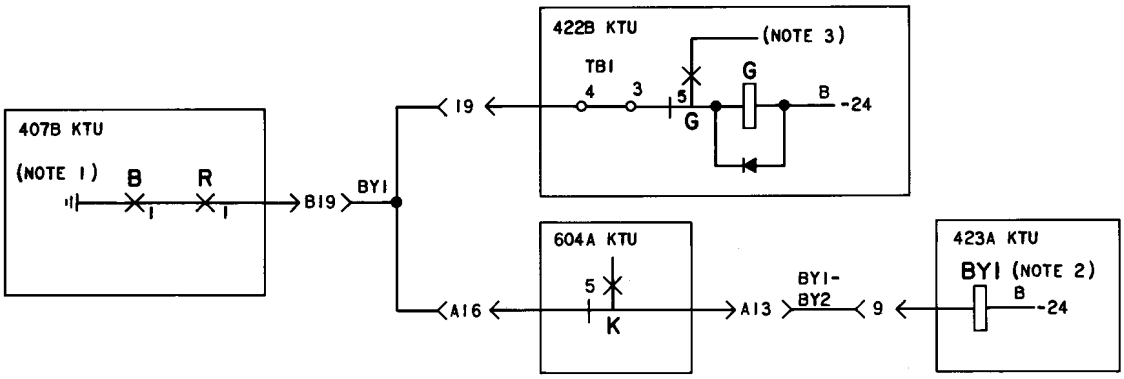


Fig. 15 — Single Link Intercom, Lamp Control (Sheet 2)



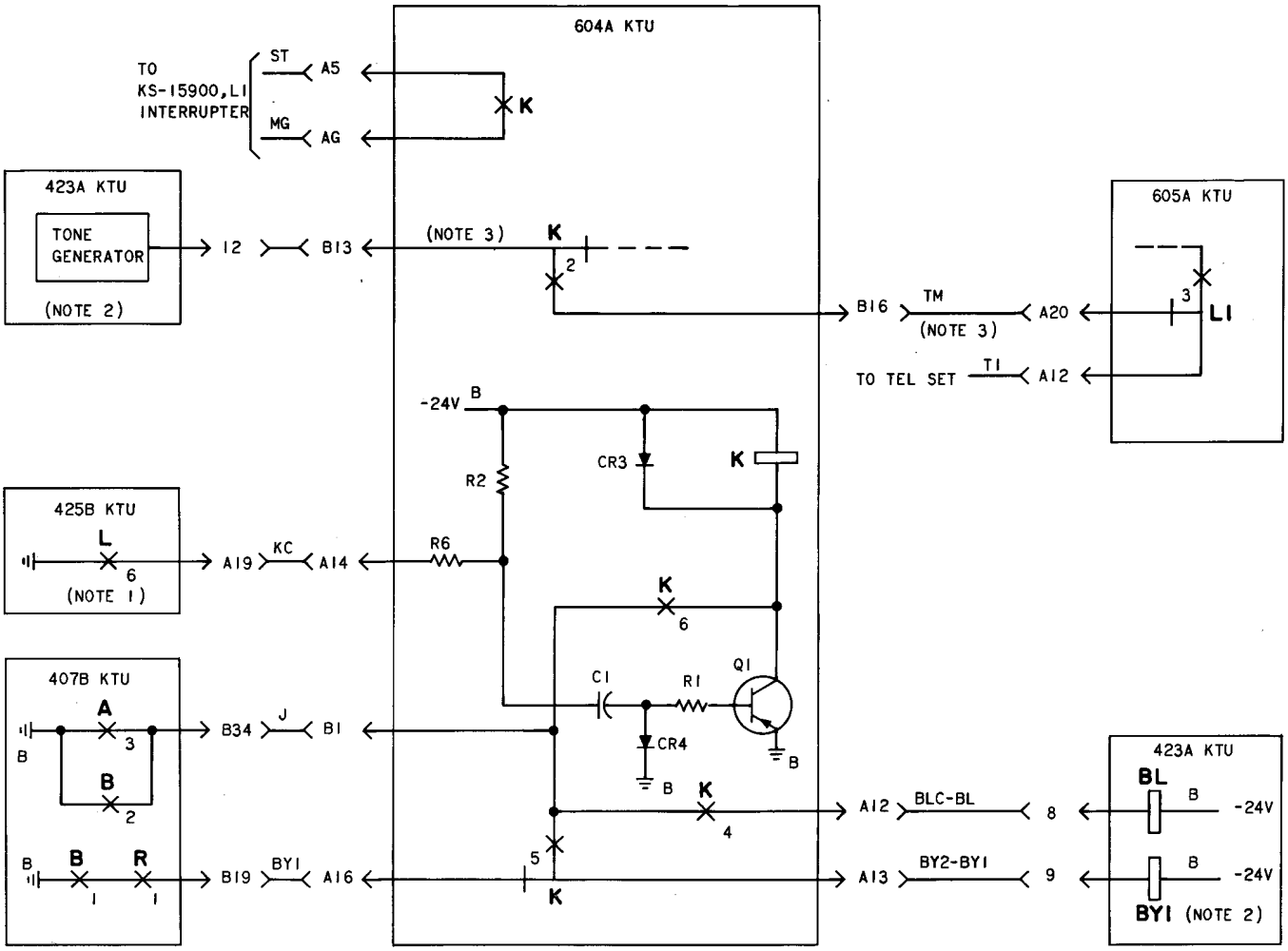
NOTES:
1. TONE GENERATOR IS ACTIVATED BY GROUND ON THE J LEAD FROM THE 407B KTU.
2. DIAL TONE IS APPLIED TO TIP SIDE OF LINE.
3. THE FIRST CIRCUIT OF A 605A KTU HAS BEEN SELECTED AS AN EXAMPLE.

Fig. 16 — Single Link Intercom, Dial Tone



NOTES:
1. AT THIS POINT DIALING HAS JUST BEEN COMPLETED.
2. OPERATION OF BYI RELAY (423A KTU) SETS TONE GENERATOR FOR AUDIBLE RINGBACK WHICH IS COUPLED TO THE TIP SIDE OF THE CALLING STATION LINE AS SHOWN IN FIG.14, DIAL TONE CIRCUIT.
3. OPERATION OF RELAY G COMPLETES THE LOCKUP PATH TO "J" GROUND FOR OPERATED Y RELAYS (422B KTU) AND THE G RELAY UNTIL ALL STATIONS DISCONNECT.

Fig. 17 — Single Link Intercom, Audible Ringback



NOTES:

1. RELAY L WHICH OPERATES AT THE COMPLETION OF DIALING RELEASES UPON SECOND STATION DETECTION IN THE DSIC, OPENING THE DISCHARGE PATH FOR C1 CAPACITOR (604A KTU). TRANSISTOR Q1 TURNS ON MOMENTARILY OPERATING RELAY K WHICH LOCKS TO J GROUND.
2. OPERATED K RELAY SETS THE TONE GENERATOR TO THE BUSY TONE MODE BY HOLDING THE BY1 RELAY AND OPERATING THE BL RELAY (423A KTU).
3. OPERATED K RELAY COUPLES THE BUSY TONE SIGNAL TO THE MULTIPLED TIP LEADS OF THE LOCKED OUT TELEPHONE SETS VIA THE TM LEAD AND INOPERATED L RELAYS (605A KTU).

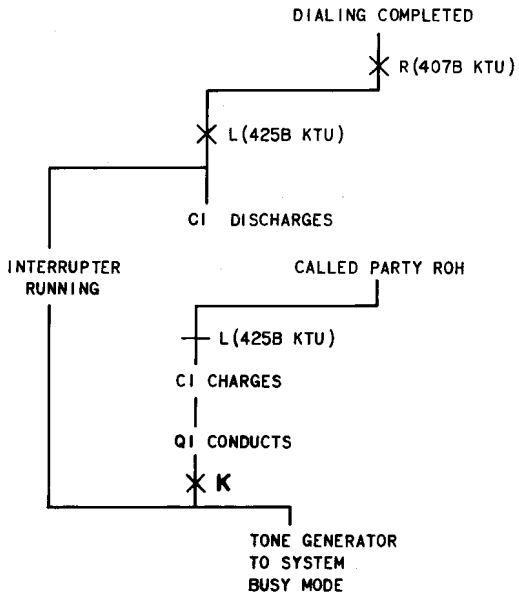
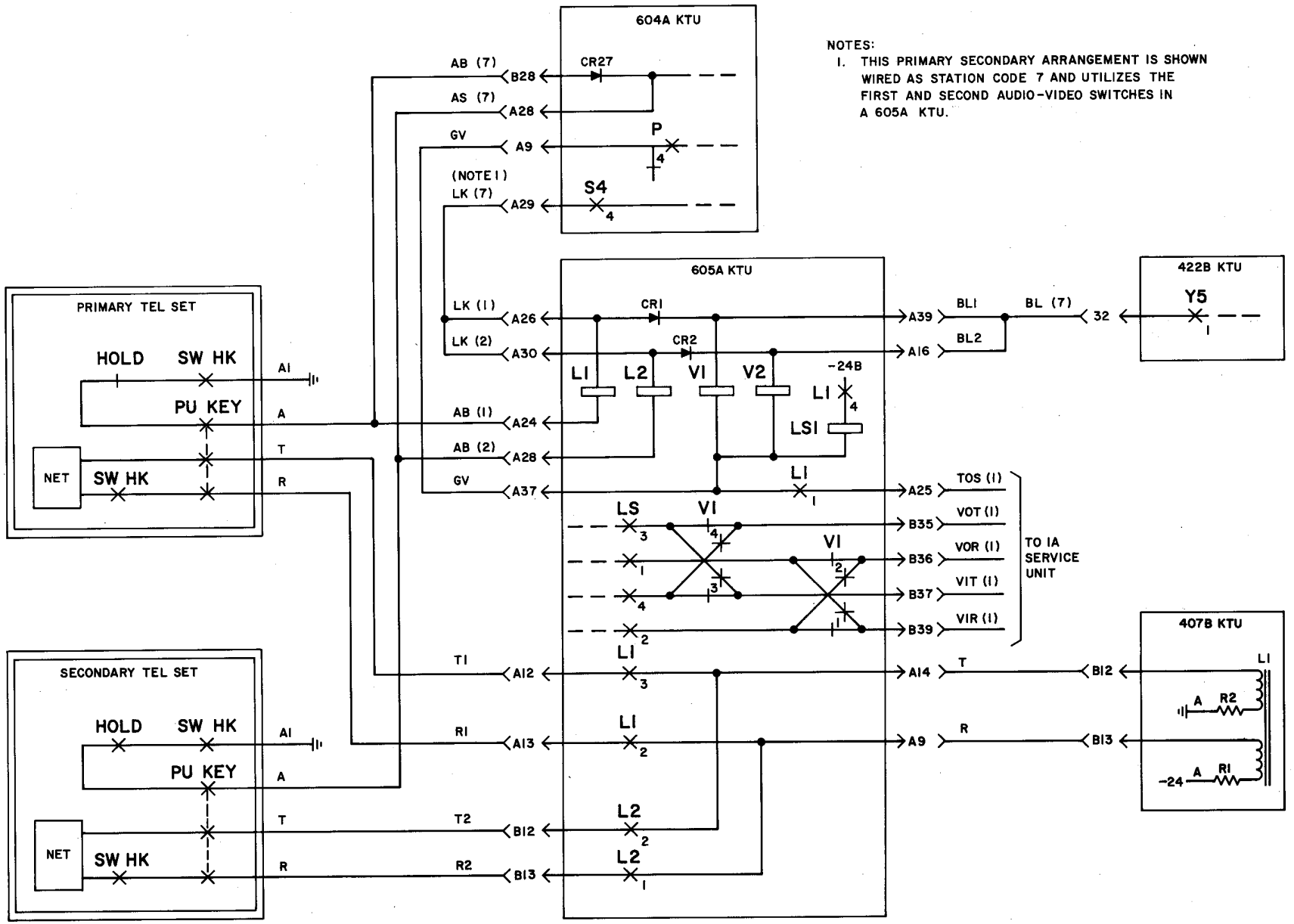


Fig. 18 — Single Link Intercom, Busy Tone

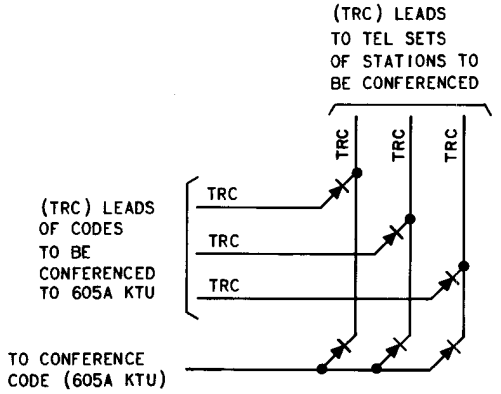


NOTES:
1. THIS PRIMARY SECONDARY ARRANGEMENT IS SHOWN WIRED AS STATION CODE 7 AND UTILIZES THE FIRST AND SECOND AUDIO-VIDEO SWITCHES IN A 605A KTU.

Fig. 19 — Single Link Intercom, Primary-Secondary Station Bridging

CONNECTIONS FOR FIRST 421A KTU

FOR STA CODE	CONNECT									
	TERM. B21 OF 427B KTU	GRD B	SIG KEY	TERMINALS ON 407B KTU						
				B30	B25	B24	B22	A36	A37	B21
	TO TERMINALS ON 421A KTU									
1	13	27	1	8		37				9
2	13	27	1	8	37					9
3	13	22,27	1	8			37	36		9
4	13	22,27	1	8		37		36		9
5	13	22,23,27	1	8	37			36	35	9
6	13	22,23,27	1	8			37	36	35	9
7	13	22,23,27	1	8		37		36	35	9
8	13	23,27	1	8	37				35	9
9	13	23,27	1	8			37		35	9
0	13	23,27	1	8		37			35	9



NOTE: THIS ARRANGEMENT REDUCES THE NUMBER OF STATION CODES AVAILABLE BY ONE PER CONFERENCE CODE.

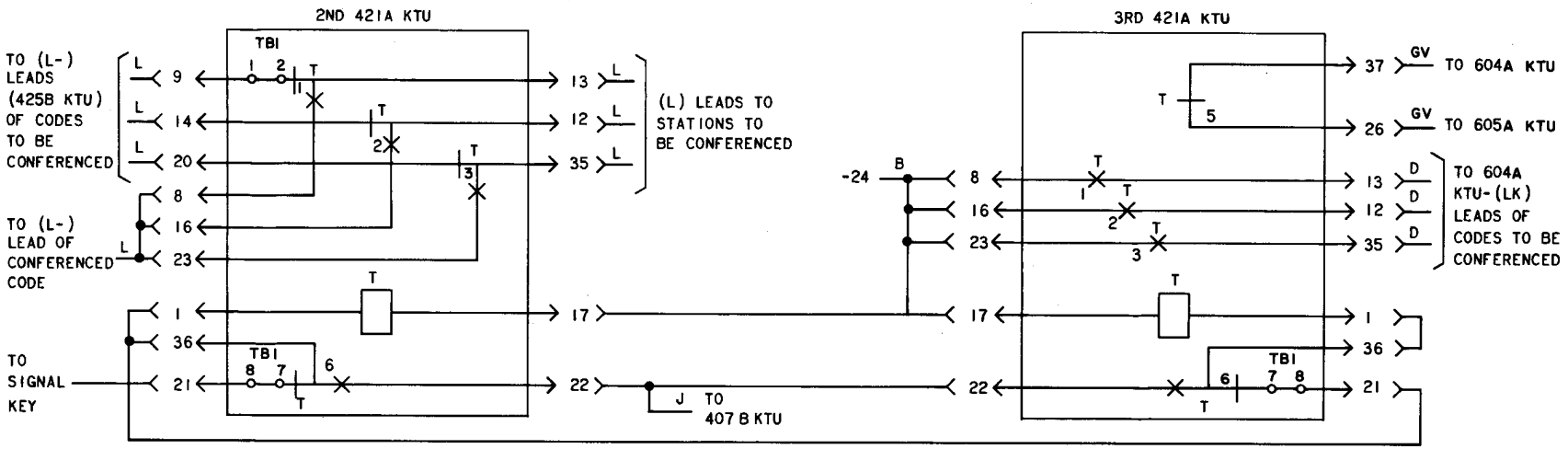


Fig. 20 — Single Link Intercom, Signal Key Preset (Audio Only) Conference

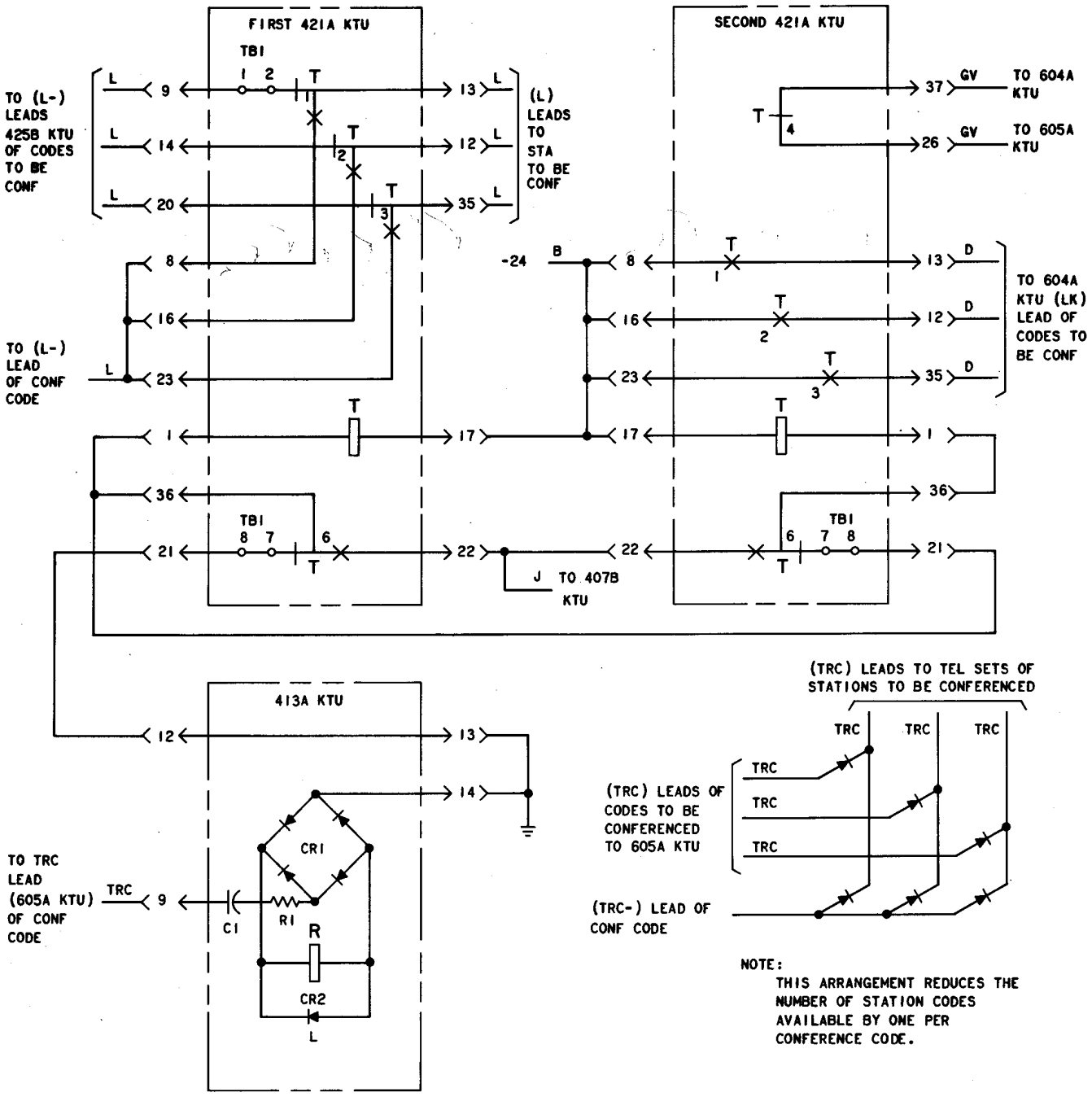


Fig. 21 — Single Link Intercom, Dial Selected Preset (Audio Only) Conference

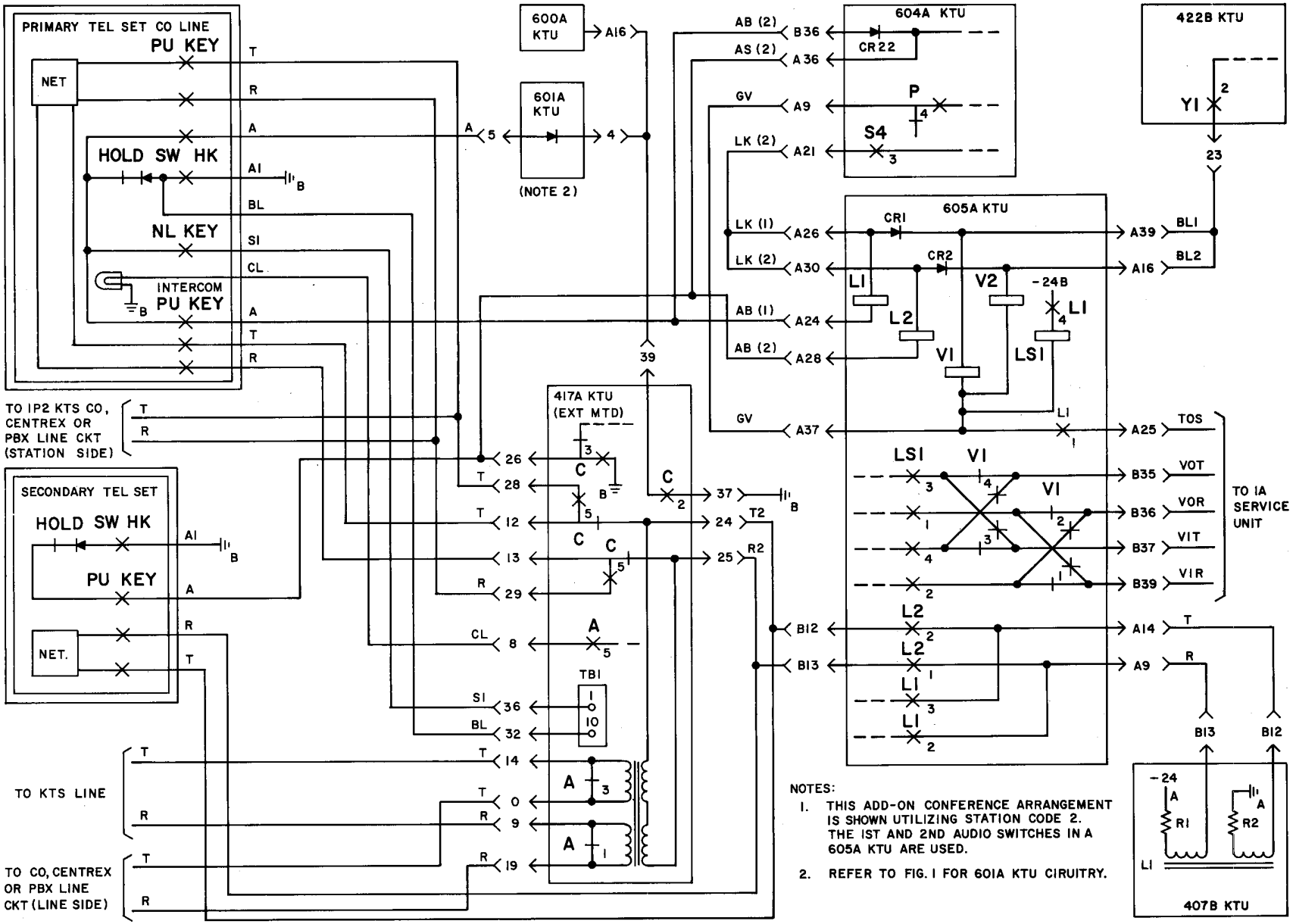
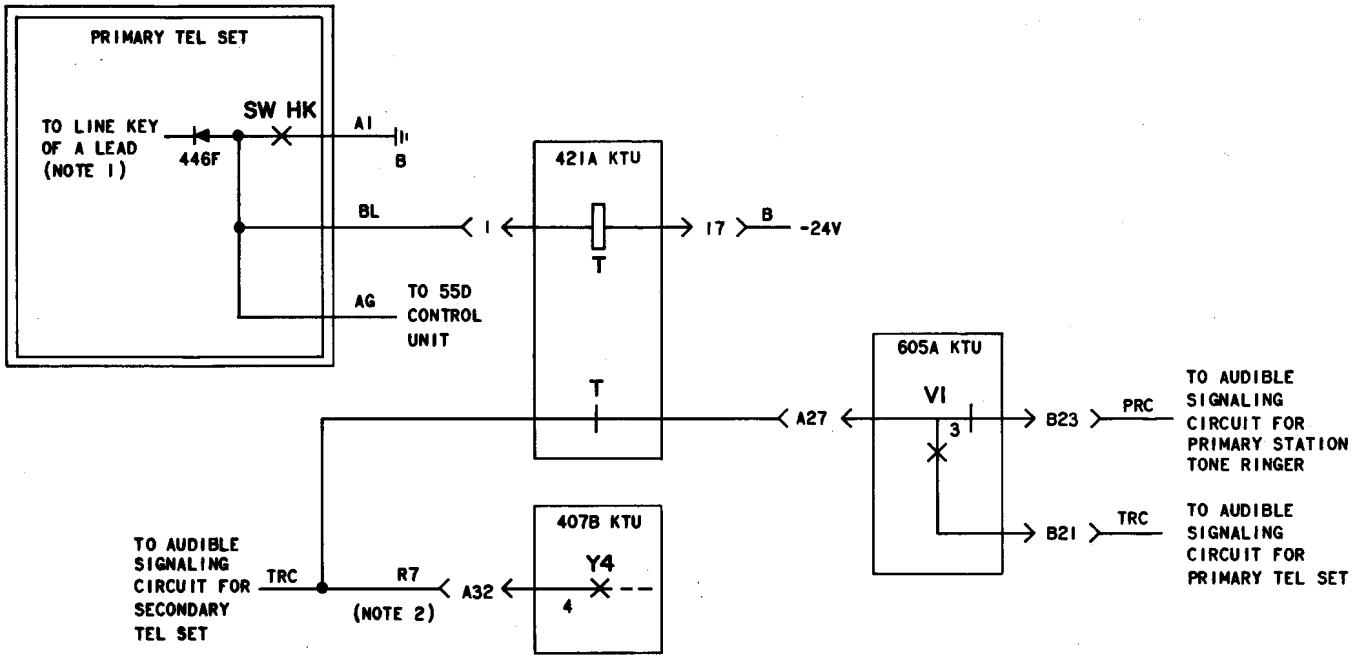


Fig. 22 — Single Link Intercom, Add-on Conference



NOTES:
1. A 446F DIODE MUST BE INSTALLED IN TEL SET AS SHOWN. REFER TO APPROPRIATE SECTION FOR TEL SET TO BE MODIFIED.
2. THIS ARRANGEMENT IS WIRED FOR PRIMARY-SECONDARY STATION BRIDGING AND IS SHOWN WIRED AS STATION CODE 7 AND UTILIZES THE 1ST AUDIO-VIDEO SWITCH IN A 605A KTU TO ISOLATE THE RINGING CIRCUITS IN THE PRIMARY STATION.

Fig. 23 — Single Link Intercom, Bridged Hunting for One Station

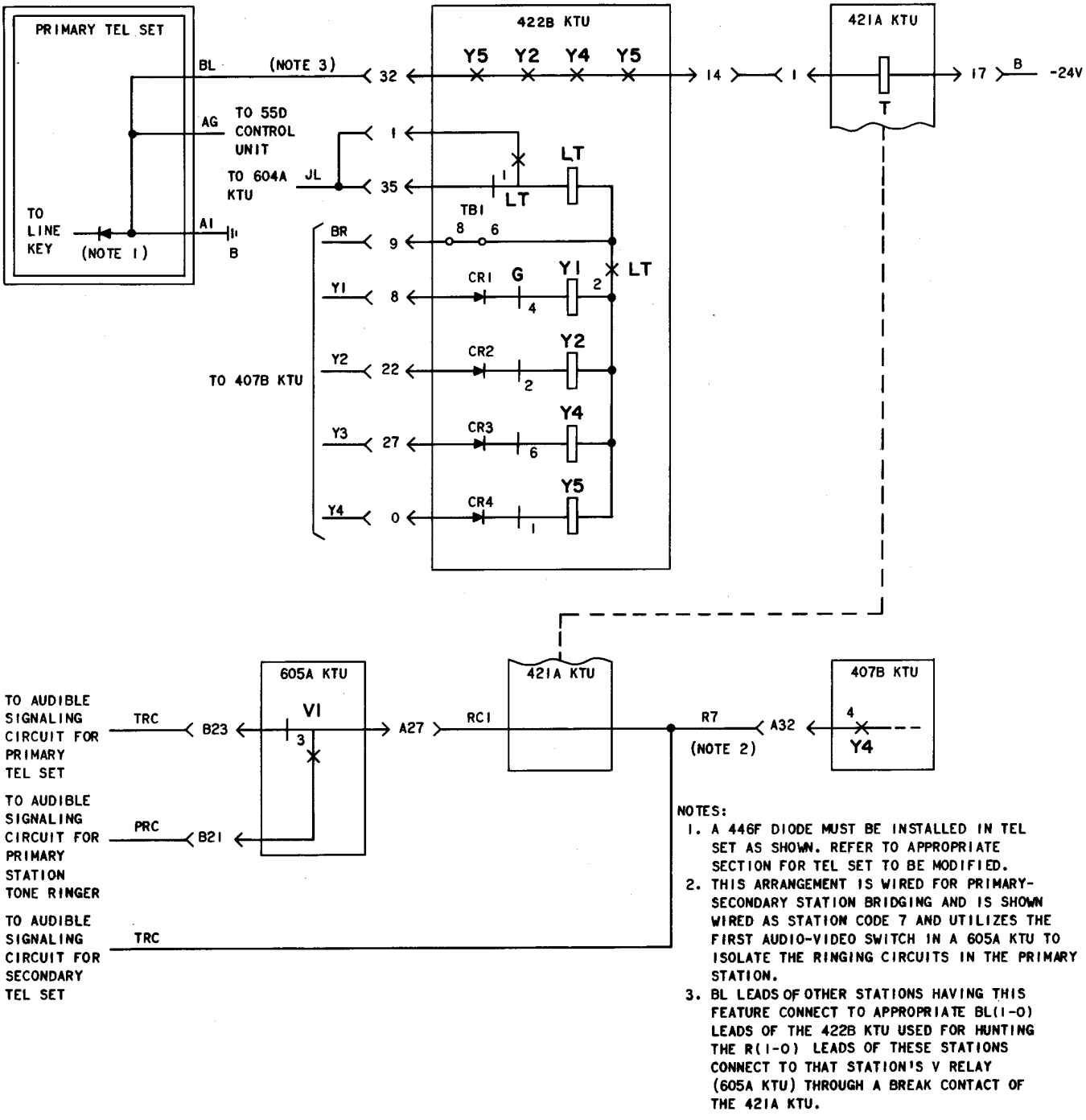


Fig. 24 —Single Link Intercom, Bridged Hunting for More Than One Station

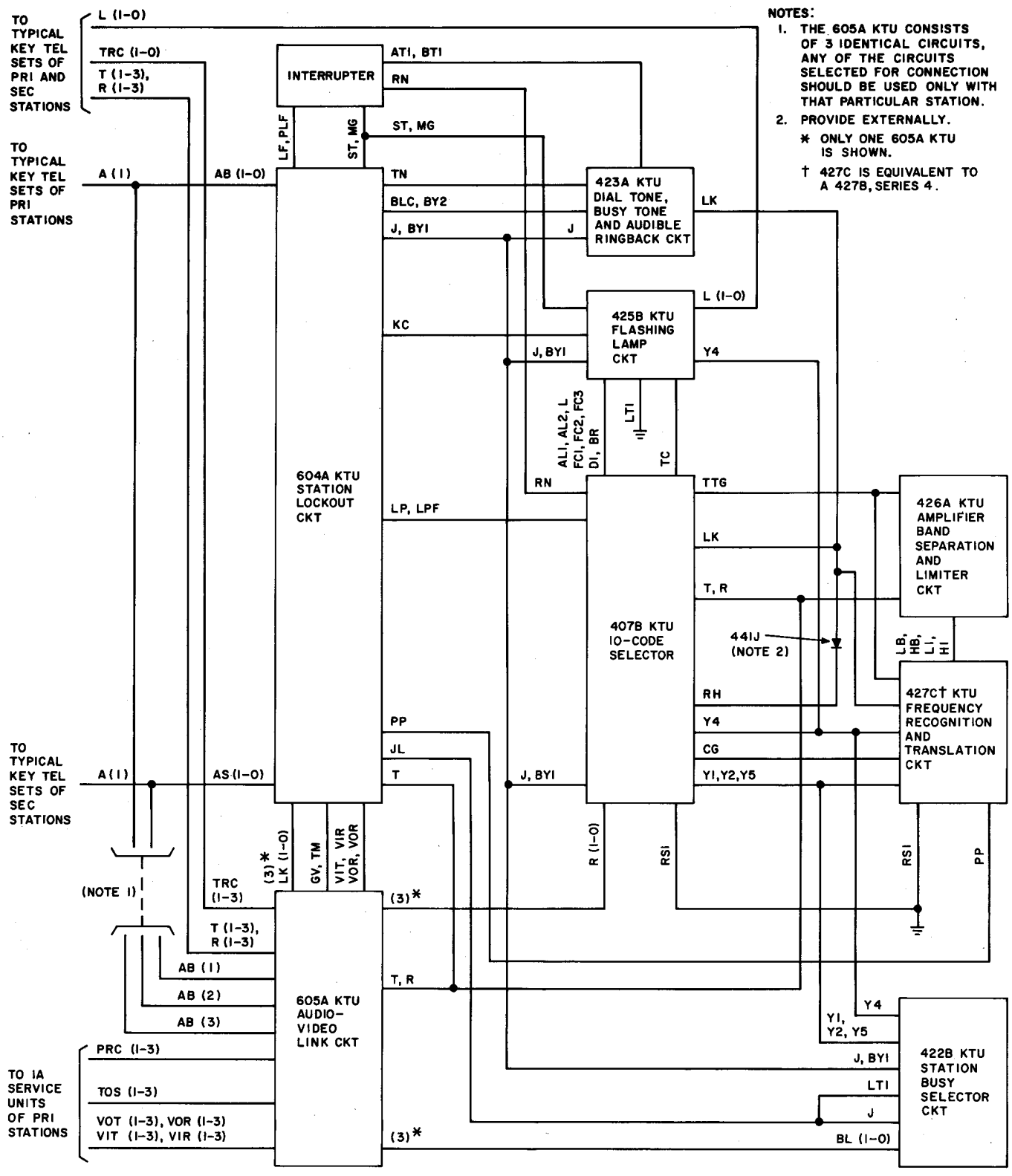


Fig. 25 — Single Link Intercom Arrangement, Block Diagram

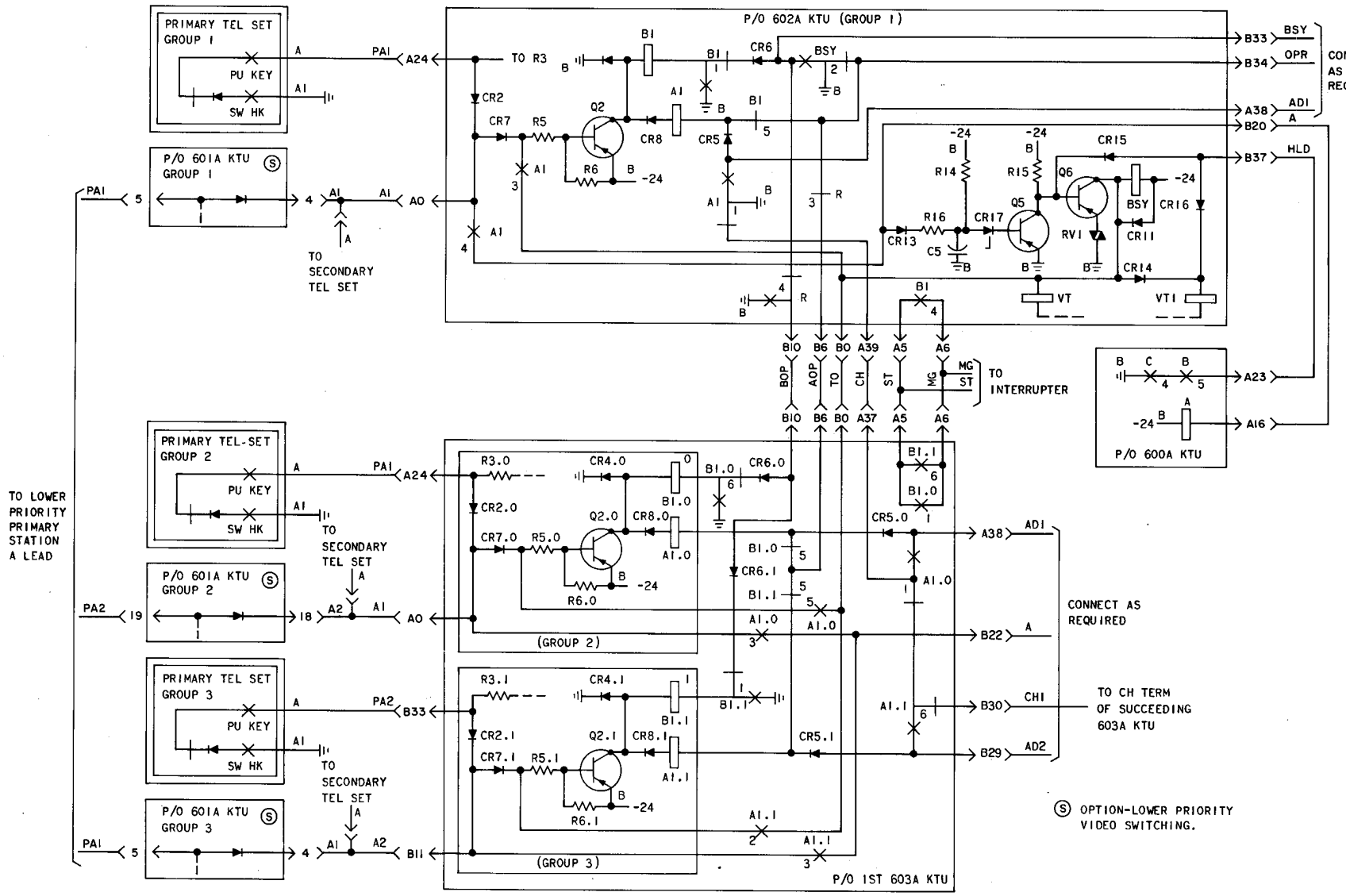


Fig. 26 — Multigroup, *A* Lead, Lockout, and Busy Tone Control

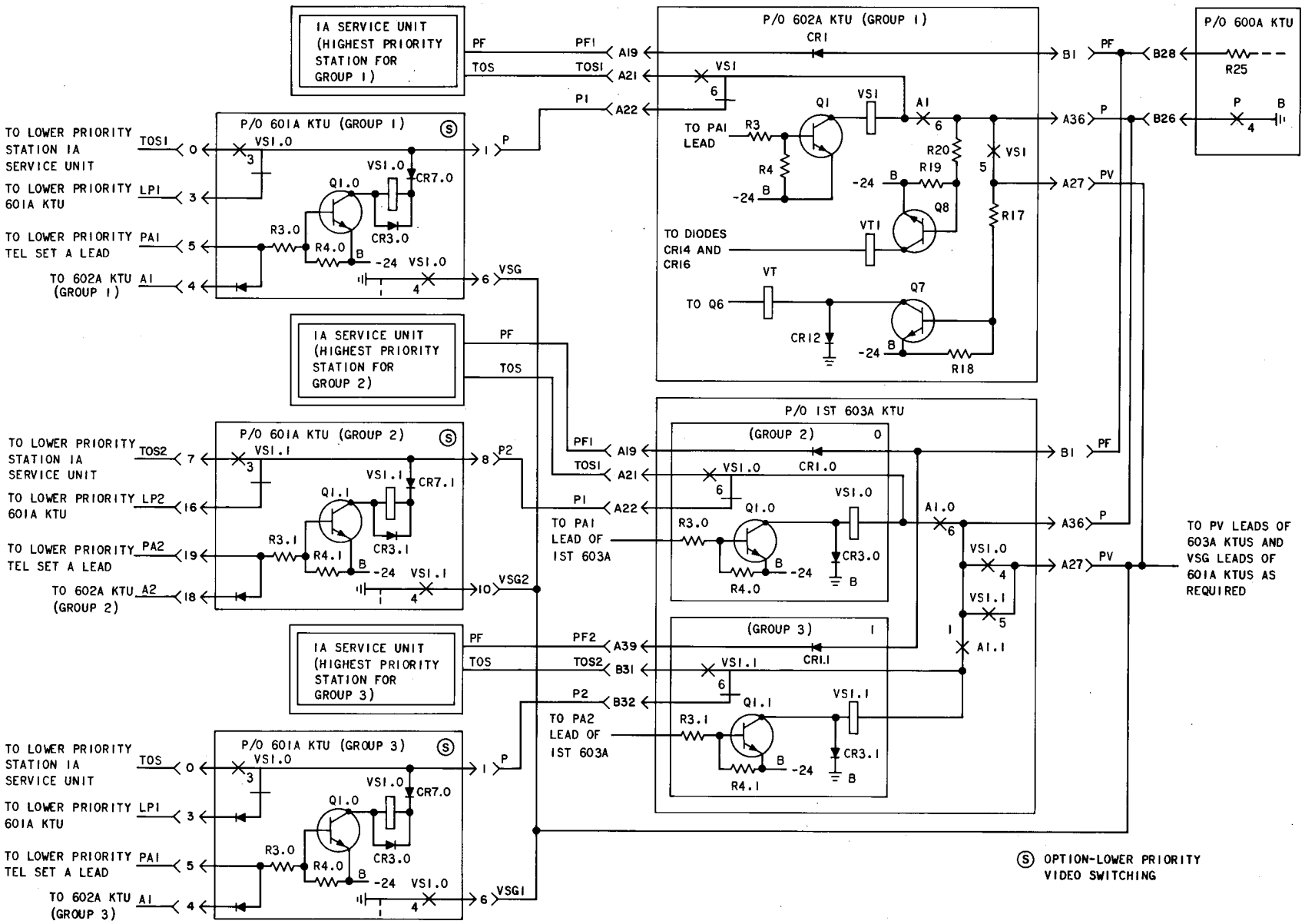


Fig. 27 — Multigroup, Video Control

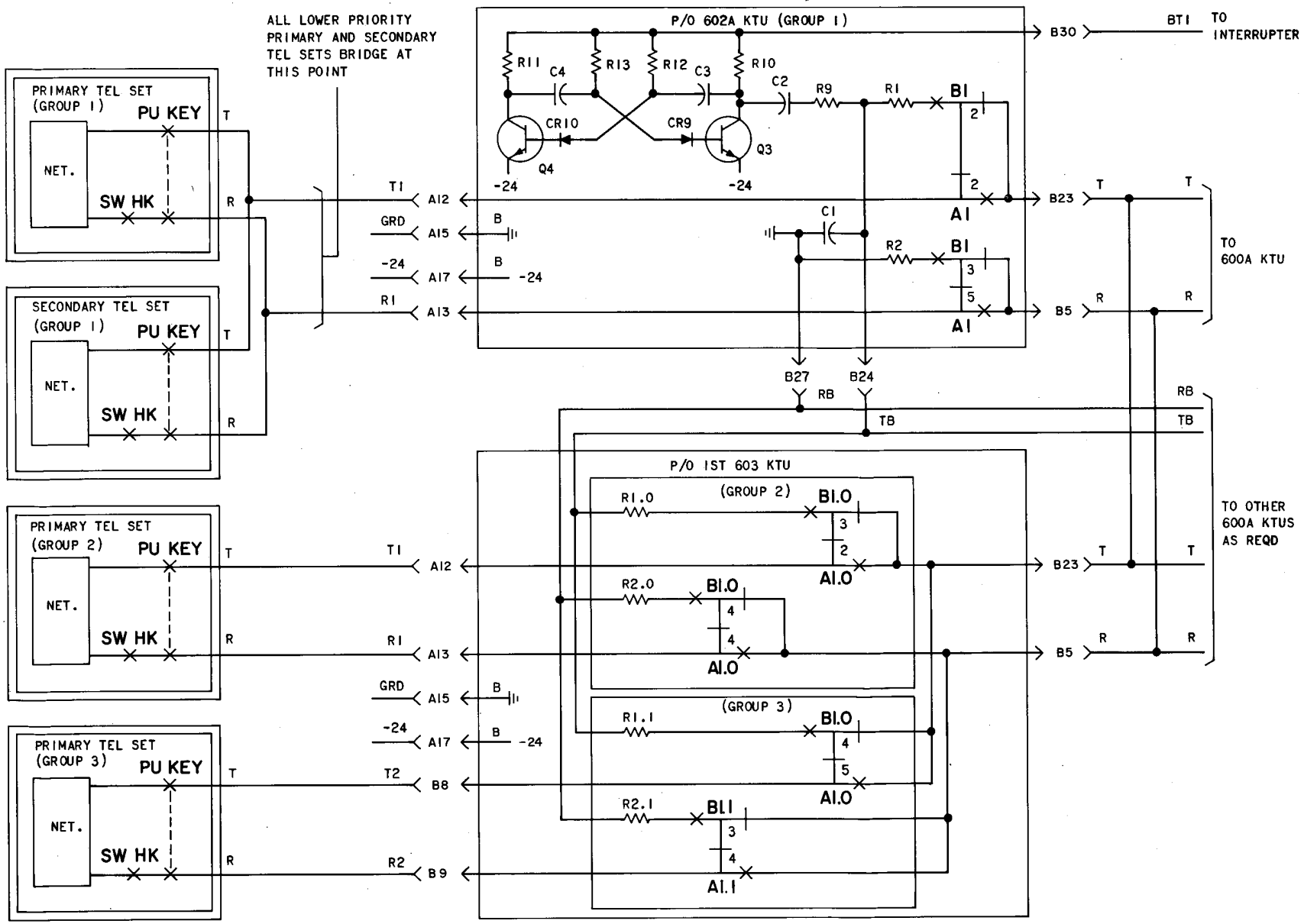


Fig. 28 — Multigroup, Audio Transmission Path and System Busy Tone

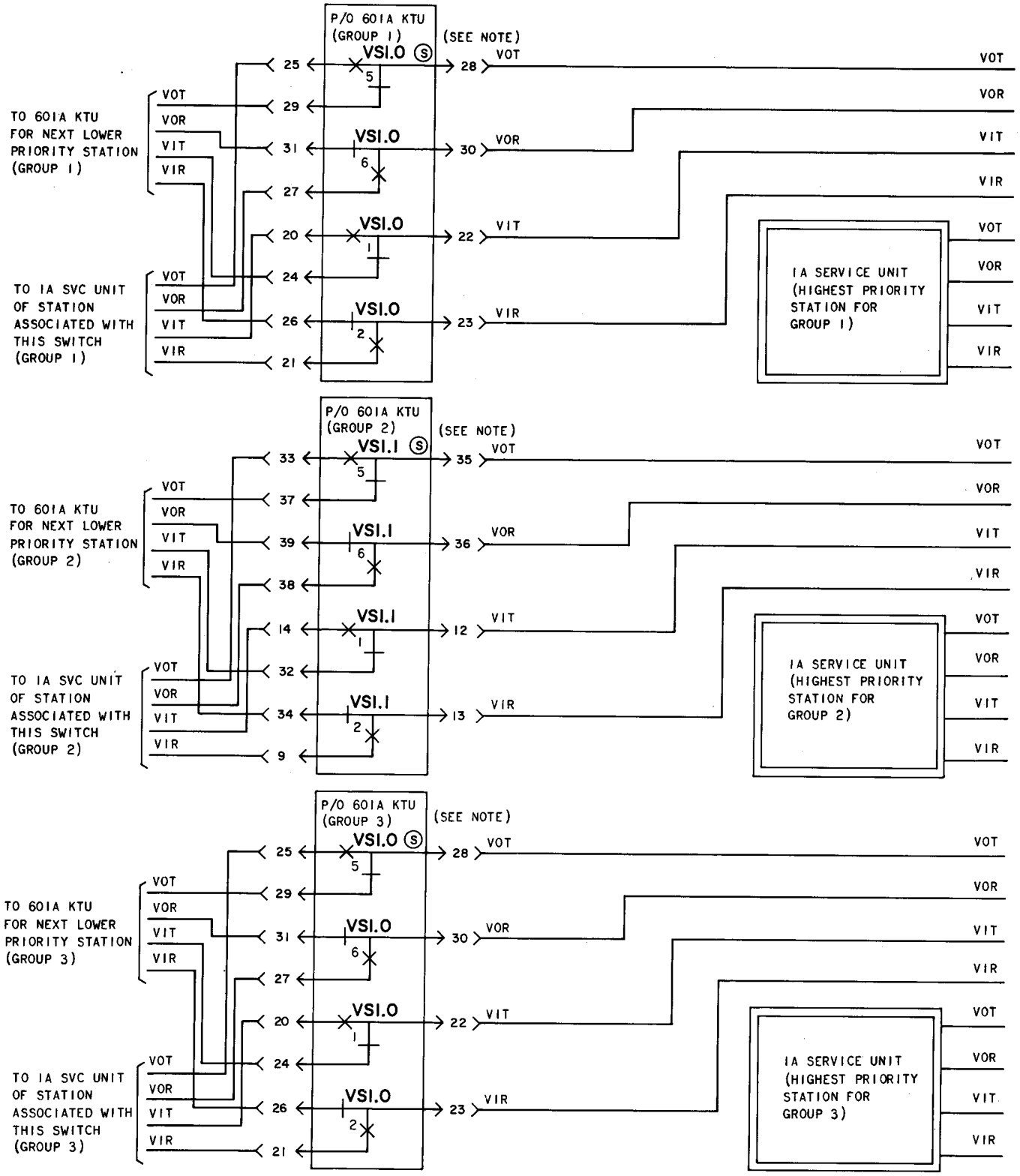
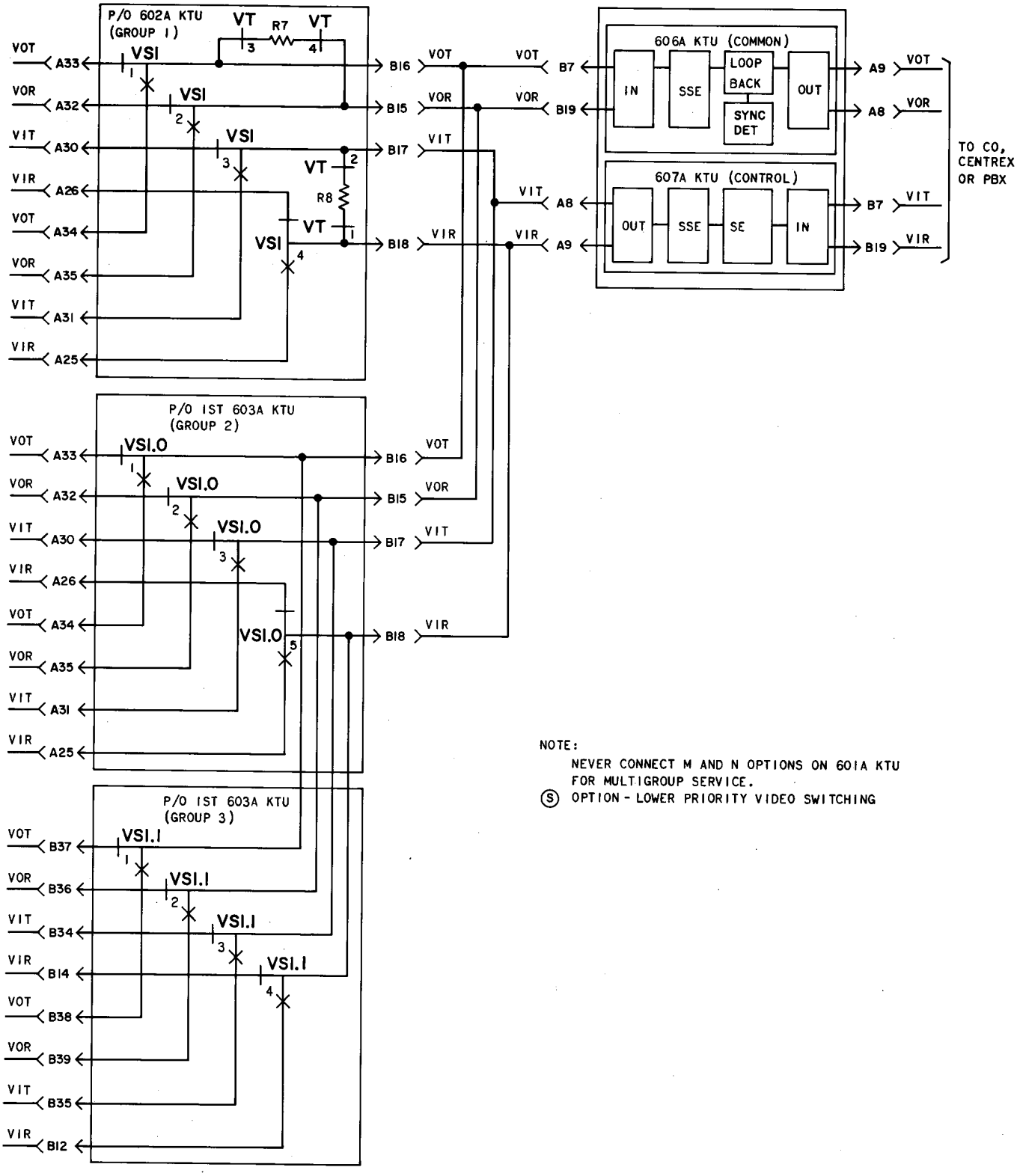


Fig. 29 — Multigroup, Video Transmission Path (Sheet 1)



NOTE:
NEVER CONNECT M AND N OPTIONS ON 601A KTU FOR MULTIGROUP SERVICE.
(S) OPTION - LOWER PRIORITY VIDEO SWITCHING

Fig. 29 — Multigroup, Video Transmission Path (Sheet 2)

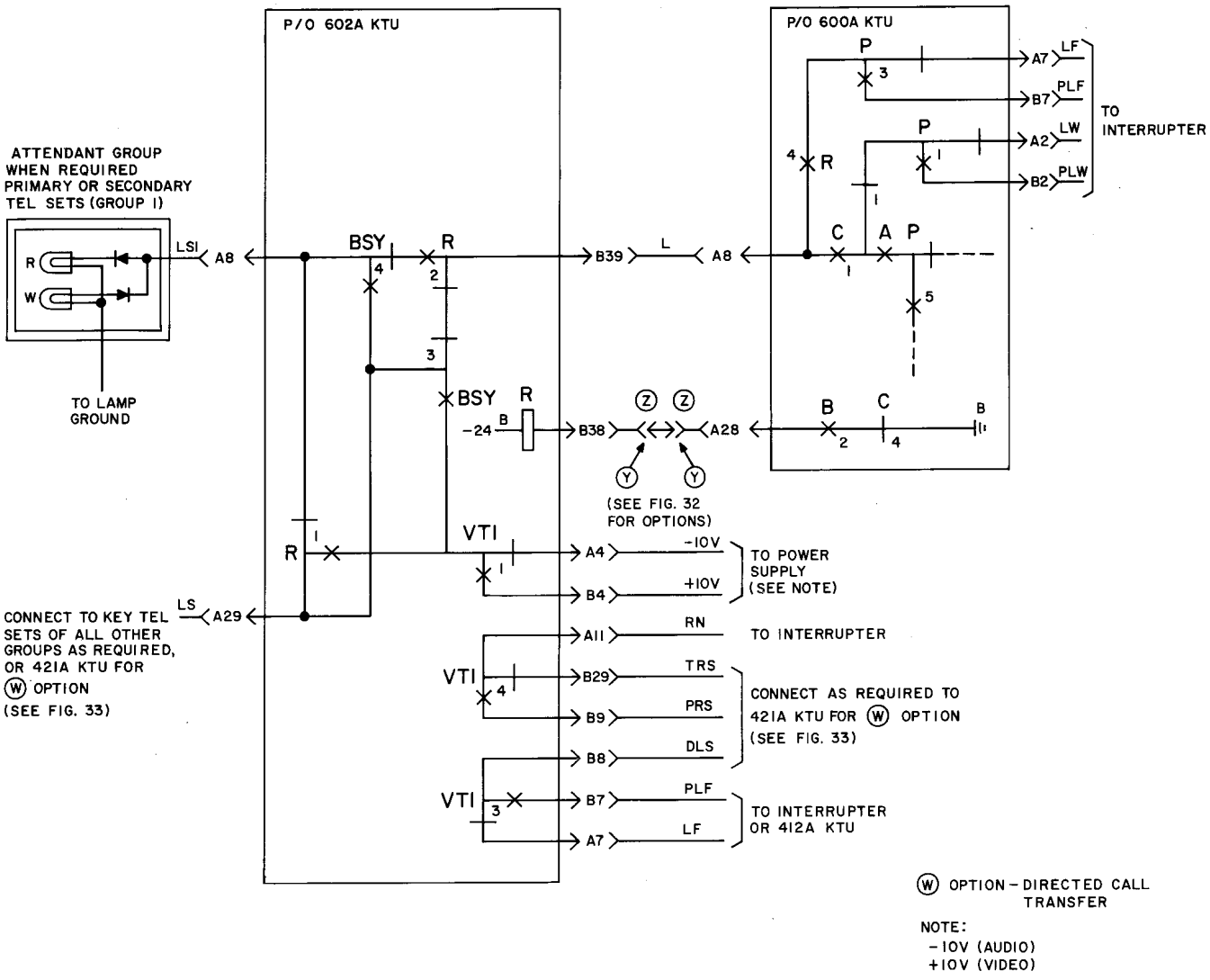


Fig. 30 — Multigroup, Visual and Audible Signaling Control

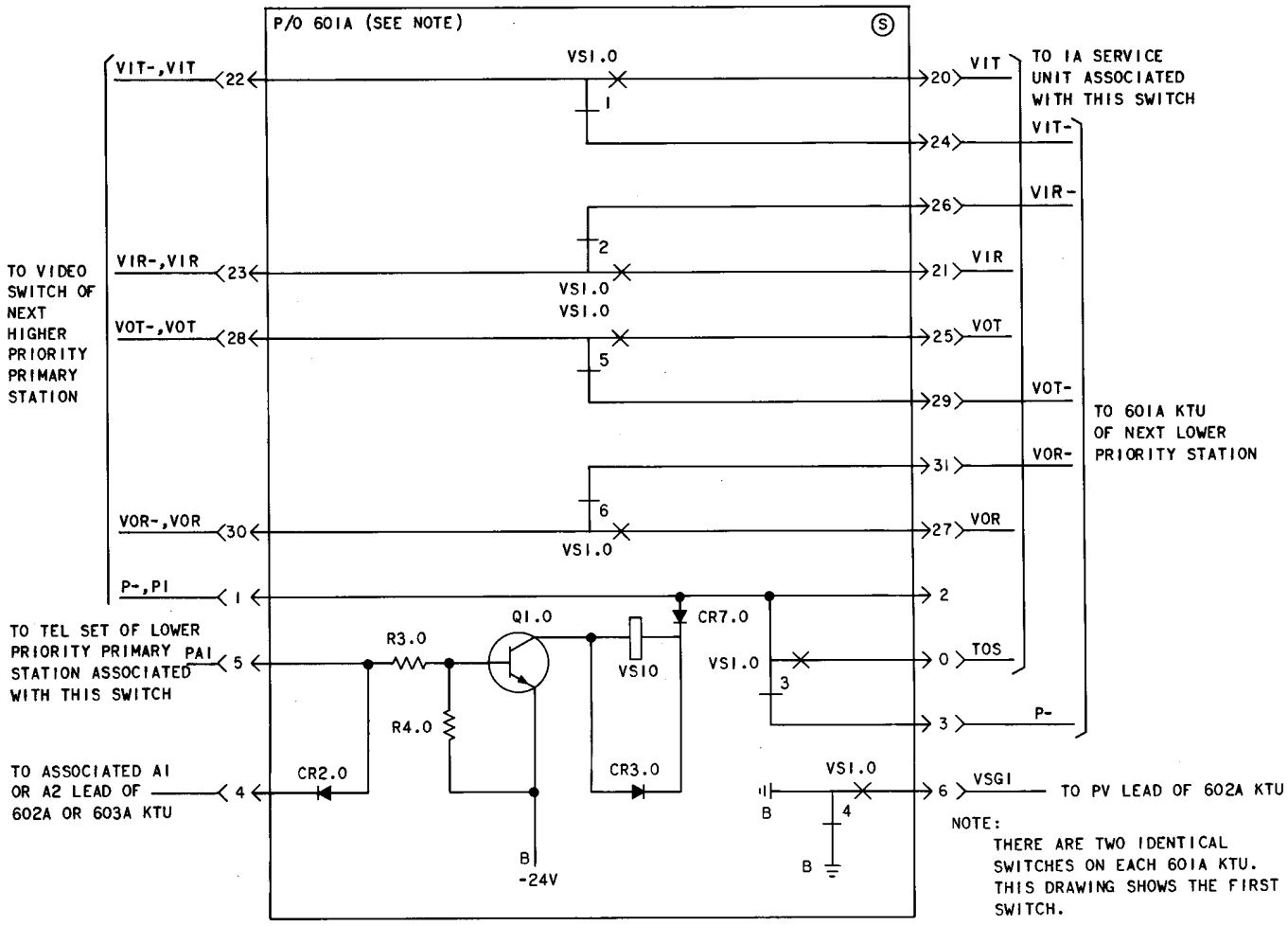
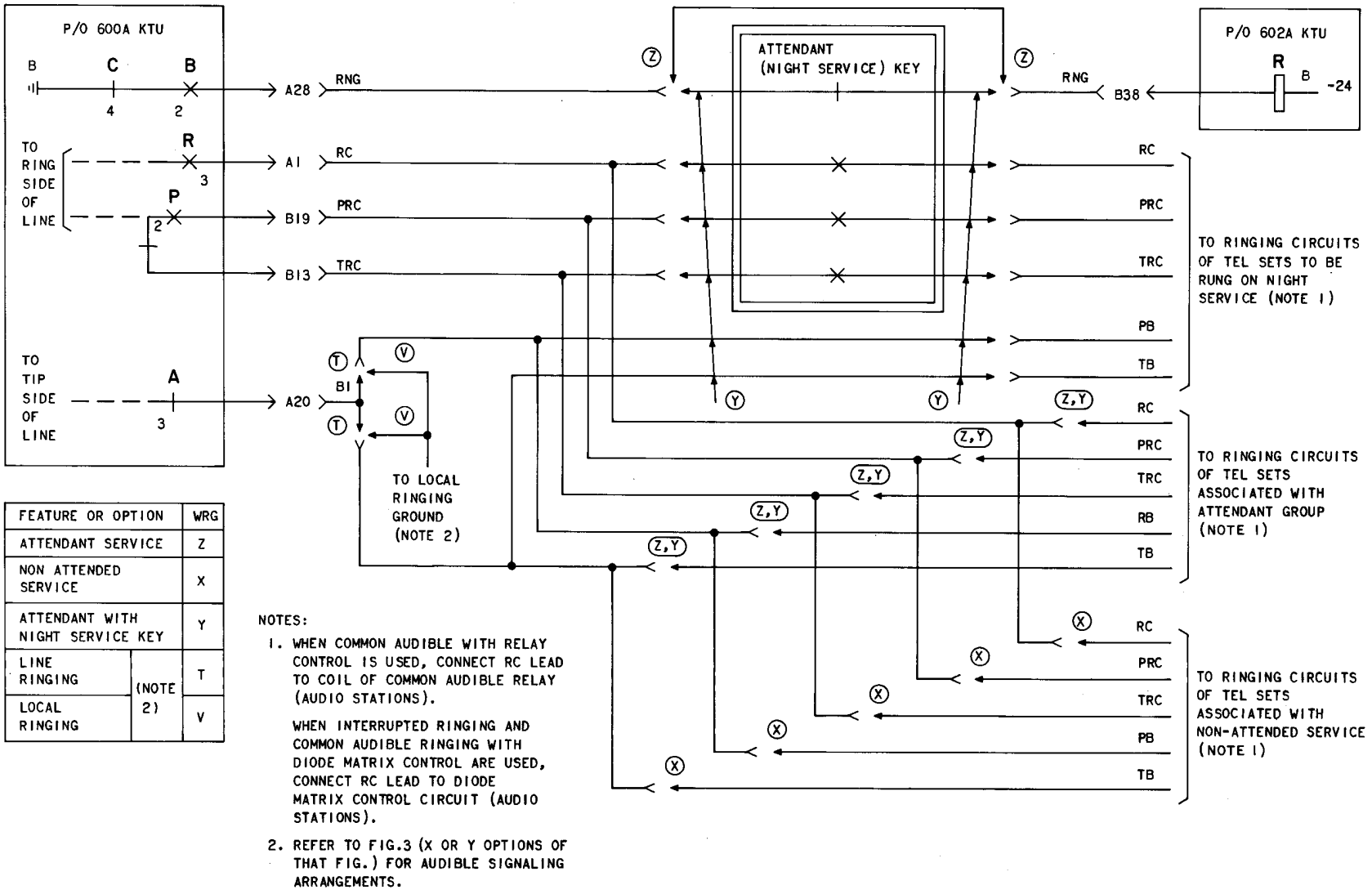


Fig. 31 — Multigroup, Video Switch (601A KTU, Ⓢ Option) for Lower Priority Station



FEATURE OR OPTION		WRG
ATTENDANT SERVICE		Z
NON ATTENDED SERVICE		X
ATTENDANT WITH NIGHT SERVICE KEY		Y
LINE RINGING	(NOTE 2)	T
LOCAL RINGING		V

NOTES:

1. WHEN COMMON AUDIBLE WITH RELAY CONTROL IS USED, CONNECT RC LEAD TO COIL OF COMMON AUDIBLE RELAY (AUDIO STATIONS).

   WHEN INTERRUPTED RINGING AND COMMON AUDIBLE RINGING WITH DIODE MATRIX CONTROL ARE USED, CONNECT RC LEAD TO DIODE MATRIX CONTROL CIRCUIT (AUDIO STATIONS).

2. REFER TO FIG.3 (X OR Y OPTIONS OF THAT FIG.) FOR AUDIBLE SIGNALING ARRANGEMENTS.

Fig. 32 — Multigroup, Attendant Service, Nonattended Service, or Night Service Key

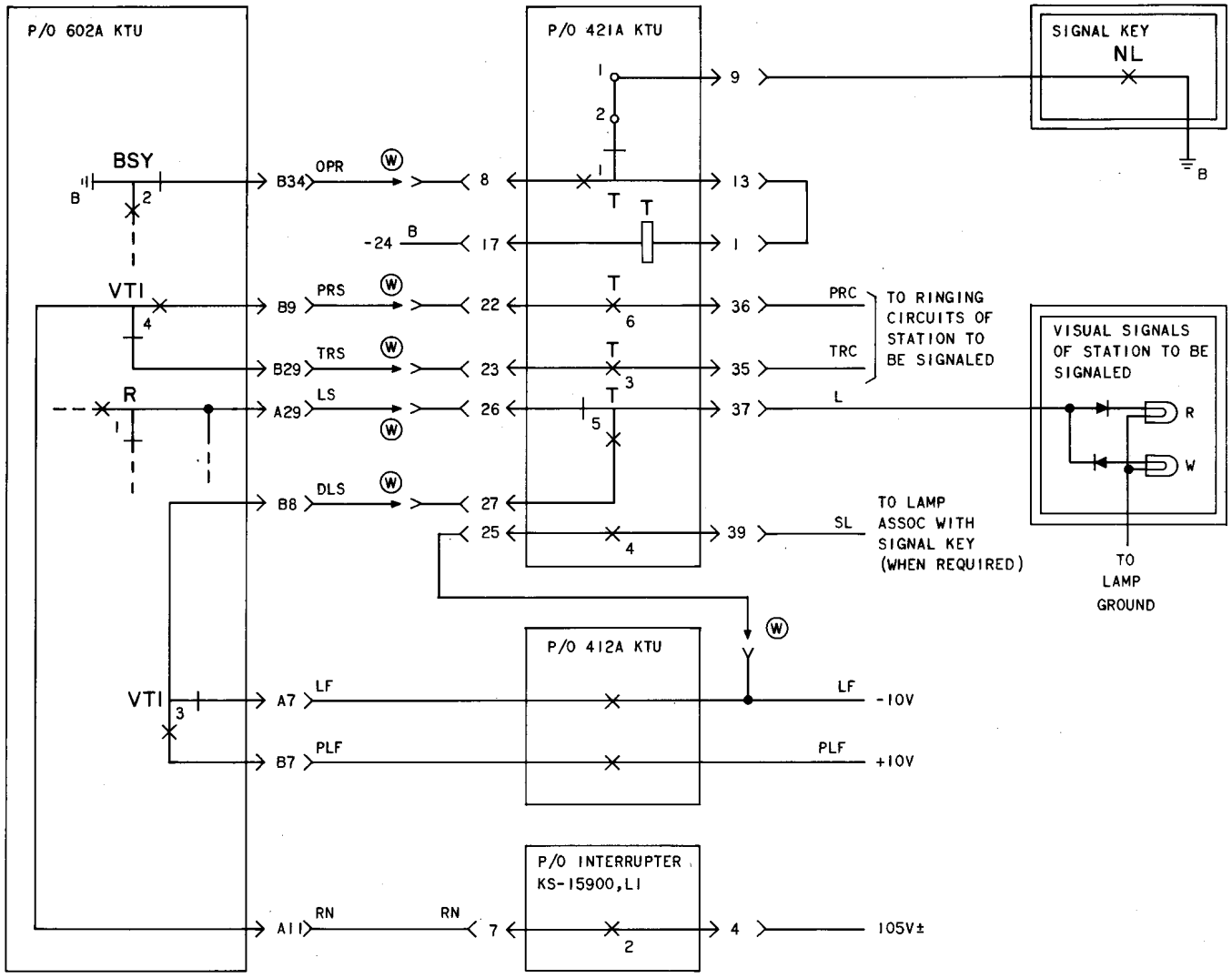


Fig. 33 — Multigroup, Directed Call Transfer (Ⓦ Option)

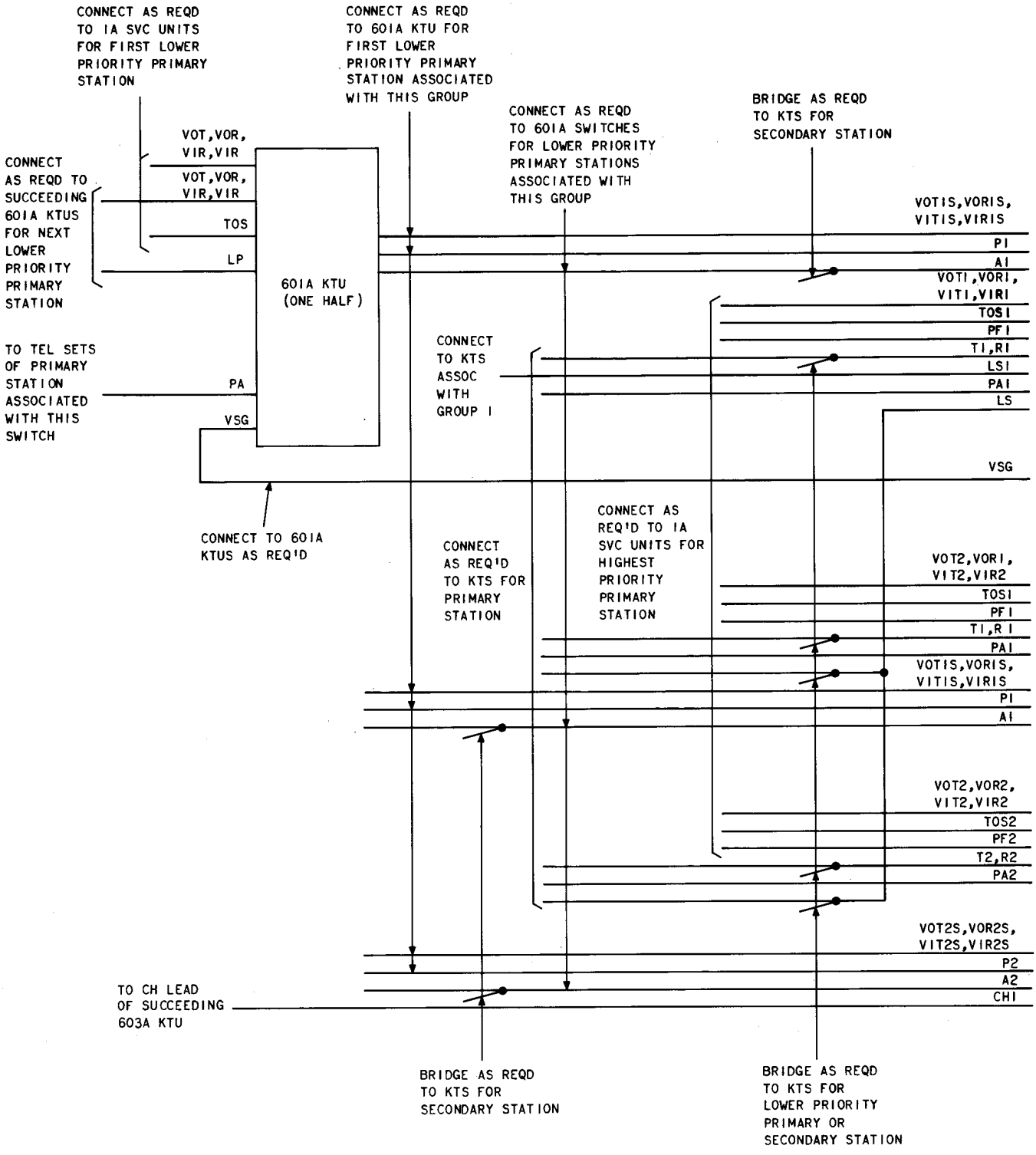


Fig. 34 — Multigroup Arrangement, Block Diagram (Sheet 1)

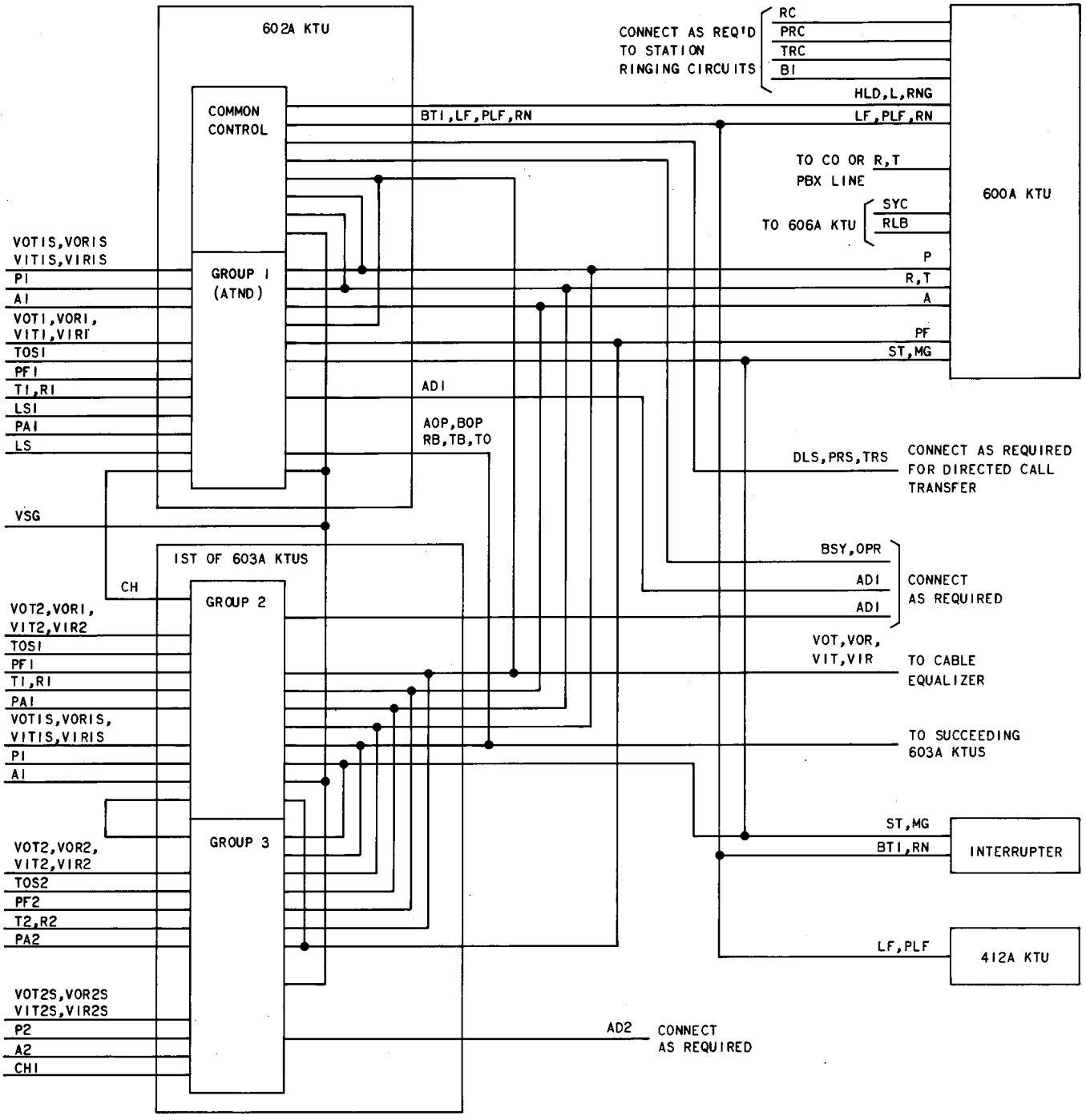


Fig. 34 — Multigroup Arrangement, Block Diagram (Sheet 2)