

EDITION IV

PRIVATE AUTOMATIC EXCHANGE

SYSTEM 15/2

Instruction Manual

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A  PRODUCT

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IN PRIVATE AUTOMATIC EXCHANGE 15/2

1) GENERAL DESCRIPTION

The TN 15/2

is a

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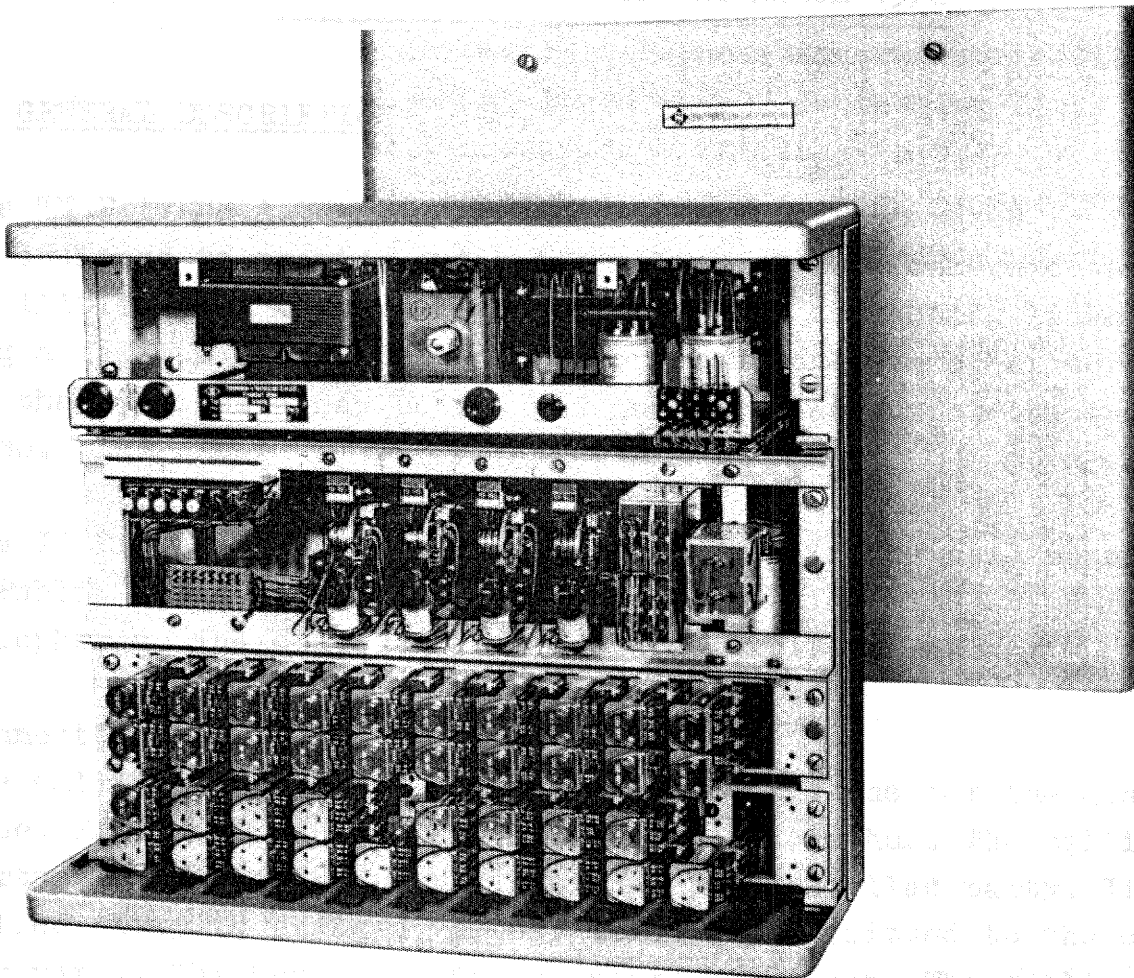


Fig. 1 TN Private Automatic Exchange 15/2

Cat. No. 24012/40

(opened)

The TN 15/2 can be equipped with optional extensions.

Security is provided by a 5-bit code to be supplied with

phones. The code is entered by means of a dial or by means of a

keyboard. The code is entered by means of a dial or by means of a

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TN PRIVATE AUTOMATIC EXCHANGE 15/2

A) GENERAL DESCRIPTION

The TN Private Automatic Exchange 15/2, as illustrated in fig. 1, is equipped to provide automatic telephone intercommunication facilities to a maximum of 15 lines with 2 connecting links allowing a maximum of 2 simultaneous conversations; in other words, of the 15 lines 4 may be engaged in conversations at the same time.

The TN Private Automatic Exchange operates in the same manner as a Public Automatic Exchange and in conjunction with standard dial telephones. The conversations are absolutely secret.

Connections are established as follows:

The calling party lifts the receiver and listens for the dial tone. This dial tone consists of a continuous hum. The calling party then dials the number assigned to the called party. If the called party is engaged, a busy tone is transmitted to the calling party. The busy tone is an intermittent hum. The calling party must replace the handset before attempting to dial again. In case the called number is free, ringing current is transmitted immediately after the dialling is completed and at regular intervals thereafter. The called phone rings accordingly and a ring-back tone is transmitted to the calling party at the same intervals. The ringing current and ring-back tone are automatically cut off when the called party lifts its receiver and the connection is established. The equipment releases after both parties replace their handset.

The PAX 15/2 may be equipped with optional executive priority. Executives provided with this facility are to be supplied with phones equipped with a priority button. In case that after dialling a party, the station is found to be engaged in a conversa-

tion, the executive equipped with a priority phone may, by pressing the priority button, exercise his priority at his discretion and cut in on the existing conversation. The parties involved may be signalled by a ticker signal on the line to prevent "snooping".

The Exchange is pre-wired for remote fuse alarm and through-dialling.

It is furthermore possible to connect:

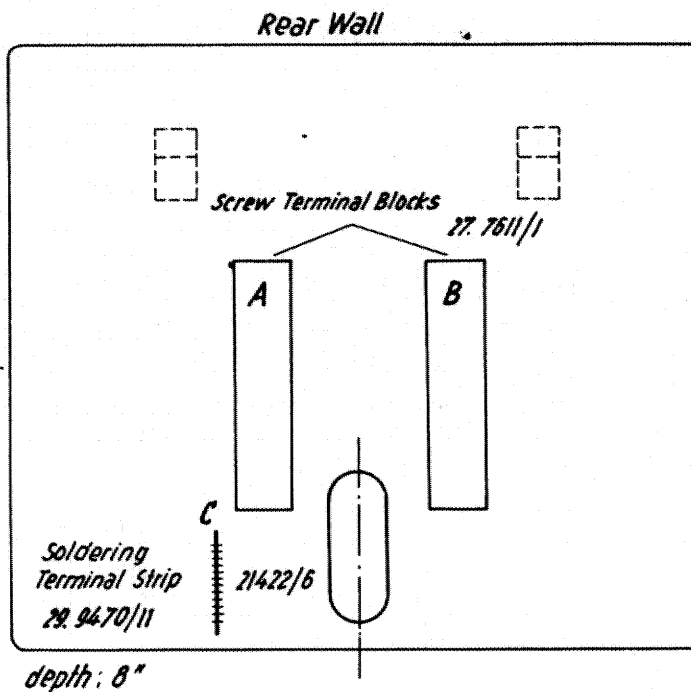
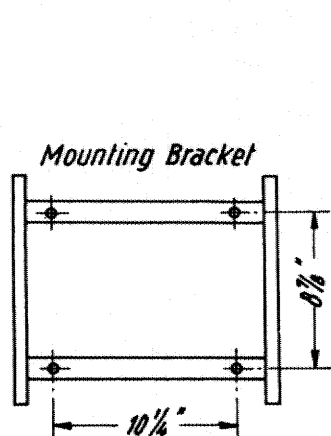
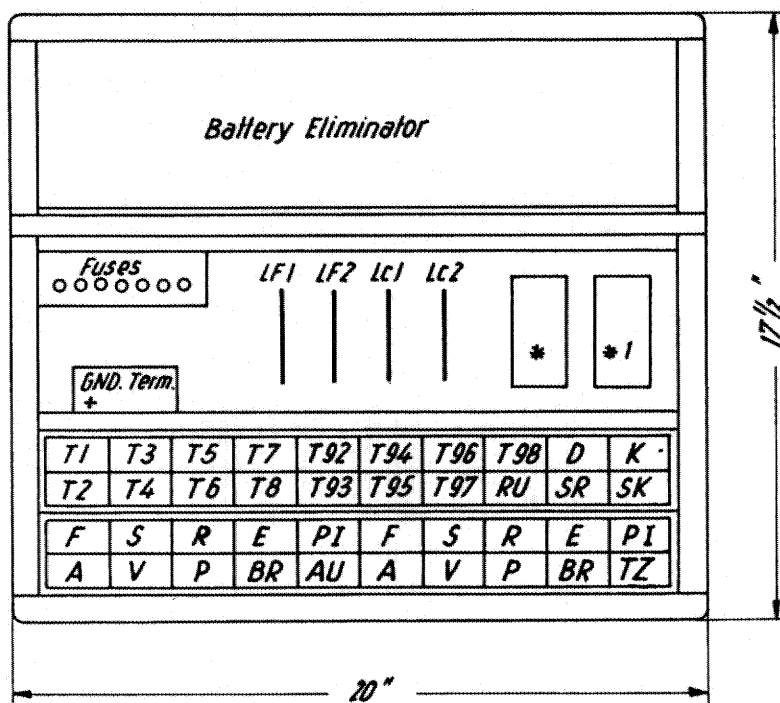
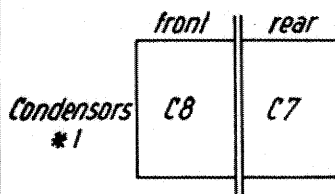
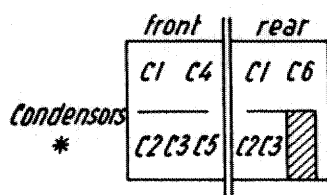
- executive phone for direct calling,
- conference facilities,
- tie-lines to another PAX or PBX,
- automatic paging either by audible or visual signals or through a PA-system,
- watchman control equipment utilizing standard telephone sets as control points.

The equipment is mounted in a metal wall cabinet with an attractive hammerlin finish. The completely enclosed cabinet also contains the power supply which provides the 24V DC operating current. The power supply may be connected to 110 - 125 - 150 - 220 or 250V, 50 or 60 cycles. For the location of the component parts see drawing 24012/40 A E.

The relays and selectors are mounted on a hinged metal frame and therefore easily accessible.

Each of the connecting links, which are available to all lines, consists of a line-finder, a line-connector and associated relays. The selectors are mounted on rubber shock absorbers ensuring a smooth and almost silent operation. Therefore, the PAX does not require a separate location, but may be installed in a convenient spot anywhere in an office. A patented driving mechanism reduces wear to an absolute minimum.

The relays are very sturdy and compact and utilize twin contacts of precious metal. They are factory adjusted and do not require



Issue I	Issue	Date	Chkd.	Issue	Date	Chkd.
Drwn. 10.11.58 Lc	II			V		
Chkd.	III			VI		
Appr.	IV			VII		

Private Automatic Exchange
 for 15 Stations - 2 Connecting Links
 with built-in Battery Eliminator

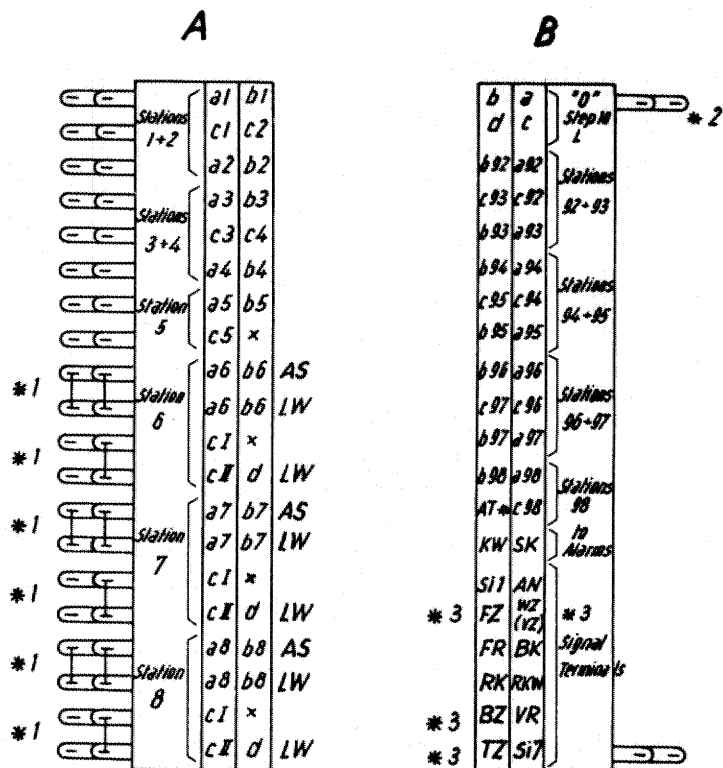
240 12/40 A E

any additional adjustments.

The lines from the telephone instruments are connected to terminal strips on the rear wall of the cabinet (for numbering arrangement see drawing 24012/40 L E).

The maximum loop resistance per line is approximately 400 ohms, therefore phones may be connected at a distance of up to 4000 yards from the PAX when utilizing No. 22 A.W.G. wire. For longer wire runs a heavier gauge wire is to be used.

The complete unit is unusually compact. It measures approximately 17 1/2" x 20" x 8" and weighs, fully equipped, about 66 lbs.



C

LF Multiple
(to Staff Locator Diagram S10e-74/18¹)

a	b	a	b	c	d
1	1	94	94	6	6
2	2	95	95	7	7
3	3	96	96	8	8
4	4	97	97	92	92
5	5	98	98	93	93
6	6	c	d	94	94
7	7	2	2	95	95
8	8	3	3	96	96
92	92	4	4	97	97
93	93	5	5	98	98
x	x	x	x	x	F5
x	x	x	x	x	x

- * to Priority Station
- *1 Remove straps for connection of staff locator - or tie line equipment.
(a, b, cX, d from LC for search- and answering connection)
- *2 for connection to staff locator, tie line equipment or voice paging adapter.
- *3 Connection to accessories, i.e. executive phone only in series with a .2 MF condensor.

Issue I		Date	Date	
Drawn 19.12.58	II		V	
Chkd.	III		VI	
Appr.	IV		VII	
Terminal Arrangement Private Automatic Exchange 15/2				240 12/40 L E

B) INSTALLATION INSTRUCTIONS

1. Location of the Switchboard

In order to reduce the station wiring to a minimum, it is advisable to locate the switchboard as centrally as possible. The best method is to locate the individual telephones on a floor plan of the building or offices concerned, and after establishing the location of the individual phones, it will not be difficult to find a relatively central location for the switchboard. Care should be taken that the switchboard itself is located in a well ventilated, dry location which is accessible at all times for maintenance. A regular AC outlet should be in the immediate vicinity.

2. Station Wiring

Each regular station requires a single twisted pair between switchboard and telephone. Telephones equipped with a priority button require, in addition to the regular pair, a second pair.

Where the maximum run between switchboard and station does not exceed 4000 yards, wires of No. 22 A.W.G. may be used. Where longer runs are required, it is necessary to use a larger gauge wire in order to keep the loop resistance within the allowed 400 ohms.

The station wiring should be run in such a manner that it is protected as much as possible from mechanical damage. Needless to say, that for a good installation the wiring should be installed as inconspicuously and neatly as possible. The wiring should also be fastened securely by means of staples at short intervals to prevent the wiring from becoming loose. The location of the telephone sets should be carefully considered when installing the station wiring and the ultimate users should be consulted to this effect. For example, some persons prefer to have their telephones on the left hand side, other users prefer

the telephone set to be located on the right hand side of their desk, or for that matter, on a special telephone table.

The wiring should be installed in such a manner that the connecting cord of a telephone set does not hang on the floor so that people will trip over it thereby damaging same.

When installing wall telephones, the height above the floor should be governed by, whether the telephone is to be used from a sitting or from a standing position.

3. Installation of the Switchboard

The switchboard is designed for wall installation, and a special mounting bracket for this purpose is included with every switchboard.

The mounting bracket is to be securely fastened to the wall, with the notched ends of the U-bars mounted on the top and facing towards the switchboard.

The switchboard is attached to the bracket, by lifting it in such a manner that the ears on the rear side of the switchboard slip over the notched ends of the U-bars.

4. Connecting the Lines to the Switchboard

The incoming station wires are run between the switchboard and the wall, and should enter the switchboard cabinet through the cable entry in the rear wall of the switchboard cabinet. They are connected pair by pair to the screw terminals of the terminal strips "A" and "B".

The call numbers available are 1 - 8 and 92 - 98. These numbers appear on the equipment terminal strips as indicated on drawing 24012/40.

Telephone sets with priority button may be assigned any number, provided of course, that one wire of the second pair from the set is connected to terminal AT on "B" and the other wire of the pair to the proper ground.

5. Connecting the PAX to the Power source

- a) Remove the cover from the built-in battery eliminator.
- b) Determine the voltage of the AC power source to which the PAX is to be connected. The power supply is wired for 220V AC when leaving the factory. In case the AC power source is 110V 60 cps, move the wire on the terminal block marked "250-220-150-125-110" from the terminal marked "220" to the terminal marked "110" and insert the proper line fuses

for 110/125 volts	1.0 ampere
" 150 "	.8 "
" 220/250 "	.6 "

These fuses are included in the shipment.

- c) Insert the power cable through the entrance hole in the upper left side of the switchboard cabinet and connect the wires to the terminal marked "N" of the terminal block which is mounted on the left hand side of the power supply. Connect the ground terminal marked $\frac{1}{2}$ to a solid ground by means of a wire of No. 12 A.W.G. Install at the same time a wire of No. 18 A.W.G. between this ground terminal and the + terminal of the terminal block which is mounted on the right hand side of the power supply.
- d) Measure the DC voltage between the terminals marked + and - S and between + and - B. The no-load DC voltage should be 30V. The DC voltage may be regulated by moving the wires on the left hand side of the terminal block of the power transformer and marked 11 - 15 from one terminal to the other.

Important: Do not remove wire from terminal "10".

6. Check Operation of completed Installation

- a) Test connected lines for opens and shorts.
- b) Make sure that all the handsets of the connected stations are in place.

- c) Connect the AC power to the switchboard.
- d) Lift handset of a connected station, the first connecting link should be seized and dial tone should be heard.
- e) Dial another connected station. This phone should ring and ring-back tone will be heard in the same rhythm as called telephone rings.
- f) Lift handset of called station, the ringing current and ring-back tone should cease and the connection should be established.
- g) Check transmission. (Do not replace handsets)
- h) Lift handset of a third connected station, the second connecting link should be seized and dial tone will be heard.
- i) Dial a connected station which is free. The phone connected to this number should ring and ring-back tone will be heard.
- j) Lift handset of ringing phone. Ringing and ring-back tone will seize and the connection is established.
- k) Check transmission.
- l) Replace the handsets of all phones.
- m) Lift handset of a connected phone.
- n) Dial the number of this station from another phone. Busy tone should be heard.
- o) If installed, check "optional priority" as follows:
Establish a conversation between two stations. Dial one of these stations from a telephone equipped with priority button. Busy tone should be heard. Depress priority button and a three-way conversation should be established during the time the button is pressed.

7. Complete Switchboard Installation

- a) Remove all red-painted hardware as this is only required during shipping.
- b) Restore the hinged relay-rack to its original position.
- c) Close switchboard cabinet.
- d) Remove all excess installation material from the job site.

C. MAINTENANCE

1. Introduction

As in any special field, it is generally considered necessary to use abbreviations. The abbreviations used in the communications' field consist of a number of symbols. Each one of the symbols has a specific meaning and they are used in all drawings and diagrams pertaining to TN equipment.

Before attempting to read the equipment diagrams, it is well advised to study the symbols on the next page.



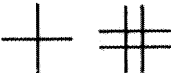
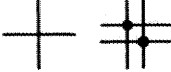




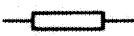

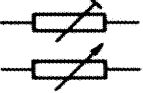



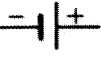


In addition to the symbols it is also necessary to have an understanding of the manner in which the circuit diagrams are to be read.







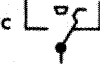
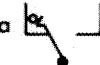
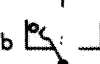

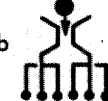

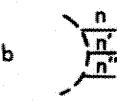
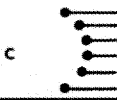


Relays used in telephone equipment may have one or more windings on the same core. These windings operate a relay independently, they usually function in separate circuits and are indicated in separate locations on the diagram. Sometimes the relays also accommodate non-active windings. These windings do not have any influence on the operation of the relays concerned. The active and non-active windings are identified by a capital letter designating the relay and by its corresponding winding terminals.

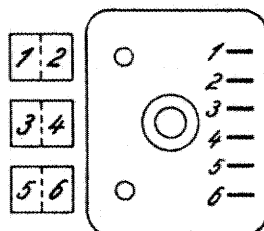
The relay contacts are not drawn according to their physical relation to the relay, but are spread over the drawing in such a manner as to reduce the lines on a diagram to a minimum in order to avoid confusion and to facilitate the tracing of a circuit.

The contacts are identified by a small letter corresponding to the relay designation and the number of the contact spring set.

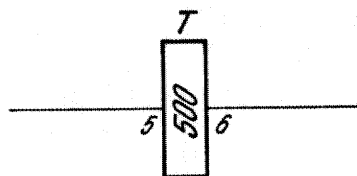
As seen from the rear of the relay, the numbering of the winding terminals and contact spring sets is as follows:

SYMBOL	DESCRIPTION
	CONDUCTORS, GENERAL
	CONDUCTORS, NOT FIXED
	CONDUCTOR CROSSING, W/O CONNECTION
	CONDUCTOR CROSSING, W. CONNECTION
	CONDUCTOR, BRANCHING
	CONDUCTOR, MULTIPLE BRANCHING
	GROUND
	MASS, E. G., METALLIC FRAME
	RESISTOR GENERAL
	RELAY, SLOWRELEASING
	VARIABLE RESISTOR
	REPEATING COIL TRANSFORMER
	CAPACITOR
	ELECTROLYTIC CAPACITOR, POLARIZED
	GALVANIC CURRENT SOURCE (DRY CELL BATT., WET CELL BATT.)
	MAKE CONTACT
	BREAK CONTACT

SYMBOL	DESCRIPTION
	CHANGE-OVER CONTACT
	MAKE BEFORE BREAK CONTACT
	CONTACT (E. G. CHANGE-OVER CONTACT) OF RELAY WHICH NORMALLY IS UNDER CURRENT
	BUTTON SWITCH CHANGE-OVER CONTACT
 a)  b)  c)	BUTTON SWITCH AS CHANGE-OVER CONTACT a) WITHOUT LOCKING POS. b) WITH LOCKING: NORMAL, BUTTON PULLED c) WITH LOCKING: NORMAL, BUTTON PUSHED
 a)  b)	KEY SWITCH a) WITHOUT LOCKING b) WITH LOCKING
 a)  b)	KEY SWITCH WITH TWO POS. a) WITHOUT LOCKING b) WITH LOCKING
 a)  b)  c)	CONTACT BANK a) GENERAL b) WITH SEVERAL GROUPS OF EXITS c) WITH INDICATION OF INDIVIDUAL STEPS
	LAMP
	DRY RECTIFIER

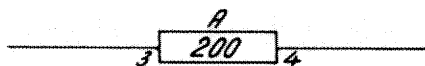


Active windings are indicated as follows:



T identifies the relay. The DC resistance of the winding is 500 ohms and the winding is connected to terminals 5 and 6.




Non-active windings are illustrated as follows:



A identifies the relay. The DC resistance of the winding is 200 ohms and the winding is connected to terminals 3 and 4.

The relay contacts are always drawn in their non-operated position.

In order to locate relay windings and contacts in a diagram, the diagram is sub-divided in squares with numerals from left to right and letters from top to bottom. The square number, giving the location of relay windings and contacts, is indicated in the description in parenthesis after the designation concerned, as well as on the diagram in the following manner:

Relay	Type	Square	$\frac{1}{2}$	Square	$\frac{3}{4}$	Square	$\frac{5}{6}$	6	5	4	3	2	1
V	3D-408a/1	H8	m	D13	b	G10	m	F10	G3	H8			
		F13	c	C5	b	I9	c						

contact v 4 is located in square C5 and is a "break" contact,

contact v 1 is located in square H8 and is a "make" contact,

contact v 2 is located in square F13 and is a "change-over" contact,

active winding V 1-2 is located in square H8,

non-active winding V 5-6 is located in square F10.

Replacement coils for relays and selectors may be ordered by indicating the type number applicable to this particular relay or selector. This number is always indicated on the coil.

Selectors and relays are to be adjusted according to factory supplied manuals.

2. Detailed Diagram Description

Diagram S3e - 5/12 VV E illustrates the circuits of a PAX 15/2. The maximum capacity of the switchboard is 15 lines and 2 connecting links. The lines are subdivided in 2 groups with call numbers 1 - 8 and 92 - 98. The connecting links are available to all lines.

In order to keep the built-in battery eliminator as small as possible, 2 separate power sources are provided. A filtered DC for the operation of the relays and for the feeding of the telephone sets. An unfiltered DC for the operation of the selectors. The operating voltage is 24 V DC.

a) Calling party lifts handset and finds a free connecting link

Lifting of the handset by the calling party will close a DC circuit in the telephone set and common relay D as well as line relay T will operate over:

ground - br 4 (L3) - k 5 (K3) - D 2-1 (H3) - T 2-1 (F3) -
t 5 (E4) - b-wire - a/b loop - a-wire - t 1 (D3) -
T 5-6 (F3) - sk 2 (G3) - D 6-5 (G3) - fuse Si 1 (N5).

The circuit for common relay K 1-6 (H4) is closed by contact d 6 (I4) and K operates via:

ground - d 6 (I4) - K 6-1 (H4) - Si 1 (N5).

Contact k 2 (H3) shorts the winding D 1-2 (H3). T holds itself via:

ground - k 2 (H3) - T 2-1 (F3) - t 2 (E3) - k 1 (G3) -
D 6-5 (G3) - Si 1 (N5).

Before the release of D 1-2 (H3), F 5-6 (H8) is energized via:

ground - d 6 (I4) - k 6 (I4) - br 2 (I5) - p 3 (I7) -
pI 5 (I7) - d 2-AS (I8) - F 6-5 (H8) - Si 2 (H7)

and holds itself over its f 2 contact (G5) via:

ground - f 2 (G5) - r 1 (H5) - p 3 (I7) - pI 5 (I7) -

d 2-AS (I8) - F 6-5 (H8) - Si 2-(H7).

Common relay K is also held over f 2 as follows:

ground - f 2 (G5) - r 1 (H5) - br 2 (I5) -
k 6 (I4) - K 6-1 (H4) - Si 1 (N5).

Relay V 5-6 (H9) of the seized connecting link operates parallel to F 5-6 (H8) and the power magnet of the line finder D-AS (I12) is activated via:

ground - a 4 (K13) - v 5 (K13) - f 6 (K13) -
br 6 (I13) - D-AS (I12) - Si 4 (I11).

Selector contact d 2-AS (I8) of the linefinder AS opens the circuit for F 5-6 (H8) which releases and consequently with f 6 (K13) opens the circuit for power magnet D-AS.

The alternate operation of d 2-AS (I8) and f 6 (K13) rotates the linefinder. In the first step of the linefinder, the function of f 2 (G5) is taken over by ground on the e-wiper of the linefinder (F5). The c-terminal of the calling party in the contactbank of the linefinder (AS) is connected to battery via contact t 6 (E4) and T 3-4 (F4). The linefinder rotates until the c-wiper of the linefinder reaches the c-contactbank terminal of the calling party. At this instant A 3-4 (E9) and F 1-2 (E8) operate in series over contacts f 4 (E7) and br 3 (E7). Contact a 4 (K13) interrupts the circuit for magnet D-AS (I12) and the linefinder stops.

Relay F 1-2 (E8) holds itself through its f 4 (E7) contact. Contact a 2 (G10) closes the circuit for S 1-2 (G10) with the result that a 1-2 and A 3-4 (E9) are in the loop circuit as follows:

ground - A 4-3 (E9) - s 6 (D8) - pI 6 (D7) - b-wiper
AS (D5) - b-wire - a/b loop - a-wire - a-wiper AS (D5) -
pI 2 (D6) - s 2 (D8) - A 2-1 (E9) - Si 2 (H7).

Contact s 1 (e6) connects a direct ground to T 3-4 (F4) via t 6 (E4) blocking the calling station from being seized by another party. Contact s 5 (K9) closes the circuit for BR 3-4 (H9) which will operate and with br 3 (E7) disconnect F 1-2 (E8) and A 3-4.

(E9) from the c-wiper (E5). Contacts br 2 (I5) and br 4 (I4) operate and block the connecting link from being seized for another call. Relay K 1-6 (H4) releases because the hold circuit over br 2 (I5) is discontinued.

Relays A, S, V and BR of the connecting link are operated and dial tone WZ (VZ) which consists of an unfiltered DC is connected to A 5-6 (K8) via:

-B (N17) - Wi (N11) - r 6 (L8) - v 2 (K8) - au 2
(L11) - C 3 (K8) - A 6-5 (K8) - a 6 (I8) - e 2 (I8) -
ground.

The 120 cps tone is induced on A 1-2 and A 3-4 (E9) and transmitted to the calling station.

b) Calling party lifts handset and finds all connecting links engaged

Relay D 1-2 (H3) cannot operate because BR 3-4 (H9) in both links is energized and ground is disconnected from D by operated br 4 (L/M3) of the links.

The relay interrupter TZ (M5), consisting of active relay windings TZ 1-2 and TZ 3-4 and an electrolytic condenser 100 MF is started via:

ground - br 5 (K5) in both links - tz 2 (M5) - TZ
4-3 (M5) - Si 1 (M5).

Contact tz 4 (M11) of the interrupter connects an intermittent unfiltered DC to the b-wire of the a/b loop as follows:

-B (N17) - Wi (N11) - tz 4 (M11) - C6 (N10) -
br 4 (M3) in both links - k 5 (K3) - D 2-1 (H3) -
T 2-1 (F3) - t 5 (E4) - b-wire - a/b loop,

and the calling party receives an intermittent 120 cps busy signal (BZ) indicating that the links are busy. The handset must be replaced before attempting to make another call.

c) Dialling a number in the group 1 - 8

The calling party receives dial tone and dials a number from 1 to 8. The release of the dial on the telephone instrument will cause interruptions in the loop circuit. The number of interruptions corresponds with the dialled digit. The interruptions in the loop circuit will cause relay A (E9) to release and attract the same number of times. Contact a 6 (I8) will operate F 5-6 in the following circuit:

ground - e 2 (I8) - a 6 (I8) - v 1 (I7) - s 4
(I7) - p 3 (I7) - pI 5 (I7) - d 2-AS (I8) - F 6-5
(H8) - Si 2 (H7)

and pulsating f 6 (K13) will operate the line connector (LW) via:

ground - a 4 (K13) - v 5 (K13) - f 6 (K13) -
br 6 (I13) - D-LW (I13) - Si 4 (H11).

Relay R 1-2 (G12) is operated after the first step of the line connector via:

ground - e-wiper (E14) - e-contactbank - R 4-5
(F14) - R 2-1 (G12) - Si 2 (H7)

and disconnects with r 2 (I10) the hold circuit for V 5-6 (H9), however, V is slow releasing and remains operated during the train of impulses by V 1-2 (F10) in series with S 1-2 (G10). After the impulses are received A remains operated and contact a 2 (G10) shorts V 1-2 (F10), resulting in the release of V.

Released contact v 3 (F13) connects ground to test relay P (F12).

d) Dialling a number in the group 92 - 98

After dialling the first digit (9) of a number in the group 92 - 98, relay V 5-6 (H9) is held over the 9th step of the d-wiper of the line connector via:

ground - e-wiper (E14) - step 9 - r 2 (I10) - s 3
(I8) - V 5-6 (H9) - Si 2 (H7).

The impulse circuit for F 5-6 (H8) remains intact via v 1 (I7). During the next train of impulses F 5-6 (H8) will be operated by a 6 (I8) and subsequently the line connector (LW) will be operated by f 6 (K13) as described in the foregoing section.

After the impulses are received, V will release and ground is connected to P via v 3 (F13).

e) Dialed number is free

Test relay P 1-2 (E13) will operate in case the dialled number is free via:

ground - a 4 (F13) - v 3 (F13) - P 6-5 (F13) -
P 2-1 (E13) - PI 2-1 (E13) - c-wiper LW (E14) -
c-wire to T relay (E15) - c-wire from LW (C4) -
c II - c I (D4) - T 4-3 (F4) - Si 1 (N5).

The 250 ohms winding P 5-6 (F13) is shorted over

ground - s 1 (F10) - p 5 (F12).

This ground through low resistance winding P 1-2 (E13) is connected to the corresponding c-contactbank terminal of the line connector and prevents the dialled number from being seized by another caller. Contact s 5 (K7) starts the relay interrupters RU (M7) and TZ (M5). Relay interrupter RU provides interruptions of 4 secs. on - 1 sec. off for ringing current FR, ring back tone FZ and ringing control RK and interruptions of 1 sec. on - 4 secs. off for reversed ringing control RKW. Intermittent ringing current from the transformer in the battery eliminator is connected to the called party by ru 6 (L12) via:

ground - transformer - ru 6 (L12) - FR (K12) -
FR (E11) - E 6-5 (E11) - e 5 (E11) - p 6 (D11) -
b-wiper (D14) - a/b loop - a-wiper (D14) - p 2
(D11) - E 2-1 (G11) - Si 2 (H7)

and the called phone will ring accordingly.

Ring back tone FZ is connected to A 5-6 (K8) at the same inter-

vals via:

-B (N17) - Wi (N11) - ru 1 (L11) - p 4 (K9) -
v 2 (K8) - au 2 (L11) - C 3 - A 6-5 (K8) - a 6
(I8) - e 2 (I8) - ground

and by induction on A 1-2 and A 3-4 (E9) transmitted to the calling party.

Reply by the called party will close a DC circuit for E 1-2 (G11) over a/b loop via:

ground - ru 6 (L12) - FR (K12) - FR (E11)
E 6-5 (E11) - e 5 (E11) - p 6 (D12) - b-wiper
(D14) - a/b loop - a-wiper (D14) - p 2 (D11) -
E 2-1 (G11) - Si 2 (H7)

and E will operate. In case the called party lifts the receiver when ringing current is transmitted, relay E will operate via the ground (N12) connected to the ringing current transformer in the battery eliminator.

Relay E holds itself over:

ground - s 1 (F10) - e 6 (F10) - E 2-1 (G11) -
Si 2 (H7).

Contact e 2 (E12) shorts P 1-2 (E13) and P releases, However, contact e 2 (E12) takes over the blocking of the called station during the conversation by connecting direct ground to the c-wiper of the line connector.

The called party is connected to the feeding current after the operation of E and the release of P over:

ground - A 4-3 (E9) - e 3 (E10) - p 6 (D11) -
b-wiper - b-wire - a/b loop - a-wire - a-wiper -
p 2 (D11) - e 1 (D10) - A 2-1 (E9) - Si 2 (H7).

Contact e 4 (K7) disconnects the relay interrupters RU and TZ. The connection is established.

f) Dialed number is engaged

If the called station is already engaged in a conversation, relay P cannot operate, intermittent unfiltered DC is connected to A 5-6 via:

-B (N17) - Wi (N11) - tz 4 (M11) - p 4 (L9) -
v 2 (K8) - au 2 (L11) - C 3 - A 6-5 (K8) -
a 6 (I8) - e 2 (I8) - ground,

and busy tone BZ is transmitted to the calling party by induction on A 1-2 and A 3-4 (E9).

The calling party must replace the handset before attempting to dial again.

g) Release

The release of the equipment takes place after both parties replace their handset thereby opening the DC circuit of the a/b loops.

Relay A 1-2 and 3-4 (E9) releases, contact a 2 (G10) shorts the circuit for S 1-2 (G10) and S releases.

Contact s 1 (E6/F10) opens the holding circuit for T 3-4 (F4) and for E 1-2 (G11).

Contact e 2 (E12) disconnects the holding circuit for T 3-4 (F4) of the called station and connects, at the same time, ground to F 5-6 (H8) via:

ground - e 2 (I8) - a 6 (I8) - d-LW (K7) - r 5
(I7) - s 4 (I7) - p 3 (I7) - pI 5 (I7) - d 2-AS
(I8) - F 6-5 (H8) - Si 2 (H7).

Contact f 6 (K13) closes the circuit for the rotary magnet of the line connector (D-LW) via:

ground - r 4 (K9) - f 6 (K13) - br 6 (I13) -
D-LW (I13) - Si 4 (H11)

and the alternate operation of d-LW (K7) and f 6 (K13) rotates the connector to its "home" position where the ground of the e-wiper is disconnected from the contactbank, R 1-2 (G12) releases and r 4 (K9) disconnects the ground for D-LW. Relay BR 3-4 (H9) is released at the same time. F 5-6 (H8) and V 5-6 (H9) operate in parallel via:

ground - e-wiper AS (F5) - r 1 (H5) - p 3
(I7) - pI 5 (I7) - d 2-AS (I8) - F 6-5 (H8) -
Si 2, respectively: br 1 (I8) - F 6-5 (H8) -
Si 2 (H7).

Rotary magnet D-AS (I12) is energized over:

ground - a 4 (K13) - v 5 (K13) - f 6 (K13) -
br 6 (I13) - D-AS (I12) - Si 4 (H11).

The alternate operation of f 6 (K13) and d 2-AS (I8) rotate the linefinder to its "home" position where the ground on the e-wiper (F5) is interrupted, consequently F 5-6 (H8) cannot operate and V releases. The connecting link is free to receive another call.

h) Through-dialling

Through-dialling to another PAX or other accessories uses the PI relay in each connecting link. This relay will only operate against an increased test-potential and the connected adapter must be equipped accordingly.

After dialling the prefix concerned, PI 1-2 (E13) will operate when the connector (LW) tests on increased test current and hold itself via pI 4 (E12) connecting PI 5-6 (E13) in series with PI 1-2 (E13) to prevent other callers from testing on the same connector terminals. Contact pI 1 (E6) binds T 3-4 (F4) and contact pI 2 and pI 6 (D6/7) connect the a/b loop from the calling party through to the adapter connected to the connector terminals.

Release of the connection is initiated by the adapter and PI

(E13) releases. Contact pI 5 (I7) closes the circuit for F 5-6 (H8) and the selectors rotate to their "home" position as described in the section above.

Note: The 10th step of the connector banks a, b and c (D/E 15) are connected to the terminal strip "B" and may be used for the connection of a voice paging adapter or a tie line adapter without losing a station number. It may then be reached by dialing "0".

i) "Optional" priority

In case the calling party has dialled a number which is already engaged in a conversation, the calling party will receive busy tone as described under f). If the caller decides to cut-in on this conversation he must depress the cut-in button on his set. This action will connect ground to terminal AT (E1) and relay AU 1-6 (G2) will operate. Contacts au 1 and au 6 (B6) will interconnect the a/b wires of the two connecting links and a 3-way conversation is established.

Contact au 5 (M8) starts the interruptor TZ (M5), the "ticker signal" TZ is connected to A 5-6 (K8) via au 2 (L11) and induced on A 1-2 and A 3-4 (E9). The parties engaged in a conversation will receive this ticker signal to notify them that a third person has cut-in on the conversation.

k) Fuse Alarm

The release of heat coil fuses Si 2-5 (L/M17) will cause common relay SR 1-6 (L14) and relay BR 1-2 (K14) of the connecting link concerned to operate via fuse contact SiK (K14). Contact br 4 (K5) blocks the connecting link from being seized. Contact sr 3 (N14) connects ground to terminal SK and sr 4 (N15) to terminal KW on "B". It is possible to connect a remote fuse alarm lamp (24V) to terminals Si and SK and an alarm bell with an external low voltage power supply to terminal KW. Release of heat coil

fuse Si 1 (L17) will cause relay SK 1-2 (N17) to operate and contact sk 6 connects ground to SK and KW giving a fuse alarm.

1) Fuses

The following fuses are to be used for the PAX 15/2.

Power supply:

for connection to 110 - 125 volts AC	1 ampere
" " " 150 " "	.8 "
" " " 220 - 250 " "	.6 "
" ringing current supply	.1 "

Equipment:

Si 1 Line and common relays	.75 "
Si 2 Relays connecting link 1	.75 "
Si 3 " " " 2	.75 "
Si 4 Selectors connecting link 1	.75 "
Si 5 " " " 2	.75 "

m) Spare parts

The following spare parts are supplied with each 15/2:

2 Resoldering type heat coil fuses .75 amp.	AO.4 DIN 41584
2 Armature restoring springs	27. 5703
1 Ratchet blocking springs	27. 5504
3 Relay spring supports	23. 7212
6 Screws	23. 7213
2 Line fuses for 110/125V AC	T1B DINN 41571
2 " " " 220V AC	TT.6B DIN 41571
2 Fuses for 60V ringing current	.10 DIN 41571

D) POWER SUPPLY

Fig. 3 illustrates the diagram of the battery eliminator which is incorporated in the cabinet of the PAX 15/2.

The unit is designed for connection to 110/125/150/220 or 250V AC, 50 - 60 cps and supplies the tones and DC current required for the operation of the PAX 15/2.

The unit is wired for connection to 220V AC when leaving the factory. In case the switchboard is to be connected to a different voltage, it will be necessary to move the input wire to the corresponding tap on the primary side of the transformer. If required, the line fuses have to be replaced with fuses applicable to the AC concerned. (See diagram)

The output of the unit supplies a filtered DC for the feeding current of the telephone sets as well as for the relays. This filtered DC is connected to terminals + and - S. An unfiltered DC is connected to terminals + and - B. This DC is used for the operation of the selectors.

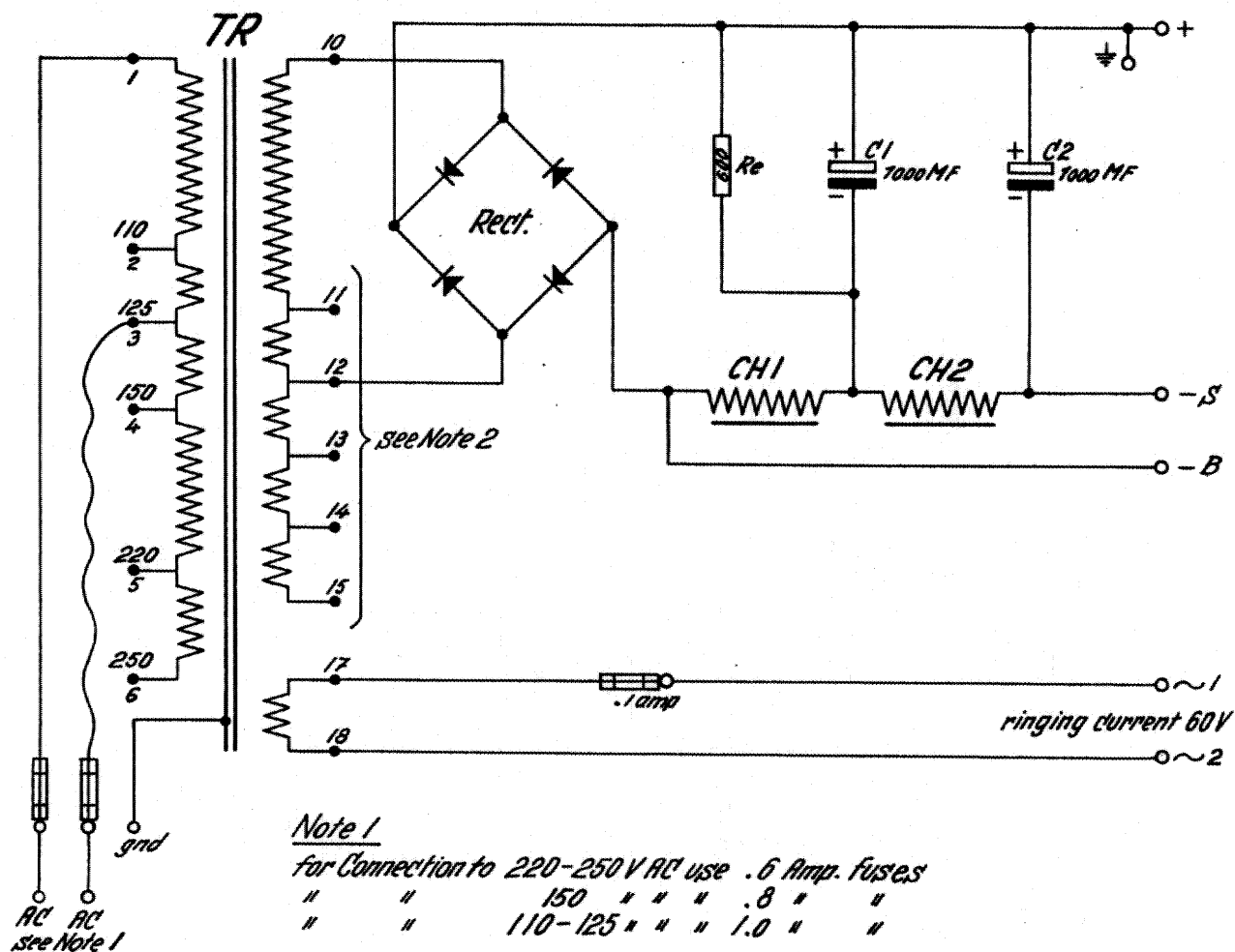
The ripple of the unfiltered DC is used as dial-tone, busy tone and ring back tone.

The output voltage may be regulated by moving one of the wires connected to the secondary side of the transformer to any terminal marked 11 - 15.

Important: Do not move the wire connected to terminal 10.

The no-load voltage is to be measured between the terminals + and - S and + and - B. It should, in both cases, measure approx. 30 volts.

The ringing current for the PAX is supplied by a separate winding on the secondary side of the transformer and measures 60V AC. A fuse of .1 ampere on the battery eliminator protects the transformer winding.



Description	Order No.
Transformer TR	BV 6H-102 a/7
Choke Coil CH1	BV 6T-74/2
" " CH2	BV 6T-55/2
Rectifier Rect.	B 40/30/1.5

Fig. 3 Battery Eliminator for PAX 15/2



WALL TELEPHONES

Installation Instructions

1. Carefully remove the telephone set from the carton.
2. Loosen the two screws on the side of the housing and open the set.
3. Obtain the proposed location of the wall telephone.
4. At the proposed location, start three holes for wood screws using the attached template as a guide. If the wall will not take wood screws, use the appropriate type of fastener.
5. If the wires from the switchboard are to be run in or through the wall, drill a hole at or near the location shown on the template, and bring the wires through. Leave an extra foot of lead length before cutting the wires.
6. Hold the base of the telephone set against the wall, and place #8 wood screws in the three mounting holes. Screw the base to the wall. See figure 1.
7. Loop any excess wire between the base of the set and the wall, and bring in about 5 inches of wire through the grommet in the lower right hand corner of the base.
8. Strip $\frac{1}{2}$ Inch of insulation from each of the leads.
9. Loosen the screws of binding posts "a", "b", "E" and "W2" on the terminal strip.
10. Connect the wires to the binding posts in accordance with figure 2. Slip the uninsulated portion of the lead between the clamping washer and the hex nut, and tighten the screw.
11. Trim the excess bare wire. Make sure the wires are firmly held in place.
12. Close the telephone set and tighten the two screws on the right side of the housing.
13. Remove the celluloid number card cover on the telephone set, write in the number assigned to this instrument and replace the celluloid cover.
14. Test the installation by making and receiving calls from this instrument as covered in the instruction manual for the particular PAX.

TELEPHONE SET

#8 WOOD SCREWS
SUPPLIED BY INSTALLER

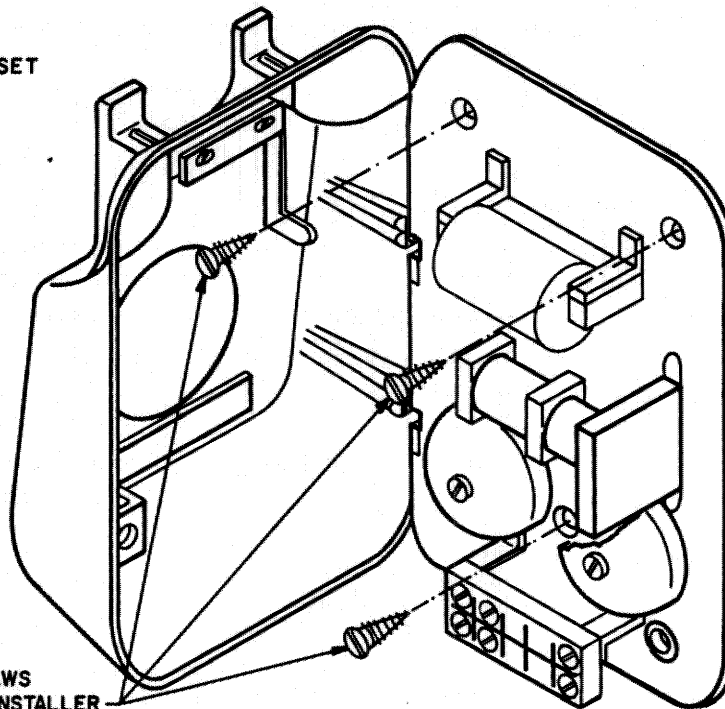


FIG. 1. TYPICAL METHOD OF MOUNTING THE WALL TELEPHONE

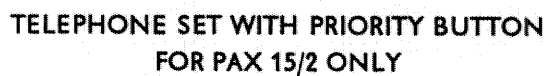
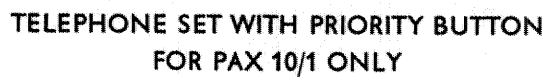


FIG. 2 WALL TELEPHONE WIRING DIAGRAMS



DESK TELEPHONES

Installation Instructions

1. Carefully remove the telephone set from the carton, and place it in its assigned location.
2. At the nearest point on the baseboard or wall, select a location for the connecting box. Make sure that the distance from the telephone set to the selected location does not exceed the length of the connecting cord.
3. At the selected location, start a hole for a wood screw, using an awl. If the wall will not take a wood screw, use the appropriate type of fastener.
4. Refer to figure 1 and disassemble the connecting box as follows:
 - A. Loosen the screw (1) in the plug section (2) of the connecting box.
 - B. Pull the plug section (2) out of the base.
 - C. Loosen the screw (4) in the cover of the base (5).
 - D. Remove the cover (5) of the base (7).
 - E. Loosen the screw (6) and remove terminals (3).
5. Screw the base (7) to the wall.
6. Screw the terminals (3) of the connecting box to the base (7) with the screw (6).

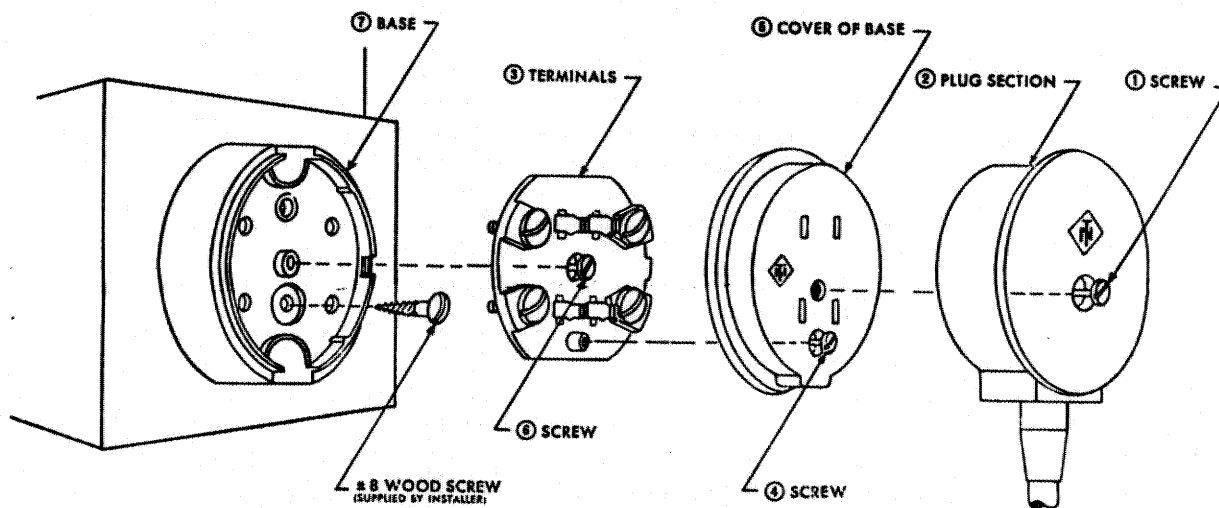
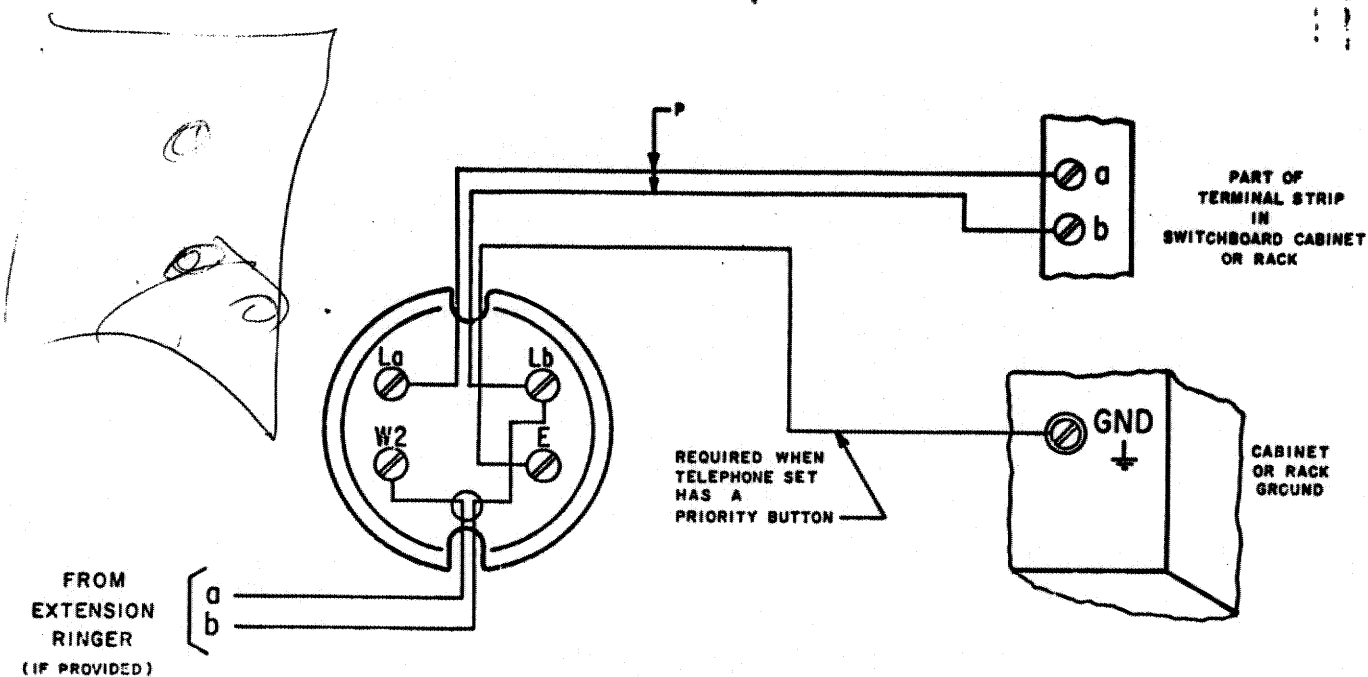
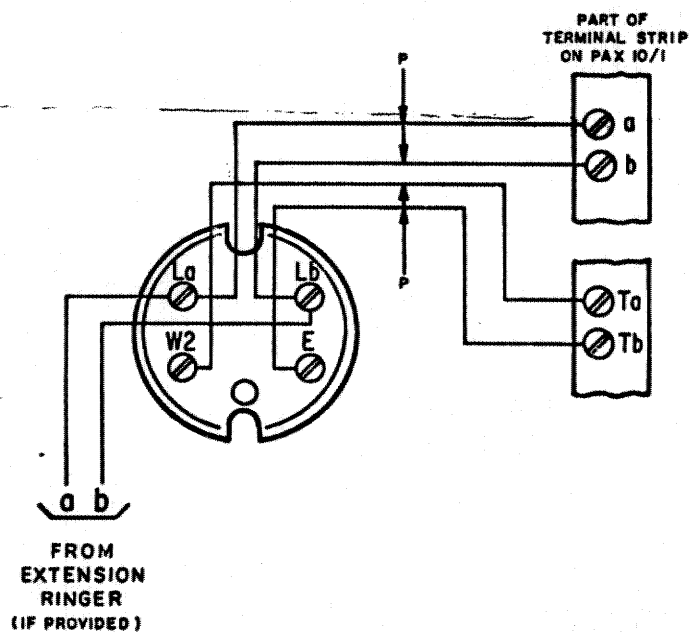


FIG. 1 ASSEMBLING THE CONNECTING BOX

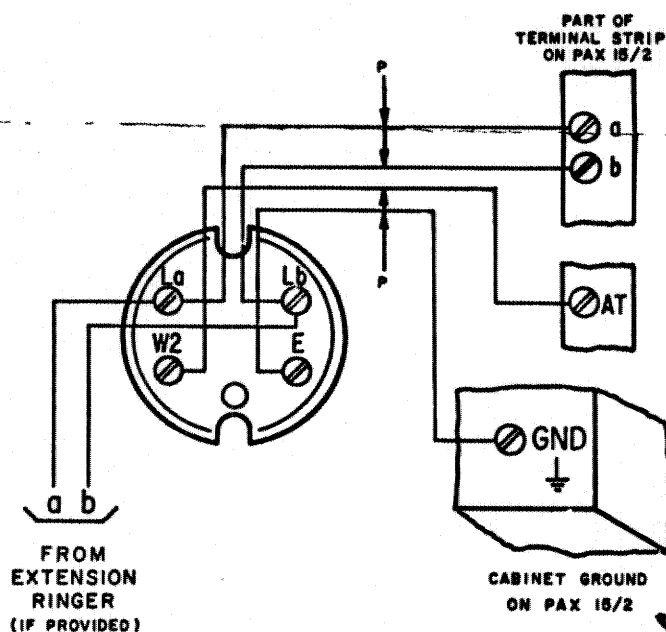
7. Bring the wires from the switchboard cabinet, through the top or bottom slot, into the connecting box. Also bring in the wires from any extension telephone, extension ringer, or other apparatus which will connect to this instrument.
8. Leave 4 inches of lead length and cut the wires. Strip $\frac{1}{2}$ inch of insulation from each of the leads.
9. Loosen the screws of the binding posts on the terminals (3).
10. Connect the wires to the binding posts in accordance with figure 2. Wrap the uninsulated portion of the lead around the screw between the washer and the hex nut in a clockwise direction.
11. Tighten the screws, making sure they firmly hold the wires.
12. Replace the cover of the base (5) and tighten the screw (4).
13. Plug in the remaining section (2) and tighten the screw (1). This completes the mounting of the connecting box.
14. Remove the celluloid number card cover on the telephone set, write in the number assigned to this instrument, and replace the celluloid cover.
15. Test the installation by making and receiving calls from this instrument as covered in the instruction manual for the particular PAX.
16. Show the telephone user how he may adjust the volume of the ringer by rotating the lever on the bottom of the telephone set.



TELEPHONE SET WITHOUT PRIORITY BUTTON
OR WITH PRIORITY BUTTON FOR PAX 27/4 OR 50/6



TELEPHONE SET WITH PRIORITY BUTTON
FOR PAX 10/1 ONLY



TELEPHONE SET WITH PRIORITY BUTTON
FOR PAX 15/2 ONLY

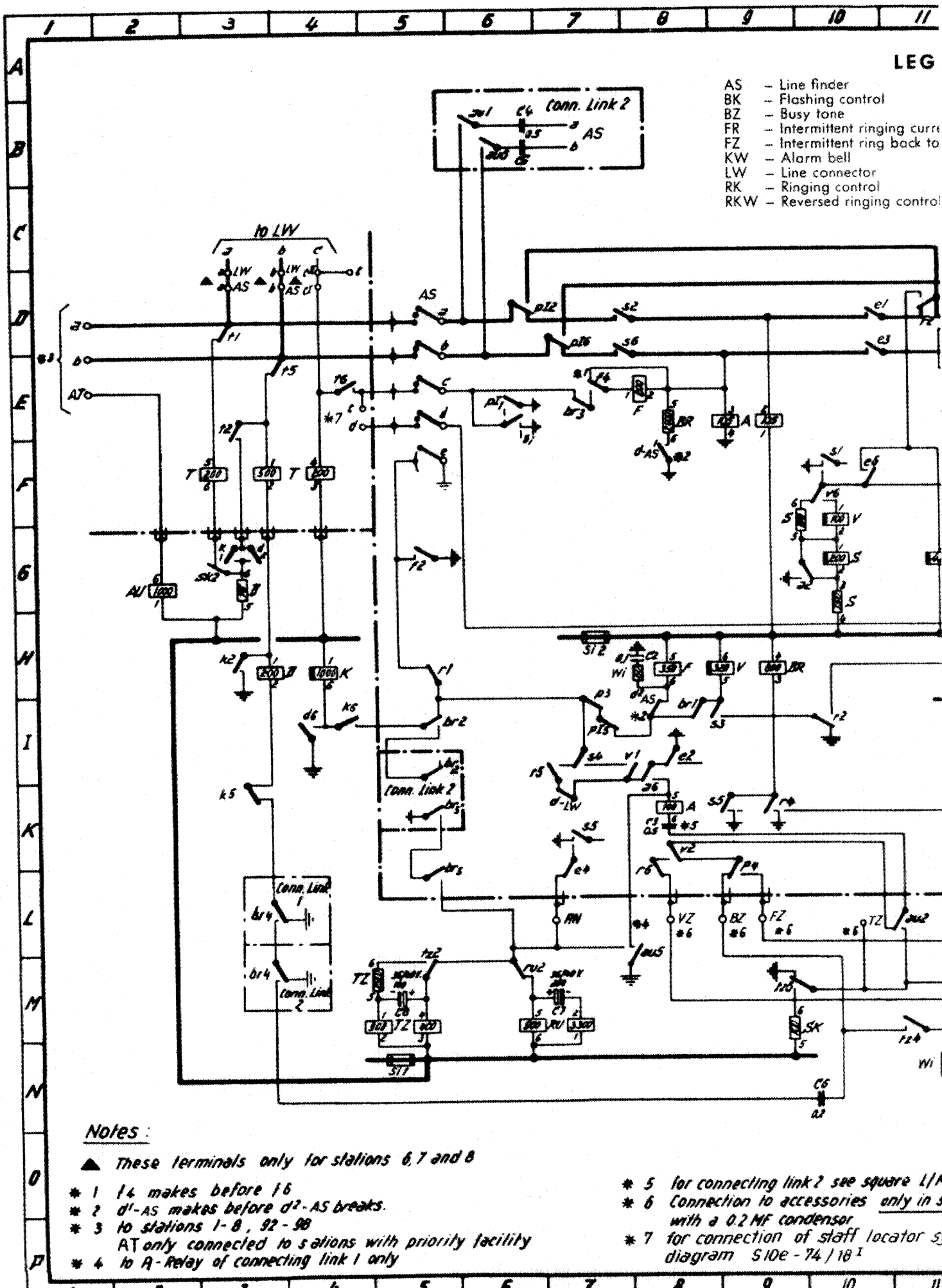
"p" DENOTES A TWISTED PAIR

FIG. 2 TELEPHONE SET WIRING DIAGRAMS

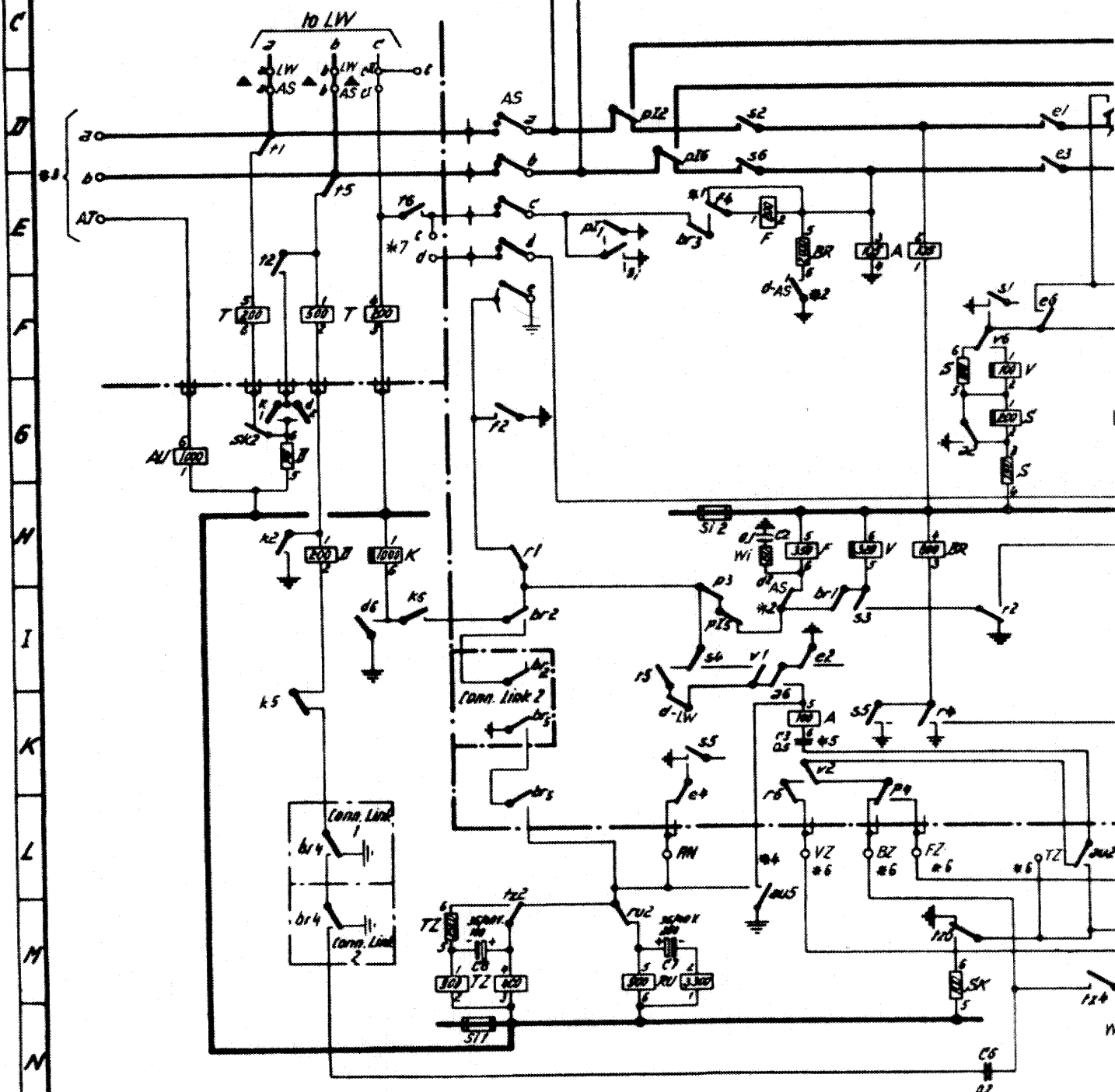
*Magic Valley
Showers
Installation*

-

51a - 112/110¹A



- AS - Line finder
 BK - Flashing control
 BZ - Busy tone
 FR - Intermittent ringing cu
 FZ - Intermittent ring back
 KW - Alarm bell
 LW - Line connector
 RK - Ringing control
 RKW - Reversed ringing cont



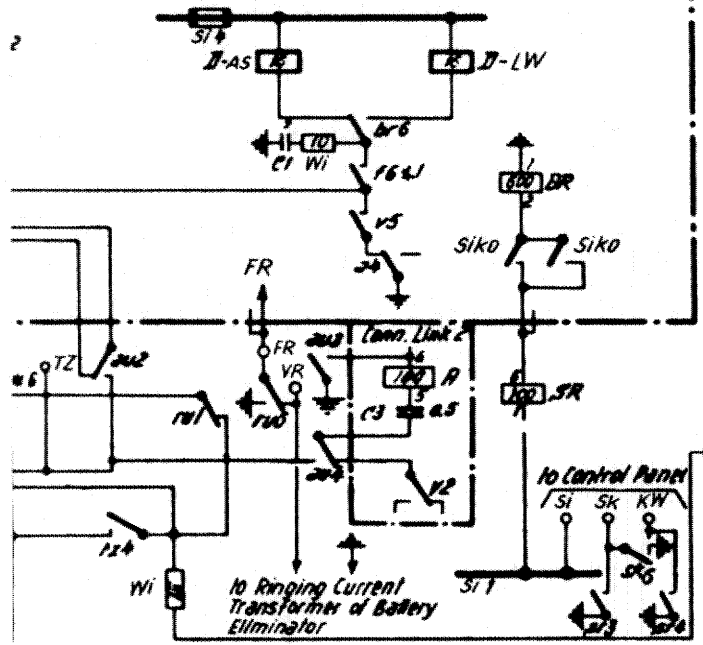
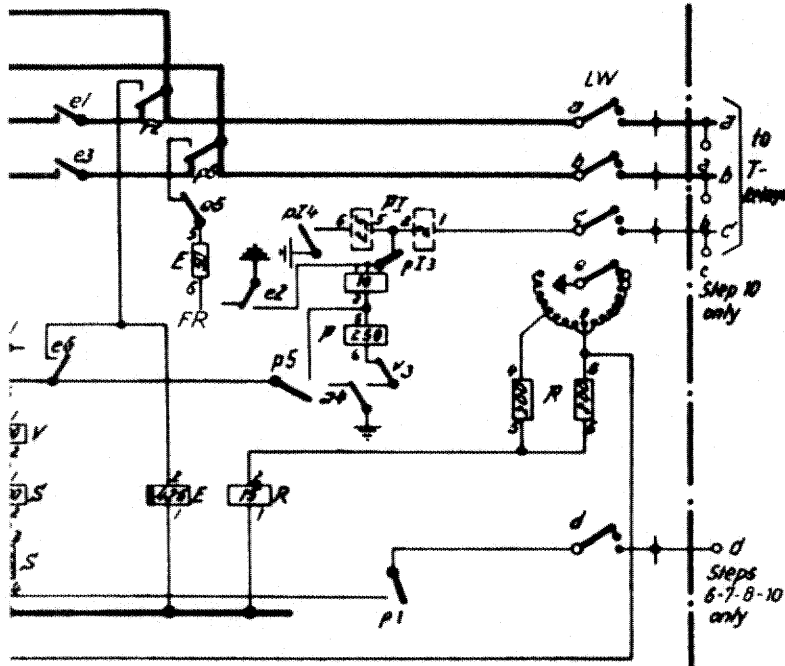
Notes:

- ▲ These terminals only for stations 6, 7 and 8
- * 1 14 makes before 16
- * 2 d1-AS makes before d2-AS breaks.
- * 3 to stations 1-8, 92-98
 AT only connected to stations with priority facility
- * 4 to A-Relay of connecting link 1 only

- * 5 for connecting link 2 see square 1,
- * 6 Connection to accessories only in with a 0.2 MF condenser
- * 7 for connection of staff locator diagram 510e-74/18¹

LEGEND

- ler control
- ie ent ringing current
- ent ring back tone
- ell
- ector
- ontrol
- d ringing control
- Si - Fuse
- Siko - Fuse contact
- Sk - Fuse control
- TR - Transformer
- TZ - Ticker signal
- VR - Continuous ringing current
- VZ - Continuous ring back tone
- Wi - Resistor
- WZ - Dial tone



square 1/M 13
ies only in series
ff locator system
31

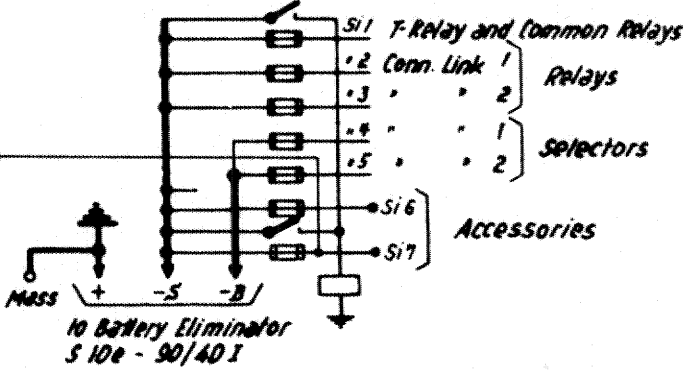
BK RK RKW
for Accessories
i.e. Executive Phone

Relay	Type	Contact			Winding Terminals	A
		Square 1	Square 2	Square 3		
T	3E-136/1	B3	m	E4	m	M
D	3B-59e/1	G3	m	I4	m	M
K	3V-50/5	G3	m	I3	m	M
AU	3B-1/65	B6	m	L12	m	M
RU	3D-325/9	L11	b	O13	c	M
TZ	3D-216/2	M5	c	N11	m	M
SR	3D-20/9			N14	m	M
SK	3B-120/2	B3	c	N14	dm	M
F	3D-358/1	G5	m	E7	c	M
A	3E-19/2	G10	c	F12/L13	c	M
S	3T-14e/1	E6, F10	dm	I8	m	M
V	3U-16/1	I7	m	F13	b	M
R	3A-120/2	N5	b	I7	m	M
P	3F-71/0	N13	m	I7	b	M
E	3V-13a/1	D10	m	D10	m	M
BR	3D-157a/1	I8	b	E7	b	M
PI	3D-64/1	E6	m	E13	b	M
AS	160/B4 IC5					
LW	160/B4 IC7					

top spring free
free contact or winding

Relay spring sets and winding terminals as seen from rear.

all fuses: 0.75 Amp.

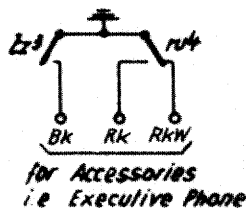
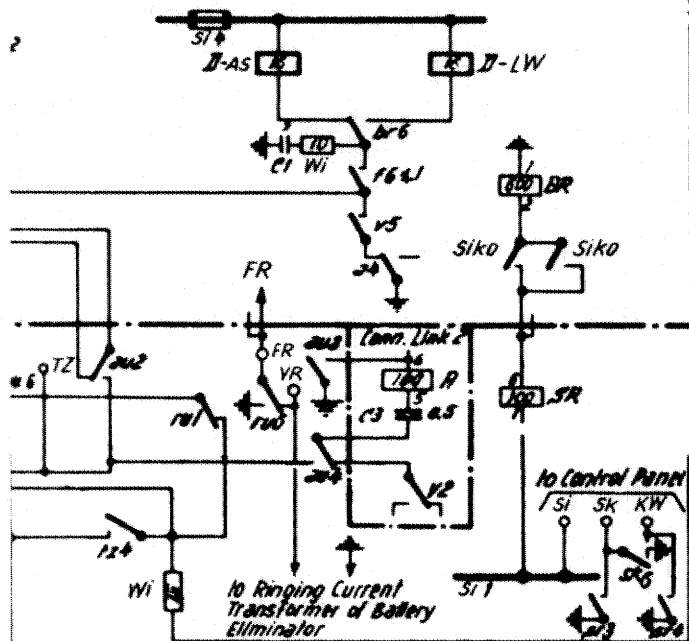
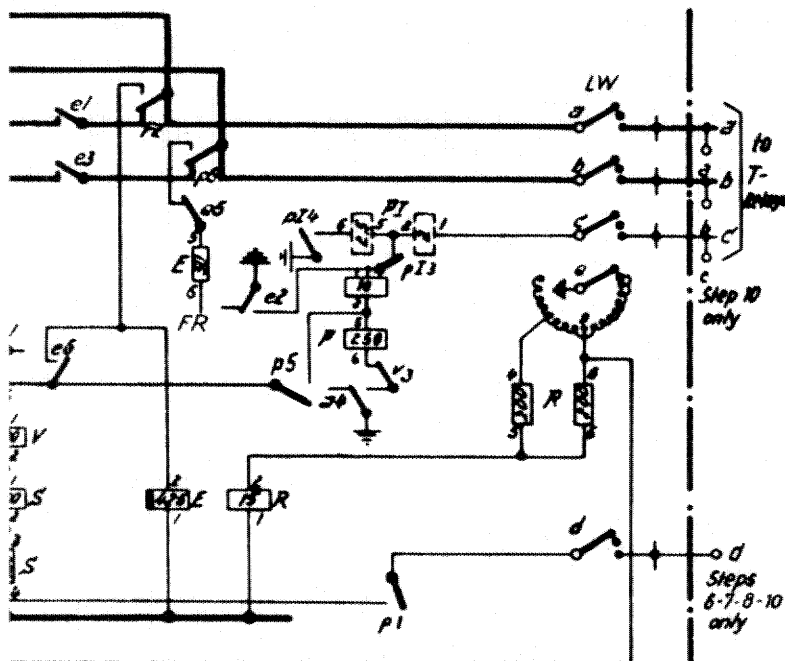


Drawn 1.7.52, 1/6	Issue IV 12.10.62 9/6	
Chkd. 9/2	240 12/40	
Appr.		
Private Automatic Exchange for 15 Stations - 2 Connecting Links with built-in Battery Eliminator		<p>S3e-5/12 IV</p> <p>E P</p>

LEGEND

ler
control
re
ent ringing current
ent ring back tone
ell
nector
control
d ringing control

Si - Fuse
Siko - Fuse contact
Sk - Fuse control
TR - Transformer
TZ - Ticker signal
VR - Continuous ringing current
VZ - Continuous ring back tone
Wi - Resistor
WZ - Dial tone



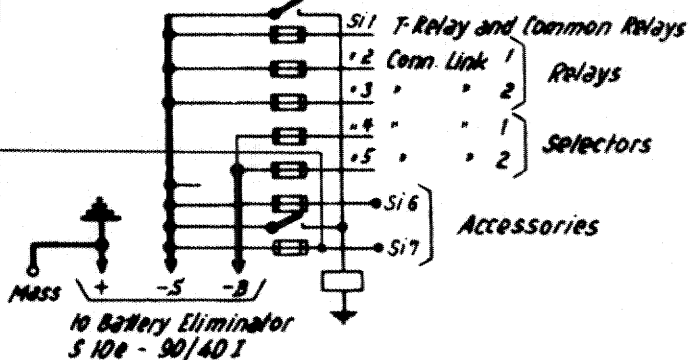
ve square 1/M 13
ies only in series
r
ff locator system
9 I

Relay	Type	Contact			Winding Terminals	
		Square	Square	Square		
T	3E-138/1	B3	E3	E4	M	M
D	3B-592/1	G3	m	I4	m	M
K	3V-50/5	G3	m	I3	m	M
AU	3B-1/66	B6	m	L12	m	M
RU	3D-325/9	L11	b	O13	c	M
TZ	3D-216/2	M5	c	N11	m	M
SR	3D-28/9			N14	m	M
SK	3B-120/2	G3	c	N14	dm	M
F	3D-358/1	G5	m	E7	c	M
A	3E-19/2	G10	c	F12/L13	c	M
S	3T-140/1	E6, F10	dm	I8	m	M
V	3U-16/1	I7	m	F13	b	M
R	3A-120/2	N5	b	I7	m	M
P	3F-71/2	N13	m	I7	b	M
E	3V-132/1	D10	m	D10	m	M
BR	3D-1570/1	I8	b	E7	b	M
PI	3D-64/1	I5	c	L14	c	M
AS	160/B4 IC5					
LW	160/B4 IC7					

top spring free
free contact or winding

Relay spring sets and winding terminals as seen from rear.

all fuses: 0.75 Amp.



Drawn 1.7.52, Issue IV 12.10.62 g/c
Chkd. 240 12/40
Appr. Private Automatic Exchange for 15 Stations - 2 Connecting Links with built-in Battery Eliminator



S3e-5/12 IV E