1. GENERAL

1.1 Tie Line Equipment K1076 will provide both-way working between an S50 PAX Type 2 and any 24V or 50V PAX which employs loop calling and loop impulsing with an impulse ratio of 66% break, 33% make. This includes the full range of Type 1 and Type 2 switchboards and also competitors' equipment which uses the same methods of calling and impulsing. The Tie Line unit used at the distant switchboard must, of course, be of a suitable type for that switchboard.

1.2 Outgoing access to a Tie Line is obtained by dialling a single digit and, since group hunting is employed, the same digit is used for outgoing calls on all Tie Lines of a group service a particular distant exchange. Digits 6, 9 and 0 are normally available for this purpose.

1.3 Each Tie Line unit occupies one line finder and one connector outlet and thus reduces the capacity of the switchboard by one line.

If preference access is provided, an additional connector outlet is occupied, thus further reducing the capacity of the switchboard by one line for each Tie Line unit concerned.

1.4 Post Office type approval for use in conjunction with "private circuits rented without Post Office terminal equipment" has been granted. See Appendix 2 for full information.

2. DRAWINGS

94560/SW - Tie Line - Schematic/Wiring.
118660- Tie Line - Equipment.
A4245/SW - S50 Tie Lines - Terminal Block Strappings.
R.A.Sheet - Relay TA - N37053 (K7594)

A point-to-point wiring chart for one Tie Line Unit is given in Section 10.

3. EQUIPMENT

The equipment which may be required at the S50 (Type 2) end of the Tie Line is as follows:-

K1076	- Tie Line Equipment	- 1 per Tie Line
K6694	- Rectifier 1/12A	- 1 per Tie Line when distant Sw/Bd is an S50.
K7452	- Relay (PF) 3000 type, 800 ohms ae. 2C	- 2 per Sw/Bd where Pref.access is required

K6693 - Rectifier 1/6A - 1 per Tie Line with outgoing pref. Disc.

K1082	- Tie Line Equipment, Auxiliary, Preference Discrimination (Includes Rectifier needed for Outgoing Preference Discrim.)	- 1 per Tie Line with incoming pref.. disc.
K1084	- Tie Line Equipment Auxiliary, long line (Local wiring form provided.)	- 1 per Tie Line of loop res. greater than 1,000 ohms.

4. MOUNTING

4.1 The Tie Line units are normally wall-mounted using
(scan text for next line was unreadable)

4.2 Long Line equipment K1084 cannot be accommodated on the Tie Line equipment mounting plate, but should be fitted to a separate K2976 Plate, Mounting, Relays 300 type using a Mounting K2969 or K2970, as required.

One Plate, Mounting K2976 can accommodate three Long Line equipments.

4.3 An alternative method of mounting can be offered by the use of K2413 Brackets, Tie Line mounting. This provides for mounting Tie Line equipments on top of the PAX unit.

Brackets K2413 are designed to accept one Mounting, Wall, hinged, twin K2970. Consequently, the maximum amount of equipment which can be fitted in this way is two Tie Line equipments K1084 without Long Line equipment, or one Tie Line equipment K1084 with Long Line equipment.

4.4 The Preference Discrimination equipment mounts on the Tie Line equipment mounting plate.

5. PREFERENCE WORKING

5.1 Preference Access

Preference Access can be provided, whereby a preference sub is automatically switched into an engaged Tie Line if all lines of the group are engaged.

Relay PF (K7452) must be fitted on each register when preference access to Tie Lines is required. See Note 10 on Drawing 94550/SW.

Wiring is provided for the relay, which mounts in the lower right-hand position in the register relay set (relay set viewed from front).

Issues 1,2 and 3 of Drg. 94550/SW show the PF coil to have a resistance of 100 ohms. This should be corrected to read 800 ohms.

5.2 Outgoing Preference Discrimination

Outgoing Preference Discrimination can be provided, whereby a preference sub is able to exercise his preference in realtion to an engaged extension on the distant switchboard. Outgoing preference discrimination cannot be given on an installation unless preference access is also provided.

A Rectifier K6693 must be added to each tie Line unit on which outgoing preference discrimination is required.

The distant Tie Line unit must be arranged for incoming preference discrimination, and this restricts the distant switchboard to a 50-line or 50/400 line Type 1 or Type 2.

(a) If the distant PAX is Type 1 (50-line or 50/400 line) then the preference caller from the Type 2 switchboard can only be given automatic preference discrimination since Type 1 PAX provides for automatic preference only.

(b) If the distant PAX is Type 2 (50-line or 50/400 line) then the preference caller can be given either optional or automatic preference discrimination. The type of preference discrimination given is, of course, decided by the preference arrangements provided for local calls on the switchboard to which the Tie Line call is incoming.

If optional preference discrimination is given, then the preference caller must dial 1 when meeting an engaged extension on the distant switchboard, even if he is given automatic preference on local calls.

5.3 Incoming Preference Discrimination

Incoming Preference Discrimination can be provided whereby a preference sub on an incoming tie line call can exercise his preference and thus intrude on an engaged extension. The distant tie line unit must be arranged for outgoing preference discrimination, and this restricts the distant switchboard to a 50 line or 50/400 line Type 1 or Type 2. The preference caller incoming to the Type 2 switchboard on the tie line can then be given either optional or automatic preference discrimination. The type given is, of course, decided by the preference arrangements provided for local calls on the switchboard to which the tie line call is incoming.

If optional preference discrimination is given, then the preference caller must dial 1 on meeting an engaged extension when making his tie line call, even if his is given automatic preference on local calls.

Tie Line Equipment, K1082 Auxiliary, Preference Discrimination must be added to each tie line unit on which incoming preference discrimination is required. See Note 5 on Drg. 94560/SW. Equipment K1082 also includes the 1/6A rectifier needed for outgoing preference discrimination.

On some early tie line units resistor R1 was 205 ohms instead of 100 ohms, and in these cases it must be replaced by a Resistor, Coil, P.O. No. 9. 100 ohms K7912.

When discriminating ringing (dial calls) is provided on the installation, it may be necessary to change the value of resistor R1. See "Facilities - Ringing, Discriminating" in the S50 section of this EP.

5.4 General Incoming Preference

General incoming preference can be provided, whereby any incoming tie line caller can exercise preference and thus intrude on an engaged extension. Callers incoming on the tie line to the Type 2 switchboard can be given either optional or automatic preference. The type given is, of course, decided by the preference arrangements provided for local calls on the switchboard to which the tie line call is incoming. If optional preference is given, then the caller must dial 1 on meeting an engaged extension when making his tie line call, even if automatic preference is provided on local calls on his switchboard.

Normally no additional equipment is required. (See note 4 on Drg. 94560/SW.) However, on some early tie line units resistor R1 was 250 ohms instead of 100 ohms and in these cases it must be replaced by a Resistor 100 ohms K7942.

When discriminating ringing (dial calls) is provided on the installation, it may be necessary to change the value of resistor R1. See "Facilities, Discriminating Ringing", in the S50 section of this EP.

6. LONG TIE LINE WORKING

6.1 For lines of up to 1000 ohms loop resistance no modification is required to the standard Tie Line Equipment K1076, except for padding where necessary. (See para. 10.8)

6.2 For lines of loop resistance from 1000 ohms to 3000 ohms it will be necessary to fit Tie Line Equipment, Auxiliary, Long Line K1064.

6.3 The upper limit of 3000 ohms quoted in paragraph 6.2 above may be raised to 3500 ohms if Incoming Preference Discrimination is not required (i.e. relays TU and TV are not fitted)

6.4 The limiting figures given for line loop resistance are intended as a guide only, and in practice it may be found possible to extend these slightly.

6.5 The maximum line attenuation is 18 dB for a normally acceptable level of speech, but this figure is only approximate since it is dependent on site conditions.

7. WORKING TO A 50V PAX

7.1 Any tie line unit which is connected to a distant 50V PAX must be modified by the addition of Rectifier MR3 (K6694). See Drg. 94560/SW Note 7.

8. IMPULSING TO A HIGH SPEED RELAY

8.1 When the impulse accepting relay at the distant tie line unit is a high speed type it may be found that a false additional impulse is accepted by

that relay when TC relay (of the tie line unit sending the impulses) releases at the end of the train of impulses.

8.2 If this difficulty is experienced, details should be sent to HOED so that a suitable modification may be recommended.

8.3 Although the auxiliary long line equipment includes a Carpenter relay, it is not expected that this relay will be subject to the above difficulty, mainly because the circuit provides for addition of series resistance to the Carpenter relay coil. (See para. 10.8)

9. LINE FINDER AND CONNECTOR OUTLETS

When the impulse accepting relay at the distant tie line unit is a high speed type it may be found that a false additional impulse is accepted by that relay when TC relay (of the tie line unit sending the impulses) releases at the end of the train of impulses.

8.2 If this difficulty is experienced, details should be sent to HOED so that a suitable modification may be recommended.

8.3 Although the auxiliary long line equipment includes a Carpenter relay, it is not expected that this relay will be subject to the above difficulty, mainly because the circuit provides for addition of series resistance to the Carpenter relay coil. (See para. 10.8)

10. WIRING

10.1 On equipments delivered after July 1962, a terminal block is provided on each equipment for termination of cables from the PAX. The chart below shows connections to both the earlier and current equipment.

10.2 Wiring Chart - one single Tie Line unit
(without any of the preference facilities)

TIE LINE UNIT		SWITCHBOARD
EQUIPMENT WITH TERMINAL BLOCK	EQUIPMENT WITHOUT TERMINAL BLOCK	MISCELLANEOUS CONNECTION STRIP
6)	TAd)	-)
5)	TAb)	+) of connector) outlet used
20)	TLa)	P)
1)	TG23)	M)
30)	LS21)	-)
40)	LS23)	+) of connector) outlet used
26)	LS27)	P)
25) Do not terminate-see Sec.10.3		M)

```
 3)                TS21)              |  NM
16)                 TG5)              |  MH
                                      |
18)                  K1)              |  AS
31)                 TG2)              |  IT
                                      |
43)                LS22)              |  - of line via. misc.conn.strip
23)                LS24)              |  + "    "   "    "     "    "
                                      |
                                      |  FUSE PANEL
                                      |  ----------
38)                 TAa)              |  BATTERY FUSE (1.5 amp)
40)                 Kb )              |
                                      |
50)                 K22)              |  EARTH BAR
  )                    )              |
                                      |
                                 -------------
                                 10 PAIR CABLE
```

NOTE 1:
Strap together terminals 38 and 48 for equipment with terminal block or TAa and Kb for equipment without terminal block.

NOTE 2:
The miscellaneous connection strip strappings and wiring must be modified. The details given in Fig.3 of DRG.94560/SW (Issues 1 and 2) are inaccurate and the modifications should be carried out in accordance with the relevant part of the revised chart given in section 11.

NOTE 3:
Remove the line relay (LR/K) of the line circuit concerned and maintain continuity of battery, eath and start circuit runs. Use outlet 56, 57, 58 or 59 if possible.

NOTE 4:
See Drg.A4245/SW for alternative terminal block strappings on first, intermediate, and last Tie Lines in a group.

10.3 PREFERENCE WORKING

Preference Access
Wire PF relay in each register. See Drg.94550/W Fig.4.(wiring provided).

A 15 pr. cable will be needed between the unit and the switchboard in place of a 10 pr.

Wire connector "preference" outlets (-, +, P, M) and preference marking wire from switchboard. (See Drg. 94560/SW Fig. 1).

Modify relevant part of miscellaneous connection strip as indicated in section 11.

Outgoing preference discrimination
Provide preference access as detailed above.

Wire Rectifier MR2 in accordance with Note 6 on Drg.94560/SW. (Wiring provided).

Incoming preference discrimination
Wire auxiliary preference discrimination equipment (TU & TV relays) in accordance with Note 5 on Drg. 94560/SW. (Wiring provided).

Terminate wire from line finder M outlet on TV22 (via terminal 25, when provided).

Check that resistor R1 on tie line unit is 100 ohm.

If discriminating ringing (dial calls) is fitted on the installation, see "Facilities - Discriminating Ringing" in the S50 section of this EP for correct value of resistor R1.

General Incoming Preference
Terminate wire from line finder M outlet on TL3 (via terminal 25, when provided)

Check that resistor R1 on tie line unit is 100 ohm.

If discriminating ringing (dial calls) is fitted on the installation, see "Facilities - Discriminating Ringing" in the S50 section of this EP for correct value of resistor R1.

10.4 LONG TIE LINE WORKING
Wire auxiliary long line equipment to Drg.94560/SW Fig. 2 and Note 10.

10.5 WORKING TO A 50V PAX
Wire rectifier MR3 in accordance with Note 7 on Drg. 94560/SW.

10.6 WIRING OF A GROUP OF TIE LINES
Wire each tie line unit individually as indicated above.
Modify each unit and wire between units in accordance with the group hunting explanatory figures on Drg. 94560/SW and Note 2 on that drawing.

10.7 WIRING OF AN ADDITIONAL GROUP
Wire as for the first group of tie lines but using a different calling digit. Refer also to section 11.

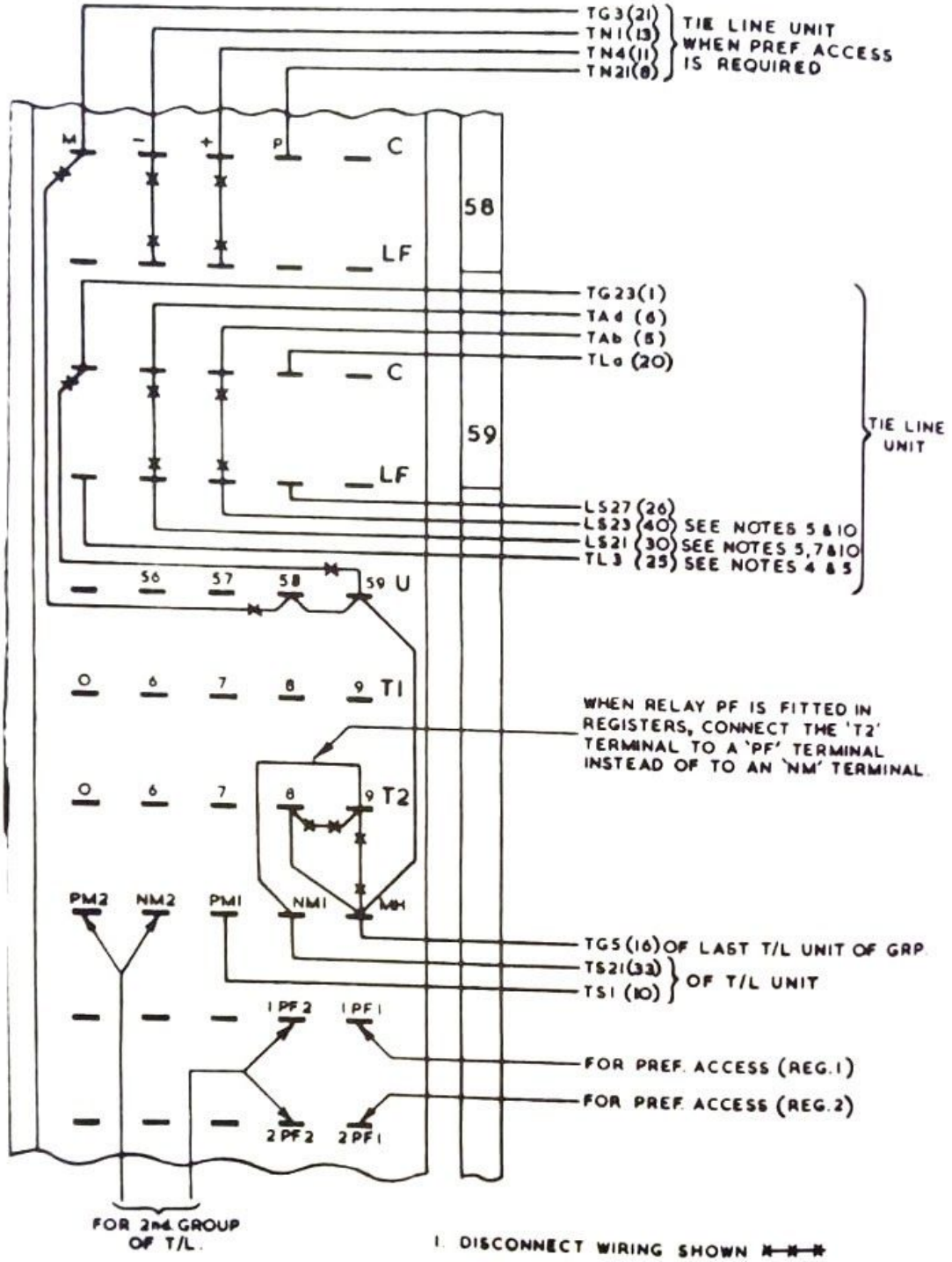
10.8 If the tie line loop resistance is less than 500 ohms, and difficulty is experienced with impulsing, or uncomfortably loud "clicks" are heard during the setting up of a tie line call, the line should be padded such that the total loop resistance is about 500 ohms. This should be done by adding equal

values of resistance to each leg of the line. Suitable resistors are P.O. No. 9 or No. 12. These can be mounted on the tie line equipment mounting plate.

Where the tie line loop resistance is greater than 1000 ohms and Tie Line Equipment, Auxiliary, Long Line, K1064 is fitted, and difficulty is experienced with impulsing to the Carpenter relay, equal resistances should be added to the battery and earth connections to the Carpenter relay, in order to reduce the current in the relay coil to approximately 6 mA.

11. MODIFICATIONS TO MISC. CONN. STRIP

11 MODIFICATIONS TO MISC. CONN STRIP



1. DISCONNECT WIRING SHOWN ✕—✕—✕
   ADD WIRING SHOWN ———
2. THE USE OF DIGIT 9 & OUTLETS 58 & 59 IS TYPICAL ONLY.
3. WHERE NOTES ARE REFERRED TO, THESE ARE ON DRG. 94560/SW.
4. FIGURES IN BRACKETS ARE TERMINAL BLOCK NUMBERS ON EQUIPT. ISSUED AFTER JULY 1962

10.11.66.

12. TANDEM TIE LINE WORKING

12.1 An S50 PAX may be used as a tandem PAX in a Tie Line network, with S25, S50 or S400 switchboards as terminal PAX installations, provided it is capable of handling the extension line, tie line and facility traffic which is anticipated not only initially by after a reasonable period of growth, otherwise an S400 line PAX should be used.

12.2 Where the resistance of a line between a terminal PAX and the tandem PAX is less than 1000 ohm this line must be padded up to a total resistance of about 1000ohm. This should be done by adding equal values of resistance to each leg of the line, suitable resistors being P.O. No.9 and No.12. These can be mounted on the tie line equipment mounting plate.

12.3 Tie Line Equipment, Auxiliary, Long Line K1084 should be inserted at the PAX tie line unit, and the battery and earth supplies to the Carpenter relay should be padded as detailed in para. 10.8.

13. CHANGES - DRG.94560/SW

Issues 1 and 2
The details given in Fig.3 were incorrect. See section 11.

Issue 3
Incorrect wiring to relay TA coil tags a and b corrected.

Issue 4
Note 2 revised and clarified with regard to wiring between TS21 and TS9 on intermediate and last lines in a group.

Issue 5
Terminal numbers added - drawing retraced.

Issue 6
Terminal numbers for Battery and Earth leads corrected.
Note in Fig. 3 re last Tie Line, clarified.
Designation of R1 and R2 in Fig. 2 reversed in Battery and Earth runs.