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POST OFFICE TELECOMMUNICATIONS HEADQUARTERS

DIAGRAM NOTES AT 60068C

SPECIFICATION T 60068

GROUP SELECTOR

UNIT AUTO. NO. 13

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1. GENERAL

This diagram shows the circuit and connexions of the 100 outlet group selector for use in Unit Automatic Exchanges No. 13. It supersedes AT 5539/1 since it can cater for both pre-STD or STD conditions by changes to U-point strapping. It differs from AT 60067 (AT 5539/0 modified for STD) by the inclusion of contact N4.

The following diagrams should be considered in conjunction with this diagram:-

AT 3721 UNIT AUTO NO. 13. SUBSCRIBERS LINE, LINEFINDER AND CONTROL RELAY SET.

AT 60075 OUTGOING CIRCUIT WITH BOTHWAY SWITCHING TO G.S.C. U.A.X. NOS. 13 AND 14.

AT 60077 LOCAL CALL TIMING CIRCUIT. U.A.X. NO. 13.

AT 60083 OUTGOING RELAY SET. G.S.C. REGISTER AND ASSISTANCE TRAFFIC. U.A.X. NOS. 12, 13 & 14.

AT 60085 FINAL SELECTOR 2-10 TYPE UNIT AUTO NO. 13.

AT 60087 DISCRIMINATOR FOR LINKED NUMBERING SCHEME. U.A.X. NO. 13.

2. FACILITY SCHEDULE

Provision is made for:-

2.1 Battery testing.

2.2 Access to 100 outlets from the linefinder direct or via a linked numbering scheme discriminator or a directly connected incoming junction or selector level outlet.

2.3 Holding the preceding equipment in the chain of connexions until the selector switches to a free outlet, or is released by a disconnexion of the calling loop.

2.4 Transmission of dial tone to the calling party where the selector is associated with a linefinder.

2.5 Vertical stepping under the control of the pulses received.

2.6 Automatic rotary hunting for a free outlet on the level dialled.

2.7 Transmission of busy tone to the caller and operation of the overflow meter if all outlets are engaged.

DIAGRAM NOTES AT 60068C - Issue 1

2.8 Transmission of N.U. tone to the caller should the level dialled be spare, barred to incoming calls or barred to CCB subscribers.

2.9 Application of forced release conditions (under time-pulse control) if a selector is held:- (a) to a permanent loop, except when directly connected to a junction i.e. without a preceding incoming equipment, (b) on N.U. tone, or (c) on busy tone (all outlets engaged).

2.10 Extension of the calling party's loop when a free outlet is found.

2.11 Passing forward a discriminating signal if the selector is taken into use by a C.C.B. subscriber, or via an incoming junction.

2.12 Automatic busying of the selector during the return of the mechanism to normal, or if it should fail to release due to a mechanical defect, or if the battery is disconnected (fuse blown).

2.13 Direct connection to an incoming junction on which dial tone is not required, i.e. without a linefinder, and with or without an incoming equipment, the latter being required on bothway circuits.

2.14 Association with a routine tester.

2.15 Delaying the operation of the rotary magnet under the control of the discriminator.

3. CIRCUIT DESCRIPTION

3.1 Outline

Access to this selector is gained by (a) the calling subscriber on the U.A.X. No. 13 direct or via the linked numbering scheme discriminator, (or an incoming call from an interdialling exchange) after the associated linefinder has operated and positioned its wipers on the bank contacts, (b) an incoming call from the parent auto exchange junction either directly connected or via an incoming equipment if the junction is bothway, or (c) a call via the selector level outlet of a group selector, where this circuit is used as a second group selector. The selector is seized and holds to the incoming loop, dial tone being transmitted to the caller where the selector is associated with a linefinder.

On receipt of the dialled pulses, vertical stepping takes place and continues until the wipers are positioned alongside the bank level required. At this point discrimination is introduced and one of the following conditions is satisfied:-

(a) the level is available to all subscribers, in which case the call is allowed to proceed.

(b) the level is available only to ordinary subscribers, in which case N.U. tone is transmitted if the call originates from a C.C.B. subscriber, calls from ordinary subscribers being allowed to proceed or

(c) the level is spare or barred to incoming calls, in which case N.U. tone is transmitted to the caller.

If the call is allowed to proceed, automatic rotary stepping commences and the selector tests for a free outlet. When a free outlet is found, rotary stepping is discontinued and the call is switched through on that outlet. If no free outlets are found on the level, rotary stepping continues until the wipers are positioned on the 11th contact; the S springs operate mechanically to transmit busy tone to the caller and also operate the level overflow meter.

When the selector is taken into use for an incoming call from a distant exchange, a positive battery is connected to the M wire to provide for trunk offering, also disconnexion of local call timing equipment. On levels 1 and 0, it effects barring of incoming calls.

When the selector switches, this positive battery is extended via the M wire to an outgoing junction circuit or a final selector.

3.2 Detail

The following circuit operations are described:-

Call from a local subscriber, ordinary or C.C.B., par. 3.2.1.

All outlets on level engaged, par. 3.2.2.

Level barring, par. 3.2.3.

Incoming junction call, par. 3.2.4.

Use as a second group selector, par. 3.2.5.

Forced release, par. 3.2.6.

Association with a routine tester, par. 3.2.7.

Association with a discriminator, par. 3.2.8.

3.2.1 Call from a local subscriber, ordinary or C.C.B.

3.2.1.1 Seizure and stepping of selector

Relay A — operating via the negative wire from the linefinder and subsequently via the calling loop, or by a loop from the discriminator.
- A1 — operates relay B.

Relay B — operating,
- B1 — extends an earth on the release relay lead.
- B3 — disconnects the testing-in battery from, and connects an earth to, the P wire.
- B4 — provides an earth for pulsing the vertical magnet VM.
- B5 — operates relay CD.

Relay CD — operating,
- CD1 — operates relay CC.
- CD2 — prepares a pulse circuit to magnet VM.
- CD3 — disconnects N.U. tone earth from, and connects either earth or dial-tone earth (see Note 3 on diagram) to contact CC3.

Relay CC	operating,
CC1	disconnects magnet RM circuit independently of springs N1.
CC2	is ineffective at this stage.
CC3	on local first group selectors transmits dial tone to the caller, via relay A.
CC4	is ineffective at this stage.
CC5	starts the common equipment via the TP start lead.

Relay A	releasing and re-operating to the dialled pulses.
A1	on release, short-corcuits relay B (which holds) and energizes the vertical magnet via the 3 ohm winding of relay CD. On re-operation, it energizes relay B and releases the vertical magnet.

The selector wiper-carriage is stepped vertically to the level determined by the number of pulses received.

The N springs are operated when the wipers move off-normal. Relay CD holds during the pulse train.

N Springs	operating,
N1	prepares the rotary magnet circuit.
N2	disconnects the testing-in battery from contact B3.
N3	disconnects the operate winding of relay CD.
N4	disconnects earth from contact A1.

On completion of the pulse train relay CD releases.

Relay CD	releasing, after its slow release period,
CD1	releases relay CC.
CD2	disconnects the vertical magnet stepping circuit.
CD3	disconnects dial tone or earth from relay A.

Relay CC	releasing,
CC1	completes the rotary drive circuit.
CC2	is ineffective at this stage.
CC3	disconnects the tone circuits from relay A.
CC4	is ineffective at this stage.
CC5	disconnects the common equipment.

Interaction between the rotary magnet RM and its interrupter springs RM1 causes the wipers to rotate round the bank-contacts until a free outlet is found. On the first rotary step the NR springs operate.

NR Springs	operating,
NR1	disconnects the vertical marking bank from the CC relay circuit and prepares an operate circuit for relay H.

3.2.1.2 Free outlet encountered

Relay HX	operating to the testing-in battery on the P wire.
HX1	disconnects the rotary drive circuit and operates relays CC and H.

Relay CC — operating,

- CC1 — disconnects the rotary drive circuit independently of contact HX1.
- CC2 — is ineffective in the case of an ordinary subscriber. On a C.C.B. call, it extends 150 ohm battery from the associated linefinder via the CB wire, U21, VMB wipers and U24 to the M wiper for C.C.B. discrimination.
- CC3), CC4) — are ineffective at this stage.
- CC5 — starts the common equipment via the TP start lead.

Relay H — operating,

- H1 — prepares to extend the M wire through the selector.
- H2), H3) — disconnect relay A and extend the transmission circuit through the selector.
- H4 — disconnects the rotary drive circuit independently of contacts CC1 and HX1.
- H5 — earths the release relay lead independently of contact B1.
- H6 — holds relays CC and H independently of contact HX1.
- H7 — extends the P wire through the selector and short-circuits relay HX which releases.

Relay A — releasing,

- A1 — short-circuits relay B, which releases.

Relay HX — releasing,

- HX1 — is ineffective at this stage.

Relay B — releasing after its slow-release period,

- B1), B3), B4), B5) — are ineffective at this stage.
- B2 — releases relay CC.

Relay H remains held by the earth on the P wire extended by the subsequent final selector.

Relay CC — releasing,

- CC1), CC3), CC4) — are ineffective at this stage.
- CC2 — extends the M wire through the selector.
- CC5 — disconnects the common equipment.

The call proceeds. Relay H is held operated at this stage.

3.2.1.3 Release of selector

During the release of the subsequent final selector, earth is disconnected from the P wire and relay H releases.

Relay H	releasing,
H1	breaks the M wire connexion through the selector and connects an earth to the incoming M wire.
H2)	disconnect the transmission circuit and connect relay A to
H3)	the incoming negative and positive wires.
H4	completes the rotary drive circuit.
H5	disconnects the earth from the release relay lead.
H6	disconnects battery via magnet RM and relay H from the incoming P wire.
H7	breaks the P wire circuit through the selector.

Interaction between the rotary magnet and its interrupter springs RM1 causes the wiper-carriage to step to the 12th rotary position, where the carriage restores vertically and returns along the normal level. During the vertical and horizontal release the rotary magnet is energized, the rotary magnet armature being prevented from engaging with the shaft and the RM1 springs not operated.

The NR and N springs restore.

NR Springs	restoring,
NR1	is ineffective at this stage.

N Springs	restoring,
N1	releases the rotary magnet.
N2	restores the testing-in battery to the incoming P wire.
N3	is ineffective at this stage.
N4	reconnects earth to contact A1.

3.2.2 All outlets on level engaged

The seizure and vertical and rotary stepping of the selector are as described in par. 3.2.1.1 with relays A and B held operated. If all the outlets are engaged, automatic rotary stepping continues until the wipers reach the 11th bank contact. The S springs operate.

S Springs	operating,
S1	disconnects the operate circuit of relay H and prepares an operate circuit for the overflow meter.
S2	prepares a busy tone circuit.
S3	is ineffective at this stage, see par. 3.2.7.

Relay HX	operating via the 11th bank contact.
HX1	disconnects the rotary drive circuit and operates relay CC.

Relay CC	operating,
CC1	disconnects the rotary drive circuit independently of contact HX1.
CC2	is ineffective at this stage.
CC3	transmits busy tone to the calling party.
CC4	operates the level overflow meter.
CC5	starts the common equipment via the TP start lead.

3.2.2.1 Release of the selector

Before release the following relays are held operated:- A, B, CC and HX.

The caller clears and relay A releases.

Relay A — releasing,
A1 — short-circuits relay B which releases.

Relay B — releasing after its slow release period,
B1 — disconnects earth from the release relay lead.
B2 — releases relay CC.
B3 — disconnects earth from the positive and P wires and prepares to reconnect the testing-in battery to the incoming P wire. The overflow meter is released.
B4 — disconnects earth from the vertical magnet circuit.
B5 — releases relay HX.

Relay CC — releasing,
CC1 — prepares the rotary drive circuit.
CC2) CC4) — are ineffective at this stage.
CC3 — disconnects busy tone from the A relay.
CC5 — disconnects the common equipment.

Relay HX — releasing,
HX1 — completes the rotary drive circuit.

The rectangular release of the selector mechanism is as described in par. 3.2.1.3 with the exception that the S springs restore also.

S Springs — restoring,
S1) S2) S3) — are ineffective at this stage.

3.2.3 Level barring

3.2.3.1 Spare level or level barred to incoming calls

The seizure and vertical stepping of the selector are as described in par. 3.2.1.1. When relay CD releases at the end of vertical stepping, relay CC remains held to R1 2000 ohm battery via the auxiliary bank contacts and appropriate strapping (see Note 2 on diagram).

Relay CD — releasing after its slow release period,
CD1 — leaves the hold circuit or relay CC dependent on contact B2.
CD2 — disconnects the vertical pulsing circuit independently of contact A1.
CD3 — transmits N.U. tone to the calling party.

3.2.3.2 C.C.B. subscriber dials a barred level (This paragraph applies only when a linefinder is associated)

The seizure and vertical stepping of the selector are as described in par. 3.2.1.1. When relay CD releases at the end of vertical stepping, relay CC remains held via the auxiliary bank contacts to a 150 ohms battery on the CB wire extended from the associated linefinder. (See Note 2 on diagram). The remainder of the circuit operation is as described in par. 3.2.3.1.

3.2.3.3 Release of the selector

The calling party clears and relay A releases.

Relay A — releasing,
A1 — short-circuits relay B which releases.

Relay B releasing after its slow release period,
B1 disconnects earth from the release relay lead.
B2 releases relay CC.
B3 disconnects earth from the P wire to release the associated linefinder and prepares to re-connect the testing-in battery to the P wire.
B4 disconnects earth from the vertical magnet circuit.
B5 is ineffective at this stage.

Relay CC releasing,
CC1 completes the rotary drive circuit.
CC2) CC4) are ineffective at this stage.
CC3 disconnects N.U. tone from relay A.
CC5 disconnects the common equipment.

The rectangular release of the selector mechanism is as described in par. 3.2.1.3.

3.2.4 Incoming junction call

3.2.4.1 When preceded by incoming equipment and linefinder

The selector can be taken into use on an incoming call from a distant exchange and the circuit operations are similar to those described in par. 3.2.1. In this case positive battery in the incoming junction circuit is connected to the M wire to provide for trunk offering, also for the disconnection of local call timing equipment. On levels 1 and 0, it effects barring of incoming calls.

When the selector switches, this positive battery is extended via the M wire to an outgoing junction circuit or final selector.

3.2.4.2 When directly connected to a junction, i.e. without a linefinder

(a) without preceding incoming equipment, i.e. on a unidirectional junction.

The connexion between U11 and U13 is omitted, and the circuit conditions previously described in par. 3.2.1 etc. apply, except as follows:-

(i) the circuit is seized via the loop, not via the negative wire.

(ii) dial tone is disconnected.

(iii) during forced-release from a spare or barred level, contact N4 prevents irregular testing in to free outlets or to the 11th contact, resulting from the reseizure of relay A while the mechanism is restoring to normal. Until the shaft has fully restored, relay B cannot reoperate.

(iv) since the CB and CBO wires are not connected, and U24 is not connected to the V.M.B., the 'make' action of contact CC2 is ineffective throughout and C.C.B. discriminating conditions will not be extended via the M wire.

(v) owing to the absence of an incoming equipment and its associated 'lock-out' relay P, arrangement is made to prevent continuous seizure and release of the tone and time-pulse equipment when the selector is seized without dialling. This is done by making the TP START earth dependent on contact N4. Start conditions for busy and NU tones are unaffected because contact N4 is operated when these are required.

(vi) positive battery (via the strap U7-32) is extended on the M wire by contact H1 when the uniselector tests in to a free outlet. This is recognized in the outgoing relay set (G.S.C. register and assistance traffic) on levels 1 and 0 as a barring condition to incoming junction calls. On other levels, it disconnects the local call timing equipment and prepares the final selector to receive trunk offering conditions.

(b) with preceding incoming equipment, e.g. on bothway and/or manual exchange junctions.

U points 11 and 13 are strapped, and the circuit conditions previously described in par. 3.2.1 etc. apply, except as follows:-

(i) the circuit is seized via the loop, not via the negative wire.

(ii) dial tone is disconnected.

(iii) since the CB and CBO wires are not connected and U24 is not connected to the V.M.B., the 'make' action of contact CC2 is ineffective throughout and C.C.B. discriminating conditions will not be extended via the M wire.

(iv) positive battery from the preceding incoming equipment is extended on the M wire by contact H1 when the selector tests in to a free outlet. This is recognized in the outgoing relay set (G.S.C. register and assistance traffic) on levels 1 and 0 as a barring condition to incoming junction calls. On other levels, it disconnects the local call timing equipment and prepares the final selector to receive trunk offering conditions.

3.2.5 Use as a second group selector

The preceding description in par. 3.2.4.2 (b) applies omitting the last par. (iv).

3.2.6 Forced release (by time pulse) if the selector is held:-

3.2.6.1 To a permanent loop

The seizure of the selector is as described in par. 3.2.1.1. The relays held operated are:- A, B, CD and CC. Following the time-pulse start period, relay TM operates.

Relay TM	operating,
TM1	completes the time-pulse release circuit.
TM2	holds relay TM via the TP hold lead.

Following the time-pulse release period H operates.

Relay H	operating,
H1) H6) H7)	are ineffective at this stage.
H2) H3)	release relay S.
H4	disconnects the rotary drive circuit independently of springs N1 and contact CC1.
H5	connects an earth to the release relay lead independently of contact B1.

Relay A releasing,
A1 short-circuits relay B and operates the vertical magnet VM. Relay B releases.

The vertical magnet operation steps the wipers to level 1 and the off-normal springs N operate. Relay CD is held in series with the vertical magnet.

N Springs operating,
N1 is ineffective at this stage.
N2 disconnects the testing-in battery from the P wire independently of contact B3.
N3 disconnects the operate winding of relay CD.
N4 disconnects earth from contact A1.

Relay B releasing after its slow release period,
B1) B5) B2) are ineffective at this stage.
B3 disconnects earth from the P wire to release the preceding linefinder and prepares to connect the testing-in battery to the P wire.
B4 releases the vertical magnet and relay CD.

Relay CD releasing after its slow release period,
CD1 releases relay CC.
CD2 is ineffective at this stage.
CD3 disconnects dial tone from, and connects N.U. tone to relay A.

Relay CC releasing,
CC1 prepares to complete the rotary drive circuit.
CC2) CC4) are ineffective at this stage.
CC3 disconnects N.U. tone from relay A.
CC5 releases relay TM and disconnects the common equipment.

Relay TM releasing,
TM1 releases relay H.
TM2 is ineffective at this stage.

Relay H releasing,
H1 re-connects earth to the M wire.
H2) H3) re-connects relay A to the negative and positive wires.
H4 completes the rotary drive circuit.
H5 disconnects earth from the release relay lead.
H6) H7) are ineffective at this stage.

The rectangular release of the selector mechanism is as described in par. 3.2.1.3.

3.2.6.2 On N.U. tone

The seizure and vertical stepping of the selector to a spare or C.C.B. barred level and the transmission of N.U. tone are as described in par. 3.2.3. The relays held operated are A, B and CC. Following the time-pulse start period relay TM operates.

Relay TM operating,
TM1 completes the time-pulse release circuit.
TM2 holds relay TM via the TP hold lead.

Following the time-pulse release period relay H operates.

Relay H operating,
H1)
H6) are ineffective at this stage.
H7)
H2) release relay A and disconnect N.U. tone from the
H3) negative and positive wires.
H4 disconnects the rotary drive circuit independently of contact CC1.
H5 connects an earth to the release relay lead independently of contact B1.

Relay A releasing,
A1 short-circuits relay B which releases.

Relay B releasing after its slow release period,
B1)
B4) are ineffective at this stage.
B5)
B2 releases relay CC.
B3 disconnects earth from the P wire to release the preceding equipment.

Relay CC releasing,
CC1)
CC2)
CC3) are ineffective at this stage.
CC4)
CC5 releases relay TM and disconnects the common equipment.

Relay TM releasing,
TM1 releases relay H.
TM2 is ineffective at this stage.

Relay H releasing,
H1 reconnects an earth to the M wire.
H2) reconnect relay A to the negative and positive
H3) wires.
H4 completes the rotary drive circuit.
H5 disconnects earth from the release relay lead.
H6)
H7) are ineffective at this stage.

The rectangular release of the selector mechanism is as described in par. 3.2.1.3.

3.2.6.3 On busy tone (all outlets on level engaged)

The circuit operations for all outlets on level engaged are described in par. 3.2.2.

The relays held operated are:- A, B, CC and HX.

Following the time-pulse start period relay TM operates.

Relay TM operating,
TM1 completes the time-pulse release circuit.
TM2 holds relay TM via the TP hold lead.

Following the time-pulse release period relay H operates.

Relay H operating,
H1)
H4) are ineffective at this stage.
H6)
H2) release relay A and disconnect busy tone from the
H3) negative and positive wires.
H5 connects an earth to the release relay lead independently of contact B1.
H7 short-circuits relay HX which releases.

Relay A releasing,
A1 short-circuits relay B which releases.

Relay HX releasing,
HX1 in conjunction with CC1 prepares the rotary drive circuit.

The remainder of the release is as described in par. 3.2.6.2 commencing with the release of relay B.

3.2.7 Association with a routine tester

The provision of test jack springs 9 and 10 in association with the S3 springs across relay HX facilitates the rotary stepping test of the selector, without the necessity for busying all outlets on the level under test, since relay HX can be short-circuited until the wipers reach the 11th outlet.

3.2.8 Association with a discriminator

When this selector is associated with a discriminator, it is often seized and stepped vertically when not required. To prevent rotary hunting and seizure of the next stage, a battery on the CC lead holds relay CC operated until the discriminator has decided to maintain the group selector route and permit rotary hunting, or release relay A and allow this selector to release.

4. DESIGN DETAILS

4.1 Relay timing information

To ensure satisfactory operation of the circuit, the lags of the timed relays should, under the appropriate circuit conditions, be within the limits shown in the table. All times are in milliseconds.

Relay	Release lag		Reason for lag
	Min.	Max.	
B (when short-circuited)	150	350	To hold during pulsing
CD	100	150	To hold during pulsing

4.2 Rectifiers are used for the following reasons:-

MR1) MR2) on incoming junction calls the rectifiers provide an operate circuit for relay K in the preceding incoming equipment when fitted, and prevent unnecessary drain on the positive battery supply, prior to the selector switching.

4.3 Resistors are used for the following reasons:-

R5 (a) prevents false operation of the vertical magnet on the release of relay A after the call has been switched through and (b) provides sufficient current to operate relay B.

4.4 This circuit has been designed to work in conjunction with the following common services:-

BUSY TONE EARTH	Diagram	AT 60131
DIAL TONE EARTH	"	AT 60131
TIME PULSE START, HOLD AND RELEASE	"	AT 5406 Fig. 2
RELEASE RELAY	"	AT 4082 Fig. 2
RELEASE ALARM EARTH	"	AT 4082 Fig. 2
N.U. TONE EARTH	"	AT 60131
POSITIVE BATTERY	"	AT 4082 Fig. 17

5. HISTORY

Issue A Wiring and Editorial changes to cater for working with linked numbering scheme discriminator. Note 8 amended. Notes 6 & 7 deleted. S.P.M. wiring deleted.

Issue B I.D.F. tags added for discriminator working - CC lead U point changed.

Issue C Contact B2 moved to prevent relay H operating to battery via resistor R3 to an earth extended on the P wire from the line relay set if relay CC has released and rotary action has commenced after sub flashes. Editorial corrections.

Telecommunications Development Department
TD 1/1/2/DW/447

March 1971

END OF DIAGRAM NOTES

Trim to these lines. 13"×8"

E-in-C. 384.

POST OFFICE ENGINEERING DEPT.
ENGINEER-IN-CHIEF'S OFFICE.

DIAGRAM TP.3006.

Drawn	Checked	Approved	Date	SUFFIX
D.H.T.	W.G. Jack	GHB	11-6-36	
Amendment: VERTICAL BANK WIRING AND NOTE 3 AMENDED			23-1-47	A

UNIT AUTO No.13A.

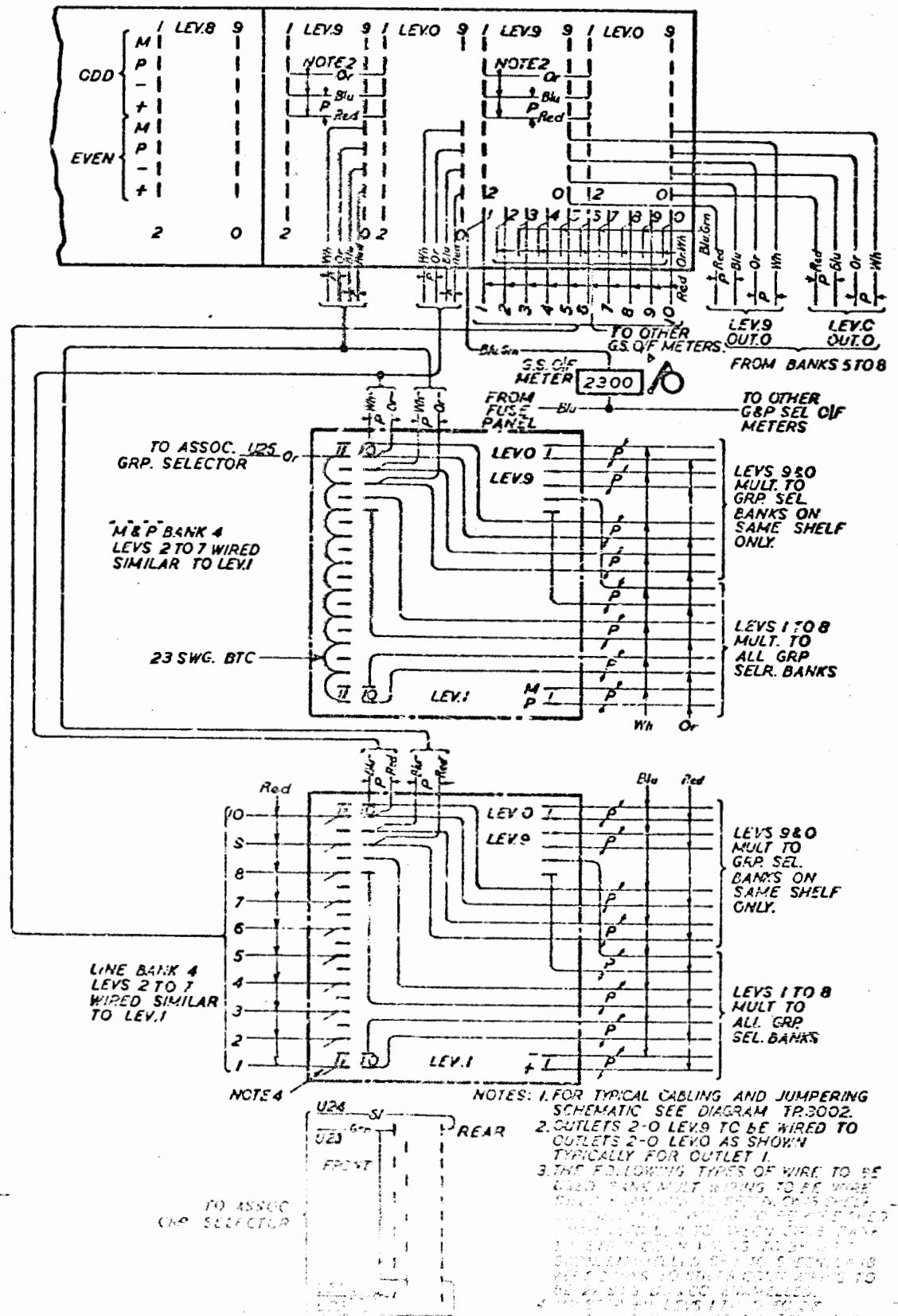
GROUP SELECTOR BANK

WIRING SCHEMATIC

SPECN T.1353.

BANK TO CONN. STRIP WIRING FOR LEVS 1 TO 0 BANKS 1 TO 4 TO BE SIMILAR TO THAT SHOWN FOR LEVS 9 & 0 OUTLET 0

BANK TO CONN. STRIP WIRING FOR LEVS 9 & 0 BANKS 5 TO 8 TO BE SIMILAR TO THAT SHOWN FOR LEVS 9 & 0 OUTLET 0.



NOTES: 1. FOR TYPICAL CABLING AND JUMPERING SCHEMATIC SEE DIAGRAM TP.3002.
2. OUTLETS 2-0 LEV.9 TO BE WIRED TO OUTLETS 2-0 LEV.0 AS SHOWN TYPICALLY FOR OUTLET 1.
3. THE FOLLOWING TYPES OF WIRE TO BE [illegible]