

DIAGRAM NOTES

concerning

NEPO 34195, ISSUE A

titled

INCOMING JUNCTION RELAY SET
WITH TOLL FACILITIES
OUT-OF-BOARD SIGNALLING 2000-TYPE

An explanation of the above circuitry is covered under the following headings:

1. GENERAL.
2. FACILITY SCHEDULE.
3. OUTLINE CIRCUIT OPERATION.
4. OPERATIONAL DETAILS.
 - 4.1 Calls from Distant Operator to Automatic Exchange Subscriber.
 - 4.1.1 Seizure.
 - 4.1.2 Operator Dials.
 - 4.1.3 Called Subscriber Answers.
 - 4.1.4 Recalls Operator.
 - 4.1.5 Subscriber Clears.
 - 4.1.6 Manual Hold.
 - 4.1.7 Release.
 - 4.1.8 Trunk Offering.
 - 4.1.9 Operator Re-ring.
 - 4.2 Calls from Distant Automatic Subscriber to Manual Board.
 - 4.2.1 Seizure.
 - 4.2.2 Operator Answers.
 - 4.2.3 Caller Clears-Manual Hold.
 - 4.2.4 Calling Party Recalls.
 - 4.2.5 Operator Clears before Calling Subscriber.
 - 4.2.6 Caller Clears after Operator.
 - 4.3 Auto-Auto Calls.
5. CIRCUIT DESIGN NOTES.

1. GENERAL.

1.1 This Diagram shows the circuit of a jack-in 2000-type relay set used in NZ 2000-type exchanges. The purpose of this relay set is to provide an interface between a loop disconnect signalling exit and an out-of-band signalling carrier system. The hybrid transformers are included in this relay set.

1.2 While these notes apply to Sheets 5 & 6 of the relay set, they will also give guidance to the principle of operation to sheet 1, bearing in mind some changes in facilities and contact numbering etc. The diagram should be considered in conjunction with the following diagrams:

- (a) NZPO 32548 B/W Termination at CB BMSB, etc.
- (b) GBW 15450 Self Level R/S SCS, or equivalent.
- (c) GBW 10760 or equivalent: Group Selector.
- (d) NZPO 34391 or equivalent: Electronic Timer.
- (e) NZPO 34179 o/g OOB R/S or equivalent.

2. FACILITY SCHEDULE.

Provision is made for -

2.1 Incoming unidirectional working.

2.2 Hybrid transformer providing a conversion from 2-wire line to 4-wire send/receive circuits.

2.3 Out-of-band signalling over the circuit on separate "E" and "M" signalling leads.

2.4 Routing of incoming calls from a distant operator or automatic exchange subscriber to a 2000-type selector, or to a manual board relay set direct or via an incoming selector.

2.5 A back busy signal to the distant outgoing OCS signalling relay set when the associated incoming selector or manual board relay set is -

- (a) on routine tests
- (b) has been basied or
- (c) has been jacked out.

2.6 A 600 or 900 ohm termination to hybrid two-wire line whenever this is not correctly matched, the value of resistance used depending on whether Fig. 2 (600 ohm) or Fig. 3 (900 ohm) type hybrid transformers are equipped.

2.7 Transmission of earth-dis-earth "P" wire sequence to the originating end on release and full junction guard until the selector is fully restored.

2.8 Manual Hold.

2.9 Operator Recall.

2.10 Repetition of "called subscriber answered" supervisory conditions.

2.11 Extension of an unbalanced line for the "4" and "5" wires to the final selector when "trunk effort" is required (Note 2.10).

3. OUTLINE CIRCUIT OPERATION.

3.1 Calls from distant operator to an automatic exchange subscriber.

3.1.1 Seizure. When the operator plugs into the circuit at the distant exchange, an earth is received over the carrier system via the "E" wire to operate relay LD. A loop is connected across the "-1" and "+1" wires to a group selector, which when seized returns an earth on the "P1" wire. This earth prepares the relay set for dialling.

3.1.2 Dialling. When the operator dials, Relay LD responds to the dial (earth) pulses on the "E" wire and a LD contact breaks the loop to the group selector (and progressively to any other selector). While LD is pulsing, relay CD operates and connects a termination across the 2-wire side of the Hybrid transformer (T1/T2). When dialling is finished and the "dial key" restored, the operator will hear the appropriate tone.

3.1.3 Called Line Free. If the called subscriber is free, and answers, the supervisory signal received from the final selector will be repeated to the distant manual board to provide supervision.

3.1.4 Operator Recall. By replacing and lifting the receiver alternately, the called subscriber may attract the operators attention by "flashing" the supervisory lamp.

3.1.5 Called Party Clears-Manual Hold. When the called subscriber clears, the LA earth is removed from the "M" wire and this causes the supervisory lamp in the cord circuit to light. The manual board relay set prevents the further release of the circuit. (This "Manual Hold" feature is used in the control of calls to or from Toll Manual Boards.)

3.1.6 Release. When the operator releases (after the subscriber has cleared and relay LA released), relay LD will be released from the "E" wire and the equipment being held is released. The circuit is now normal.

3.1.7 Trunk Offering. If the called subscriber is "busy", it is possible to offer the call. Operation of the manual board "ring key" results in this relay set unbalancing the loop extended to the incoming selectors. This unbalance causes the final selector to switch to the engaged line. The call is then offered to the subscriber who may clear. The "ring key" is again operated and the subscriber re-rung. When the subscriber answers normal supervisory signals are returned.

3.2 Calls from Distant Automatic Exchange to Manual Board.

3.2.1 Seizure.

(a) Manual board relay set directly connected -

When a calling subscriber is connected by the distant auto equipment to the outgoing OOB relay set at that exchange, an earth applied by the carrier equipment to the "E" wire of the incoming OOB relay set, operating relay LD.

This causes a loop to be placed across the directly connected manual board relay set GMB 15450 or equivalent, which lights a calling lamp on the switchboard and returns a "busy" earth on the P1 wire. Ringing tone is transmitted from the manual board relay set to the calling subscriber.

(b) Manual board relay set access via selector level -

Access to the manual board relay set from the incoming OOB relay set may be via the level of a selector connected to the incoming OOB relay set. In this case "seizure" and "dialling" occur as explained in 3.1.1 and 3.1.2. When the selector train has been positioned on the required MB relay set, the calling lamp is lit and ring tone returned as in 3.2.1 (a).

3.2.2 Operator Answers. When the operator inserts her answer plug in the jack associated with the manual board relay set, an answer signal is passed over the OOB carrier system to the distant O/G relay set, and the circuit is conditioned for speech.

3.2.3 Calling Party Clears - Manual Hold. When the calling subscriber clears, earth is removed from the "E" wire, and the operator cord circuit supervisory lamp glows indicating "calling subscriber cleared". Until the operator removes her plug, however, an earth will be maintained on the P1-wire by the manual board relay set. This manual hold condition is passed to the originating exchange via the OOB system, holding the calling subscriber and the intervening switching equipment.

3.2.4 Calling Party Recalls. If under "manual hold" conditions, the calling party lifts off his receiver, the calling loop will be received by the I/C OOB relay set as an earth on the "E" lead. The "-1" and "+1" wires to the manual board relay set will be looped, and the operator's supervisory will be dimmed.

3.2.5 Release. When the operator withdraws her plug, the manual board relay set removes the earth from the P1-wire. The "manual hold" condition is removed by the I/C OOB relay set, and the distant exchange equipment is released.

3.3 Auto-Auto calls. Details are given in the appropriate sub paras of para. 3.

4. OPERATIONAL DETAILS.

4.1 Calls from Distant Operator to Automatic Exchange Subscriber.

4.1.1 Seizure. When the operator plugs into the manual board relay set at the distant exchange, it causes an earth to be forwarded over the "E" wire to the incoming relay set, to operate relay LD.

Relay LD	operating;
LD1	loops the "-1" and "+1" wires to the group selector, via T1/T2.
LD2	disconnects the "P1" wire earth from the "E" wire and U.B.T. (Electronic Timer).

The loop on the "-1" "+1" wires causes an earth to be returned on the "P1" wire which operates relay RR via D3, IO1, RC3 and OD3.

Relay RR operating,

- RR1 provides a holding circuit for relay RR, independent of contacts RG3 and CD3.
- RR2 disconnects the "M" wire from U.E.1. and "P1".
- RR3 operates relay RG.

Relay RG operating,

- RG1 prepares circuit for Trunk offering.
- RG2 prepares circuit for U.E.1. "DO" lead and relay CD.
- RG3 disconnects the operating circuit for relay RR, and provides a holding circuit for relay RG, independent of contact RR3.

The circuit is now ready to receive dial pulses.

4.1.2 Operator Dials. The pulses from the Operator's dial pulse relay LD. On the first break pulse, relay LD releases.

Relay LD releasing (on first "break" pulse),

- LD1 disconnects the loop to the "-1" and "+1" wires.
- LD2 connects the "P1" earth to relay CD which operates, and to Electronic timer U.E.1. which starts timing the length of break pulse.

Relay CD operating,

- CD1 connects the 600 or 900 ohm termination across the 2-wire side of T1/T2 (Hybrid Transformer).
- CD2) connects "-1" and "+1" wires direct to the pulsing contact LD1.
- CD3 further disconnects the operating circuit for relay RR; places resistive shunt across relay RR for slugging purposes.

Relay LD operating (to "make" pulse),

- LD1 reconnects the loop to the "-1" and "+1" wires.
- LD2 disconnects the "P1" earth to relay CD, which remains operated during pulsing due to "slow release" and resets Electronic Timer U.E.1.

During dialling, relay LD pulses and relay CD remains operated.

Although the "DO" lead of U.E.1. is connected to the "P1" earth via the pulsing contact LD2, relay IG does not operate, unless the break pulse persists beyond 75 ms as measured by the electronic timer U.E.1.

The train of pulses actuates the group selector (and progressively any other selector).

When the dialling ceases, relay LD remains operated and relay CD releases.

Relay LD remains operated,

LD1 loops the "-1" and "+1" wires to the group selector, via T1/T2.

LD2 disconnects the "P1" wire earth from U.E.1. "DO" lead, resetting the Electronic Timer.

Relay CD releases,

CD1 disconnects the 600 or 900 ohm termination across T1/T2.

CD2) reconnects T1/T2 to "-1" and "+1" wires.
CD4)

CD3 has no useful function at this stage.

"Ring tone" will be heard from the final selector if the called line is free. Relays operated at this stage - LD, RR and RG. When the circuit is equipped with a 900 ohm hybrid transformer (Fig. 3), in the pre-answer condition an 1800 ohm termination is maintained across the hybrid 2-wire.

4.1.3 Called Subscriber Answers. When the called subscriber answers, the potential across the "-1" and "+1" wires is reversed, diode D5 ceases to pass current and relay LA will operate.

Relay LA operates,

LA1 disconnects R4/C4 or R6/R7/C4 termination across "-1" and "+1" wires.

LA2 connects earth to the "M" wire which extinguishes the supervisory lamp in the operators cord circuit.

Speech now takes place.

Relays operated while talking - LD, RR, RG and LA.

4.1.4 Recall Operator. If the called subscriber wishes to attract the attention of the operator, the switchhook is depressed and released slowly. This releases relay LA and takes the contact LA2 earth off the "M" wire, which has the effect of lighting the cord circuit supervisory lamp. Then when the switchhook is released, relay LA is re-operated and contact LA2 earth is re-applied to the "M" wire, which extinguishes the cord circuit supervisory lamp. The called subscriber equipment is not released, due to contact LD1 maintaining a loop on the "-1" and "+1" wires; this maintains an earth on "P1" wire. Relay LD is held by the operator's cord circuit (see par. 4.1.6).

4.1.5 Subscriber Clears. When the call is finished, the called subscriber replaces the receiver and releases relay LA.

Relay LA releasing,

LA1 reterminates R4/C4 or R6/R7/C4 termination across "-1" and "+1" wires.

LA2 disconnects earth from the "M" wire which causes the supervisory lamp in the operators cord circuit to light.

4.1.6 Manual Hold. Because relay LD is held by the manual board relay set until the operator removes the cord circuit plug, the circuit stays in this condition, known as "Manual Hold". Contact LD1 maintains a loop on the "-1" and "+1" wires and this causes the earth on "P1" wire to remain, holding the circuit.

Relays operated at this stage - LD, RR and RG.

4.1.7 Release. When the operator removes the plug from the jack of the manual board relay set, the earth is removed from the "E" wire.

Relay LD releases.

Relay LD releasing,

LD1 disconnects the loop across the "-1" and "+" wires (but see contact IG2).

LD2 connects the "P1" wire earth to the U.E.1. "DO" lead.

Relay CD operates, and the U.E.1. (Electronic Timer) will operate relay IG after 75 ms.

Relay CD operates,

CD1)
CD2) have no useful function at this stage.
CD4)

CD3 places resistive shunt across relay RR for slugging purposes.

Relay IG operates,

IG1 disconnects the "P1" earth from relay RR (which releases in 70-105 ms).

IG2 re-loops the "-1" and "+1" wires (loop persists until relay RG releases).

Relay RR releases (after 70-105 ms).

RR1 has no useful function at this stage.

RR2 "P1" earth is connected to the "M" wire to cause the relay set "Busy" lamp to light ("junction guard" letter).

RR3 disconnects relay RG (which releases in 160-240 ms).

Relay RG releasing (after 160-240 mS),
RG1 disconnects the loop to "-1" and "+1" wires.
RG2 (a) maintains U.E.1. (and relay IG) operated,
(b) and releases relay CD.
RG3 prepares fast re-operate of relay RR on next seizure.
Relay CD releases,

CD1)
CD2) have no useful function at this stage.
CD4)
CD5 completes fast re-operate of relay RR on next seizure.

The loop having been disconnected to the "-1" and "+1" wires, the earth on "P1" is dependent on the release of the selector train. When selectors are fully restored, U.E.1. (and relay IG) will release.

The circuit is now ready for further calls.

4.1.8 Trunk Offering (Note 5.2). If the called subscriber's line is busy, the operator hears "busy tone".

Relays operated at this stage - LD, RR and RG.

If the operator wants to offer the call to the called subscriber, the "ring key" in the operator's cord circuit is operated momentarily. This causes a "timed release" (of 200-300 mS) of relay LD.

Relay LD releases (for 200-300 mS).

LD1 disconnects the loop across the "-1" and "+1" wires (but see contact IG2).

LD2 connects the "P1" wire earth to the U.E.1. "DO" lead and also operates relay CD.

Relay CD operates,

CD1 connects the 600 ohm termination across the 2-wire side of T1/T2.

CD2)
CD4) connects "-1" and "+1" wires to contact IG2.

CD3 places resistive shunt across relay RR for slugging purposes.

Relay IG operates (75 mS after the earth is applied to U.E.1.),

IG1 disconnects the "P1" earth from relay RR (which releases in 70-105 mS).

IG2 re-loops the "-1" and "+1" wires.

Relay RR releases (after 70-105 ms),

- RR1 has no useful function at this stage.
- RR2 has no useful function at this stage.
- RR3 prepares the trunk offering earth signal and disconnects relay RG (but due to its release time, does not release).

Relay LD operates after "timed release",

- LD1 re-loops the "-1" and "+1" wires.
- LD2 disconnects the "P1" wire earth and releases U.E.1. and relays IG and CD (slow-to-release).

Relay IG releases,

- IG1 prepares the "P1" earth to re-operate relay RR via RY1 and contact CD3.
- IG2 connects the earth on contact RR3 to the "-1" wire, via contacts RG1 and CD2 (trunk offering earth signal).

Relay CD releases (slowly),

- CD1 has no useful function at this stage.
- CD2) re-connects T1/T2 to "-1" and "+1" wires.
- CD4)
- CD3 completes slow operate circuit (via thermistor RY1) for relay RR.

Relay RR operates slowly (via contact CD3 thermistor RY1, contact IG1 diode D3),

- RR1 provides holding circuit.
- RR2 has no useful function at this stage.
- RR3 disconnects the trunk offering earth signal.

The earth on the "-1" wire causes the final selector to go into a talking condition which reverses the potential across the "-1" and "+1" wires, this operates relay LA.

Relay LA operates,

- LA1 disconnects R4/C4 termination across "-1" and "+1" wires.
- LA2 connects earth to the "M" wire which extinguishes the supervisory lamp in the operator's cord circuit.

The operator may now offer the toll call to the called subscriber.

Relays operated at this stage -LA, LD, RR and RG.

4.1.9 Operator Re-ringing. If the called subscriber accepts the call, he is requested to replace the handset. This action releases relay LD which lights the cord circuit supervisory lamp as already described (par. 4.1.5).

By operating the "ring key", the circuit will function as in par. 4.1.8 and cause the called subscribers bell set to be rung.

The circuit now functions as in par. 4.1.3.

4.2 Calls from Distant Automatic Subscriber to Manual Board.

4.2.1 Seizure.

(a) Manual Board Relay Set Directly Connected -

When the distant outgoing OOB relay set is seized by a subscriber via the switching train, the OOB carrier system causes an earth to be placed on the "E" lead of the I/C relay set, operating relay LD.

Relay LD operating,

LD1 places the hybrid transformer windings, in series with ~~R3~~ ^{R5} and D5, across the "-1" and "+1" leads to the manual board relay set. The associated "call" lamp on the switchboard is lit, and an earth is returned by the manual board relay set on the P1 lead. This earth operates RR via D3, IG1, RG3 and CD3.

LD2 Disconnects the P1 lead from the electronic timer U.E.1.

Relay RR operating,

RR1 provides a hold circuit for RR independent of RG3 and CD3.

~~RR3~~ disconnects the "M" lead from U.E.1.

~~RR2~~ operates relay RG.

Relay RG operating,

RG1 prepares a short circuit path round LD1 conditional on the operation of IG.

RG2 prepares a circuit for CD and the delayed operation of the timer.

RG3 provides a holding circuit for RG independent of ~~RR3~~ ².

Ring tone is passed from the manual board relay set and, via the hybrid and carrier system, to the calling subscriber.

(b) Manual Board Relay Set Access via Selector Level -

In this case the seizure of the distant OOB relay set by the calling subscriber results in seizure of the I/C OOB relay set as explained in 4.1.1. The associated group selector is stepped as in 4.1.2 and a free manual board relay set is attached by this group selector. Seizure of the manual board relay set then occurs as described in 4.2.1 (a), the "call" lamp being lit and ring tone returned to the calling subscriber.

4.2.2 Operator Answers. When the operator inserts her answer cord, the manual board relay set reverses the polarity of potential on the -1, +1 wires. Diode D5 is now back-biased and relay LA operates. LA1 removes the 600 ohm (R_5) or 1800 ohm ($R_6 + R_7/2$) termination across the -1 and +1 wires. LA2 connects earth to the "M" wire causing the answer signal to be transmitted to the originating relay set.

Speech can now take place.

4.2.3 Caller Clears - Manual Hold. When the calling subscriber clears, the OOB carrier system causes the "E" lead earth to be removed, resulting in the release of relay LD.

Relay LD releasing,

LD1 opens the -1, +1 loop. The loop will however be released by 1G2 in 75 mS, at momentary (75 mS) release of relay LA occurs.

LD2 applies the P1 earth to the "delayed operation" lead DO of the electronic timer U.E.1 and to relay CD which operates.

Relay CD operating,

CD3 applies the R10A/R10B 900 ohm shunt to relay RR to render that relay slow to release.

In 75 mS, the earth applied to the electronic timer DO lead causes relay IG to operate.

Relay IG operating,

IG1 opens the RR circuit and relay RR releases after 70-105 mS.

IG2 re-closes the -1, +1 loop, re-operating LA.

RR releasing (70-105 mS),

RR2 connects the P1 wire earth via LD 2 to the M wire to hold the distant switching equipment via the OOB system. The momentary release of relay LA, being less than the release period of a B relay or its equivalent at the originating end, does not cause the release of the switching train.

RR3 releases RG (160-240 mS),

RG releasing,

RG1 disconnects the loop to the M.B. relay set, causing the "caller clear" supervisory lamp to light, and relay LA to release.

RG2 maintains U.E.1. (and relay IG) operated, and releases relay CD.

RG3 short circuits thermistor RY1, ensuring that relay RR will operate fast on the next seizure.

releasing.

LA1 re-terminates the hybrid 2-wire in 600 or 1800 ohm.

LA2 removes its earth from the M wire but this has previously been overlapped by the P1 earth via RR2, so no disconnection of M-wire earth occurs.

CD releasing,

CD3 prepares RR re-operate circuit.

As long as the operator's plug remains in the jack, the manual board relay set maintains the P1-wire earth, which, being applied to the "M" wire, is passed back to the originating relay set as a manual hold condition, and holds the calling subscriber's line circuit under control of the called operator.

4.2.4 Calling Party Recalls. Should the caller now lift off his receiver, his loop will cause the COB carrier system to apply an earth to the "E" lead of the I/C relay set operating relay LD.

Relay LD operating,

LD1 loops the "-1" and "+1" wires to the manual board relay set causing the supervisory lamp on the switchboard to be extinguished.

Relay LA re-operates,

LD2 disconnects the P1 earth from the "M"-wire and the timer IG lead, releasing relay IG.

LA re-operating,

LA1 removes the hybrid 2-wire termination.

LA2 applies earth to the "M" wire to hold the O/G relay set and switching equipment.

IG releasing,

IG1 applies P1-wire earth to relay RR which operates in its fast mode.

IG2 prepares the short circuit round LD1.

RR operating,

RR1 holds relay RR.

RR2 isolates the "M" wire.

RR3 operates RG.

- RG operating,
- RG1 further prepares the short circuit round LD 1.
- RG2 prepares for the operation of CD and the delayed operation of the timer.
- RG3 locks RG independent of RR3.

The circuit is again in the speech condition.

4.2.5 Operator Clears before Calling Subscriber. When the operator withdraws her plug the manual board relay set restores the polarity of the "-1" and "+1" wires, releasing relay LA.

- Relay LA releasing,
- LA1 restores the two wire hybrid termination.
- LA2 removes the earth from the M-lead and the distant O/G relay set registers the fact that the called party has cleared.

The switch train in the originating exchange, the OOB carrier system and associated relay sets, and the manual board relay set are now held under control of the caller's loop.

4.2.6 Caller Clears after Operator. When the caller clears, the calling loop is disconnected at the originating exchange. The OOB carrier system removes the E-lead earth, releasing relay LD.

- Relay LD releasing,
- LD1 opens the loop to the manual board relay set but this is released in 75 mS by the operation of IG.
- LD2 applies the P1-earth to the timer to operate CD immediately and IG in 75 mS.
- CD operating,
- CD1 terminates the hybrid in 600 or 900 ohms.
- CD3 applies a 900 ohm shunt (R10A and R10B) to relay RR to provide a release delay.
- CD2) switch the hybrid windings out of the holding loop.
- CD4)
- IG operating in 75 mS,
- IG1 removes the RR holding circuit from the P1-wire. RR releases slowly (70-105mS).
- IG2 re-applies the holding loop to the manual board relay set.
- RR releasing,
- RR2 connects the earth on P1 to the M-wire, providing a back-looping condition to hold the distant relay set until the manual board relay set has cleared.
- RR3 releases RG (150-240 mS).

- RG releasing.
- RG1 opens the holding loop and the manual board relay set starts to release.
- RG2 applies the P1-earth to the IO lead of the timer to hold IG, and removes it from relay CD which releases in its fast mode.

When the manual board relay set has released it removes the earth from the P1-wire and hence the M-wire and releases IG. All relays are normal. Should there be an intervening selector between the I/C junction-relay set and the manual board relay set this selector will restore on removal of the P1-earth by the MB relay set. An earth dis-earth sequence will be repeated on the M-wire during this action, releasing the distant switching equipment then re-guarding the junction during the restoration of the selector. When ultimately the M-wire earth is removed, the distant outgoing relay set will be available for calls.

4.3 Auto to Auto calls. Details are given in the appropriate sub paras of para. 4.

5. CIRCUIT DESIGN NOTES.

5.1 Relay CD.

- (a) Usual CD lag of 100-150 ms with diode D1 in parallel while relay RG is operated.
- (b) fast release (approximately 20 ms; on open circuit), when relay RG releases.

5.2 Relay IG. 75 ms operate lag from NZPD.34391. If the "break" signal to U.E.1. lasts longer than 75 ms, Relay IG operates performing the following functions:

- (a) Initiates the release of relay RR,
- (b) Recloses the loop to the selectors.

5.3 Relay RR. 70-105 ms release lag. If the "break" signal lasts longer than 145-180 ms, relay RR releases performing the following functions:

- (a) Opens its holding circuit,
- (b) Connects the "P1" wire to the send lead to transfer "P1" wire information to the originating end for junction guard purposes,
- (c) Initiates the release of relay RG and if Note 5.2 or 6.2 applies, prepares a Trunk Offering signal.

5.4 Relay RG. 160-240 ms release lag, on diode shunt. If the "break" signal lasts longer than 305-420 ms, relay RG will release, opening again the loop to the selectors.

This now releases the A relay in the final selector, which in turn initiates the release of relay B on its lag of 150-225 ms. This means that the B relay in the final selector releases only if the "break" pulse persists for 455-645 ms.

5.5 Relay RT. Operates when the Group Selector Routiner is about to seize the group selector for routing. Contacts of relay RT disconnect the "negative" and "positive" wires and prevent -

(a) the termination, and

(b) the Operator seizing the group selector, either of which interfere with the routiner tests. As soon as the selector is seized, a guarding earth is returned on the "P1" wire, which causes the manual relay set to "back busy" (light the Busy lamp).

5.6 Diode D1. Causes relay CD to have the usual release lag of 100-150 mS when relay RG is operated. Otherwise, a release lag of approximately 20 mS applies.

5.7 Diode D2. Causes relay RG to have a 160-240 mS release lag.

5.8 Diode D3. Isolates relay RR from the selector "P1" wire during the release sequence.

5.9 Diode D4. In conjunction with diode D6 prevents any interaction between CD/U.E.1. and "M" wire.

5.10 Diode D5. Polarises relay LA.

5.12 Diode D6. See D4.

5.12 Diode D7. Prevents relay RR being permanently locked via RR1, RG3, and RR3 to earth.

5.13 RX1. Non-linear resistor; provided to reduce sparking on contact IG1.

5.14 R10A and R10B. Provides resistive shunt across relay RR for slugging purposes when relay CD operates, thus giving a release time of 70-100 mS for relay RR.

5.15 PY1. (Thermistor 1A) delays the operation of relay RR thereby lengthening the time of the unbalance earth sent to the final selector.

5.16 Design Line Limits.

5.16.1 The loop Conductor Resistance on exit is 1400 ohms (relay LA).

5.16.2 The insulation resistance must not be less than 50,000 ohms from either wire to -

(a) any other wire, or

(b) to earth.

5.16.3 The Conductor Resistance on the "E" wire is 1450 ohms.

5.16.4 The Conductor Resistance on the "W" wire will be determined by the carrier equipment.

END OF TELEGRAM NOTES.