

DIAGRAM NOTES (ISSUE 2)

concerning

GBW.13770

titled

U.A.X. N.Z. 13

REVERTIVE CALL RELAY SET

GENERAL

The diagram shows the circuit arrangement of the equipment to be used for Revertive Call Relay Sets for 2-party and 5-party lines at a U.A.X. N.Z. 13 .

The diagram should be considered in conjunction with the following diagrams or their equivalents.

GBW.13760	Ringing Codes Circuit
GBW.13890	Group Selector

FACILITY SCHEDULE

Provision is made for:-

1. Revertive (party to party) calls on a 2- or 5- party line.
2. Holding the previous apparatus in the chain of connections.
3. Return of N.U. tone to the caller if an incorrect first ("tens") digit or an unallotted final digit is dialled.
4. Application of the appropriate ringing conditions to the line.
5. Forced release (under time pulse control) from permanent loop, NU tone, and called party fails to answer conditions.
6. Guarding the circuit against intrusion during the progress and release of a call.

CIRCUIT OUTLINE

The circuit is designed to receive two dialled digits.

The first digit (9) performs preliminary operating functions, preparing the circuit for the receipt of the second digit.

The second digit (0 in the case of a 2-party line and 1, 2, 3, 4, or 5 in the case of a 5-party line) prepares to connect the appropriate ringing condition to the line.

When the calling party restores the handset the ringing condition is connected to the line.

The called party answering trips the ringing, indicating to the calling party (whose instrument bell was also responding to the ringing) that the call has been answered. The calling party lifts the handset and the connection is established.

If the caller dials an incorrect first digit or an unallotted final digit N.U. tone is returned on the line.

Forced release is initiated in the event of a permanent loop or NU tone condition being sustained or if the called party does not answer within 180-380 secs.

Release is effected when both parties restore the handsets.

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## Circuit Detail

1. SEIZURE

The Group Selector switches to the R2 marking battery on the P wire, and the calling loop is extended via contacts PM2, PM3, H2 and H3 to relay A.

Relay A operating to the loop across the incoming line wires.

A1 operates relay B.

Relay B operating

B1 operates relay BR.

B2 prepares an operate circuit for the d-e winding of relay CD.

Relay BR operating.

BR1 earths the P wire to hold previous equipment.

BR2 disconnects the R2 marking battery from the P wire.

BR3 prepares the impulsing circuit for the CS switch magnet.

BR4 prepares a holding earth for relay FD.

BR5 extends earth via wiper CS5 on the home contact (No. 1) to operate relay CD on its d-e winding.

BR6 has no useful function at this stage.

Relay CD operating.

CD1 further prepares the impulsing circuit for the CS switch magnet.

CD2 )  
& ) have no useful function at this stage.

CD3 )  
CD4 connects relay TM to the time pulse start lead, preparing to force the release of the circuit if the caller fails to dial within 180 to 380 secs. (see par. 8(a) forced release).

CD5 has no useful function at this stage.

CD7 has no useful function at this stage.

CD8 disconnects the operate circuit of relay NU.

The circuit is now ready to receive the first impulse train ("tens" digit).

Relays operated at this stage:- A, B, BR, CD.

2. DIALLING THE "TENS" DIGIT

The caller dials the "tens" digit.

Relay A responding to the "tens" impulse train.

A1 repeats the impulses to the CS switch magnet in series with the a-b winding of relay CD.

The CS switch wipers rotate to the position corresponding to the digit dialled. When wiper CS5 moves off the home contact the d-e winding of relay CD is disconnected.

At the end of the impulse train relay A is held by the calling loop.

Relay A holding

A1 releases relay CD (slow-to-release) and holds relay B which, being slow-to-release, held during impulsing.

Relay CD releasing at the end of its slow release period

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

CD3 )  
CD4 disconnects the forced release circuit.

CD5 - see (a) below

CD7 has no useful function at this stage.

CD8 - see (b) below

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There are now two possibilities (a) digit 9 dialled - one impulse, or (b) incorrect digit dialled.

Relays operated at this stage:- A, B, BR.

(a) digit 9 dialled.

Relay CD having released as above, contact CD5 extends earth at contact BR5 via wiper CS5 on bank contact No. 1 and contact FD1 to operate relay FD.

Relay FD operating

- FD1 holds relay FD to earth at contact BR4.
- FD2 prepares an operate circuit for relay E.
- FD3 connects relay NU to contacts 3, 4, 5 and 6 of the CS4 arc, preparing to return NU tone to the caller if the next digit dialled is an unallotted digit.
- FD4 disconnects the CS switch homing circuit against the release of contact BR3.
- FD5 further earths the P wire against the release of contact BR1.
- FD6 extends earth at contact BR5 via wiper CS5 on bank contact No. 2 and contact B2 to operate relay CD on its d-c winding.

Relay CD operating

- CD1 prepares the impulsing circuit for the CS switch magnet.
- CD2 - See Circuit Notes.
- CD3 extends earth at contact BR5 via contact FD2 to operate relay E.
- CD4 prepares the forced release circuit.
- CD5 has no useful function at this stage.
- CD7 }  
& } have no useful function at this stage.  
CD8 }

Relay E operating

- E1 prepares an operate circuit for relay NP or H from wiper CS3.
- E2 has no useful function at this stage.
- E3 provides an alternate hold circuit for relay E against the release of contact CD3.
- E4 further disconnects the CS switch homing circuit against the release of contact BR3.
- E5 - See Circuit Notes.

The circuit is now ready to receive the final digit.

Relays operated at this stage:- A, B, BR, CD, FD, E

(b) incorrect digit dialled.

Relay CD having released as above, contact CD8 extends earth via contacts BR6 and FD3 to operate relay NU.

Relay NU operating

- NU1 connects N.U. tone to a winding of relay A, whence it is induced into the lines and returned to the caller.
- NU2 extends the relay TM earth via the time pulse start lead to relay TA in the ring and tone circuit, providing an alternative machine start condition. Forced release is initiated if the caller fails to replace the handset within 180-380 secs.

For release see par. 7(b) and 8(c).

3. DIALLING THE UNITS DIGIT.

The caller, having dialled the correct "tens" digit, now dials the "units" digit.

Relays operated at this stage:- A, B, BR, CD, FD, E.

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Relay A responding to the "units" impulse train

A1 reports the impulses to the CS switch magnet in series with the a-b winding of relay CD.

The CS switch wipers rotate to the position corresponding to the digit dialled. When wiper CS5 moves off bank contact No. 2 the d-e winding of relay CD is disconnected. Relay CD still holds owing to the impulses passing through the a-b winding and to the slow release slug.

At the end of the "units" impulse train relay A is held by the calling loop

Relay A holding

A1 releases relay CD (slow-to-release) and holds relay B which, being slow-to-release, held during impulsing.

Relay CD releasing at the end of its slow release period.

CD1 has no useful function at this stage.  
 CD2 connects earth via contact E5 to relay FD, providing an alternative holding circuit for relay FD against the release of contact BR4.  
 CD3 leaves relay E dependent on Contact E3.  
 CD4 has no function at this stage due to relay E being operated.  
 CD5 has no useful function at this stage.  
 CD7 has no useful function at this stage.  
 CD8 connects earth via contact BR6 to wiper CS4, operating relay NU if an unallotted final digit has been dialled

There are now three possibilities.

- (a) Digit 0 dialled - 2-party line working, see par. 4.
- (b) Digit 1, 2, 3, 4 or 5 dialled - 5-party line working, see par. 5.
- (c) Digit 6, 7, 8 or 9 dialled - unallotted digit, see par. 6.

4. 2-PARTY LINE WORKING.

If the final digit dialled was "0" (10 impulses), the CS switch wipers will have been stepped to position 12, and relay CD will have released as above. No further action takes place until the caller restores the handset, or forced release takes place.

Relays operated at this stage:- A, B, BR, FD, E

When the handset is restored the line loop is broken and relay A releases.

Relay A releasing

A1 releases relay B (slow-to-release)

Relay B releasing at the end of its slow release period.

B1 release relay BR  
 B2 has no useful function at this stage.

Relay BR releasing,

BR1 leaves the P wire earth dependent on contact FD5.  
 BR2 }  
 & } have no useful function at this stage.  
 BR3 }  
 BR4 leaves relay FD dependent on earth at contact E5 via contacts CD2 and FD1  
 BR5 releases relay E (slow-to-release) and extends earth via contact E1 to operate relay H.  
 BR6 has no useful function at this stage.

Relay H operating during the release lag of relay E.

- H1 provides an alternative hold circuit for relay FD against the release of contact E5
- H2 } switch the lines from relay A to the ringing circuit,
- & } connecting ringing current to the lines as detailed below.
- H3 }
- H4 prepares a hold circuit for relay F on its a-b winding
- H5 provides a hold circuit for relay H against the release of contact E1.
- H6 connects relay RS to the "Revertive Ring Pulse" lead.
- H7 prepares to connect the forced release circuit, on the release of E2.

Relay E releasing at the end of its slow release period.

- E1 leaves relay H holding via contact H5
- E2 leaves the forced release circuit dependent on H7
- E3 } have no useful function at this stage
- & }
- E4 }
- E5 leaves relay FD dependent on contact H1

Relay RS responds to the revertive ring pulses on the "Revertive Ring Pulse" lead

- RS1 } connect cont. ring via the d-e winding of relay F
- & } and Ring Rot. Batt. via resistor R3
- RS2 } to the -ve and +ve line wires alternately to ring both party line subscribers' bells alternately. ( $\frac{1}{2}$  sec. on,  $\frac{1}{2}$  sec. off)

Forced release is provided if the called party does not answer within 180 to 380 secs. (see par. 8).

Relays operated at this stage:- FD, H, (RS)

The called party answers

The called party lifts the handset, looping the line and operating relay F on its d-e winding.

Relay F operating

- F1 (x) - early break - disconnects the short circuit from the a-b winding of relay F, which holds.
- F2 } disconnect the ringing circuit and connect relay A across the line
- & }
- F3 }

Relay A operating to the line loop

- A1 operates relay B

Relay B operating

- B1 operates relay BR
- B2 has no useful function at this stage

Relay BR operating

- BR1 } have no useful function at this stage
- BR2 } & }
- BR3 }
- BR4 provides an alternative holding earth for relay FD against the release of contact H1.
- BR5 releases relay H
- BR6 has no useful function at this stage

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Relay H releasing

- H1 leaves relay FD dependent on earth at contact BR4.  
 H2 } further connects relay A across the line against the release of  
 & } contacts F2 and F3  
 H3 )  
 H4 releases relay F  
 H5 has no useful function at this stage  
 H6 disconnects relay RS from the "Revertive Ring Pulse" lead  
 H7 disconnects the forced release circuit

Relay F releasing

- F1 has no useful function at this stage  
 F2 }  
 & } leave relay A connected to the line via contacts H2 and H3  
 F3 )

The ringing having ceased, the calling party knows that the called party has answered and may now pick up the handset. The call is now established and conversation may proceed.

Relays operated at this stage:- FD, A, B, BR

5. 5-PARTY LINE WORKING

If the final digit dialled was 1, 2, 3, 4 or 5 the CS switch wipers will have stepped to the position (11, 10, 9, 8 or 7 respectively) corresponding to the digit dialled, and relay CD will have released as above. No further action takes place until the caller restores the handset or forced release takes place.

Relays operated at this stage:- A, B, BR, FD, E

When the handset is restored the line loop is broken and relay A releases.

Relay A releasing

- A1 releases relay B (slow-to-release)

Relay B releasing at the end of its slow release period

- B1 releases relay BR  
 B2 has no useful function at this stage.

Relay BR releasing

- BR1 leaves the P wire earth dependent on contact FD5  
 BR2 }  
 & } have no useful function at this stage  
 BR3 )  
 BR4 leaves relay FD dependent on earth at contact E5 via contacts CD2 and FD1  
 BR5 releases relay E (slow-to-release) and extends earth via contact E1 to operate relay MP  
 BR6 has no useful function at this stage

Relay MP operating during the release lag of relay E

- MP1 provides an alternative hold circuit for relay FD against the release of contact E5  
 MP2 prepares to connect the forced release circuit, on the release of E2  
 MP3 provides a hold circuit for relay MP against the release of contact E1  
 MP4 earths the machine start lead  
 MP5 connects relay PM to the ring start and hold leads

Relay PM operating when the next ring start pulse occurs

- PM1 holds relay PM for the duration of the ring hold pulse  
 PM2 connects the -ve line wire to contact AC1  
 PM3 connects the +ve line wire to ring return earth

PM4 connects relay AC via wiper CS6 to the ringing code lead (A, D, M, R or S) corresponding to the final digit dialled (1, 2, 3, 4 or 5 respectively).

Relay AC responding to the ringing code earth pulses

AC1 when operated connects Cont. Ring, to the -ve line wire

Relay PM restoring at the end of the ring code hold pulse

PM1 disconnects the ring code hold lead  
 PM2 }  
 & } re-connect the lines to relay A  
 PM3 }  
 PM4 disconnects relay AC from the ringing code conductor

Relay PM then remains unoperated for 2.1 - 2.4 secs. until the next ring start pulse occurs. The code ringing cycle then repeats until the called party answers.

Forced release is provided if the called party does not answer within 180-380 secs. (see par. 8).

Relays operated at this stage:- FD, MP, (PM, AC)

The called party answers

The called party lifts the handset, looping the line. During the next unoperated period of relay PM the line loop is extended via contacts H2 and H3 to relay A.

Relay A operating

A1 operates relay B

Relay B operating

B1 operates relay BR  
 B2 has no useful function at this stage

Relay BR operating

BR1 }  
 BR2 }  
 & } have no useful function at this stage  
 BR3 }  
 BR4 provides an alternative holding earth for relay FD against the release of contact MP1  
 BR5 releases relay MP  
 BR6 has no useful function at this stage

Relay MP releasing

MP1 leaves relay FD dependent on earth at contact BR4  
 MP2 disconnects the forced release circuit  
 MP3 further disconnects the relay MP hold circuit  
 MP4 disconnects earth from the machine start lead  
 MP5 disconnects relay PM from the ring start lead

The ringing having ceased, the calling party knows that the called party has answered and may now pick up the handset. The call is now established and conversation may proceed.

Relays operated at this stage:- FD, A, B, BR

6. UNALLOTTED FINAL DIGIT DIALLED

If the final digit dialled was 6, 7, 8 or 9 the CS switch wipers will have stepped to the position (6, 5, 4 or 3 respectively) corresponding to the digit dialled and relay CD will have released as above.

Earth at contact CD2 is now extended via contact BR6, wiper CS4 on bank contact No. 3, 4, 5 or 6 and contact FD3 to operate relay NU.  
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Relay NU operating

- NU1 connects NU tone to a winding of relay A, whence it is induced into the lines and returned to the caller.
- NU2 extends the relay TM earth via the time pulse start lead to relay TA in the ring and tone circuit, providing an alternative machine start condition.

The caller must now restore the handset. For release see par. 7(b) and 8.

7. RELEASE.

(a) Release of successful call

Release takes place when both caller and called party restore their handsets.

The last party to replace the handset breaks the line loop and releases relay A.

Relay A releasing

- A1 releases relay B (slow-to-release)

Relay B releasing at end of its slow release period

- B1 releases relay BR
- B2 has no useful function at this stage

Relay BR releasing

- BR1 leaves the P wire earth dependent on contact FD5
- BR2 prepares to re-connect the R2 marking battery to the P-wire
- BR3 prepares the CS switch homing circuit
- BR4 releases relay FD
- BR5 }  
& } have no useful function at this stage  
BR6 }

Relay FD releasing

- FD1 disconnects the hold circuit of relay FD
- FD2 }  
& } have no useful function at this stage  
FD3 }
- FD4 completes the CS switch homing circuit
- FD5 disconnects earth from the P wire, releasing previous equipment, and prepares to re-connect the R2 marking battery
- FD6 has no useful function at this stage

The CS switch wipers rotate to the home position (No. 1), where the driving circuit is broken at wiper CS1. The R2 resistance battery is connected to the P wire via wiper CS2 on the home contact and contacts BR2, CD7 and FD5,

The circuit is now ready for another call.

(b) Release when N.U. tone is being returned to the caller.

If N.U. tone is being returned the caller must replace the handset. This causes the line loop to be broken and releases relay A.

Relay A releasing

- A1 releases relay B (slow-to-release)

Relay B releasing

- B1 releases relay BR
- B2 has no useful function at this stage

Relay BR releasing releases relays NU and E (if operated), and relay FD is released when contact E5 breaks



The CS switch is stepped by self-interruption to the home position (No. 1), where the driving circuit is broken at wiper CS1. The R2 resistance battery is connected to the P wire via wiper CS2 on the home contact and contacts BR2, CD7 and FD5.

The circuit is now ready for another call.

#### 8. FORCED RELEASE.

Arrangements are made to release the circuit by time pulse release when any of the following conditions have lasted for between 180 - 380 secs:-

- (a) if the caller fails to complete dialling after seizing the circuit or after dialling the "tens" digit.

Contact CD4 operated connects relay TM to the Time Pulse Start lead.

- (b) called party fails to answer.

Contact MP2 or H7 operated connects relay TM to the "Time Pulse Start" lead.

- (c) NU tone is being returned to the caller. Contact MU2 connects relay TM to the "Time Pulse Start"

The first start pulse to occur after one of these conditions has been set up will operate relay TM.

#### Relay TM operating

TM1 enables relay TM to hold to the "Time Pulse Hold" lead  
TM2 operates relay TMR

If the initiating condition continues for a further 180 secs. the release pulse will bring about the release of the circuit as follows:-

- (a) caller has failed to complete dialling

Contact A1 is operated and TMR1 releases relay B

#### Relay B releasing at the end of its slow release period

B1 releases relay BR  
B2 releases relay CD

Relay BR releasing releases relays FD and E and disconnects the earth from the P wire, releasing previous equipment. The release of the group selector breaks the calling loop and relay A releases.

The CS switch is stepped by self-interruption to the home position (No. 1), where the driving circuit is broken at wiper CS1. The R2 resistance battery is connected to the P wire via wiper CS2 on the home contact and contacts BR2, CD7 and FD5.

The circuit is now ready for another call.

- (b) called party fails to answer.

Contact BR5 is unoperated and contact H5 (or MP3) is operated, and TMR2 releases relay H (or MP)

#### Relay H releasing

H1 releases relay FD  
H2 } connect relay A to the line. A operating has no effect  
H3 }  
H6 disconnects relay RS from the "Revertive Ring Pulse" lead  
H7 disconnects the forced release circuit

Relay MP releasing

MP1 releases relay FD  
 MP2 disconnects the forced release circuit  
 MP4 disconnects the machine start condition  
 MP5 disconnects relay PM for the "Ring Start" lead

Relay FD releasing completes the CS homing circuit, via contact FD4.

The CS switch is stepped by self-interruption to the home position (No. 1), where the driving circuit is broken at wiper CS1. The R2 resistance battery is connected to the P wire via wiper CS2 on the home contact and contacts BR2, CD7 and FD5.

The circuit is now ready for another call.

- (c) NU tone is being returned to the caller. The disconnections are as in (a) above.

CIRCUIT NOTES(a) Relay A

Made high impedance at speech frequencies to prevent speech currents leaking to battery.

(b) Relay B

Made slow-to-release to enable it to hold during impulsing of relay A.

(c) Relay CD

Made slow-to-release to enable it to hold on its a-b winding during impulsing of relay A.

(d) Relay E

Made slow-to-release to prevent disconnection of BR5 earth at contact E1 before relay MP or H has had time to operate on the release of contact BR5.

(e) Relay F

Made slow-to-operate to ensure that it is fully fluxed before it operates.

(f) Contacts CD2, E5, B2, FD6

In the event of the calling party restoring the handset after dialling the first digit (i.e. without completing the Call) contacts CD2 (operated), E5 (operated), B2 (normal) and FD6 operated provide a hold circuit for relay CD, delaying the release of CD to enable the circuit to release correctly.

END