

SIZE	E- 610057	SHEET 1	TOTAL 8
AUTOMATIC ELECTRIC CO. NORTHLAKE, ILLINOIS U.S.A.			

## CIRCUIT EXPLANATION

M

OUTGOING TRUNK CIRCUIT  
 AUTO TO AUTO OR AUTO TO MANUAL,  
 CLR HOLDING, CLASS OF SERVICE TONE,  
 E & M SIGNALING  
 H-610057

(Written specifically for circuit issue 19\*  
 but may also apply to later issues. Refer  
 to H print for appropriate E issue number.)

\*Not Updated for NAFM FIGS

GENERAL

Changed  
 GENERAL  
 numbering  
 and Sec-  
 tions

2.01.2,  
 2.01.3,  
 2.01.5.1,  
 and  
 2.01.5.2  
 8/72: mb  
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G.O.C.  
 Chavaz  
 Issue 6

This circuit is arranged to operate with two types of compos-  
 ite signaling equipment, Lenkurt Carrier Type 45 and Polar-  
 Duplex. Signals are received via lead E and are sent via  
 lead M.

FEATURES

- (a) Arranged for ring-back tone for auto-to-manual operation
- (b) Arranged to provide class-of-service tone on calls from local office
- (c) Provides Line termination, Peg count, and ATB indication
- (d) Arranged for CLR holding
- (e) Arranged for use with Carrier or Polar duplex signaling equipment

CIRCUIT OPERATIONCarrier ("Y" strap)

In the "normal" state, lead M is open. In the "seized" state, resistance (lamp L) battery is connected to lead M. Resistor E and capacitor A provide spark suppression across the pulsing contacts of A. When lead M is in the "seized" state at one end of the trunk, lead E is grounded at the other end. When lead M is in the "normal" state at one end, lead E is open at the other end.

WRITTEN BY

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APPROVED

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ISSUE

6

DRAWING NO.

E- 610057

Polar-Duplex ("X" strap)

In the "normal" state, direct ground is connected to lead M. In the "seized" state, resistance (lamp L) battery is connected to lead M. Resistor E is connected across the pulsing contacts of A to prevent false operation of the signaling relay associated with the Polar-Duplex equipment. As with Carrier, lead E is grounded when the distant M lead is in the "seized" state and is open when the distant M lead is in the "normal" state.

In order to avoid repetition of the above conditions, every time the state of lead M changes, the status of lead M will be referred to as "normal" or "seized" in accordance with the above description.

1.00 FIGS 1, 2, 3 (NAFM)1.01 Outgoing Calls from Toll Selector1.01.1 Seizure

Resistance (#2H) battery via lead C marks this circuit idle to the preceding selector. Upon seizure, the loop is closed to A via leads -L and +L (if reverse battery is not required) or via leads -REV and +REV (if reverse battery is needed for answer supervision). Relay A operates, closes B, removes ground from lead ATB, and changes the status of lead M from its "normal" to its "seized" state. Relay B operates, closes #2F, and grounds lead C (via lead C1 or "Z" wiring, if provided) to mark this circuit busy and to hold the preceding equipment. Relay F operates to its "X" contacts only, removes line termination from the loop, and connects lead RB TONE (if provided - NOTE 12 of H-610057) to lead -L or -REV via capacitors D and B.

1.01.2 Pulsing (Operated: Relays A, B, and "X" contacts of F)

Relay A follows the pulses of the dialed digit, and when at normal, opens B, closes C, and changes lead M from its "seized" state to its "normal" state to repeat the pulses to the succeeding equipment. On the first pulse, C operates and disconnects lead -L from lead R(-) and connects resistance bridge across leads R(-) and T(+). Due to their slow-to-release characteristics, B and C remain operated during pulsing.

After the last pulse of the dialed digit, A re-operates, closes B, opens C, and changes lead M from its "normal"

state to its "seized" state. After its slow-to-release interval, C restores and connects lead -L to lead R(-) and disconnects resistance bridge from across leads R(-) and T(+).

### 1.01.3 Supervision (Operated: Relays A, B, and "X" contacts of F)

#### 1.01.3.1 Without "T" Strap

If the called line is busy, busy tone is returned to the calling party from the succeeding equipment via leads R(-) and T(+). When the call is from the local office (leads -L, +L and C) no supervision is required other than a class-of-service tone.

When the called party answers, ground via lead E closes #1H. Relay H operates and closes K (FIG. CT if used) and 1. Relay F operates fully and disconnects lead RB **TONE** from lead -L. Relay K (FIG. CT if used) operates, locks, removes the short circuit from #1D, and initiates operation of its weighted spring. The weighted spring oscillates and closes J intermittently. Due to its slow-to-operate interval, J does not operate until the oscillation of the spring decreases sufficiently. Battery via lead C closes #1D. Relay D operates and connects its #2 winding in series with capacitor B across leads -L and +L, closing a loop across leads -L and +L. Class-of-service tone present on the C lead is detected by the called Operator. When the oscillations of the weighted spring of K decreases sufficiently, J is closed. After its slow-to-operate interval, J operates, locks, opens K, and opens #2D, removing the class-of-service tone from the trunk facility. Relay K restores and short-circuits #1D. Relay D restores,

If the call is from a tandem office (leads -REV, +REV and C), D does not operate. When the Operator answers, H operates as previously described, closes #1F and K, and reverses battery via leads -REV and +REV for **answer** supervision. Class-of-service tone is sent to the Operator from the tandem office. Relays F, K, and J operate as previously described, but K and J, in operating, have no effect on this circuit since the call is from a tandem office.

#### 1.03.1.2 "T" Strap

The operation is similar to that described in Section 1.03.3.1 except when D operates the loop across leads -L and +L is closed via "T" strap.

#### 1.04 Recall to Distant Office (Operated: Relays A, B, F, H and J)

If the calling party wishes to recall the distant office Operator, the intermittent operation of the telephone hook-switch will cause A to intermittently change the status of lead M to signal the distant office Operator.

#### 1.05 Release (Operated: Relays A, B, F, H, and J)

##### 1.05.1 Auto to Manual ("H" wiring)

When the calling party disconnects #1 and #2A are opened. Relay A restores, closes C, and returns lead M to its "normal" state to give the Operator "on-hook" supervision. Relay C operates. When the Operator disconnects, ground is removed from lead E which opens #1H. Relay H restores and opens J, B and #1F. Relay J restores. After its slow-to-release interval B restores, opens C and #2F, grounds lead PC and removes the ground from lead C to release the preceding equipment. Relay F restores. After its slow-to-release interval C restores, transfers ground from lead PC to lead ATB, and connects resistance (#2H) battery to lead C to mark this circuit idle. The circuit is now at normal.

##### 1.05.2 Auto to Auto (Without "H" wiring)

When the calling party disconnects #1 and #2A are opened. Relay A restores, opens B, closes C and returns lead M to its "normal" state to give the Operator "on-hook" supervision. Relay C operates. When the Operator disconnects, ground is removed from lead E which opens #1H. Relay H restores and opens J and #1F. Relay J restores. After its slow-to-release interval, B restores, opens C and #2F, grounds lead PC and removes the ground from lead C to release the preceding equipment. Relay F restores. After its slow-to-release interval C restores, transfers ground from lead PC to lead ATB, and connects resistance (#2H) battery to lead C to mark this circuit idle. The circuit is now at normal.

#### 1.06 Test Facilities

To perform a local pulse repeating test of the pulse repeating relay (A) in this trunk circuit, a hand test telephone is initially inserted into springs 1 and 2 of the TEST JACK to determine whether the circuit is idle or in use. If idle, the BUSY KEY is operated to prevent associated equipment from seizing the circuit.

The plug from an Impulse Speed and Percent Make Test Set (H-75401 or equivalent) is then inserted into springs 7 and 8 of the TEST JACK and the PULSE TEST KEY is operated. The pulsing relay (A) follows the pulses from the hand test telephone and repeats these pulses to the Test Set for measuring.

## 2.00 FIGS. 4A, 5A, 6A and 7A

### 2.01 Outgoing Calls From Toll Selector

#### 2.01.1 Seizure

Resistance (resistor N) battery via lead C marks this circuit idle to the preceding Selector. Upon seizure, the loop is closed to #1 and #2A via leads -L and +L (if reverse battery is not required) or via leads -REV and +REV (if reverse battery is needed for answer supervision). Relay A operates, closes B, removes ground from lead ATB, and changes the status of lead M from its "normal" to its "seized" state. Relay B operates, closes #2D, transfers lead C from resistance (resistor N) battery to ground to mark this circuit busy and to hold the preceding equipment, and connects resistor L across leads R(-) and T(+) and -L and +L or -REV and +REV. Relay D (2-step) operates to its "X" contacts, removes idle line termination from across leads R(-) and T(+), and connects lead RB TONE to lead -L or -REV via capacitors B and D in series (dial-to-dial operation not provided, see NOTE 12, H-610057), providing ring-back tone for the calling party.

#### 2.01.2 Pulsing (Operated: Relays A, B, and "X" contacts of D)

Relay A follows the pulses of the dialed digit, and when at normal, opens relay B, closes relay C, and changes lead M from its "seized" state to its "normal" state to repeat the pulses to the succeeding equipment. On the first pulse, relay C operates, connects capacitor C2 in series with a resistor (100 ohms) across leads +(L) and -L or +REV and -REV, and connects the resistance bridge (resistor G) across leads T(+) and R(-). Due to their slow-to-release characteristics, relays B and C remain operated during pulsing.

After the last pulse of the dialed digit, relay A re-operates, closes relay B and opens relay C, and changes lead M from its "normal" to its "seized" state. After its slow-to-release interval, relay C restores, and connects lead -L

SHEET 6

E- 610057

or -REV to lead R(-), disconnects capacitor C2 in series with a resistor (100 ohms) from across leads +L and -L or +REV and -REV, and disconnects the resistance bridge (resistor G) from across leads T(+) and R(-).

### 2.01.3 Supervision (Operated: Relays A, B, and "X" contacts of D)

If the called line is busy, busy tone is returned to the calling party from the succeeding equipment via leads R(-) and T(+). When the call is from the local office (leads -L, +L, and C), no supervision is required other than a class-of-service tone.

When the called party answers, ground via lead E closes H. After its slow-to-operate interval, H operates, closes #1D, reverses battery polarity to leads +REV and -REV, and transfers lead RC from ground to lead ST, discharging capacitor C1 via resistor R1 in series with the multiple combination of TN and resistor R2 in series with potentiometer R3, thereby closing TN. Relay D operates fully, disconnects lead RB TONE from lead -L, disconnects resistance (relay C in series with resistors M, R4, and R5, or resistors M and R4 if wiring R used - see NOIE 78, H-610057) battery and connects lead RT to lead -L or +REV via capacitor B. Relay TN operates, transfers lead CT from ground to resistance (#1TR) ground, connects #2TR to leads +L and -L or -REV and +REV, via capacitor B and leads TT and RT. Class-of-service tone present on the C lead is coupled via lead CT to #1TR and magnetically to #2TR and leads +L and -L or +REV and -REV. Class-of-service tone is detected by the called Operator.

When the discharge current of capacitor C1 has decreased sufficiently, TN is opened. Relay TN restores, transfers lead CT from resistance (#1TR) ground to ground, and disconnects leads TT and RT from #2TR, removing class-of-service tone from the trunk facility. The duration of class-of-service tone may be adjusted by means of potentiometer R3.

If the call is from a tandem office (leads -REV, +REV, and C), operation is similar in every respect to that previously described for a local office except that the class-of-service tone is sent to the called Operator from the tandem office.

### 2.01.4 Recall to Distant Office (Operated: Relays A, B, D, and H)

If the calling party wishes to recall the distant office

ISSUE

6

DRAWING NO.

E- 610057



Operator, the intermittent operation of the telephone hookswitch will cause A to intermittently change the status of lead M to signal the distant office Operator.

#### 2.01.5 Release (Operated: Relays A, B, D, and H)

##### 2.01.5.1 Auto to Manual ("H" wiring)

When the calling party disconnects, #1 and #2A are opened. Relay A restores, closes C, and changes the status of lead M from its "seized" to its "normal" state. Relay C operates, momentarily disconnects lead R(-) from leads -L and +REV, and connects capacitor C2 in series with resistor (100 ohms) to lead -L. The circuit is held until the Operator disconnects. When the Operator disconnects, ground is removed from lead E, opening H. After its slow-to-release interval, H restores, returns normal battery polarity to leads +REV and -REV, opens B and #1D, and transfers lead RC from lead ST to ground, charging capacitor C1. After its slow-to-release interval, B restores, removes ground from lead C, opens C and #2D, grounds lead PC, and disconnects resistor L from across leads R(-) and T(+). Relay D restores and connects resistance bridge (resistor G) across leads T(+) and R(-). After its slow-to-release interval, C restores, connects lead R(-) to leads -L and -REV, removes ground from lead PC, grounds lead ATB, disconnects resistance bridge from across leads R(-) and T(+), and connects resistance (resistor N) battery to lead C to mark this circuit idle at the Selector banks. The circuit is now at normal.

##### 2.05.1.2 Auto to Auto (Without "H" wiring)

When the calling party disconnects, #1 and #2A are opened. Relay A restores, opens B, closes C, and transfers lead M from its "seized" to its "normal" state to give the Operator "on-hook<sup>w</sup>" supervision. Relay C operates, and momentarily disconnects lead R(-) from leads -L and +REV. When the Operator disconnects, ground is removed from lead E, opening H. After its slow-to-release interval, H restores, opens #1D, returns normal battery polarity to leads +REV and -REV, and transfers lead RC from lead ST to ground, charging capacitor C1. After its slow-to-release interval, B restores, opens #2D and C, transfers lead C from ground to open circuit, grounds lead PC, and disconnects resistor L from across leads R(-) and T(+). Relay D restores and connects resistance bridge (resistor G) across leads T(+) and R(-). After its slow-to-release interval, C restores, removes ground from lead PC, grounds lead ATB, removes resistance bridge from

across leads R(-) and T(+) connects lead R(-) to leads -L and -REV, and connects resistance (resistor N) battery to lead C to **mark** this circuit idle at the Selector banks. The circuit is now at normal.

## 2.06 Test Facilities

Operation is the same as described in Section 1.06 except that optional wiring is provided to enable the circuit to meet local pulse repeating tests, see NOTE 78, H-610057.