

**PUBLIC SERVICES  
CRAFTS' MANUAL  
FOR  
STATION, NETWORK,  
AND TESTBOARD**



## PUBLIC SERVICES CRAFTS' MANUAL

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# PUBLIC SERVICES CRAFTS MANUAL FOR STATION, NETWORK, AND TESTBOARD

**ISSUE 3, JULY 1980**

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STATION NETWORK AND TESTBOARD**

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## INTRODUCTION

### 1. GENERAL

**1.01** The purpose of this manual is to familiarize coin personnel with the many intricate phases of coin service. This includes an overview of the total coin operation with emphasis on:

1. Station equipment
2. Central office testing and circuit design requirements
3. Trouble analysis of station, loop and central office equipment
4. Cord board, TSPS, and ACTS operation
5. Loop plant
6. Coin improvement items including dial-tone-first (DTF).

**1.02** Charge-a-Call service is distinct from coin service in that no coin handling components are needed at the station and no coin supervision functions are required from the serving central office. This manual is intended to cover only coin telephone service; for information on identification, installation, and maintenance of Coinless Telephone Sets used for Charge-a-Call service, refer to Section 506-500-100.

**1.03** To understand and effectively clear troubles on coin service, a basic knowledge of the above items is necessary.

**1.04** Coin service today, consists of Dial-Tone-First (DTF), Coin-First (CF) and Postpay type service. All utilize the single slot coin station and all place different demands upon central office and test desk equipment.

**Note 1:** This manual is not intended to replace any BSP, Booklet, or Manual, but is provided to supplement information already available to the craftsman.

**Note 2:** Information in this manual pertains to 1A/2A, 1C/2C, 1D/2D, 1E-type, 10A, and 20A (see Table A) sets only and does not include the old multislot sets.

**1.05** Prior to the development of the single slot coin telephone and introduction of DTF service, coin operation was relatively simple. The coin station (multislot) placed very few demands upon the central office and test desk equipment. If the central office equipment could furnish a threshold capable of collecting or refunding a coin deposit, test for the presence of a coin, provide a minimum amount of talking battery and ring the station ringer, the station performed quite effectively.

**1.06** Social changes, during the 1960s made the multislot coin station a prime target for: vandalism, strong arm robbery, fraud, and theft of service. This brought about the introduction of the more rugged single slot coin station and a new environment for coin service.

**1.07** Presently there are four types of single slot coin stations all having an identical outside appearance:

“A” Series—designed for all coin first areas for use in coin-first operation

“C” Series—a convertible set that can be used in either a dial-tone-first mode or a coin-first mode

“D” Series—for use in dial-tone-first mode only

“E” Series—for postpay operation only.

**1.08** Components for the single slot coin stations although appearing the same and physically fitting the same mountings are not always compatible. Station component compatibility charts will be found in Chapter 1, Part 5.

**1.09** The operational description of the single slot coin station is explained in Chapter 1. The operational description must be understood by the central office and test desk force maintaining coin service. The station totalizer of a station located for test purposes in the central office or at the testboard as outlined in Chapter 1 affords a natural trouble indicator and trouble analyzer for loop plant, station and central office trouble conditions. The master test frame, maintenance control center, district junctor test frame, J test boxes, and coin supervisory test sets are good test facilities but lack the trouble detecting features that the coin station totalizer provides. A D-type station cannot be used as a trouble analysis tool and thus should not be used as a test station in the central office or testboard location.

## **2. GENERAL SYSTEM CONSIDERATIONS FOR DTF CONVERSION**

### **STATION COMPATIBILITY**

**2.01** The operational description for the "A" series coin station is similar to that of the "C" series station wired in the coin-first mode (Chapter 1, Part 1). The difference being—the "A" series coin station requires that talking battery always be negative to the ring side of the line with ground on the tip side. The "A" series station therefore, will not operate with office or loop condition when reversals are present. In central offices providing both DTF and CF type service it becomes necessary to modify the "A" series stations to "C" series.

**2.02** With closing of cord boards and implementation of TSPS, personnel involved in coin service must be aware of the polarity sensitivity of the "A" series coin station.

### **EXAMPLES:**

1. The trunks to cordboards, TSPS, and ACTS provide +48-volt talking battery towards the customer on the ring side of the line when serving DTF service. This is deposit recognition for less than initial rate.
2. In step-by-step offices polarity reversals may be experienced due to malfunction of switching operations or local calls completed to a coin station.

**2.03** The following items are of a general nature and pertain to all switching systems. It should be noted that they are not listed in any particular order relating to their importance or urgency but are considerations in converting an existing central office (CO) to dial-tone-first (DTF) coin operation.

### **2.04 Cutover Coordination.**

- (a) Conversion of offices to DTF operation requires coordination of the central office and station changes if coin telephone service is to be maintained during cutover. Cutover to DTF coin operation can cause customer confusion. This confusion is compounded when temporary incompatibilities are introduced between the central office and coin telephones by the cutover procedures used. The central office serving arrangements permit side-by-side operation of coin-first and dial-tone-first stations without line segregation during and following cutover. However, full cutover of all coin telephones to DTF operation in a local central office will allow the customer to more rapidly learn the new method of operation without need to identify the type of station (coin-first or dial-tone-first) which he is trying to use.

### **2.05 Cutover Procedures.**

- (a) The following DTF cutover procedures are recommended. Also refer to the DTF factors for the CO section of this manual and to GL 78-08-161 and IL 79-04-074 for alternate procedures when D-type stations/D-180707 kits are employed and for update information on DTF circuit options.

- (1) **Modify:** Test desk, test cabinets, test sets.
- (2) **Modify:** CO equipment with the exception of +48-volt options.
- (3) **Modify or change:** Stations to "C" series.
- (4) **Modify:** Toll equipment with the exception of +48-volt options.
- (5) Prepare announcement circuits and announcements.
- (6) Implement +48-volt options.

- (7) Test all circuits using a "C" series coin station wired in the DTF mode.
- (8) **Convert:** Line equipment to loop start. Verify loop limiting options on line relays in electromechanical office.
- (9) **Convert:** Stations to the DTF mode.
- (10) **Change:** Dial instruction cards.
- (11) Make final test of station in DTF mode.
- (12) Make final test of all associated CO, Toll, and Test Desk equipment.
- (13) Make final check of announcements.

#### 2.06 **Deposit Required Announcement:**

The standard announcement (Section 780-200-020) that is recommended for use when the required initial rate coin deposit has not been detected is as follows: "The call you have made requires a 10-cent (initial rate) deposit. Please hang up momentarily, listen for dial tone, deposit 10-cent (initial rate) and dial your call again, this is a recording." In addition, when all announcement trunks are busy during heavy traffic conditions, calls should be routed to recorder tone. Routing to another recording can only confuse the customer.

**2.07 Coin Present Tests:** Local coin overtime and stuck coin tests (to determine successful coin collect or coin return actions) must be made using positive (+48 volt) battery. Coin deposits of less than the initial rate will not be detected by a negative battery test (-48 volts), since the unoperated initial rate contact (T1) at the station will prevent coin ground detection.

#### 2.08 **Subscriber Line Multiplex (SLM)**

**Operation:** If an SLM or subscriber carrier system is to be used, ensure that it will accommodate coin service and specifically, DTF service. For General Trade SLM Units, refer to Product Evaluation Reports; for SLC-40, refer to GL 78-06-047 and Section 363-201-100.

#### 2.09 **Talking Battery Polarity on Operator**

**Trunks:** A +48-volt battery is necessary at the DTF wired coin telephone when an operator is monitoring coin deposits. Unless the trunk provides this polarity the operator will be unable to monitor initial deposits which are less than the

local call initial rate (5 cents in 10-cent areas, 5 cents and 10 cents in 15-cent areas and 5 cents, 10 cents, and 15 cents in 20-cent areas).

**2.10 Toll Grade Battery:** The coin service improvement program which initiated dial-tone-first service included option changes in central office circuitry to eliminate **toll grade battery**. The low impedance presented by this supply can result in currents at the coin station (on short loops) in excess of 200 ma which limits the design options for new station circuitry. All circuits which supply toll grade battery toward the station must therefore be modified per the appropriate drawing issue which eliminates the toll grade battery supply.

#### 2.11 **Coin Station Test Line:**

A Coin Station Test Line Circuit SD-1C297-01 is available to assist the coin station repairperson in testing the capabilities of the coin telephone without the need for a test deskperson. This circuit, which was introduced in 1971 was covered by EL 1388 (GL 71-07-150) and further discussed in GL 78-04-099 and IL 79-10-273, can test either CF or DTF wired coin stations in all types of central offices, except No. 3 ESS and remote switching system (RSS) at this time. When changing from CF to DTF operation there is an option change which must be made in the test circuit [remove option "S" (step-by-step office only) on SD-1C297-01].

**2.12 Coin Instruction Cards:** The recommended format for coin instruction cards is covered in GL 73-11-069. This letter covers the recommended format for 20-cent initial deposit rates at coin-first or dial-tone-first telephones and is adaptable to other rate situations. The more standard the instruction cards are made the more easily the customer can identify the services the coin telephone provides.

**2.13 DTF Call Completion:** Implementation of dial-tone-first coin operation provides the coin telephone customer with the ability to reach the operator, directory assistance operator, or emergency center (911) without the need for an initial coin deposit. This gives the customer the capability of making information or special toll calls (collect, credit card, or third number billed) even without coins.

#### 2.14 **Permanent Signals.**

(a) The introduction of DTF can result in a higher instance of permanent signals. A receiver off-hook will result in a permanent signal.

(b) With coin-first operation a coin deposit in addition to a receiver off-hook is required to get a call into the permanent signal condition.

**TABLE A**  
**CODE SIGNIFICANCE**

<b>CODE</b>	<b>HOUSING</b>	<b>MODE OF OPERATION</b>	<b>DIAL</b>
1A1	Box Type	Coin-First Only	Rotary
1A2			TOUCH-TONE
2A1	Panel Type		Rotary
2A2			TOUCH-TONE
1C1	Box Type	Coin-First or Dial-Tone-First	Rotary
1C2			TOUCH-TONE
2C1	Panel Type		Rotary
2C2			TOUCH-TONE
1D1	Box Type	Dial-Tone-First Only	Rotary
1D2			TOUCH-TONE
2D1	Panel Type		Rotary
2D2			TOUCH-TONE
1E1	Box Type	Postpay	Rotary
1E3			None (Manual)
10A	Box Type	Charge-a-Call	TOUCH-TONE
20A	Panel Type	Charge-a-Call	TOUCH-TONE

# **CHAPTER I**

## **COIN STATIONS**

## 1C/2C-TYPE COIN TELEPHONE SET DETAILED DESCRIPTION

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**1. GENERAL**

1.01 The 1C/2C coin telephone set is capable of providing coin service in either coin-first (CF) or dial-tone-first (DTF) systems. The set can be converted in the field from one mode of operation to the other.



*Components in this set are designed to operate reliably in a temperature range between -30 degrees and +140 degrees Fahrenheit.*

1.02 The 1C/2C set is available with rotary or TOUCH-TONE® dial.

1.03 Codes for the 1C- and 2C-type sets are described in Table A.

TABLE A  
CODE SIGNIFICANCE

CODE	FIRST NO.	LETTER	SECOND NO.
1C1	Box Type	CF or DTF Mode (Convertible)	Rotary Dial
1C2			TOUCH-TONE Dial
2C1	Panel Type		Rotary Dial
2C2			TOUCH-TONE Dial

1.04 Abbreviations used in this section are as follows:

ACTS—Automated Coin Toll Service

CF—Coin-First

DTF—Dial-Tone-First

TT—TOUCH-TONE Dial

DP—Dial Pulse

DON—Dial Off Normal

EM—Electromechanical

EIB—Expanded-in-Band

CR—Coin Relay

RE—Reset Electromagnet

CO—Central Office

TSPS—Traffic Service Position System

SH—Switchhook

SCR—Silicon Controlled Rectifier (voltage and current controlled electronic switching).

2. FUNCTIONS

A. Coin Chute (Fig. 1)

Nickel Operation

2.01 *Nickel Operation—Valid Coin Accepted (Fig. 2).*

- (1) Nickel is deposited in coin entrance and passes magnetic trap.
- (2) Nickel continues and is checked for size and weight as the nickel separator rotates.
- (3) Nickel is channeled into the nickel magnet area.
- (4) The nickel magnet sets up an eddy current effect which slows its movement down the chute.
- (5) The nickel continues on, falls toward the rear of the chute, strikes the nickel anvil, bounces over the nickel divider, and is accepted.

2.02 *Nickel Operation—Coin Rejected (Fig. 2).*

- (1) Light weight magnetic slugs or coins will be stopped by the magnetic trap.
- (2) If the size or weight is incorrect, it will be stopped at various locations in the chute and must be retrieved by operation of the coin release mechanism.
- (3) If the eddy current characteristics are incorrect, the bounce on the nickel anvil will cause the coin to be rejected.

Dime Operation

2.03 *Dime Operation—Valid Coin Accepted (Fig. 3).*

- (1) Dime is deposited in coin entrance and passes magnetic trap.
- (2) Dime continues and is checked for size and weight as the dime separator rotates.
- (3) Dime is channeled into the dime magnet area.
- (4) The dime magnet sets up eddy current effect which slows its movement down the chute.
- (5) Dime drops through the dime divider and is accepted.

2.04 *Dime Operation—Coin Rejected (Fig. 3).*

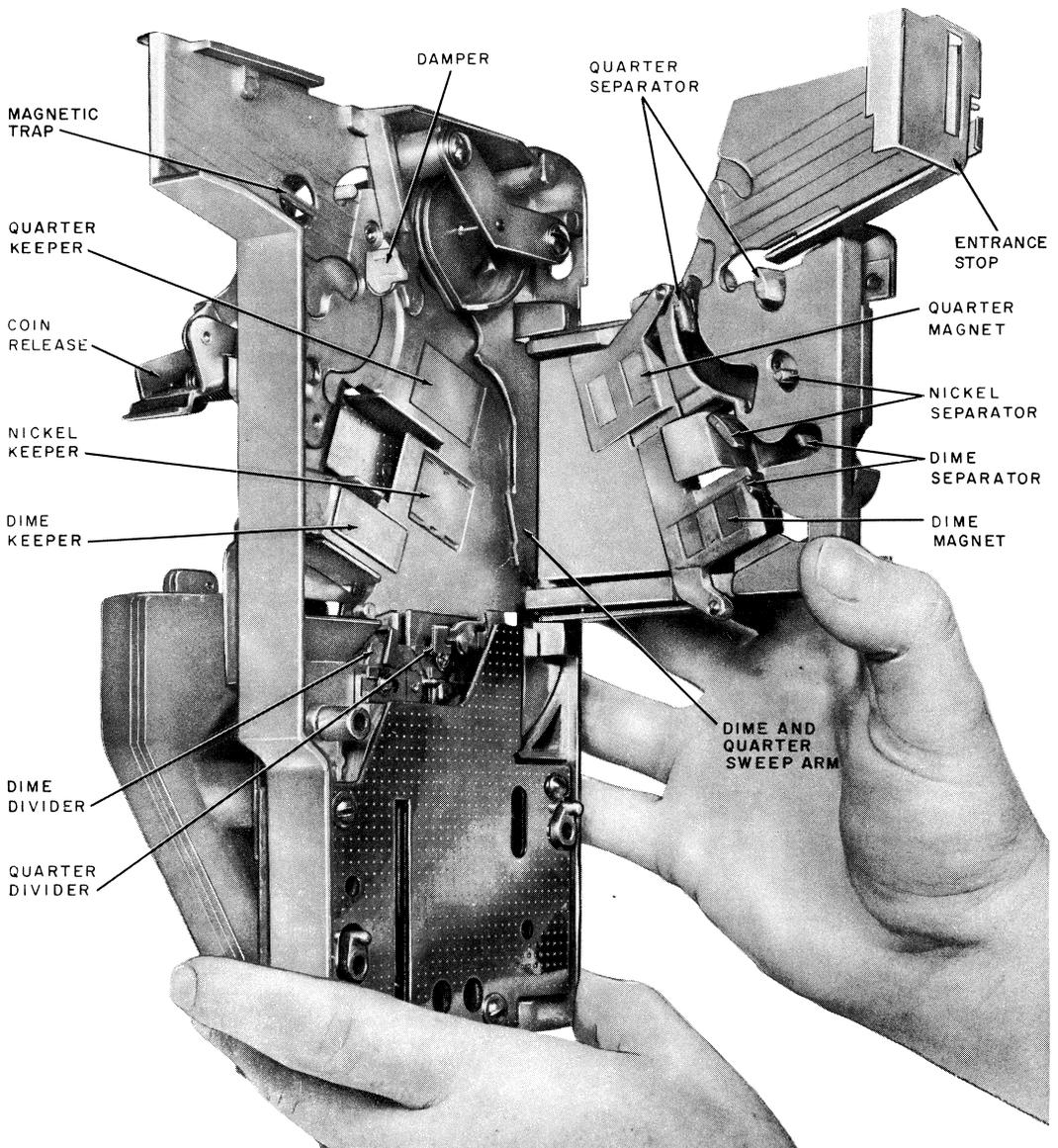


Fig. 1—Typical Coin Chute

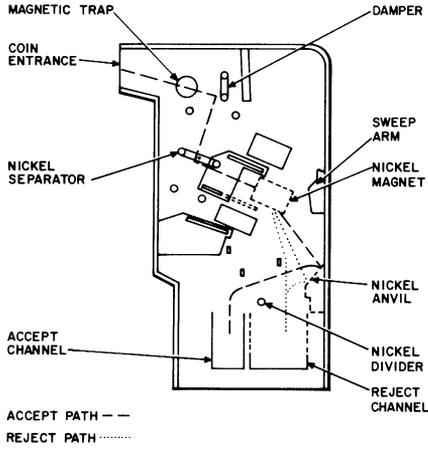


Fig. 2—Nickel Path in a Typical Coin Chute

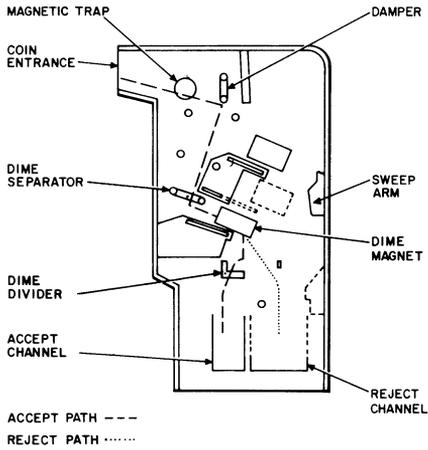


Fig. 3—Dime Path in a Typical Coin Chute

- (1) Light weight magnetic slugs or coins will be stopped by the magnetic trap.
- (2) If the size or weight is incorrect, such as a penny used in coin phone tests, it will be stopped at various locations in the chute and must be retrieved by operation of the coin release mechanism.

- (3) If the eddy current characteristics are incorrect the dime magnet, with the aid of the divider, will reject the coin.

**Quarter Operation**

**2.05 Quarter Operation—Valid Coin Accepted (Fig. 4).**

- (1) Quarter is deposited in coin entrance and passes magnetic trap.
- (2) Quarter continues and is checked for size and weight as the quarter separator rotates.
- (3) Quarter is channeled into the quarter magnet area.
- (4) The quarter magnet sets up an eddy current effect which slows its movement down the chute.
- (5) Quarter strikes the right side (as viewed in Fig. 4) of quarter divider and is accepted.

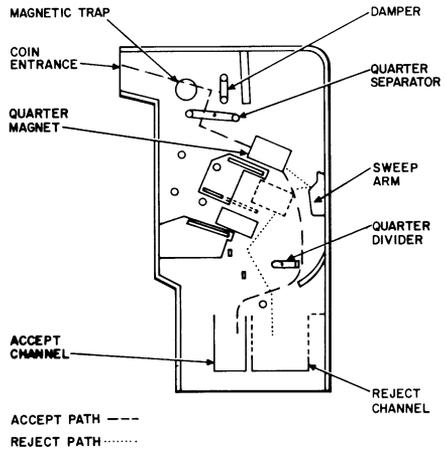


Fig. 4—Quarter Path in a Typical Coin Chute

**2.06 Quarter Operation—Coin Rejected (Fig. 4).**

- (1) Light weight magnetic slugs or coins will be stopped by the magnetic trap.

- (2) If the size or weight is incorrect, it will be stopped at various locations in the chute and must be retrieved by operation of the coin release mechanism.
- (3) If the eddy current characteristics are incorrect, the bounce on the sweep arm will cause the coin to be rejected.

#### Coin Release

#### 2.07 Coin Release Mechanism Operation.

- (1) The magnetic trap is withdrawn to release trapped magnetic material.
- (2) The chute opens to release coins stopped at various locations.
- (3) Sweep arms clear material from the coin magnet areas and direct stopped material to the reject channels.

#### B. Totalizer (Fig. 5)

**2.08** The totalizer is an electromechanical device that has the ability to total initial rate deposits, prepare the set for calling, and signal coin denominations to the operator. Minimum loop current required to operate the totalizer reliably is 23 milliamps.

**2.09** Accepted coins fall through the chute and strike totalizer arms, which project into the chute. Nickels and dimes strike the lower arm while quarters strike the upper arm. Arm deflection causes a ratchet wheel to rotate and operate a cam. Each cog on the ratchet wheel represents a 5-cent increment. The cam shaft is rotated 10 degrees by each nickel deposited, 20 degrees by each dime, and 50 degrees by each quarter.

#### C. DTF and CF Mode

**2.10** The totalizer contains several components described as follows:

##### (a) *DTF Mode*

##### (1) *T1 (Initial Rate) Contacts.*

- (a) Its normally open contacts, when operated, provide a path for the initial rate ground test.

- (b) Its normally closed contacts allow totalizer to total deposits up to initial rate before reading out.

##### (2) *T2 (Totalizer Off Normal) Contacts.*

- (a) Operate (transfer) when any coin is deposited.
- (b) The normally closed contacts short the totalizer during talking.
- (c) The normally open contacts, when operated, provide a path through the speech network to allow totalizer to restore to normal when going on-hook.

##### (3) *S (Stepping) Relay and its S1 Contacts.*

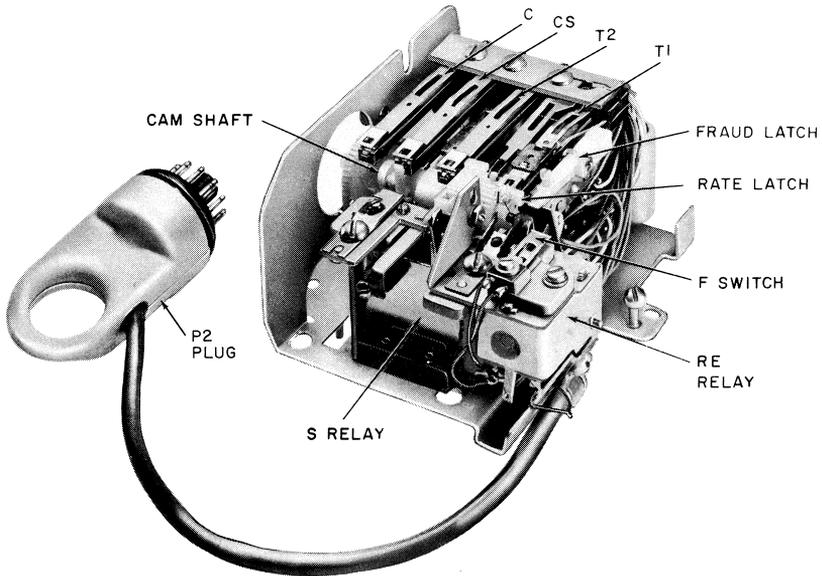
- (a) The operating and releasing action of the S relay steps the totalizer back 10 degrees each time it operates.
- (b) This action continues until T2 goes back to normal thus shorting the totalizer.
- (c) Operation of S1 transfer contacts alternately applies power to the S relay and coin tone oscillator, thus stepping totalizer back to home position and generating coin signals.

##### (4) *C (Coin Arm Off-Normal) Contacts.*

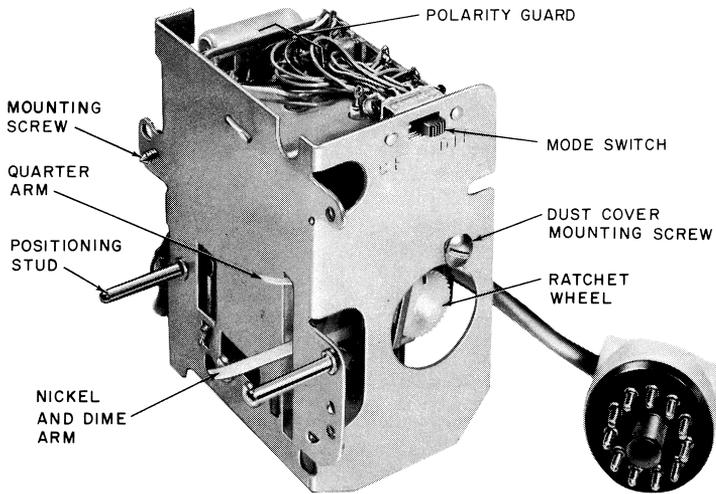
- (a) On all coin deposits, the C contacts transfer to prevent the totalizer from stepping back while the coin arm is held down by a coin.
- (b) The normally closed C contacts, when opened, remove the current path from the S relay while the normally open contacts, when closed, connect a click suppression circuit.

##### (5) *CS (Coin Signal Speed Changing) Contacts.*

- (a) The CS contacts operate only on quarter deposits.



VIEW A



VIEW B

Fig. 5—1A Totalizer

(b) The normally closed CS contacts open to allow more voltage across the S relay, thus providing a faster readout.

(c) The normally open CS contacts bypass the normally closed C contacts to allow the S relay coil to energize thereby allowing early totalizer response before the quarter arm returns to normal.

(6) **RE (Reset Electromagnet).**

(a) The primary function of the RE relay is to reset the T1 contacts to normal on coin collect or refund pulses.

(b) When the initial rate is registered in the totalizer, the T1 contacts operate and the spring loaded rate latch engages holding T1 in its operated position.

(c) When the RE armature operates, it disengages the rate latch and T1 restores to normal.

(d) A second function of the RE relay is to control the F (fraud) switch.

(7) **Antifraud Provisions (F Switch Contacts and FRAUD Latch).**

(a) Operation of the RE opens the F switch.

(b) The fraud latch drops down each time the totalizer goes off home position.

(c) If the RE operates while the fraud latch is down (totalizer off home position) the F switch will open and be held open by the fraud latch until the totalizer steps back to home position, thus preventing the possibility of fraudulently satisfying the initial rate ground check. This prevents calls from being made for less than initial rate.

(8) **Internal Polarity Guard:** The polarity guard around the totalizer circuit allows it to operate on positive or negative battery.

(b) **CF Mode**

(1) **T1 (Initial Rate) Contacts.**

(a) The normally open contacts operate to close the ring lead and cause CO ground start when initial rate is deposited.

(b) The normally closed contacts open to remove dial short when initial rate is deposited.

(2) **T2 (Totalizer Off-Normal) Contacts.**

(a) Operate (transfer) when any coin is deposited.

(b) The normally closed contacts short the totalizer during talking.

(c) The normally open contacts when operated, provide a path through the speech network to allow totalizer to restore to normal when going on-hook.

(3) **S (Stepping) Relay and Its S1 Contacts.**

(a) The operating and releasing action of the S relay steps the totalizer back 10 degrees each time it operates.

(b) This action continues until T2 goes back to normal thus shorting the totalizer.

(c) Operation of S1 transfer contacts alternately applies power to the S relay and coin tone oscillator, thus stepping totalizer back to home position and generating coin signals.

(4) **C (Coin Arm Off-Normal) Contacts.**

(a) On all coin deposits, the C contacts transfer to prevent the totalizer from stepping back while the coin arm is held down by a coin.

(b) The normally closed C contacts, when opened, remove the current path from the S relay; while the normally open contacts, when closed, connect a click suppression circuit.

(5) **CS (Coin Signal Speed Changing) Contacts.**

- (a) The CS contacts operate only on quarter deposits.
- (b) The normally closed CS contacts open to allow more voltage across the S relay, thus providing a faster readout.
- (c) The normally open CS contacts bypass the normally closed C contacts to allow the S relay coil to energize, thereby allowing early totalizer response before the quarter arm returns to normal.

(6) **RE (Reset Electromagnet).**

- (a) The primary function of the RE relay is to reset the T1 contacts to normal on coin collect or refund pulses.
- (b) When the initial rate is registered in the totalizer, the T1 contacts operate and the spring loaded rate latch engages and holds T1 in its operated position.
- (c) When the RE armature operates, it disengages the rate latch and T1 restores to normal.
- (d) A second function of the RE relay is to control the F (fraud) switch.

(7) **Antifraud Provision (F Switch Contacts and Fraud Latch).**

- (a) The F switch provides no essential function in the CF mode.
- (b) The fraud latch operates when totalizer is off normal and RE is operated, thus preventing fraudulent ground start and the station is put out of service.

(8) **Polarity Guard:** The polarity guard around the totalizer circuit allows it to operate on positive or negative battery.

2.11 Output characteristics of the totalizer are as follows:

(1) **Tone Pulsing:**

- (a) Fast readout (quarter only)—5 beep tones
  - (1) Pulsing rate—12-17 PPS.

(b) Slow readout (nickel and dime only)

- (1) Nickel—1 beep tone
- (2) Dime—2 beep tone
- (3) Pulsing rate—5-8.5 PPS.

**D. Coin Chassis (Fig. 6)**

2.12 The coin chassis is a framework for mounting electrical components as follows:

- (1) **B Relay**—The B relay contacts close during totalizer readout and place a capacitor across the speech circuit to prevent the customer from hearing coin signals.
- (2) **Coin Signal Oscillator**—Generates a dual frequency signal, controlled by totalizer readout indicating to the ACTS receiver or operator what value of coin has been deposited.
- (3) **A Relay**—Provides ground lifting in DTF mode and controls totalizer readout in CF mode.

**E. Coin Dial Unit (Fig. 7)**

2.13 The dial and housing assembly contains the switchhook contacts and rotary or TOUCH-TONE dial. The switchhook contacts are operated as the handset is lifted. Contacts SH1, SH2, and SH4 perform the same functions in both CF and DTF modes. SH3 differs as described in (3).

- (1) **SH1**—When operated, SH1 connects the receiver in the speech circuit. The normally closed contacts (when handset is on hook) provide for insufficient deposit refund.
- (2) **SH2**—A mercury switch, connected in parallel with SH4, which prevents switchhook dialing in the CF mode.
- (3) **SH3**—In the DTF mode, its normally closed contacts, when operated, allow totalizer to total deposits up to initial rate before reading out. In CF mode (handset on hook), SH3 normally closed provides a short path to permit insufficient deposit refund.
- (4) **SH4**—Closes ring lead when operated.

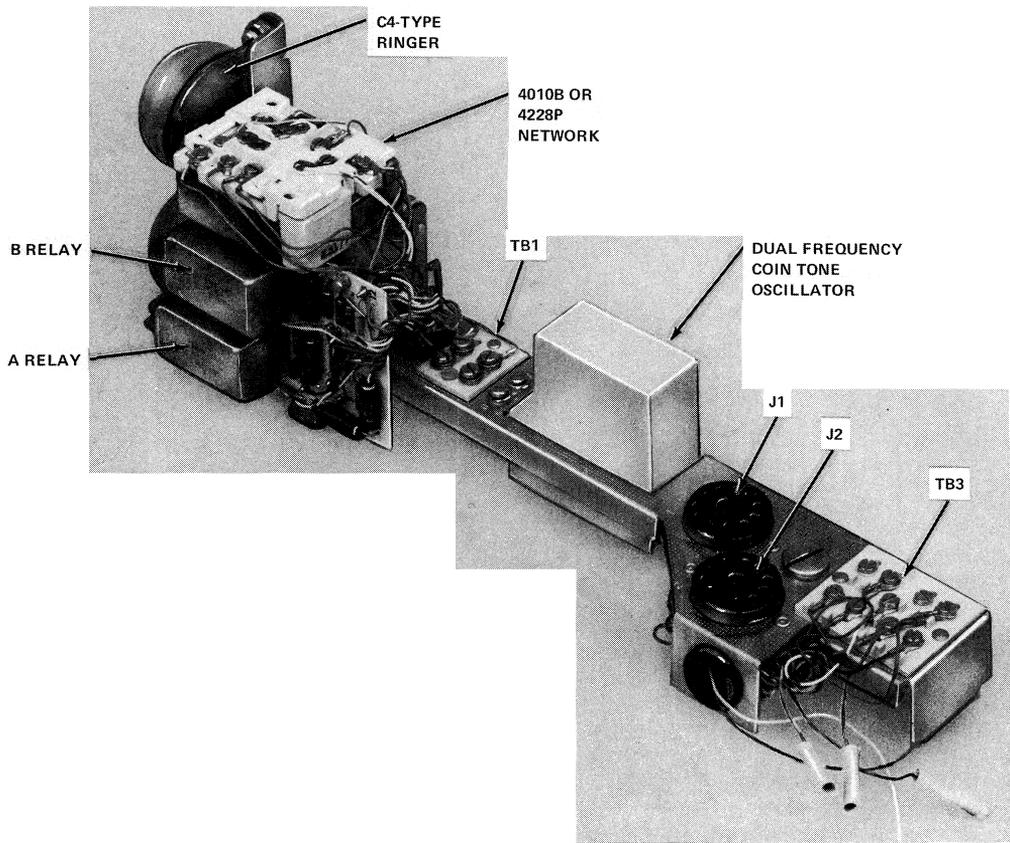


Fig. 6—31A Coin Chassis

(5) **Rotary dial contacts.**

- (a) DP—Dial pulsing contacts
- (b) DON 1—Operates when dial is off normal. Shorts receiver to prevent acoustic shock.
- (c) DON 2—Used in DTF mode only. Prevents totalizer readout during dialing.

(6) **TOUCH-TONE dial common switch.**

**Note:** This procedure and Fig. 10 refer to TOUCH-TONE dials.

- (a) The break contact places a resistor in series with the receiver to enable customer to hear low level TOUCH-TONE signals.
- (b) The transfer contacts disconnect the transmitter and connect the dial oscillator.
- (c) The make contact is used in DTF mode only. It prevents totalizer readout during dialing.

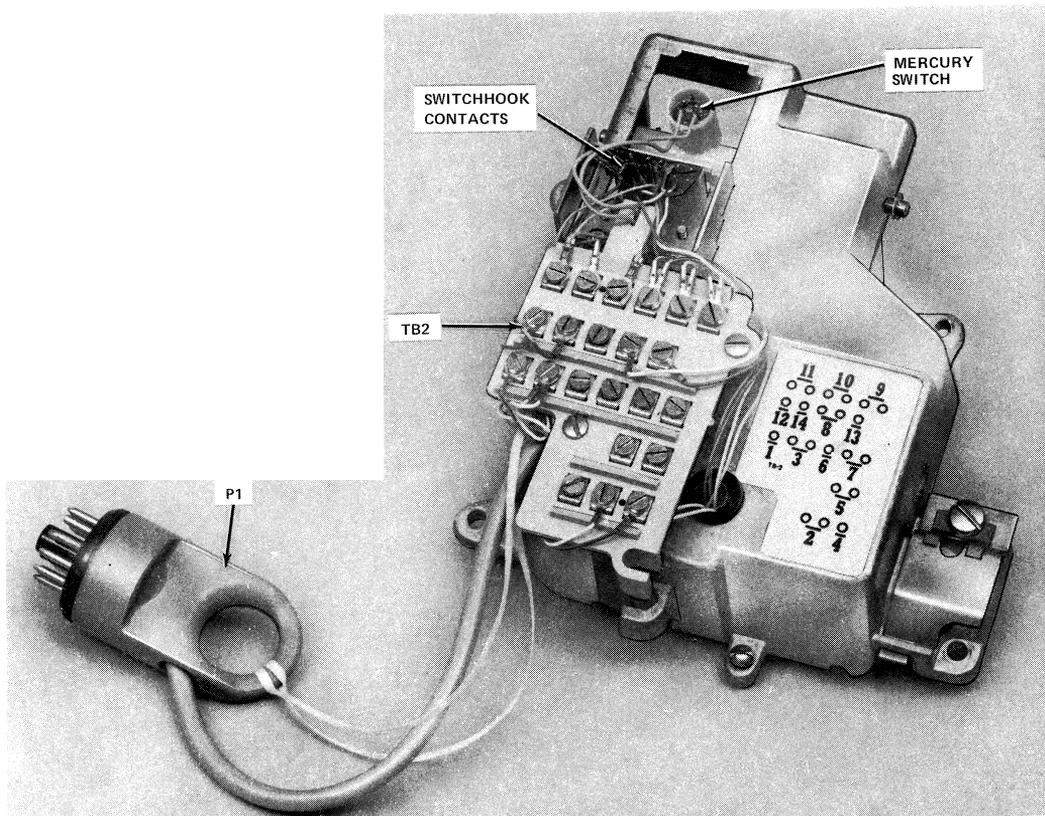


Fig. 7—Typical Coin Dial Unit

**F. Coin Relay and Hopper Assembly (Fig. 8)**

2.14 The coin relay and hopper assembly is an electromechanical unit which controls the coin collect or coin refund function.

2.15 The resistance of the 1A coin relay winding is approximately 1020 ohms at 70 degrees Fahrenheit and is effected by temperature changes.

2.16 Operating Values of Coin Relays are:

- Minimum operate current—41 milliamps
- Nonoperate current—30 milliamps

- Operating time—450 ±50 milliseconds (+20° to 100°F)

2.17 Hopper trigger (HT) contacts are closed by the first coin deposited. All coins deposited are temporarily stored in the hopper, on the coin trap, until dumped when the coin relay operates.

2.18 The selector card is polarized to move to the right or left, depending on the polarity of the central office voltage applied. This mechanically operates the cam which in turn operates the coin vane in hopper to collect or refund coins.

2.19 Upon release of coin relay operating cycle, the HT and coin trap restore to normal.

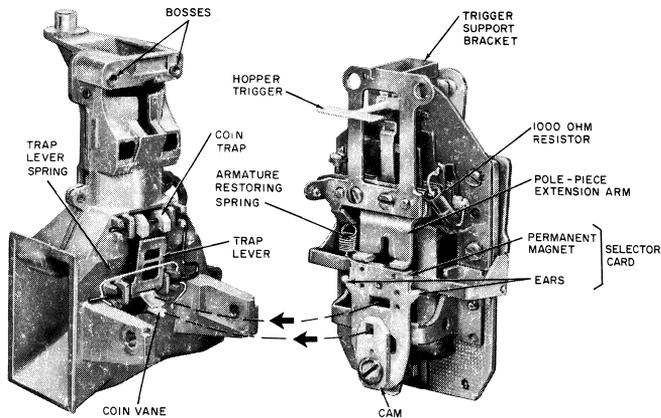


Fig. 8—1AA Coin Relay

### G. Other Component Circuits (Fig. 9 through 12)

**2.20 Speech Circuit:** The speech circuit is a standard telephone speech network. The tip and ring connections are reversed with respect to the usual 500 set connections to guarantee a path from tip to ground that does not go through the transmitter. The ground connection is at the ac balance point of the network to reduce noise due to unbalance when the ground is connected.

### 2.21 Ground Lifting Circuit (Used in DTF only) (Fig. 9 and 10).

(a) The ground lifting circuit is composed of the A relay, a polarity guard, and associated varistors, resistors, and capacitors. When loop current is flowing in the ring lead, the A relay operates to remove the ground connection at the station. Removal of ground at the station reduces noise unbalance.

(b) Capacitors outside the polarity guard lower the ac impedance and prevent transients induced by collect or refund pulses.

### 2.22 Coin Return Network (Used in DTF only) (Fig. 9 and 10).

(a) The coin return network is composed of an SCR, a zener diode, and associated resistors, thermistor, and diode. The principle function of this circuit is to allow refund to occur if the T1 contact in the ground lead is open.

(b) When the high negative voltage coin pulse is applied to the tip lead, the SCR switches and permits current to flow allowing coin relay and RE to operate.

(c) When -48 volts is applied to the tip lead, during the initial rate ground test, current flows if T1 is operated. The -48 volts is insufficient to switch the SCR.

(d) When the coin present test is made with +48 volts on the tip lead, the diode bypasses the network to allow successful completion of the test.

(e) The zener diode controls the firing level (67 volts) of the SCR.

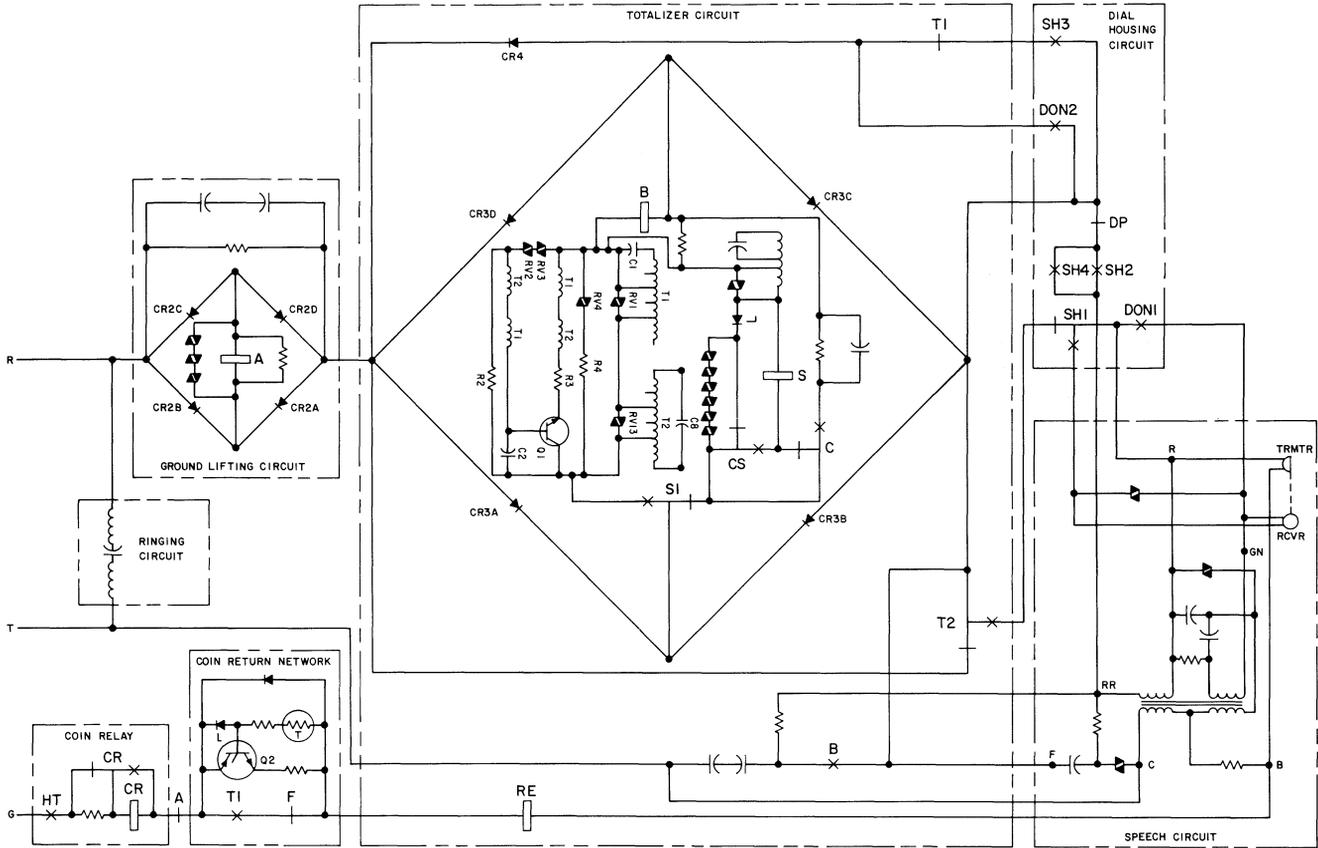


Fig. 9—1C1/2C1 Coin Telephone Set—Schematic (DTF Mode)

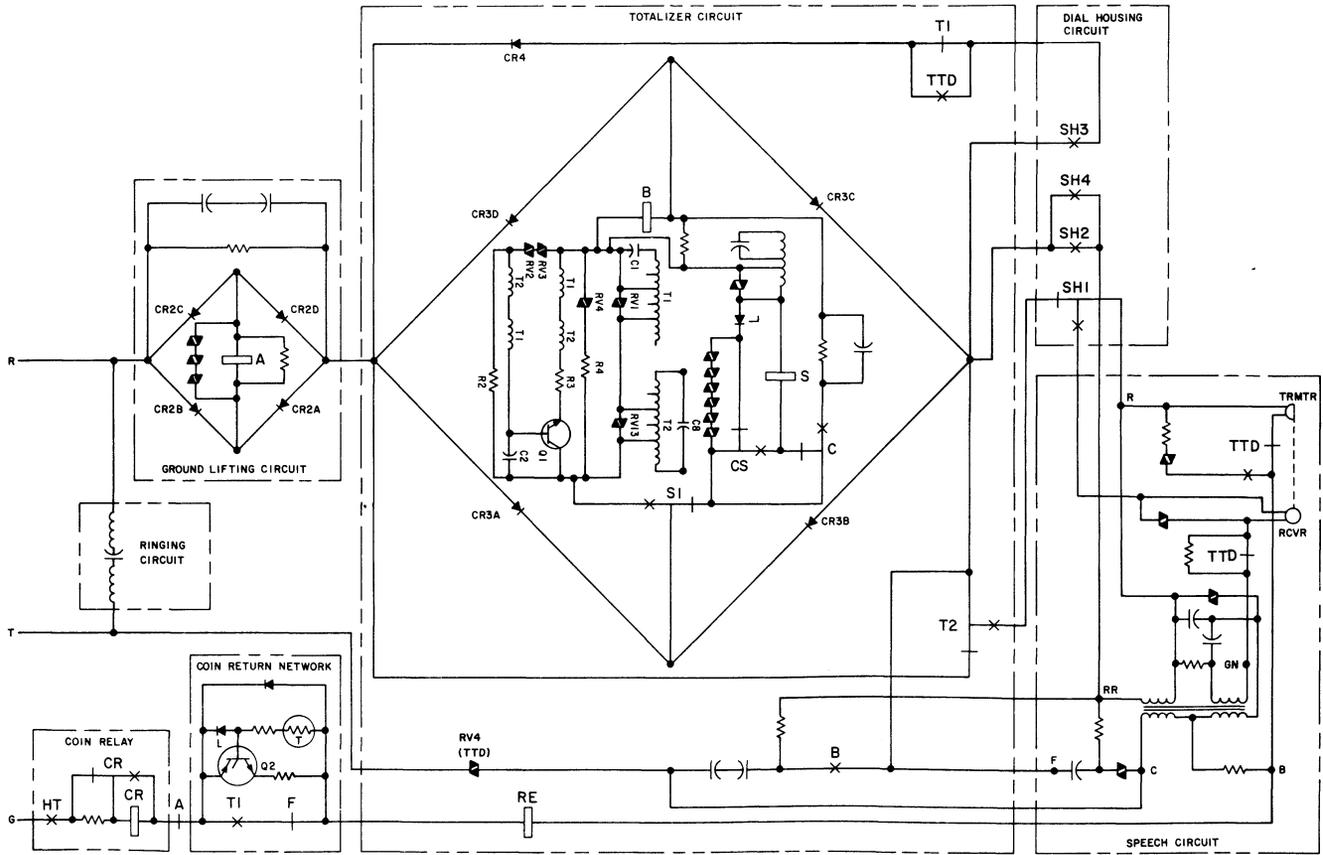


Fig. 10—1C2/2C2 Coin Telephone Set—Schematic (DTF Mode)

- (f) Resistors and thermistor are used to compensate for temperature variation.

**2.23 Tip Relay Circuit (Used in CF only) (Fig. 11 and 12).**

- (a) The A relay circuit is placed in the tip lead in the CF mode.
- (b) After initial rate deposit, and tip is grounded at the CO, the A relay operates and allows the totalizer to read out after each subsequent coin deposit.

**3. THEORY OF OPERATION**

**DIAL-TONE-FIRST SERVICE (Fig. 9 and 10)**

**A. Originating A Call**

**3.01** In DTF service, the central office line equipment is wired for loop start (ring -48 volts; tip grounded).

**3.02** When the handset is lifted, switchhook contacts SH3, SH2 and SH4, and SH1 operate in that order and loop current flows from the ring lead to tip. This path is through the A relay winding, the normally closed T2 contact, the operated SH1 and SH4 contacts, through the speech network to tip. Current through this path operates the CO line equipment and the A relay to remove station ground. Dial tone is received.

**3.03 Dialing With No Deposit Made.**

- (a) If dialing a number with no deposit required, the number can be dialed immediately after dial tone is received and the call will be forwarded.

- (b) If dialing a number which requires a deposit, and no deposit is made, the initial rate ground test is made by the central office. This test occurs at different times (during or after dialing) in various switching systems.

- During the initial rate ground test, the CO removes -48 volts from ring and connects it to tip, (ring open) thus temporarily releasing the A relay.
- When no ground is detected (indicating HT or T1 open), the initial rate test has not been satisfied and a recording will instruct

the customer to reinitiate his call with the proper deposit.

**3.04** For a partial deposit of initial rate, T2 operates as well as HT and the dial and talking path is maintained. This path is from the ring terminal through the A relay winding, through normally closed T1, operated SH3 contacts, DP contacts (rotary dial only), operated SH2 and SH4 contacts, through the speech network, transmitter, normally closed contacts (TOUCH-TONE dial only), back through the speech network to tip.

**3.05** Upon deposit of initial rate, T1 operates, removing the short from totalizer and B relay winding. This allows B relay to operate and current flow to the totalizer and coin signal oscillator. A path now exists from the ring terminal through the A relay winding, B relay winding, S (stepping) relay winding, C and S1 totalizer contacts, through DP contacts (rotary dial only), operated SH2 and SH4 contacts, through the speech network and transmitter, normally closed contacts (TOUCH-TONE dial only), back through the speech network to tip. As S1 transfers and the totalizer reads out, the coin tone oscillator is energized intermittently. The operated B relay bypasses the speech circuit.

**3.06** When the totalizer steps back to home, T2 restores, shorting the totalizer and B relay winding. The B relay releases, removing the AC short across the speech network. Even though the totalizer is returned to home position, T1 contact remains operated because it is mechanically latched in its transferred position.

**3.07** A dialing and talking path now exists from the ring lead to tip. This path is through the A relay winding, normally closed T2 contacts, normally closed DP contacts (rotary dial only) operated SH2 and SH4, the speech network, transmitter, normally closed contacts (TOUCH-TONE dial only) back through the speech network to tip.

**3.08** With a rotary dial, the dial-off-normal contacts short out the receiver during dialing.

**3.09** With a TOUCH-TONE dial, the common switch contacts operate during dialing to remove the transmitter from the speech network and also removes the shunt across the level limiting resistor to reduce oscillator sidetone in the receiver.

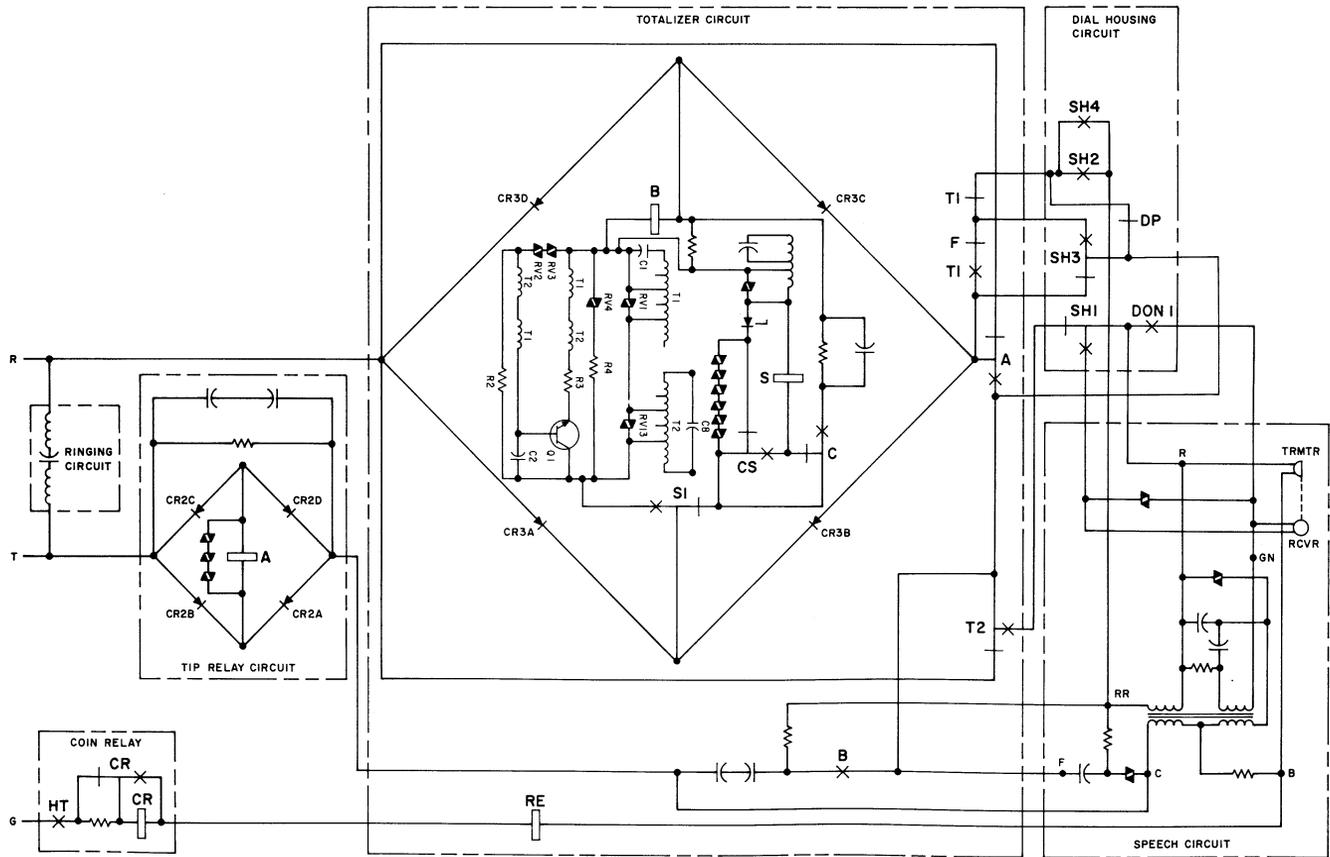


Fig. 11—1C1/2C1 Coin Telephone Set—Schematic (CF Mode)



**B. Restoring Set to Standby**

**3.10** Upon completion of call, customer hangs up handset, SH contacts restore, and the A relay releases. CO removes -48 volts from ring, ground from tip, and a collect (+130 volts) or refund (-130 volts) pulse is applied to tip, operating the coin relay and reset electromagnet (RE).

**3.11** Operation of coin relay collects or refunds coin(s), and operation of RE unlatches totalizer contact T1.

**3.12** The operated coin relay closes its make contact causing the current to bypass the relay and flow through the resistor which was previously shorted. The short across the relay winding causes the relay to be slow release. The resistor, having approximately the same resistance as the coin relay winding, is placed in the circuit to protect relay contacts in the CO and HT contacts in the set.

**3.13** As the coin relay releases, the HT contacts open, placing the coin phone in its idle or standby condition.

**Note:** See coin disposal test, paragraph 3.22.

**C. Call Abandoned**

**3.14** *Partial Initial Rate Deposited (paragraph 3.04).*

(a) Upon hanging up handset, SH contacts restore. When SH3 restores, the short around the totalizer is removed and current flows through the A relay winding, polarity guard, B relay winding, S relay winding, C and S1 contacts, operated T2, normally closed SH1, and the speech network to tip.

(b) Operation and release action of the S relay causes the totalizer to step back to its home position.

(c) When the totalizer has been stepped to home, T2 contact restores, shorting the totalizer and opening the telephone circuit. Shorting the totalizer releases the B relay. Opening the circuit releases the A relay. Both relays restore to normal.

(d) The CO, detecting the open circuit, applies -130 volts return battery to tip side of line to return the deposit. This causes the coin relay and RE to operate.

(e) As the coin relay releases, HT opens, placing set in its idle or standby condition.

**3.15** *Initial Rate Deposited (paragraph 3.05).*

(a) Upon hanging up handset, SH contacts restore and A relay releases. CO removes -48 volts from ring, ground from tip, and a refund (-130 volts) pulse is applied to tip, operating the coin relay and RE, thus releasing T1.

(b) As the coin relay releases, HT opens, placing set in its idle or standby condition.

**D. Nickel Local Overtime**

**3.16** After the called party answers, the CO initiates timing.

**3.17** Approximately 30 seconds before the end of the initial period, collect voltage is applied and the initial deposit is collected.

**3.18** After approximately a 30 second interval, a coin present test is made.

**3.19** If a nickel is deposited, T2 and HT in the coin station operate, the CO reverses battery on the line (applies +48 volts with tip grounded) for approximately 600 milliseconds and the totalizer reads out. When totalizer reads out, T2 reverts to normal.

**3.20** With T2 in its normal position, CO applies +48 volts to tip, with ring open, to check for coin presence. If test is satisfied, conversation may continue.

**3.21** If a nickel is not deposited, a recording is connected to the line and requests overtime deposit.

- After 30 seconds, an additional coin presence test is made. If a coin is not deposited, the call is terminated.

**E. Coin Disposal Test**

**3.22** Immediately after collect or return voltage is applied following customer disconnect, (on a completed local call) the CO makes a coin disposal test by applying +48 volts to the tip side of the line with ring open.

**3.23** If no coin ground is detected, the HT contacts are open and the test is satisfied. If ground is detected, the HT contacts are still closed, indicating a failure to dispose of coin.

**3.24** If ground was detected in paragraph 3.23, the CO again applies collect or return voltage and repeats test.

**F. Toll Call**

**3.25** Originate a call as in paragraphs 3.01, 3.02, and 3.03.

**3.26** After the number is dialed, the CO automatically applies return voltage and any previous coin deposit is returned, (when coin return option is provided).

**3.27** The call is then connected to either a TSPS trunk (ACTS or operator), or to a cord switchboard operator trunk.

**3.28 If the call is connected to a TSPS.**

- (1) A TSPS operator or ACTS equipment is automatically connected to the calling party.
- (2) The local office TSPS trunk applies +48 volt battery on the ring side of the line toward the station. This replaces the normal -48-volt talk battery on the line which removes the short across the totalizer (positive battery blocked by CR4).

**Note:** If multiwink signaling (or EIB signaling) is provided, +48-volt battery is provided only when an operator or ACTS equipment is attached.

- (3) The TSPS operator requests the deposit required for initial talk period as displayed on the position, then monitors the coin tones for correct deposit and releases the position from that call.

(4) After the called party answers, the TSPS trunk times the call and at the end of the initial charge period causes the CO to collect the initial deposit and routes the call to an idle TSPS position. (This may not be the same position as before.)

(5) The operator or ACTS equipment is connected to the call and instructs the customer to signal when through. The position is released and the TSPS trunk continues to time the call automatically.

(6) When the customer flashes the switchhook at the end of the call, an idle TSPS position or ACTS equipment is connected. The operator or ACTS equipment requests coin deposit monitors the coin tone signals for correct deposit, collects the deposit, and releases.

(7) The customer hangs up handset. The TSPS sends a coin collect signal to the local office, and a coin disposal test is made, (on ESS and Step-by-Step only). The station is now idle and ready for another call. ***A delay of up to 5 seconds may be required to release the TSPS or CO equipment.***

**3.29 If the call is connected to a cord switchboard operator.**

- (1) A +48-volt battery is applied to the ring side of the line toward the station.
- (2) The operator requests the deposit required for initial period, monitors the coin tone signals for correct deposit and forwards the call.
- (3) The operator times the call, and at the end of the initial period, collects the deposit, and instructs the customer to signal when through.
- (4) When the customer flashes the switchhook at the end of the call, the operator determines the overtime charge, and requests a coin deposit in the amount of the overtime charge. The operator monitors the coin tone signals for correct deposit, collects the deposit, then disconnects.
- (5) The customer hangs up handset and the station is now idle and ready for another call.

**G. Incoming Call**

**3.30** The CO applies ringing over tip and ring to the station.

**Note:** Collect to coin service is no longer provided.

**3.31** When the handset is lifted, ringing is shorted which trips a relay in the CO thus removing ring battery from the line. The shorting path is from ring, through the A relay winding, normally closed T2, DP contacts (rotary dial only), operated SH2 and SH4 contacts, through the speech network to tip.

**3.32** The CO now applies talk battery to ring and ground to tip.

**COIN FIRST SERVICE (Fig. 11 and 12)****A. Originating A Call**

**3.33** In CF service, the central office is monitoring the ring to ground path (ring -48 volts, tip open).

**3.34** When the handset is lifted, switchhook contacts SH3, SH2 and SH4, and SH1 operate in that order and a path exists from ring to the HT contacts. This path is through the normally closed T2 contacts, the DP contacts (rotary dial only), operated SH2 and SH4, through the speech network, transmitter, contacts (TOUCH-TONE dial only), RE, coin relay winding to the normally open HT.

**3.35** For a partial deposit of initial rate, T2 operates as well as HT.

**3.36** Upon deposit of initial rate, T1 operates, thereby closing the normally open T1 contact, completing the ring to ground path. This path is from ring through the normally closed A relay contact, through operated T1 contacts, F contacts, operated SH3, DP contacts (rotary dial only), operated SH2 and SH4, through the speech network, transmitter, normally closed contacts (TOUCH-TONE dial only), RE, coin relay, HT contacts, to ground.

**3.37** The CO applies dial tone and grounds the tip side of the line.

**3.38** Grounding the tip operates the A relay causing the A contacts to transfer. Opening the normally closed A contact removes the shorting path from the totalizer. A path now exists through the B relay winding, S (stepping) relay winding, C and S1 totalizer contacts, through operated T1, normally closed F contacts, operated SH3, DP contacts (rotary dial only), operated SH2 and SH4, through the speech network, transmitter, normally closed contacts (TOUCH-TONE dial only), back through the speech network, through the A relay winding to tip. As S1 transfers and the totalizer reads out, the coin tone oscillator is energized intermittently. The operated B relay shorts the speech circuit so the customer cannot hear the generated beep tones.

**3.39** When the totalizer steps back to home position, T2 restores, shorting the totalizer and B relay winding. The B relay releases, removing the AC short across the speech network. Even though the totalizer is returned to home position, T1 contact remains operated because it is mechanically latched in its transferred position.

**3.40** A dialing and talking path now exists from the ring lead to tip. This path is through the normally closed T2 contacts, normally closed DP contacts (rotary dial only) operated SH2 and SH4, the speech network, transmitter, normally closed contacts (TOUCH-TONE dial only) back through the speech network, through the A relay to tip.

**3.41** When dialing with a rotary dial, the dial-off-normal contacts short out the receiver.

**3.42** With a TOUCH-TONE dial the common switch contacts operate during dialing to remove the transmitter from the speech network and also removes the shunt.

**Note:** If the call is a local noncharge call, the deposit will be returned upon completion of call as described in paragraph 3.43.

**B. Restoring Set to Standby**

**3.43** Upon completion of call, customer hangs up handset, SH contacts restore, and the A relay releases. CO removes -48 volts from ring, ground from tip, and a collect (+130 volts) or refund (-130 volts) pulse is applied to tip, operating the coin relay and reset electromagnet (RE).

**3.44** Operation of coin relay collects or refunds coin(s), and operation of RE unlatches totalizer contact T1.

**3.45** The operated coin relay closes its make contact causing the current to bypass the relay and flow through the resistor which was previously shorted. The short across the relay winding causes the relay to be slow release. The resistor, having approximately the same resistance as the coin relay winding, is placed in the circuit to protect relay contacts in the CO and HT contacts in the set.

**3.46** As the coin relay releases, the HT contacts open, placing the coin phone in its idle or standby condition. See coin disposal test, paragraph 3.55.

**C. Call Abandoned**

**3.47 *Partial Initial Rate Deposited, (paragraph 3.35).***

(a) Upon hanging up handset, SH contacts restore and current flows from ring to station ground through the normally closed A contact, normally closed SH3, operated T2, normally closed SH1, the transmitter contacts (TOUCH-TONE dial only) RE, coin relay and HT.

(b) The CO recognizing the ground, applies ground to tip which operates the A relay and removes the short ground around the totalizer.

(c) Current now flows through the polarity guard, B relay winding, S relay winding, C and S1 contacts operated T2, normally closed SH1, the speech network, and the A relay winding to tip.

(d) Operation and release action of the S relay causes the totalizer to operate and step back to home.

(e) When the totalizer has been stepped back to home, T2 contact restores, shorting the totalizer and opening the telephone circuit. Shorting the totalizer releases the B relay. Opening the circuit releases the A relay. Both relays restore to normal.

(f) The CO, detecting the open circuit, applies -130 volts return battery to tip side of line

to return the deposit. This causes the coin relay and RE to operate.

(g) As the coin relay releases, HT opens, placing set in idle or standby condition.

**3.48 *Initial Rate Deposited (paragraph 3.36).***

(a) Upon hanging up handset, SH contacts restore and A relay releases. CO removes -48 volts from ring, ground from tip, and a refund (-130 volts) pulse is applied to tip, operating the coin relay and reset electromagnet (RE). T1 contacts of the totalizer are restored.

(b) As the coin relay releases, HT opens, placing set in idle or standby condition.

**D. Nickel Local Overtime**

**3.49** After the called party answers, the CO initiates timing.

**3.50** Approximately 30 seconds before the end of the initial period, collect voltage is applied and the initial deposit is collected.

**3.51** After approximately a 30 second interval, a coin present test is made.

**3.52** If a nickel is deposited, T2 and HT in the coin station operate. When totalizer reads out, T2 reverts to normal.

**3.53** With T2 in its normal position, CO applies -48 volts to tip, with ring open, to check for coin presence. If test is satisfied, conversation may continue.

**Note:** The ESS and combined CF/DTF offices will use +48 volt coin present test. The +48 volt coin present test is then applied. It has no effect in the operation of a coin-first station, but in a combination office (CF/DTF), this feature is necessary to operate a DTF station which has a diode (CR4) around the totalizer.

**3.54** If a nickel is not deposited, a recording is connected to the line to request an overtime deposit.

- After 30 seconds, an additional coin presence test is made. If a coin is not deposited, the call is terminated.

#### E. Coin Disposal-Test

**3.55** Immediately after collect or return voltage is applied following customer disconnect, the CO makes a coin disposal test by applying +48 volts to the tip side of the line (ESS), or by applying -48 volt in EM offices on local calls.

**3.56** If no coin ground is detected, the HT contacts are open and the test is satisfied. If ground is detected, the HT contacts are still closed, indicating a failure to dispose of coin.

**3.57** If ground was detected in paragraph 3.56, the CO again applies collect or return voltage and repeats test.

#### F. Toll Call

##### 3.58 *Coin-First Station—Coin-First Office.*

- (1) Originate a call as in paragraphs 3.33 through 3.40.
- (2) After the number is dialed, the CO automatically applies return voltage and the deposit is returned (when coin return option is provided).
- (3) The call is then connected to either a TSPS trunk or to a cord switchboard operator trunk.
- (4) ***If the call is connected to a TSPS.***
  - (a) A TSPS operator is automatically connected to the calling party.
  - (b) The TSPS operator requests the deposit required for initial talk period as displayed at the position, then monitors the coin tone signals for correct deposit and releases the position from that call.
  - (c) After the called party answers, the TSPS trunk times the call and at the end of the initial charge period causes the CO to collect the initial deposit and routes the call to an idle TSPS position. (This may not be the same position as before.)

(d) The operator is connected to the call and instructs the customer to signal when through. The position is released and the TSPS trunk continues to time the call automatically.

(e) When the customer flashes the switchhook at the end of the call, an idle TSPS position is connected. The operator requests a deposit in the amount displayed at the position, monitors the coin tone signals for correct deposit, collects the deposit, and releases the position.

(f) The customer hangs up handset. The TSPS sends a coin collect signal to the local office and a coin disposal test (ESS, Step-by-Step offices only) is made. The station is now idle and ready for another call. ***A delay of up to 5 seconds may be required to release the TSPS or CO equipment.***

##### (5) ***If the call is connected to a cord switchboard operator:***

- (a) The operator requests the deposit required for initial period, monitors the coin tone, signals for correct deposit and forwards the call.
- (b) The operator times the call, and at the end of the initial period collects the deposit, and instructs the customer to signal when through.
- (c) When the customer flashes the switchhook at the end of the call, the operator determines the overtime charge required, and requests a coin deposit in the amount of the overtime charge. The operator monitors the coin tone signals for correct deposit, collects the deposit, then disconnects.
- (d) The customer hangs up handset and the station is restored to the idle state and ready for another call, refer to paragraph 3.29(4).

##### 3.59 *Coin-First Station—Coin-First/Dial-Tone-First Office.*

- (1) Originate a call as in paragraphs 3.33 through 3.40.

(2) After the number is dialed, the CO automatically applies return voltage and any previous deposit is returned, (when coin return option is provided).

(3) The call is then connected to either a TSPS trunk or to a cord switchboard operator trunk.

(4) ***If the call is connected to a TSPS.***

(a) A TSPS operator is automatically connected to the calling party.

(b) The local office TSPS trunk applies +48-volt battery on the ring side of the line toward the station. This replaces the normal -48-volt talk battery on the line.

(c) The TSPS operator requests the deposit required for initial talk period as displayed at the position, then monitors the coin tone signals for correct deposit and releases the position from that call.

(d) After the called party answers, the TSPS trunk times the call and at the end of the initial charge period causes the CO to collect the initial deposit and routes the call to an idle TSPS position. (This may not be the same position as before.)

(e) The operator is connected to the call and instructs the customer to signal when through. The position is released and the TSPS trunk continues to time the call automatically.

(f) When the customer flashes the switchhook at the end of the call, an idle TSPS position is connected. The operator requests coin deposit in amount displayed at the position, monitors the coin tone signals for correct deposit, collects the deposit, and releases the position.

(g) The customer hangs up handset. The TSPS sends a coin collect signal to the local office and a coin disposal test (on ESS and Step-by-Step only) is made. The station is now idle and ready for another call. ***A delay of up to 5 seconds may be required to release the TSPS or CO equipment.***

(5) ***If the call is connected to a cord switchboard operator.***

(a) The +48-volt battery is applied to the ring side of the line toward the station.

(b) The operator requests the deposit required for initial period, monitors the coin tone signals for correct deposit, and forwards the call.

(c) The operator times the call, and at the end of the initial period, collects the deposit, and instructs the customer to signal when through.

(d) When the customer flashes the switchhook at the end of the call, the operator determines the overtime charge, and requests a coin deposit in the amount of overtime charge. The operator monitors the coin tone signals for correct deposit, collects the deposit, then disconnects.

(e) The customer hangs up handset and the station is restored to the idle state and ready for another call.

#### G. Incoming Call

**3.60** The CO applies ringing over tip and ring to the station.

**3.61** When the handset is lifted, ringing is shorted which trips a relay in the CO thus removing ring battery from the line. The shorting path is from ring, through the normally closed T2 contacts, DP contacts (rotary dial only), operated SH2 and SH4 contacts, through the speech network, through the A relay winding, to tip.

**3.62** The CO now applies talk battery to ring and ground to tip.

#### 4. SEQUENCE CHARTS

**4.01** The following is an alphabetical listing of Sequence Charts:

A—Local Call (DTF), Deposit Required

B—Local Call (DTF), No Deposit Required

C—Call Abandoned, Insufficient Deposit  
Refund (DTF)

D—Call Abandoned, Initial Rate Deposited  
(DTF)

E—Nickel Local Overtime (CF and DTF)

F—Coin Disposal Test (CF and DTF)

G—Toll Call (DTF)

H—Incoming Call (CF or DTF)

I—Local Charge Call (CF)

J—Local Non-Charge Call (CF)

K—Call Abandoned, Insufficient Deposit  
Refund (CF)

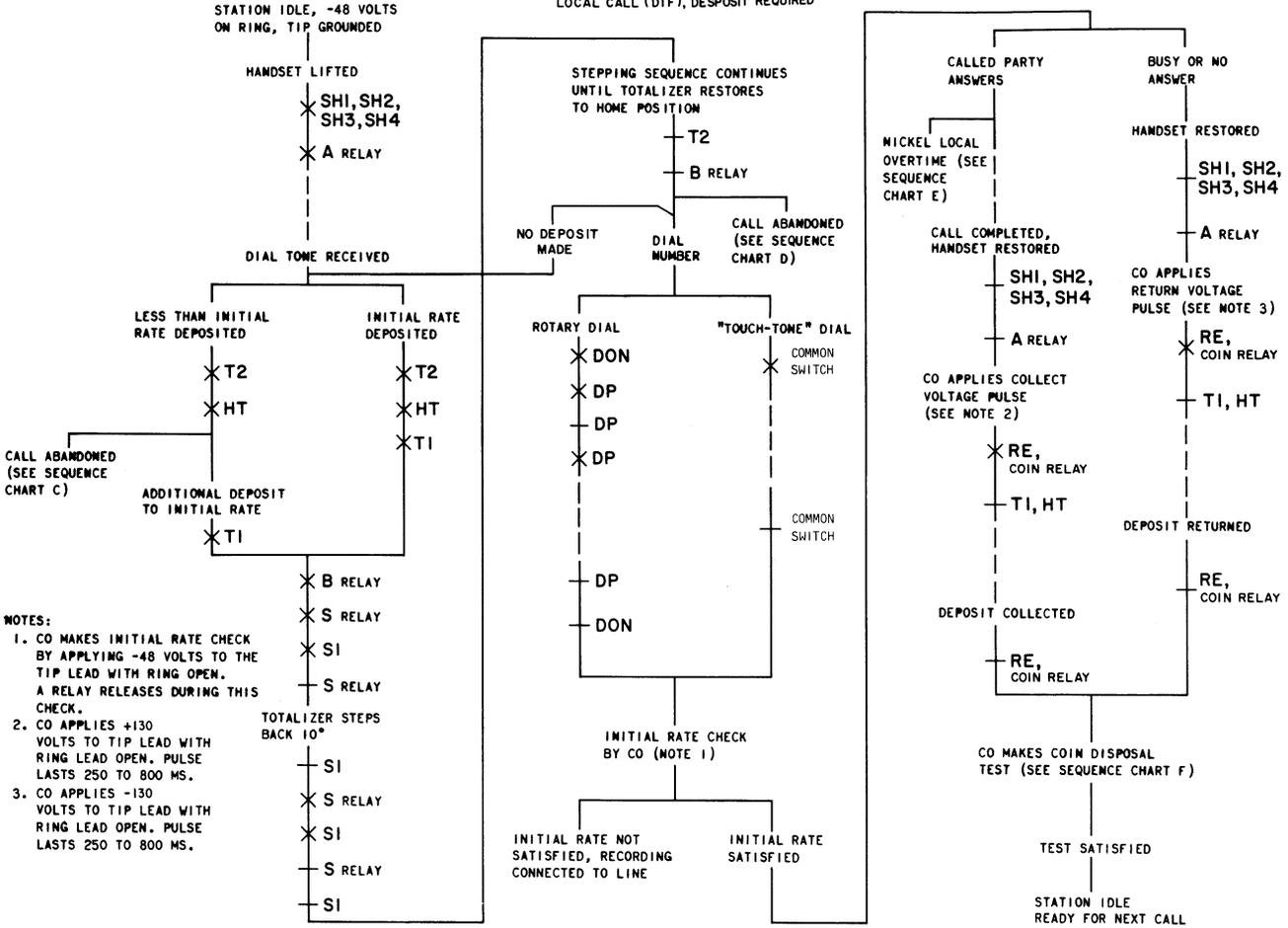
L—Call Abandoned, Initial Rate Deposited,  
No Dial Tone (CF)

M—Call Abandoned, Initial Rate Deposited,  
Dial Tone Received (CF)

N—Toll Call—CF Station, CF Office

O—Toll Call—CF Station, CF/DTF Office

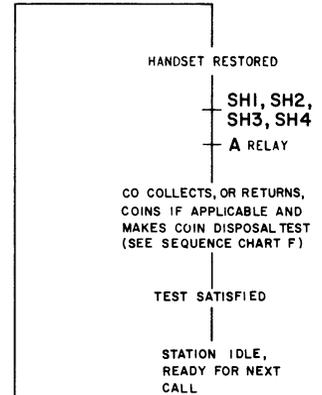
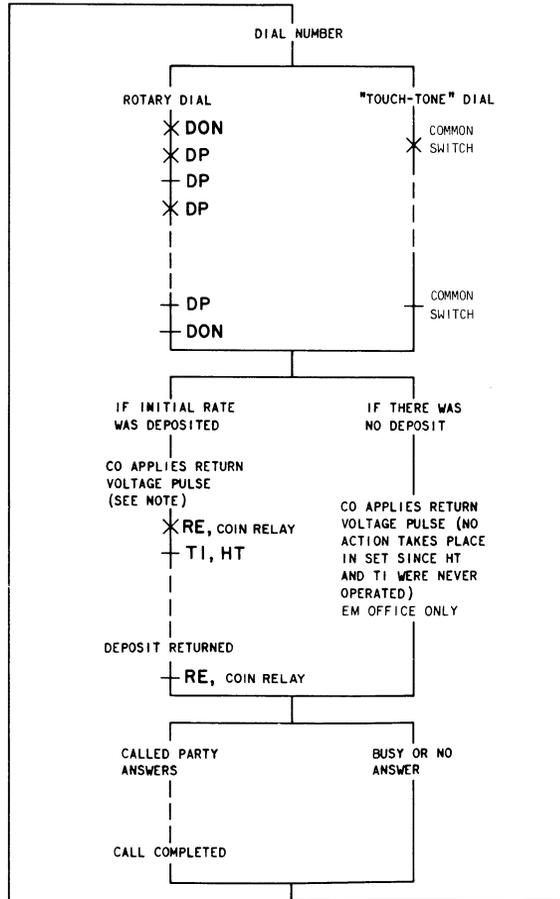
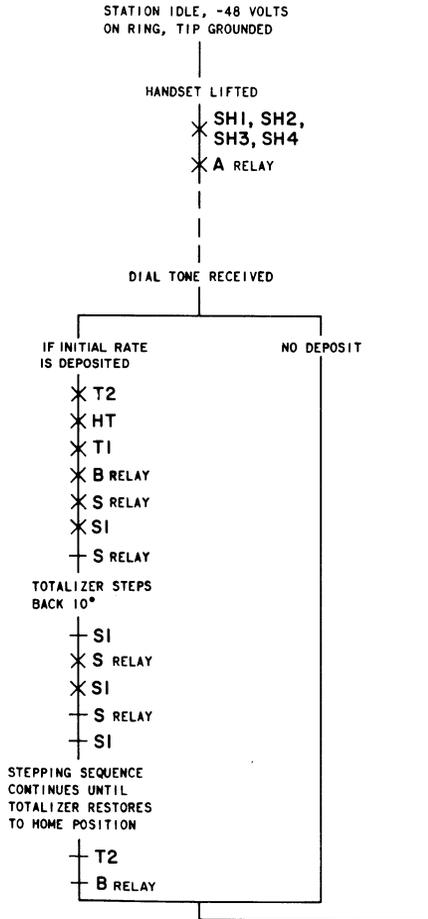
SEQUENCE CHART A  
LOCAL CALL (DTF), DEPOSIT REQUIRED



NOTES:

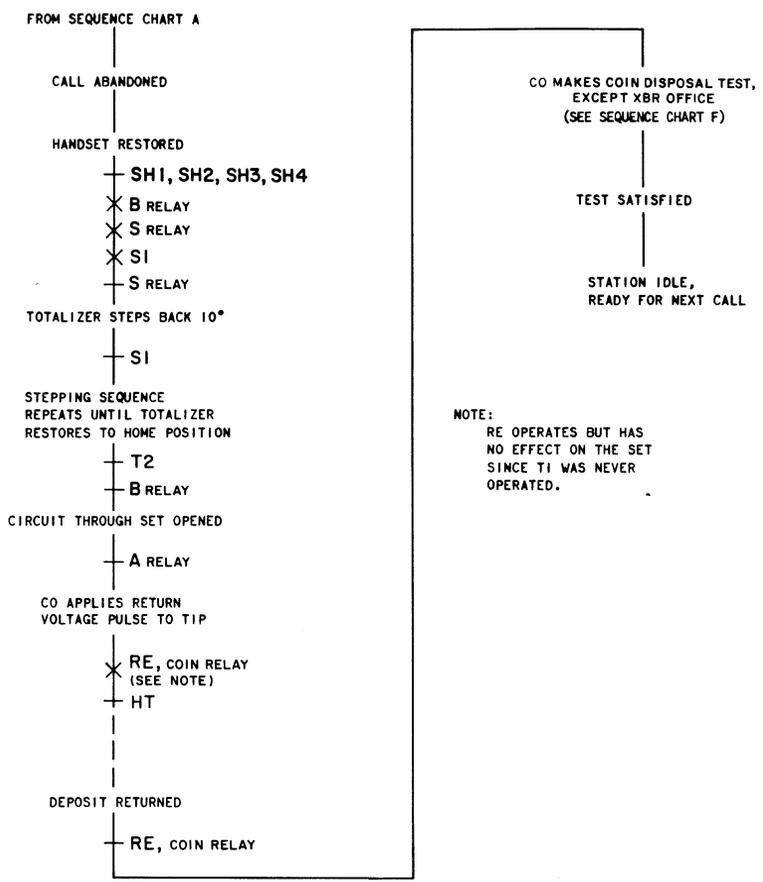
1. CO MAKES INITIAL RATE CHECK BY APPLYING -48 VOLTS TO THE TIP LEAD WITH RING OPEN. A RELAY RELEASES DURING THIS CHECK.
2. CO APPLIES +130 VOLTS TO TIP LEAD WITH RING LEAD OPEN. PULSE LASTS 250 TO 800 MS.
3. CO APPLIES -130 VOLTS TO TIP LEAD WITH RING LEAD OPEN. PULSE LASTS 250 TO 800 MS.

SEQUENCE CHART B  
LOCAL CALL (DTF), NO DEPOSIT REQUIRED



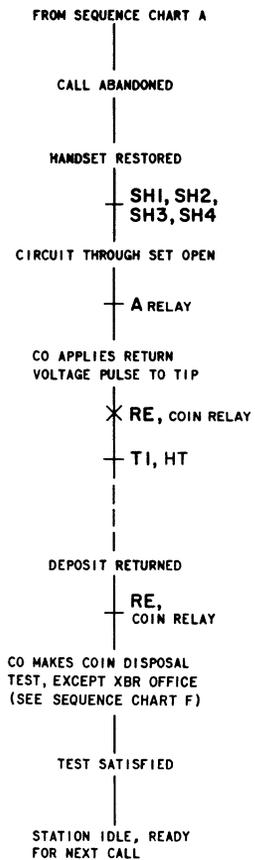
NOTE:  
CO APPLIES -115 TO -135 VOLTS TO TIP LEAD WITH RING LEAD OPEN. PULSE LASTS 250 TO 800 MS.

SEQUENCE CHART C  
 CALL ABANDONED,  
 INSUFFICIENT DEPOSIT REFUND (DTF)

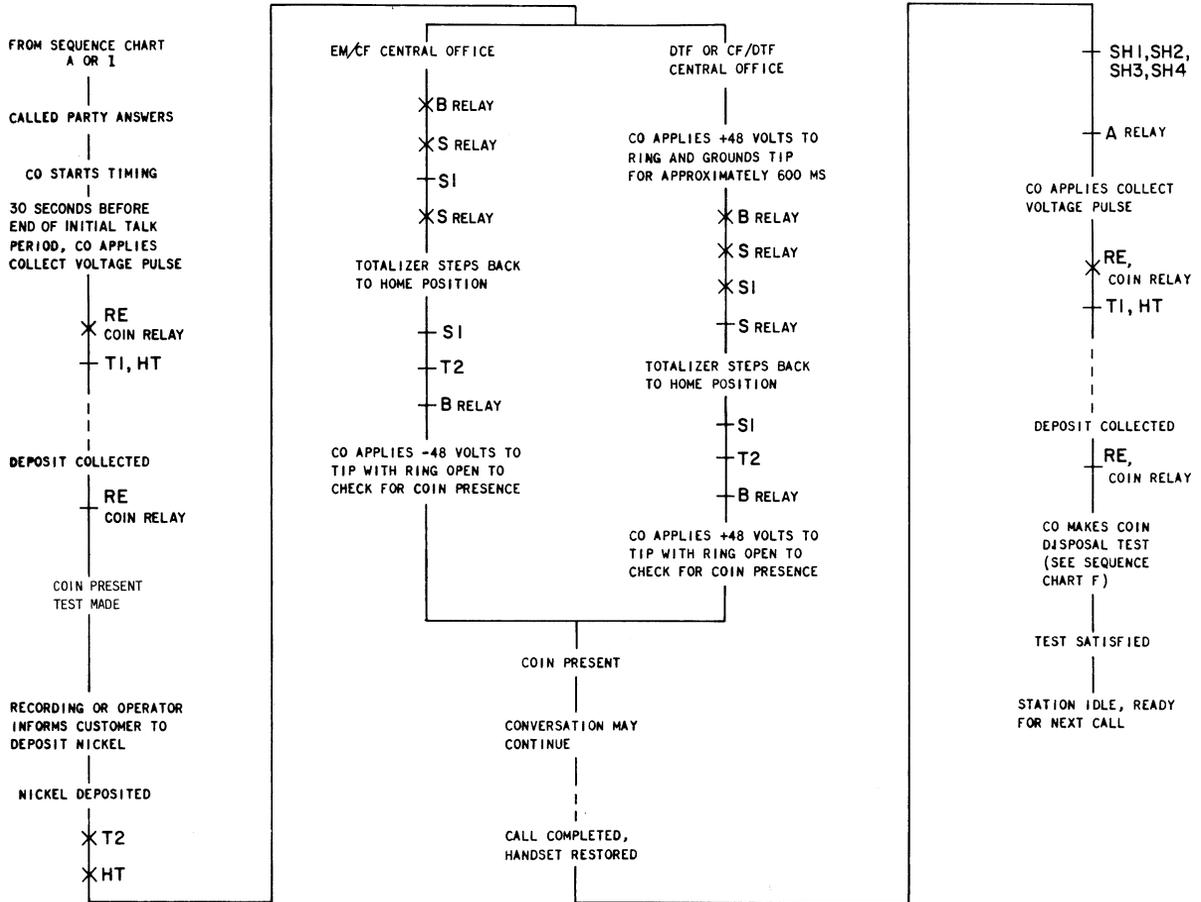


NOTE:  
 RE OPERATES BUT HAS  
 NO EFFECT ON THE SET  
 SINCE T1 WAS NEVER  
 OPERATED.

SEQUENCE CHART D  
CALL ABANDONED,  
INITIAL RATE DEPOSITED (DTF)



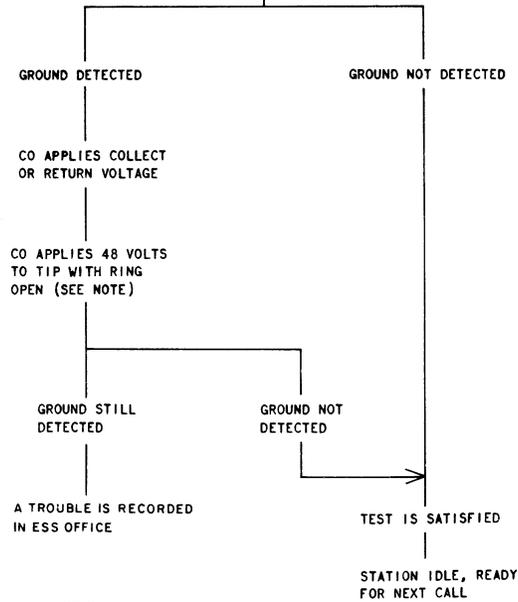
SEQUENCE CHART E  
NICKEL LOCAL OVERTIME (CF AND DTF)



SEQUENCE CHART F  
COIN DISPOSAL TEST (CF AND DTF)

FROM SEQUENCE  
CHARTS A,B,C,D,E,G,  
I,J,K,L,M,N, AND O

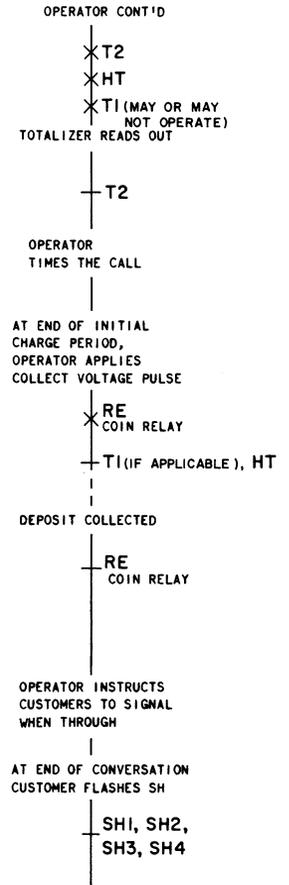
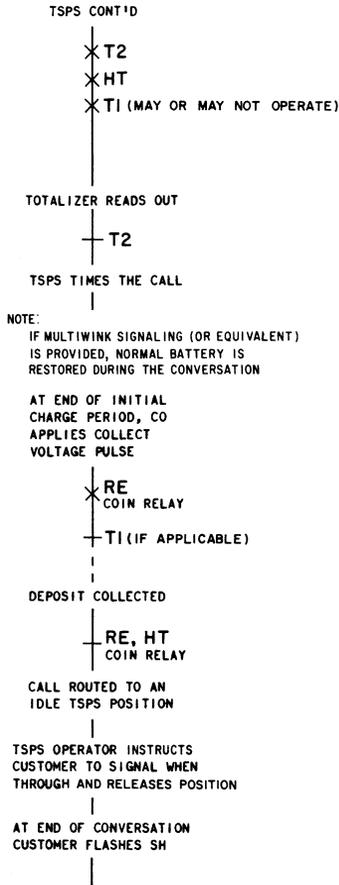
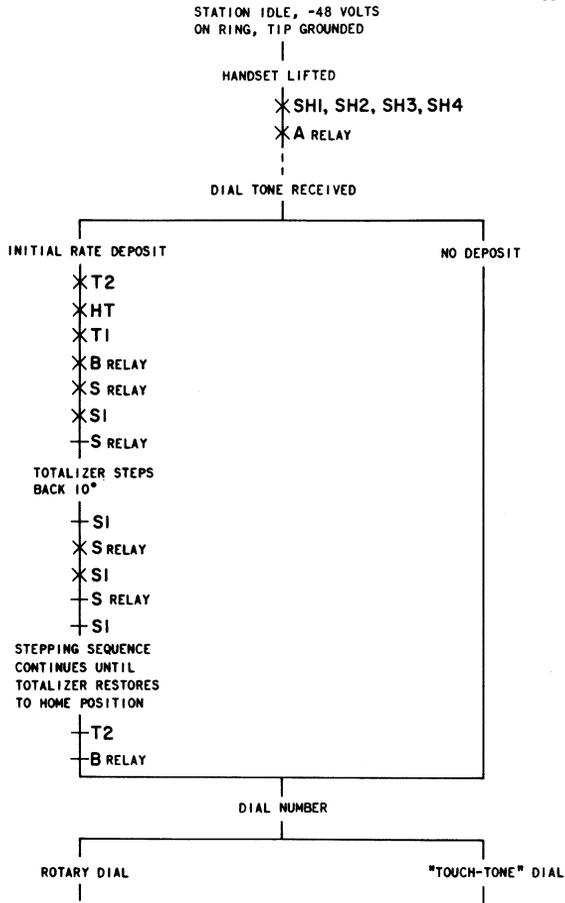
CO APPLIES 48 VOLTS TO  
TIP WITH RING OPEN  
(SEE NOTE)

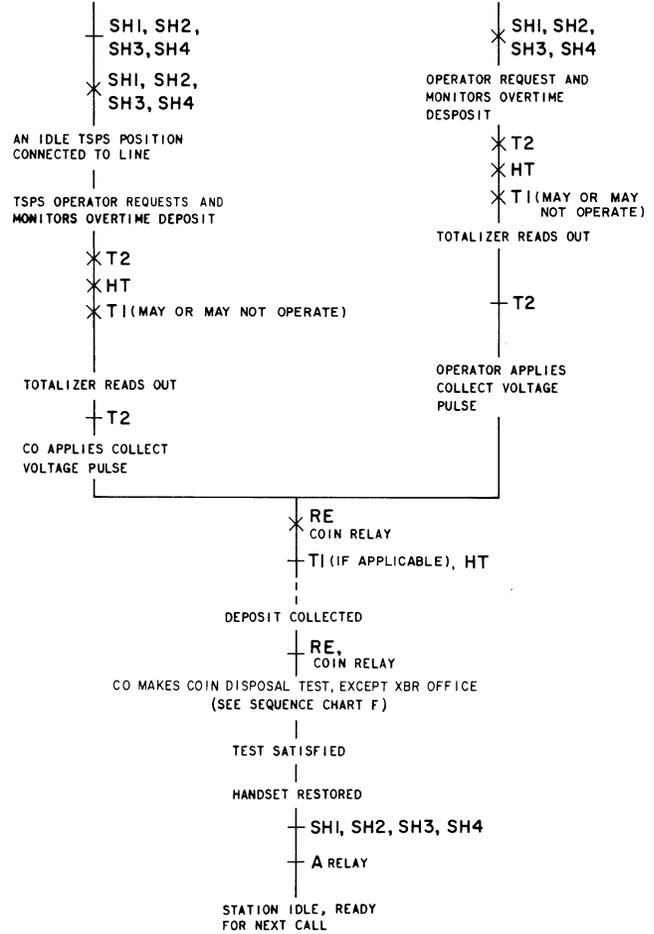
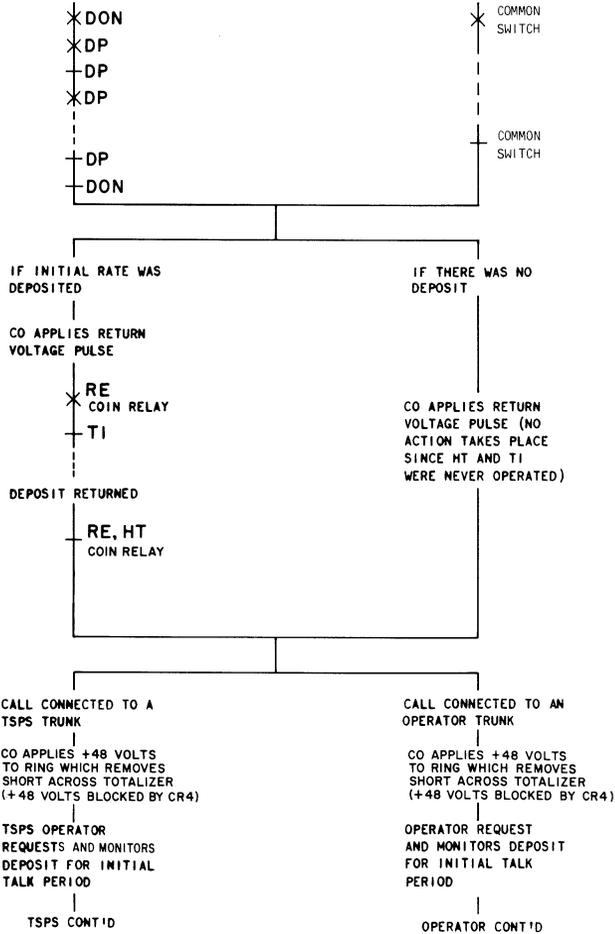


NOTE:

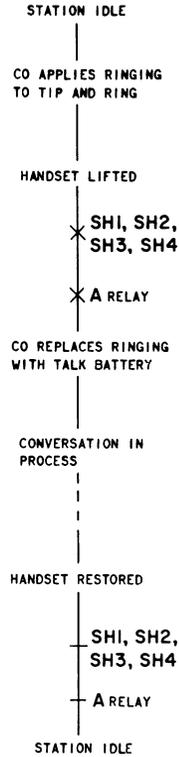
IN A EM/CF OFFICE, -48 VOLTS IS APPLIED; IN A DTF OR CF/DTF OFFICE, +48 VOLTS IS APPLIED; HOWEVER IN SOME OFFICES, COIN RETURN VOLTAGE MAY BE USED FOR THIS TEST.

SEQUENCE CHART G  
TOLL CALL-DTF STATION, DTF OFFICE

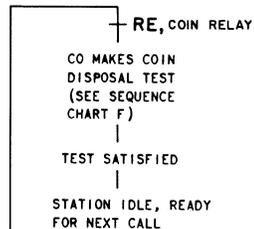
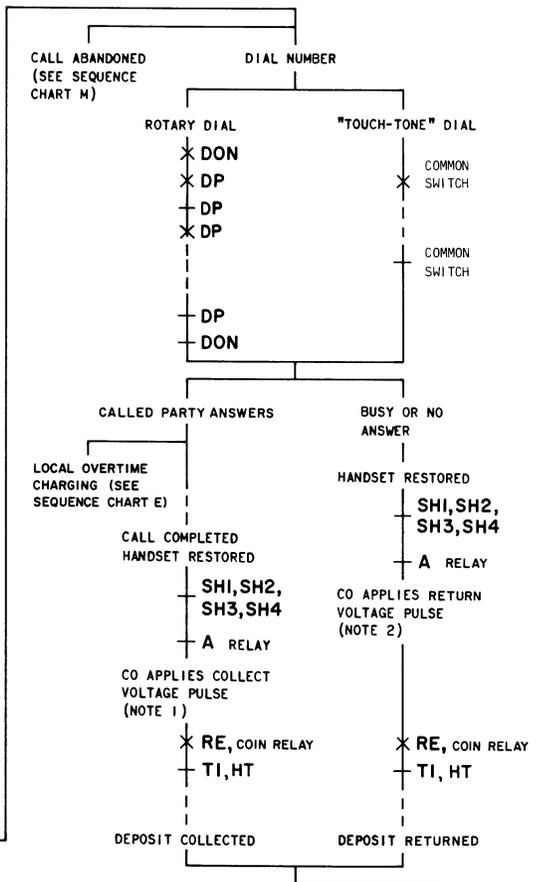
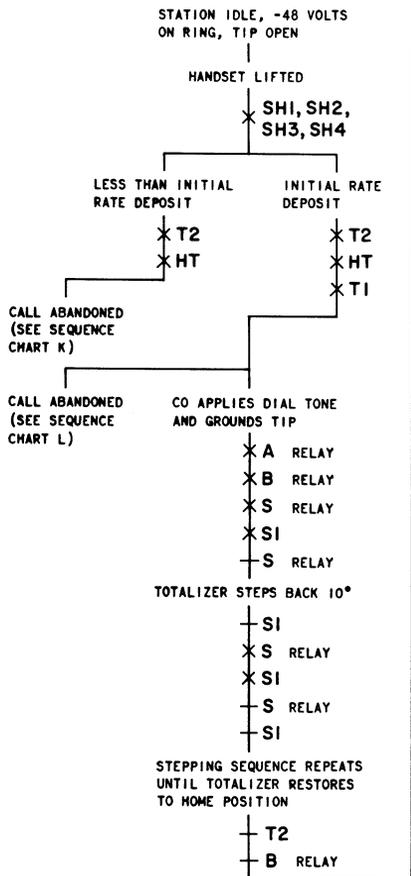




SEQUENCE CHART H  
INCOMING CALL (CF OR DTF)



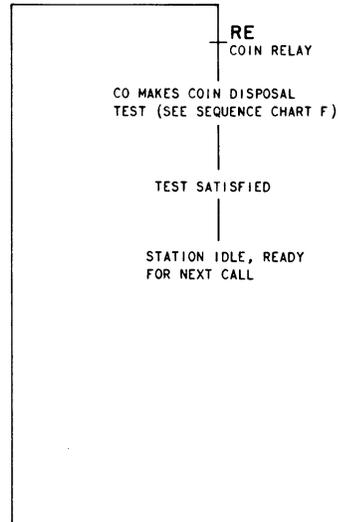
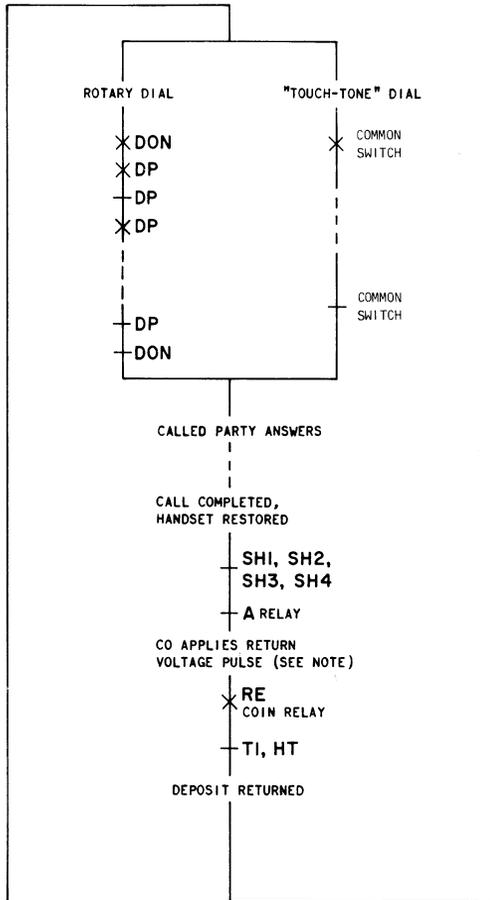
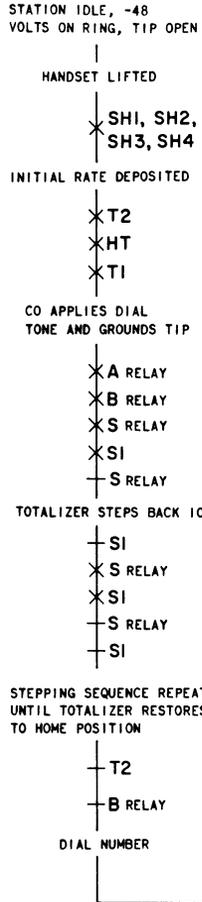
SEQUENCE CHART I  
LOCAL CHARGE CALL (CF)



NOTES:

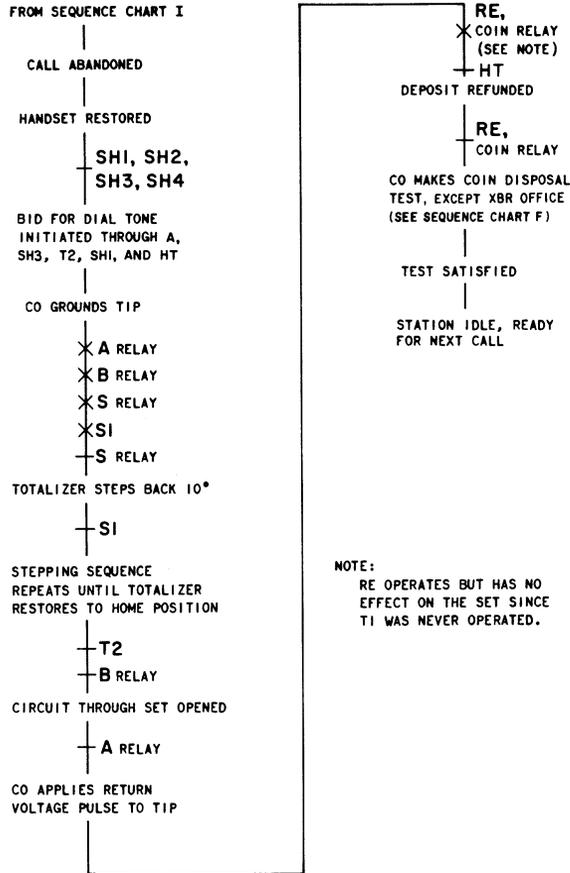
1. CO APPLIES +130 VOLTS TO TIP LEAD. PULSE LASTS 250 TO 800 MS.
2. CO APPLIES -130 VOLTS TO TIP LEAD. PULSE LASTS 250 TO 800 MS.

SEQUENCE CHART J  
LOCAL NON-CHARGE CALL (CF)

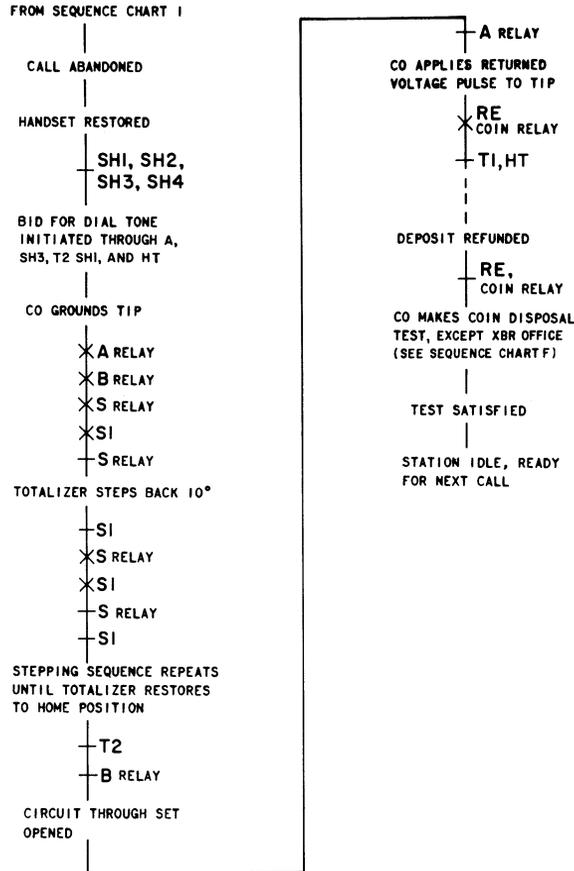


NOTE:  
CO APPLIES -130 VOLTS TO TIP LEAD.  
PULSE LASTS 250 TO 800 MS.  
IN A CF/DTF OFFICE, DEPOSIT MAY BE RETURNED AFTER NUMBER IS DIALED AS SHOWN IN SEQUENCE CHART B.

SEQUENCE CHART K  
 CALL ABANDONED, INSUFFICIENT  
 DEPOSIT REFUND (CF)



SEQUENCE CHART L  
 CALL ABANDONED INITIAL RATE  
 DEPOSITED, NO DIAL TONE (CF)



SEQUENCE CHART M  
CALL ABANDONED AFTER  
INITIAL RATE DEPOSITED AND  
DIAL TONE RECEIVED (CF)

FROM SEQUENCE CHART I

CALL ABANDONED

HANDSET RESTORED

SH1, SH2,  
SH3, SH4

A RELAY

CIRCUIT THROUGH SET OPEN

CO APPLIES RETURN VOLTAGE  
PULSE TO TIP

RE  
COIN RELAY

TI, HT

DEPOSIT REFUNDED

RE  
COIN RELAY

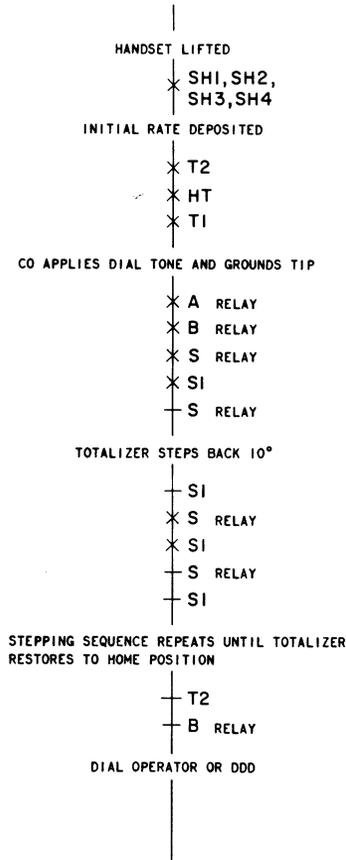
CO MAKES COIN DISPOSAL  
TEST EXCEPT XBR OFFICE  
(SEE SEQUENCE CHART F)

TEST SATISFIED

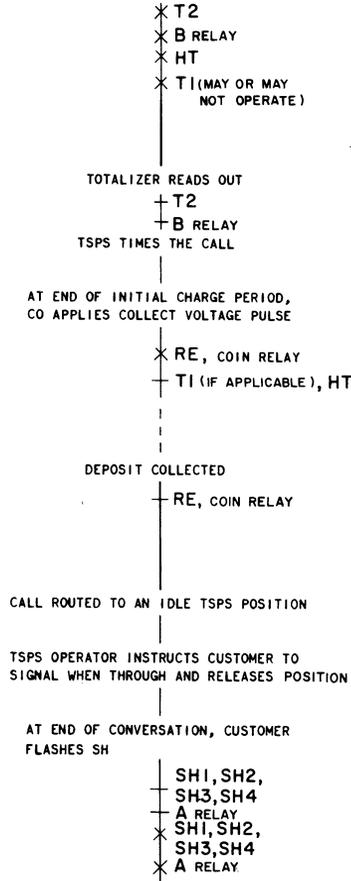
STATION IDLE, READY  
FOR NEXT CALL

SEQUENCE CHART N  
TOLL CALL-CF STATION, CF OFFICE

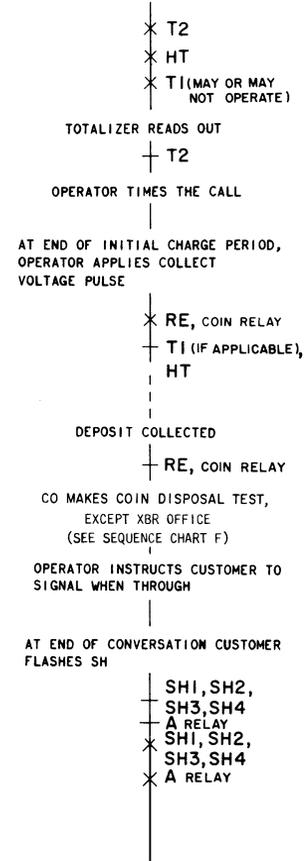
STATION IDLE, -48 VOLTS ON RING, TIP OPEN

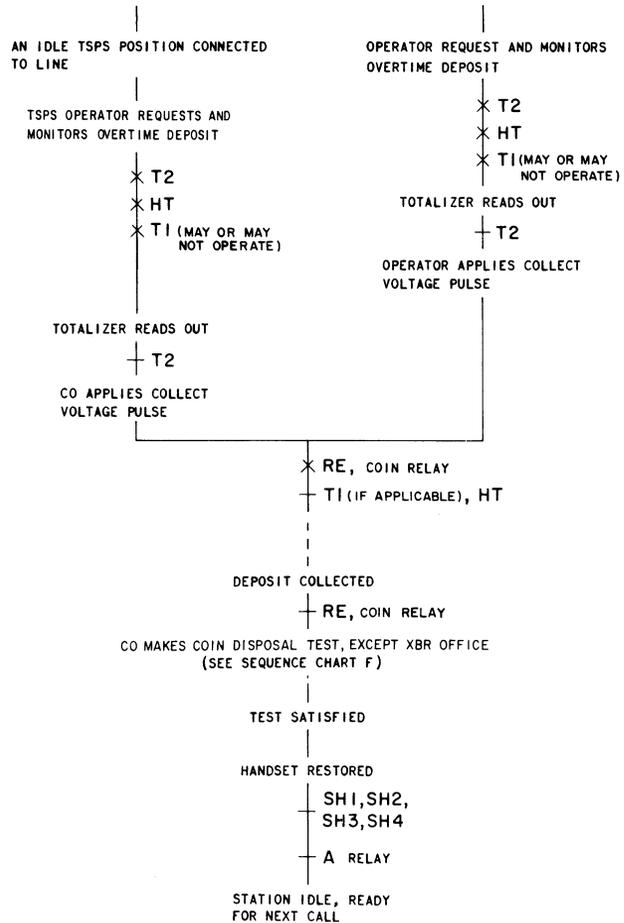
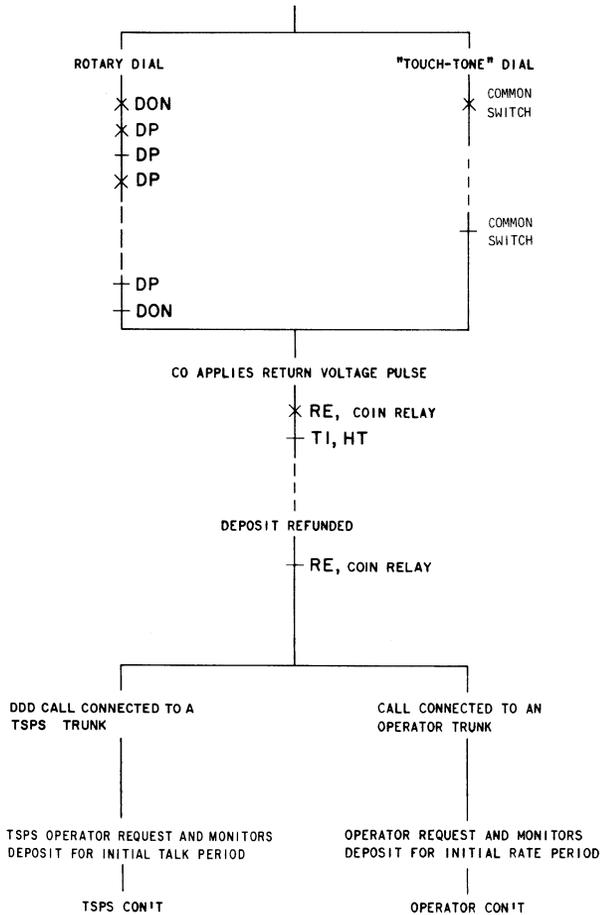


TSPS CON'T

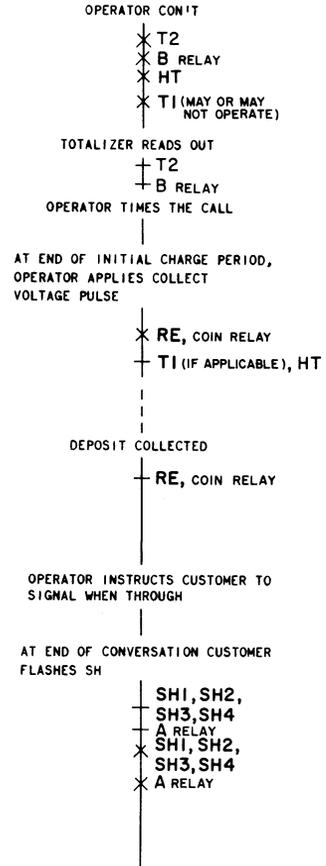
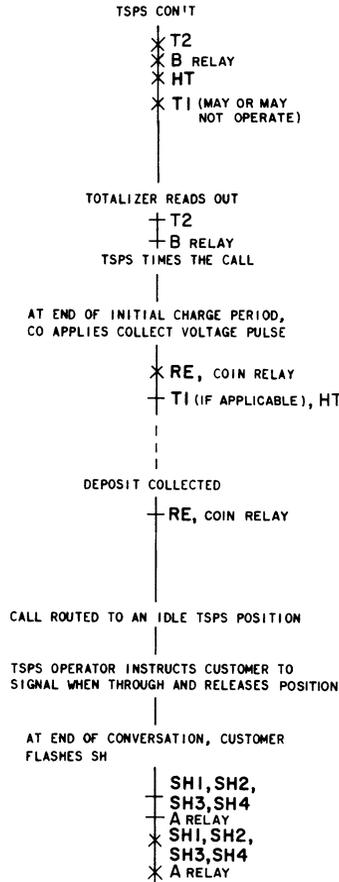
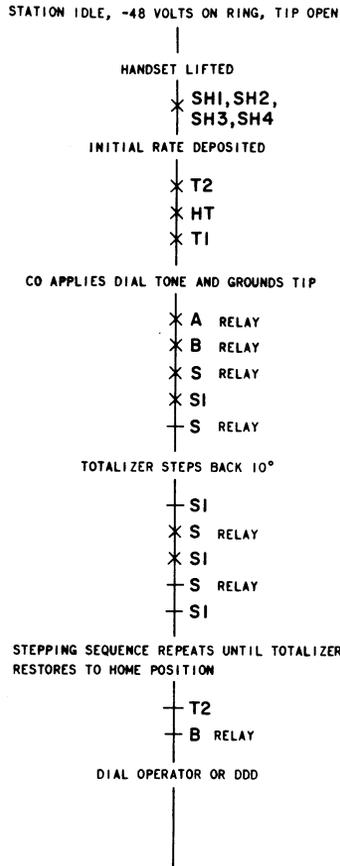


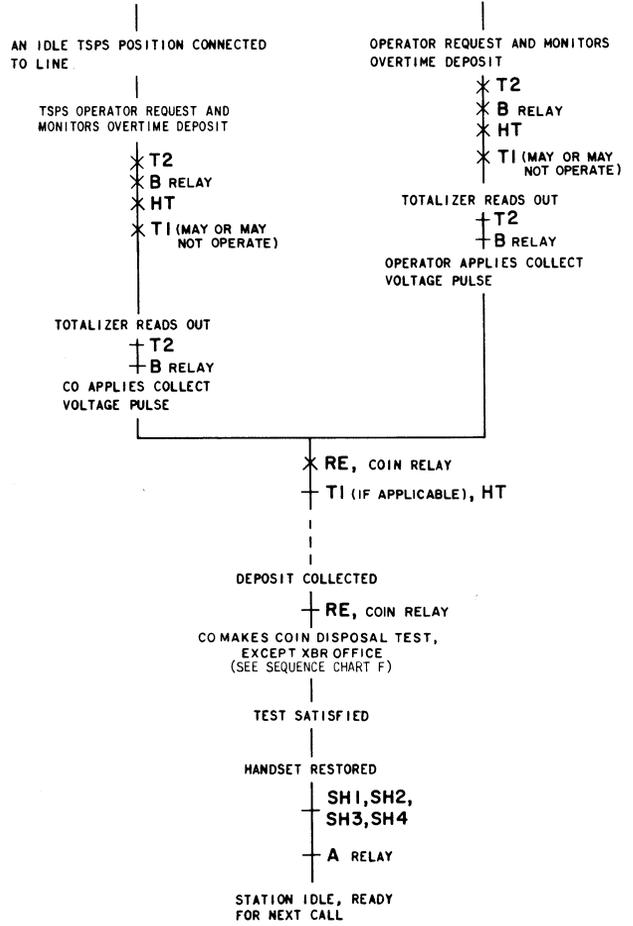
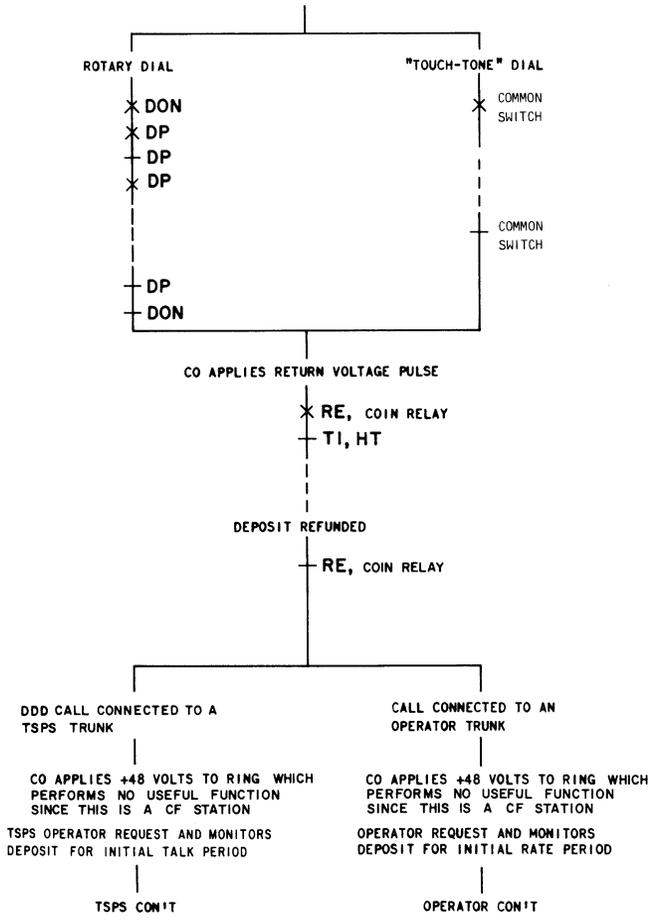
OPERATOR CON'T





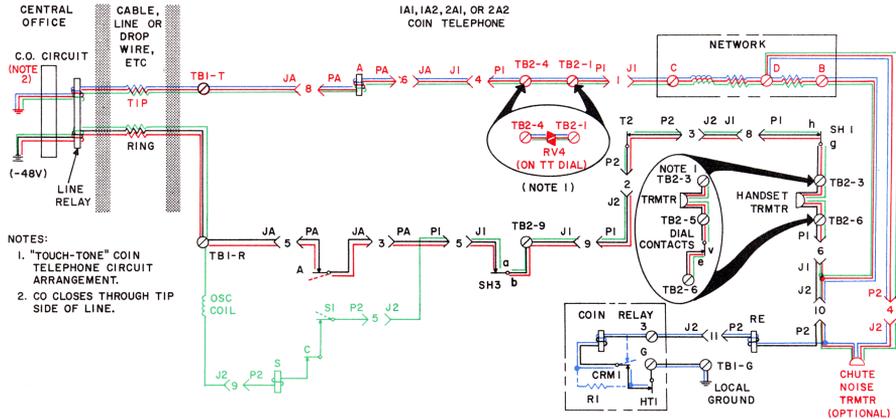
SEQUENCE CHART O  
TOLL CALL-CF STATION, CF/DTF OFFICE





## COLOR FUNCTIONAL SCHEMATICS

### 1A/2A/1C/2C-TYPE COIN TELEPHONE SETS



#### LEGEND

**CIRCUIT CONDITION:**

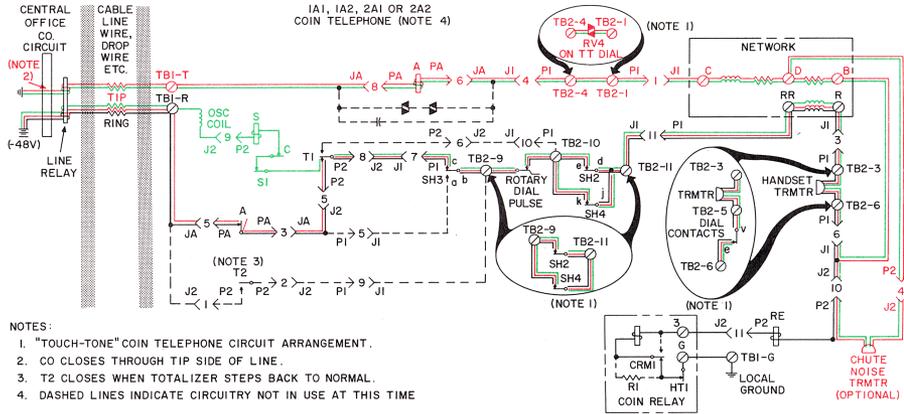
- Handset on switchhook
- T2 operated (coin deposited)
- HT1 (hopper trigger) operated

**CIRCUIT ACTION:**

1. **Black** — This circuit causes the tip side of line to be closed through to ground in the CO. Dial tone is placed on line but is ineffective. Current in this circuit (48V) is not sufficient to operate RE or coin relay.
2. **Red** — A relay operates, causing its normal contacts to open removing the short across the S (stepper) relay.
3. **Green** — (a) Operation of S relay causes its normally closed S1 contact to open. The S1 contact in opening causes the S relay to release, thus closing the S1 contact. This operating and releasing action of the S relay steps the totalizer 10 degrees back to normal each time it operates. (Each \$.05 amount deposited causes the totalizer to rotate 10 degrees.)  
(b) When the totalizer has been stepped back to normal, T2 contact restores (opens its make contact, which in turn, opens the telephone circuit.)
4. **Blue** — (a) The CO, detecting the open telephone circuit, sends out negative 100 to 130 volts return battery to return the deposit.  
(b) The RE relay in operating would normally restore the T1 contact. Since the initial rate was not deposited, the T1 was normal and the operated RE relay has no effect.  
(c) The operated coin relay, closes its make contact causing the current to bypass the relay and flow through the resistor which was previously shorted. The short across the relay winding causes the relay to be slow release. The resistor, having approximately the same resistance as the coin relay winding, is placed in the circuit to protect contact HT when it restores, and to protect the resistance lamp in the central office circuit.  
(d) As the coin relay releases, the HT contact opens placing the coin telephone set in its idle state.

**Fig. 1—Call Abandoned With Less Than Initial Rate Deposited (Deposit Refunded)—1A/2A-Type**





LEGEND

CIRCUIT CONDITION:

- Outgoing call
- Handset off-hook (SH1, SH2, SH3, SH4 operated)
- T2 operated (coin deposited)
- T1 operated (initial rate deposited)
- HT (hopper trigger) operated

CIRCUIT ACTION:

1. **Black** — This circuit causes the tip side of line to be closed through to ground in the CO. Dial tone is placed on line. Current in this circuit (48V) is not sufficient to operate RE or coin relay.
2. **Red** — A relay operates causing its normal contact to open which removes the short across the S (stepper) relay.
3. **Green** — (a) Operation of S relay causes its normally closed S1 contact to open. The S1 contact in opening causes the S relay to release thus closing the S1 contact. This operating and releasing action of the S relay steps the totalizer 10 degrees back each time it operates.  
(b) When the totalizer has stepped back to normal the T2 contact restores and places the telephone circuit in its dialing and talking state.

Fig. 3—Initial Rate Deposited—Origination State—1A/2A-Type

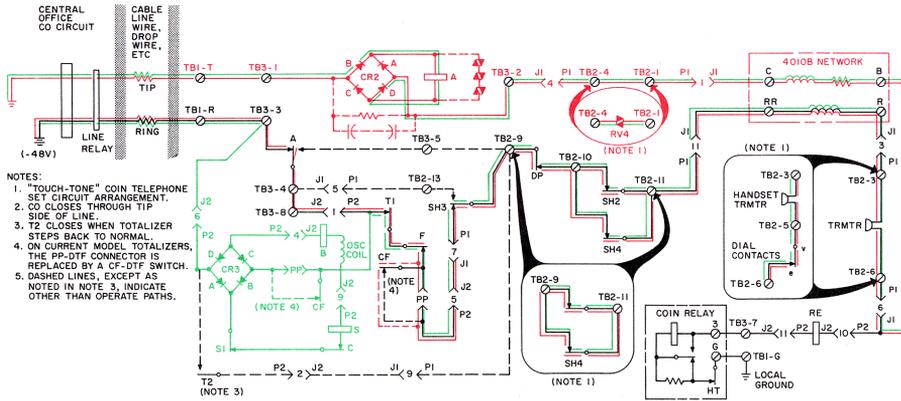


Fig. 4—Initial Rate Deposited—Origination State—1C/2C-Type (CF)

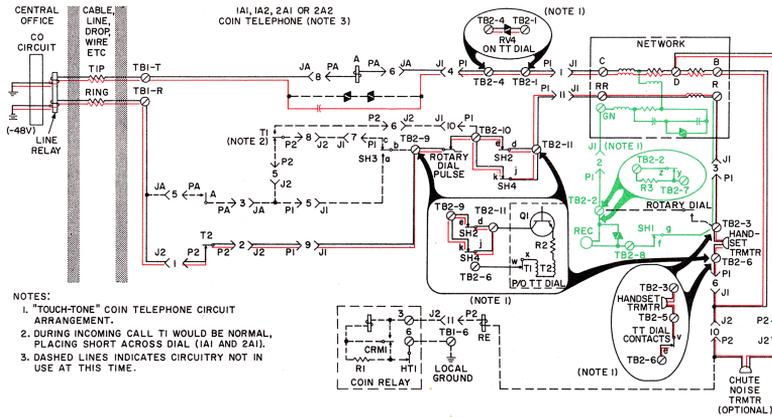


Fig. 5—Dialing, Talking, and Listening Circuits—1A/2A-Type

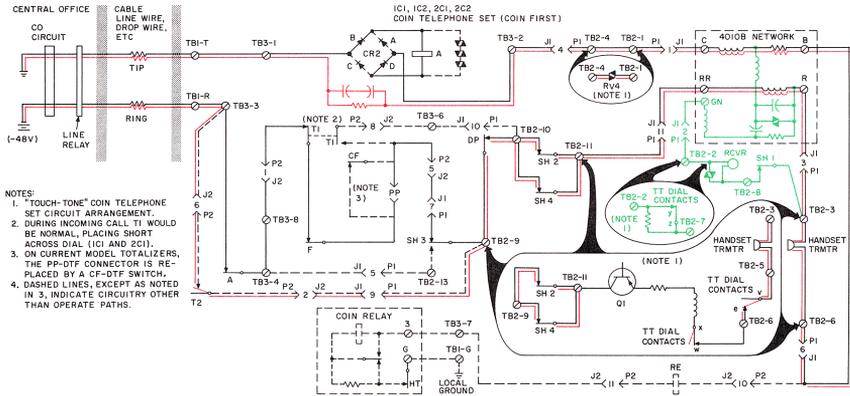
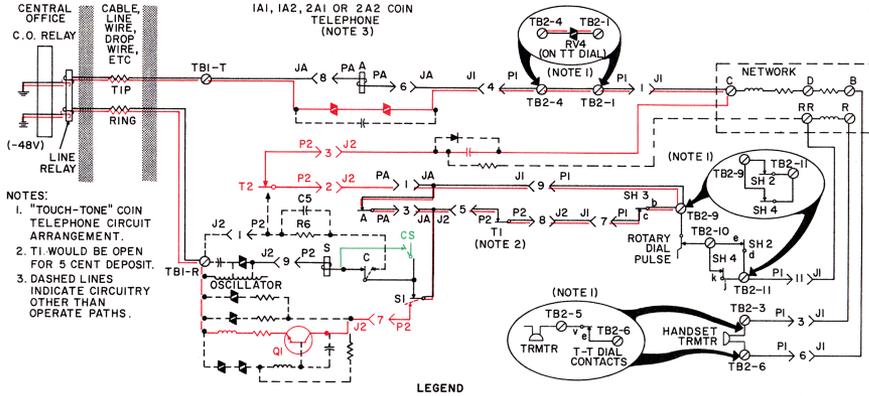


Fig. 6—Dialing, Talking, and Listening Circuits—1C/2C-Type (CF)



LEGEND

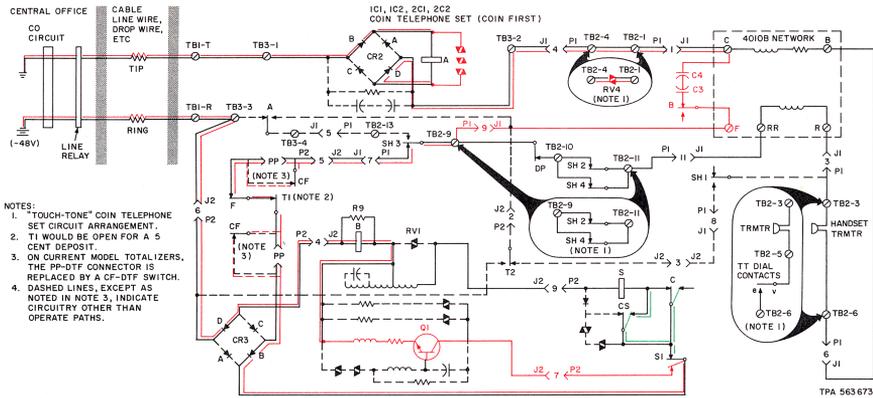
CIRCUIT CONDITION:

- Nickel, Dime, or Quarter deposit requested by operator
- T2 operated as result of deposited coin
- C and CS contacts normal for nickel or dime deposit
- C and CS contacts operated for quarter deposit

CIRCUIT ACTION:

1. **Black** — Oscillator charging circuit and S relay operating path for nickel or dime deposit. The circuit is shown for dime deposit. Nickel deposit circuit would be the same, except T1 contact would be normal (open) instead of closed as shown.
2. **Black and Green** — Oscillator charging circuit and S relay operating path for quarter deposit. CS contact operates when totalizer rotates 45°, enabling charging of the S relay before C contact restores. This enables a faster readout of the oscillator circuit.
3. **Red** — Oscillator readout (tone signal) path. Contact S1 transfers the current flow from the totalizer to the transistor. Current flow is increased and decreased due to the changing polarity on the emitter and base of the transistor caused by the transformer action of the tank circuit. This produces tone signal heard by operator during operate and release stepping of S relay. The signal bypasses the network through the T2 contacts and the AC shorting capacitor.

Fig. 7—Coin Signal Tone Circuit—1A/2A-Type



LEGEND

CIRCUIT CONDITION:

- Nickel, Dime, or Quarter deposit requested by operator
- T2 operated as result of deposited coin
- C and CS contacts normal for nickel or dime deposit
- C and CS contacts operated for quarter deposit

CIRCUIT ACTION:

1. **Black** — Oscillator charging circuit and S relay operating path for nickel or dime deposit. The circuit is shown for dime deposit. Nickel deposit circuit would be the same, except T1 contact would be normal (open) instead of closed as shown.
2. **Black and Green** — Oscillator charging circuit and S relay operating path for quarter deposit. CS contact operates when totalizer rotates 45°, enabling charging of the S relay before C contact restores. This enables a faster readout of the oscillator circuit.
3. **Red** — Oscillator readout (tone signal) path. Contact S1 transfers the current flow from the totalizer to the transistor. Current flow is increased and decreased due to the changing polarity on the emitter and base of the transistor caused by the transformer action of the tank circuit. This produces tone signal heard by operator during operate and release stepping of S relay. The signal bypasses the network through the B relay contacts and the AC shorting capacitors.

Fig. 8—Coin Signal Tone Circuit—1C/2C-Type (CF)

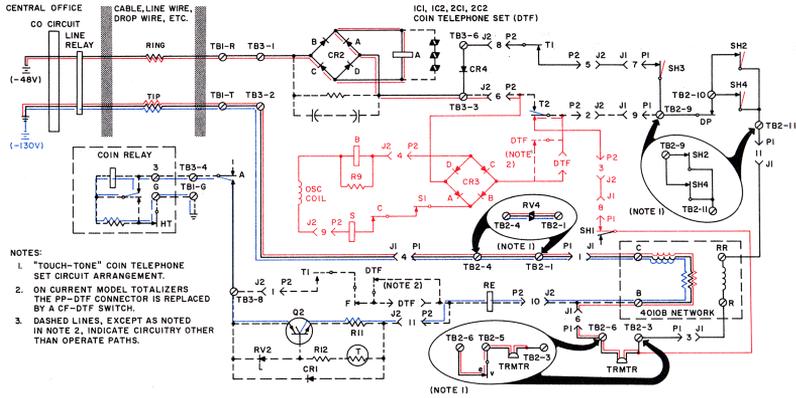
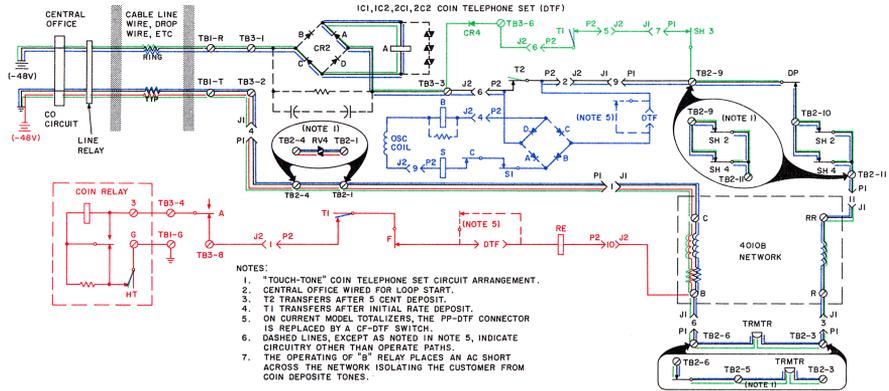


Fig. 9—Call Abandoned With Less Than Initial Rate Deposited (Deposit Refunded)—1C/2C-Type (DTF)



- NOTES:
1. "TOUCH-TONE" COIN TELEPHONE SET CIRCUIT ARRANGEMENT.
  2. CENTRAL OFFICE WIRED FOR LOOP START.
  3. T2 TRANSFERS AFTER 5 CENT DEPOSIT.
  4. T1 TRANSFERS AFTER INITIAL RATE DEPOSIT.
  5. ON CURRENT MODEL TOTALIZERS, THE PP-DTF CONNECTOR IS REPLACED BY A CF-DTF SWITCH.
  6. DASHED LINES, EXCEPT AS NOTED IN NOTE 5, INDICATE CIRCUITRY OTHER THAN OPERATE PATHS.
  7. THE OPERATING OF "B" RELAY PLACES AN AC SHORT ACROSS THE NETWORK ISOLATING THE CUSTOMER FROM COIN DEPOSITE TONES.

**LEGEND**

**CIRCUIT CONDITION:**

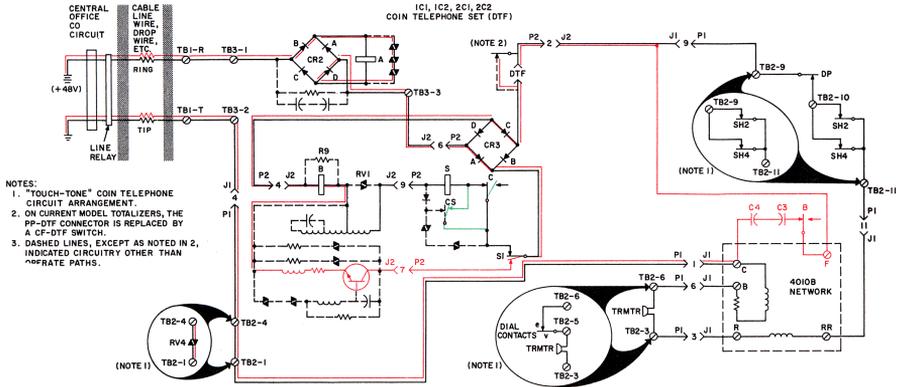
- Handset off-hook
- HT and T2 operated with 5-cent deposit
- T1 operated with initial rate deposit

**CIRCUIT ACTION:**

1. **Black — Standby**  
Central office wired for loop start — Ring is negative while tip is grounded. When handset is lifted, SH1, SH2 and SH4, and SH3 transfer. Loop current flows through A relay and dial tone is placed on the line.
2. **Red — Ground Test For Initial Rate Deposit**  
After a sufficient number of digits have been dialed, the CO removes battery from the ring and connects it to the tip; opens the ring releasing the A relay. This action permits the CO to look for coin station ground. If ground is not found (HT and T1 open) and this should be a charge call, customer will hear a recording requesting an initial rate deposit.
3. **Green — 5-Cent Deposit**  
With a deposit less than initial rate, coin relay HT contacts close and totalizer contacts T2 open. A path exists from Ring to Tip through normally closed T1, operated SH3, SH2 and SH4, and network.
4. **Blue — Initial Rate Deposit**  
Normally closed T1 contacts open applying current to oscillator and totalizer. Totalizer "reads out" and steps back to home position.

**Fig. 10—Standby, Ground Test for Initial Rate Deposit, 5-Cent Deposit, and Initial Rate Deposit—1C/2C-Type (DTF)**





**LEGEND**

**CIRCUIT CONDITION:**

- Nickel, Dime, or Quarter deposit requested by operator
- C and CS contacts normal for nickel or dime deposit
- C and CS contacts operated for quarter deposit

**CIRCUIT ACTION:**

1. **Black** — Oscillator charging circuit and S relay operating path for nickel or dime deposit.
2. **Black and Green** — Oscillator charging circuit and S relay operating path for quarter deposit. CS contact operates when totalizer rotates 45°, enabling charging of the S relay before C contact restores. This enables a faster readout of the oscillator circuit.
3. **Red** — Oscillator readout (tone signal) path. Contact S1 transfers the current flow from the totalizer to the transistor. Current flow is increased and decreased due to the changing polarity on the emitter and base of the transistor caused by the transformer action of the tank circuit. This produces tone signal heard by operator during operate and release stepping of S relay. The signal bypasses the network through the B relay contacts and the AC shorting capacitors.

**Fig. 12—Coin Signal Tone Circuit—1C/2C-Type (DTF)**

## 1D/2D-TYPE COIN TELEPHONE SET DETAILED DESCRIPTION

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### 1. GENERAL

1.01 The 1D/2D coin telephone set is used in conjunction with system standard dial-tone-first (DTF) central office arrangements to provide coin telephone service.

1.02 The 1D/2D set consist of a ringer, polarity guard and surge protector, active speech network, handset, switchhook, and dial for residential like functions. Functions unique to coin service are handled by integrated circuits, A and B relays, 47A (MD) or 47A2 signal, coin return network, and coin relay.

1.03 These sets are available with rotary or TOUCH-TONE® dial.

1.04 Codes for the 1D- and 2D- type sets are described in Table A.

TABLE A

CODE SIGNIFICANCE

CODE	FIRST NO.	LETTER	SECOND NO.
1D1	Box Type	DTF Mode	Rotary Dial
1D2			TOUCH-TONE Dial
2D1	Panel Type		Rotary Dial
2D2			TOUCH-TONE Dial

1.05 For detailed information on component and coding of these sets, refer to Section 506-410-401.

1.06 Abbreviations used in this section are as follows:

- DTF—Dial-Tone-First
- CO—Central Office
- CDR—Customer Dial Receiver
- HT—Hopper Trigger
- SCT—Stuck Coin Test
- IRCPT—Initial Rate Coin Preset Test.

**1.07 Initial Rate Setting.**

- (1) Initial rate may be adjusted from 5¢ to \$3.15 in 5¢ increments. Since there is no totalizer, this set is less likely to be put out of service by improper CO sequences.
- (2) Initial rate setting is accomplished by inserting one or more leads into the **negative** field (-VCC) with remaining leads inserted in positive field (+VCC). Six leads, terminated on back side of chassis are color coded and individually plug ended. Each lead represents a specified amount (see Table B). These plug-ended leads are pressed on the pin connectors to establish an initial rate setting.

**TABLE B**  
**INITIAL RATE LEADS**

LEAD COLOR	LEAD MONETARY VALUE
BR	5 Cents
R	10 Cents
Y	20 Cents
S	40 Cents
W-BL	80 Cents
W-BR	1 Dollar — 60 Cents

**2. FUNCTIONS**

**2.01** Fig. 1 and 2 show block diagrams of rotary and TOUCH-TONE coin telephone sets, respectively. The 32A coin chassis includes an active network for speech equalization, the ringer, and a dual frequency coin tone oscillator. The front cover consists of a dial, switchhook, handset, and terminal board (TB2), which connects to the chassis via an 11-pin connector (J1). The 47A (MD) or 47A2 signal is attached to the side of the coin chute where coins are sensed as they leave the lower chute area. The 47A (MD) or 47A2 signal connects to the chassis via a 15-pin connector (J2).

**IDENTIFICATION AND DESCRIPTION OF COMPONENTS**

**2.02** Polarity Guard and Surge Protector—maintains proper set polarity and limits surge voltage behind station protector to prevent circuit damage.

**2.03** A-Relay (Ground Lifter)—operates on loop current to remove the coin relay ground path from the tip side of the line. This feature prevents the line unbalance that would be caused by a tip to ground path.

**2.04** B-Relay (Initial Rate)—is a latching relay which has two windings. One winding causes the relay to latch on initial rate deposit and the other unlatches the relay when the coin relay is actuated for coin collection or return.

**2.05** IC1 Integrated Circuit (Coin Logic)—is a hybrid integrated circuit (HIC) in a 40-pin dual in-line package. It acts as a controller of set functions during coin deposits, switchhook flashes, and dial operation.

**2.06** IC2 Integrated Circuit (Coin Tone Oscillator)—is a 14-pin HIC similar in construction to ICs used as TOUCH-TONE dial oscillators. It provides dual frequency coin deposit signals. It is switched on by the IC1 to provide a slow readout for 5¢ and 10¢ deposits and a fast readout for a 25¢ deposit.

**2.07** Speech Network—is a network which interconnects the loop, transmitter, and receiver. It provides ac and dc voltage equalization over the loop range and also TOUCH-TONE dial and coin tone equalization. During coin signaling, the speech portion is disabled so that the customer hears low level coin tones.

**2.08** Ringer—the C4B ringer is used. It is mounted on the 32A chassis frame and connected across the line.

**2.09** Dial—the TOUCH-TONE version uses a 70-type dial which operates on either normal or reverse CO battery to provide end-to-end signaling capabilities. The rotary version has the dial pulse contacts in the ring lead.

**2.10** 47A (MD) or 47A2 Signal—attaches to the side of the chute the same as the 1A totalizer of the 1C coin telephone set. Sensor elements in the coin paths convert mechanical energy of the coin to a voltage signal which in turn signals the coin logic.

**2.11** 1A-Type Coin Relay—is located in the tip to ground path. It collects or refunds the contents of the hopper when the tip to ground current flow is a minimum of 41 milliamps.

### 3. THEORY OF OPERATION

**Note:** The CO battery requirements for system standard DTF service are defined as follows.

- (a) **Negative Battery:** -48 volt dc on ring with ground on tip.
- (b) **Positive Battery:** +48 volt dc on ring with ground on tip.
- (c) **Initial Rate Coin Present Test (IRCPT):** -48 volt dc on tip (20 ma dc maximum) with ring open in Section 105-250-100 this test is referred to as (-) coin present test.
- (d) **Stuck Coin Test (SCT):** +48 volt dc on tip (20 ma dc maximum) with ring open in Section 105-250-100 this test is referred to as (+) coin present test.
- (e) **Coin Collect:** +130 volt dc on tip (41 ma dc minimum) with ring open.
- (f) **Coin Refund:** -130 volt dc on tip (41 ma dc minimum) with ring open. Collect and refund may be followed by a SCT to assure the coins cleared the hopper. The SCT passes if no current flows, which indicates that the HT contacts have been restored.

#### ORIGINATING A LOCAL CALL

**3.01** In DTF service, the customer is instructed to:

- listen for tone
- deposit coins
- dial.

With the contention that upon hearing dial tone a customer will know he has accessed a working system. This is in contrast to coin first operation, where the customer must invest initial rate to get dial tone.

#### IDLE STATE

**3.02** In the on-hook condition the CO has -48 volt dc on R and ground on T. No loop current flows because switchhook contacts are open.

#### LOCAL CHARGE CALL, ANSWERED

**3.03** When the customer picks up the handset, the switchhook closes and loop current flows. The A-relay operates and the network and TOUCH-TONE dial are enabled. A reset pulse initializes the logic and the set is ready for coin deposits. The CO recognizes a bid for service and supplies dial tone. The customer hears dial tone and deposits the first coin. The coin strikes the respective sensor element in the signal, the value is registered, and the coin continues on to operate the hopper trigger (HT) contacts. As soon as the coin is registered in the logic, the coin oscillator generates coin tones. Immediately after the coin tone which makes initial rate, the B-relay is operated. After each deposit is signaled, the network and dial are reenabled. Loop battery is removed when the initial rate coin present test (IRCPT) is made, causing the A relay to release momentarily. This provides a path from tip-to-ground. The CO reapplies negative battery causing A relay to reoperate and removes ground from tip of line. When the customer hangs up, the switchhook opens, the A relay releases, coins are collected by collect battery from the CO and the B relay is released. As the coin relay armature releases, the hopper trigger (HT) restores and a stuck coin test (SCT) is applied. If the coin has cleared the hopper, HT is open and the test passes. The set is now ready for the next call.

#### LOCAL CHARGE CALL, NOT ANSWERED

**3.04** This call proceeds, as in paragraph 3.03, until busy signal is heard or there is no answer to ringing. Upon hanging up, the CO recognizes the disconnect and coin return battery is applied. The coin relay refunds the initial deposit, a SCT is performed, and the set is ready for the next call.

#### CALL TO A NONCHARGE NUMBER

**3.05** When the customer picks up the handset, the switchhook closes, loop current flows, and the set initializes as in paragraph 3.03. On receipt of dial tone, the customer dials a noncharge number. Call is completed in normal manner. The CO provides a refund cycle to return any coins that may have been deposited by mistake.

**ABANDONED CALL**

**3.06** This is a situation whereby the customer terminates prior to dialing, during dialing, or before receiving a busy or audible ringing signal. When the switchhook opens at termination the CO recognizes the disconnect and applies a refund. If coins have been deposited, they are returned as in 3.04. If no money has been deposited, no current will flow through coin relay because HT is open.

**CHARGEABLE CALL WITH INSUFFICIENT OR NO DEPOSIT**

**3.07** This call proceeds, as in paragraph 3.03, until the IRCPT is made. The call is routed to an announcement trunk and the customer is advised how to properly make the call. If partial funds were deposited, a refund is made, and the set is ready for the next call.

**AUTOMATIC LOCAL OVERTIME**

**3.08** Areas which have initial and overtime charging on local calls serve the customer as follows. One-half minute before the end of the initial period, the initial deposit is collected. A local coin overtime test is made at the end of the initial period. It will indicate the presence of a coin, if the customer had deposited 5¢ (HT closed), and the call is allowed to continue until 30 seconds from the end of the first overtime when the routine is repeated. If the customer did not deposit 5¢ (or another coin to close HT), the local coin overtime test will not indicate the presence of a coin and the call is connected to an announcement which prompts the customer to deposit 5¢. After 30 seconds another local coin overtime test is made and if coin is not detected the call is disconnected.

**LOCAL CALL—SIMULTANEOUSLY DEPOSITING COINS AND DIALING**

**3.09** If a customer deposits a coin which is registered in the logic during dial operation, coin signaling is deferred until the dial is released. If the dial is operated during a coin tone, that tone is completed and the remaining coin tones are delayed until the dial is released. If the dial is operated during a silent interval, the sequence halts immediately, and resumes on dial release. Thus the dial has priority over the coin logic for local calls. This prevents simultaneous coin and dial signaling which would cause misregistered digits.

**ORIGINATING A TOLL CALL**

**3.10 Toll Call Through a Cord Switchboard.**

(a) The customer picks up the handset, receives dial tone and dials "O" (no deposit needed). When the operator connects, the trunk supplies refund in the event money had been deposited. Normal battery is replaced by positive battery for the remainder of the call. The customer announces the called number and the operator specifies the initial charge. The customer deposits coins which are read out as they are deposited. The operator starts timing the call and at the end of the initial period, collects the initial deposit and announces "***your initial period is up, please signal when finished.***" The customer either flashes the switchhook or hangs up when through. If he flashes, he is advised of overtime charges. If he hangs up, the operator uses the ring back key. The operator listens to the coin signals, collects the money, and terminates. The customer hangs up and the set is ready for the next call initiation. The TOUCH-TONE dial is active during normal and reversed battery to provide end-to-end signaling.

**3.11 Toll Call Through a TSPS.**

(a) Operator assisted (0 + NPA + 7 digits) or operator dialed ("O"-) calls progress as in paragraph 3.10 except the operator is located at a TSPS console. The customer may also begin by dialing the toll number or 1 + the toll number depending upon local practice. A position is seized and refund is applied. Positive battery is supplied. Initial charge is announced, and coin signals are heard by the position attendant. Overtime charges may be handled by another position in the group. The set functions as before by signaling each coin as deposited.

**4. FEATURES**

**4.01** The following is a list of features applicable to the 1D/2D coin telephone set.

- (1) Stable and reliable operation from -30° to +140°F
- (2) Assures consistent coin signaling in all environments

- (3) Coin misregistration greatly reduced over previous coded sets which was caused by totalizer malfunction.
- (4) Circuit presents a constant DC resistance to the CO for all signaling and switching functions.
- (5) The network uses low transmitter current and ac amplification.
- (6) Set resistance is almost constant at approximately 300 ohms.



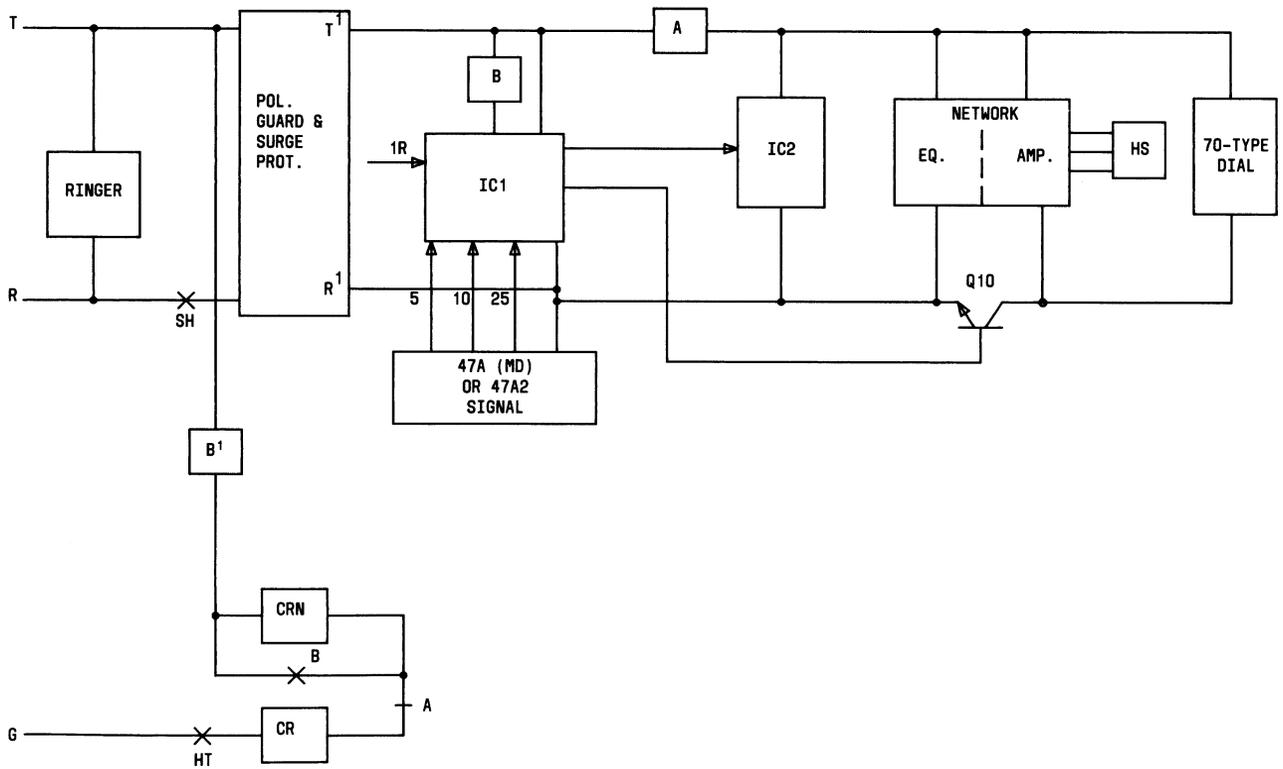


Fig. 2—1D2/2D2 Coin Telephone Set, Schematic

## 1E-TYPE COIN TELEPHONE SET

### DETAILED DESCRIPTION

#### POSTPAY SERVICE—THEORY OF OPERATION

##### DIAL POSTPAY (FIG. 1)

**Note:** This detailed description is based on the operation of a 50A hopper (MD). The new 51A hopper has the same effect on the set circuit, the difference being that the hopper trigger (HT) and 4480 ohm resistor in the 50A hopper has been replaced by an electronic delay circuit in the 51A hopper.

1.01 In Postpay service, the central office (CO) supplies -48 volt to ring with tip grounded.

1.02 When the handset is lifted, switchhook contacts operate and current flows from the ring lead to tip. The path is through the normally closed T2 contact, DP, operated SH2 and SH4, through the speech network, through normally closed T1 [parallel with hopper trigger (HT)] to tip.

1.03 The called number is then dialed and the called party must answer before a coin deposit is made. When the called party answers, the CO automatically opens (splits) the transmission path and sends a **deposit-coin** tone to the calling party.

**Note:** The “deposit-coin” tone is a low frequency tone to inform the calling party that the called party has answered and the initial rate deposit should be made immediately.

1.04 During the time the connection is split, the CO S relay operates and reverses the loop to the set (negative on tip, ground on ring). This reversed loop prepares the set to receive the initial rate by causing the ring lead to be more positive than tip. With the loop reversed, the totalizer will not restore because diode CR4 is forward biased and SH3 (NO) is closed, thus shorting the totalizer and allowing an accumulation of deposits up to, or more than, the initial rate.

1.05 If the totalizer is set for more than 5-cent initial rate, and the calling party deposits a nickel, the HT will operate but is shorted by the normally closed totalizer contact T1. Any time the initial rate requirement is satisfied, totalizer contact T1 will open.

1.06 With HT and T1 both open, the 4480 ohm resistor, located on the 50A hopper, is momentarily placed in series with the loop which creates essentially a low current pulse.

**Note:** This momentary pulse must have a minimum width of 100 milliseconds and a maximum of 300 milliseconds. The CO recognizes the pulse by use of two relays with different release currents.

1.07 When the CO recognizes this pulse, the CO margin relay will release, thus removing the split connection and establishing the talking circuit. This marginal relay is critical to loop length. Over range will cause improper operation.

1.08 When the switchhook is restored, SH3 (NO) contact opens, and the short around the totalizer is removed. Current now flows through the totalizer, operating the S relay, and the totalizer steps back to **home** position.

**Note:** Unlike a Coin-First or Dial-Tone-First set, the totalizer in a postpay set remains off **home** through the total call period for local calls.

1.09 In cases of toll calling, when the customer dials the operator, the CO recognizes the toll call, will not reverse tip and ring, thus the ring lead remains negative throughout the call.

**Note:** When operator call back is required, negative battery must be supplied on the ring lead.

1.10 With negative on ring, diode CR4 is reversed biased, thus allowing the totalizer to **read out** all coin deposits requested by the operator. In addition, the 446F diode across HT contact is forward biased, shorting the HT contact, thus reducing the noise (caused by opening and closing of HT) transmitted to the operator.

**MANUAL POSTPAY (FIG. 2)**

1.11 The manual coin telephone set consists of the talking and signaling circuitry of a

standard 500-type telephone set but also provides coin signaling upon deposit of coins.

1.12 The manual set is usually connected directly to an operator circuit, and the operator will hear all coin deposit tones.

1.13 As in dial postpay service, it is necessary that the CO provide negative battery at all times when the set is connected to an operator circuit.

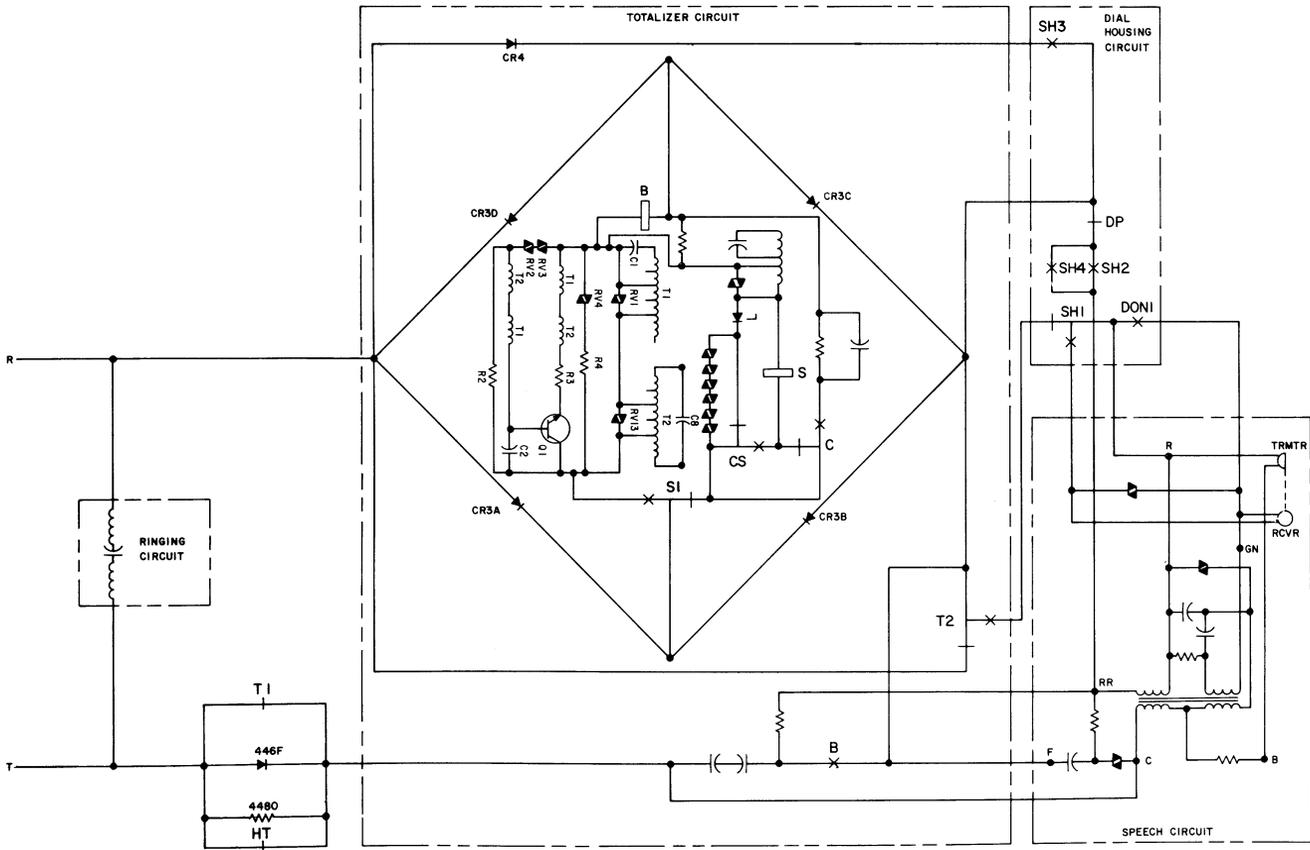


Fig. 1—1E1 Coin Telephone Set, Schematic

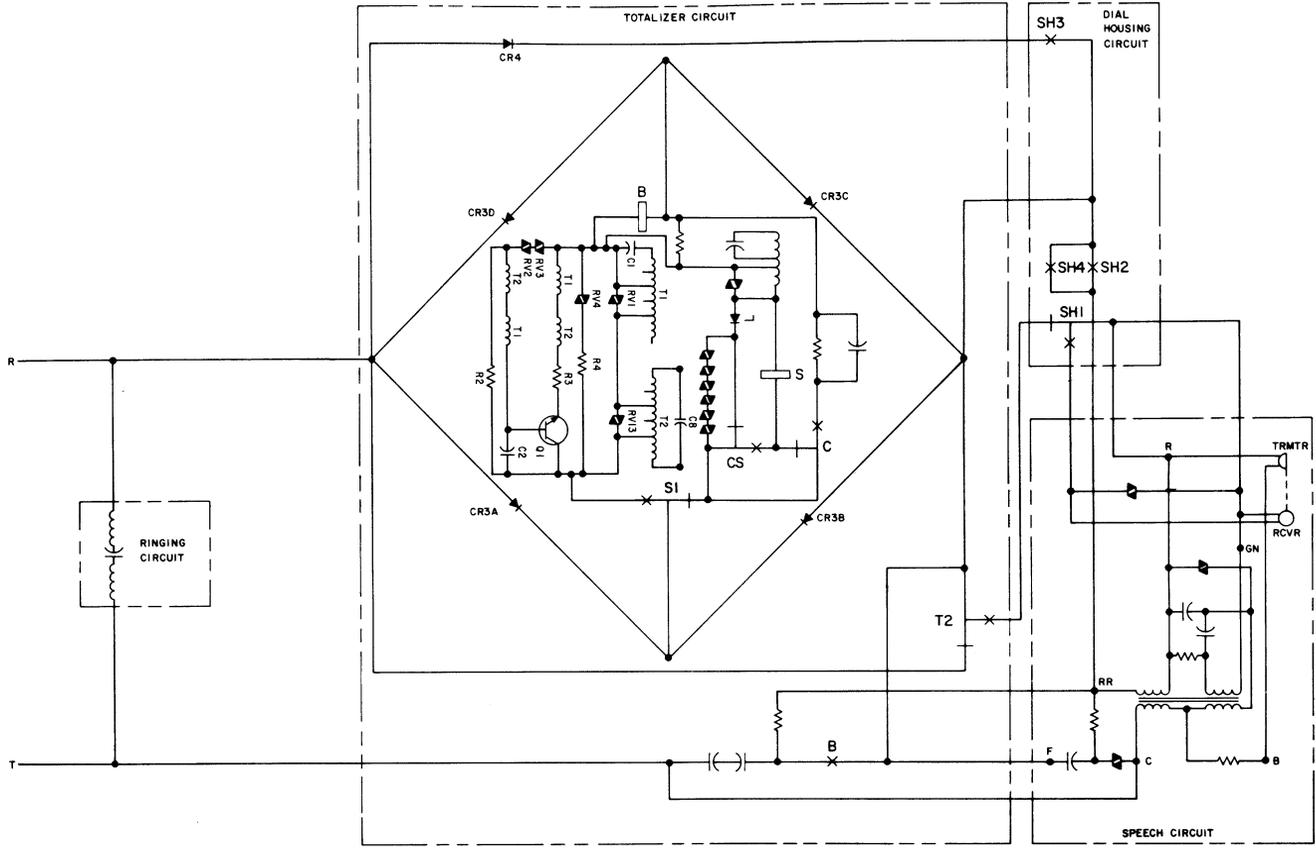


Fig. 2—1E3 Coin Telephone Set, Schematic

## **COMPONENTS AND COLOR SELECTION**

- 1.01** For component and color selection information on 1A/2A, 1C/2C, and 1E-type coin telephone sets or 1D/2D coin telephone sets, refer to Sections 506-410-400 and 506-410-401, respectively.

**TABLE A**  
**COMPONENT AND COLOR SECTION**  
**(1A/2A-TYPE SETS)**

COIN TEL SET	FRONT COVER		DIAL AND HOUSING		DIAL	NUMBER PLATE ASSY	INFORMATION PLATE	HANDSET
	COVER UNIT ASSY (MD)	COIN COVER UNIT *	DIAL AND HOUSING ASSY (MD)	COIN DIAL UNIT *				
1A1-03 (Black)	819054032 (P-90E403)	70A1-03	841317241	60A1-44 60A2-44	8WA or 8W (MD)	818418527		
1A1-44 (Chrome)	819054446 (P-90E444)	70A1-44	819042748 (P-90D274)	60A1-44 60A2-44				
1A1-51 (Moss Green)	819054511 (P-90E451)	70A1-51		60A1-44 60A2-44				
1A2-03 (Black)	819055039 (P-90E503)	71A1-03	840346977	61A1-44	70A (MD) or 70B	840156319	840156319	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52† G13-Type‡
1A2-44 (Chrome)	819055443 (P-90E544)	71A1-44	840346977	61A1-44	70A (MD) or 70B	840156319	840156319	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52† G13-Type‡
1A2-51 (Moss Green)	819055518 (P-90E551)	71A1-51	840346977	61A1-44	70A (MD) or 70B	840156319	840156319	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52† G13-Type‡
2A1-67 (Brushed Stainless)				61A1-44	8WA or 8W (MD)	818720526		
2A2-67 (Brushed Stainless)				61A1-44	70A (MD) or 70B			
					35T3A			

\* These coin cover unit and coin dial unit codes are for ordering information to obtain the unit, wired, tested, and equipped for the correct mode of operation. Since the units may be field converted from one type to another, maintenance, and installation should be based on the first three (3) characters of the code only. It is important therefore to ensure that the unit being used is wired properly and that the coin cover unit has the proper information plate and instruction cards for the type of service with which it is being used. All rotary coin cover units are equipped with 8WA dials and all TOUCH-TONE coin covers units are equipped with 70A (MD) or 70B dials.

† G3AHF-52 and G3AKF-52 are optional flame retardant handsets and cords that can replace the G3AH-52 and G3AK-52 respectively. The G3AK and G3AKF are equipped with a moisture resistant transmitter barrier and special transmitter cap.

‡ A G13D amplified handset can be used. Refer to Section 501-211-102 for complete information.

**TABLE A (Contd)**  
**COMPONENT AND COLOR SECTION**  
**(1A/2A-TYPE SETS)**

HOUSING AND MTG PLATE ASSY	CHUTE-TOTALIZER	COIN CHASSIS	COIN RELAY AND HOPPER ASSY	RETURN CHUTE ASSY	COIN RETURN ASSY	COIN RECP RAIL	CASH COMPT. DOOR
818512036 (P-85A203)	811554286 (P-15E428) Consist of 20A Chute 811555796 (P-15E579) Totalizer	840693634 with DF Oscillator	1AA Coin Relay Consist of 1A Coin Relay and 811557172 Coin Hopper Assembly	811557305 (Current return chute assemblies are made of plastic instead of diecasting)	812165462	1B	2A-03 or 2B-03 (Optional)
818512444 (P-85A244)							2A-44 or 2B-44 (Optional)
818512519 (P-85A251)							2A-51 or 2B-51 (Optional)
818512036 (P-85A203)							2A-03 or 2B-03 (Optional)
818512444 (P-85A244)							2A-44 or 2B-44 (Optional)
818512519 (P-85A251)						2A-51 or 2B-51 (Optional)	
						1D	5A-67

**TABLE B**  
**COMPONENT AND COLOR SECTION**  
**(1C/2C/1E-TYPE SETS)**

COIN TEL SET	MODE OF OPERATION	FRONT COVER		DIAL AND HOUSING		DIAL	NUMBER PLATE ASSY	INFORMATION PLATE	HANDSET				
		COVER UNIT ASSY (MD)	COIN COVER UNIT *	DIAL AND HOUSING ASSY (MD)	COIN DIAL UNIT								
1C1-03 (Black)	CF	819054032	70A1-03	841317241 or 819042748 (P-90D274)	60A1-44	8WA or 8W (MD)	818418527	840156319 for Coin First	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52 † G13-Type‡				
1C1-44 (Chrome)	CF	819054446	70A1-44		60A2-44								
	DTF	(P-90E444)	70A2-44		60A1-44								
1C1-51 (Moss Green)	CF	819054511	70A1-51		60A2-44								
	DTF	(P-90E451)	70A2-51	60A1-44									
1C2-03 (Black)	CF	819055039	71A1-03	840346977 (70A Dial)	61A1-44	70A (MD), or 70B, 35T3A (MD)	840156319 for Coin First			840156327 for Dial Tone First  (Used on 1C-and 2C-Type sets only)	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52 † G13-Type‡		
	DTF	(P-90E503)	71A2-03	61A2-44									
1C2-44 (Chrome)	CF	819055443	71A1-44	819042755 (P-90D275)	61A1-44								
	DTF	(P-90E544)	71A2-44	61A2-44									
1C2-51 (Moss Green)	CF	819055518	71A1-51	(35T3A Dial)	61A1-44								
	DTF	(P-90E551)	71A2-51	61A2-44									
2C1-67 (Brushed Stainless)	CF			841317241 or 819042748 (P-90D274)	60A1-44	8WA or 8W (MD)	818720526					840156327 for Dial Tone First  (Used on 1C-and 2C-Type sets only)	G3AH-03, G3AK-03, G13-Type‡
	DTF			841317258 or 840152227	60A1-84								
2C1-84 (Bronze)	CF				60A2-84								
	DTF												
2C2-67 (Brushed Stainless)	CF			840346977	61A1-44	70A (MD), 70B, 35T3A (MD)		840156327 for Dial Tone First  (Used on 1C-and 2C-Type sets only)	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52 † G13-Type‡				
	DTF				61A2-44								
	CF				61A1-44								
	DTF				61A2-44								
2C2-84 (Bronze)	CF			840347173	61A1-84	70A (MD), 70B, 35T3A (MD)				840156327 for Dial Tone First  (Used on 1C-and 2C-Type sets only)	G3AH-03, G3AK-03, G13-Type‡		
	DTF				61A2-84								
	CF				61A1-84								
	DTF				61A2-84								
1E1-03 (Black)	Dial Post Pay	840658033	70A5-03	841317241 or 819042748 (P-90D274)	60A2-44	8WA or 8W (MD)	818418527					840156087	G3AH-52† G3AK-52† G3AHF-52† G3AKF-52 † G13-Type‡
1E1-44 (Chrome)		840658447	70A5-44										
1E1-51 (Moss Green)		840658512	70A5-51										
1E3-03 (Black)	Manual Post Pay	840659031	70A4-03	841317266 or 812366516 (P-23F651)	60A4-44	840994727 Apparatus Blank Assembly							
1E3-44 (Chrome)		840659445	70A4-44	Housing Assembly									
1E3-51 (Moss Green)		840659510	70A4-51										

\* These coin cover unit and coin dial unit codes are for ordering information to obtain the unit, wired, tested, and equipped for the correct mode of operation. Since the units may be field converted from one type to another, maintenance, and installation should be based on the first three (3) characters of the code only. It is important therefore to ensure that the unit being used is wired properly and that the coin cover unit has the proper information plate and instruction cards for the type of service with which it is being used. All rotary coin cover units are equipped with 8WA dials and all TOUCH-TONE coin cover units are equipped with 70A (MD) or 70B dials.

† G3AHF-52 and G3AKF-52 are optional flame retardant handsets and cords that can replace the G3AH-52 and G3AK-52 respectively. The G3AK and G3AKF are equipped with a moisture resistant transmitter barrier and special transmitter cap.

**TABLE B (Contd)**  
**COMPONENT AND COLOR SECTION**  
**(1C/2C/1E-TYPE SETS)**

HOUSING AND MTG PLATE ASSY	CHUTE-TOTALIZER	COIN CHASSIS	COIN RELAY AND HOPPER ASSY	RETURN CHUTE ASSY	COIN RETURN ASSY	COIN RECP RAIL	CASH COMPT. DOOR
818512036 (P-85A203)	20A1A Consist of 20A Chute and 1A Totalizer	31A with DF Oscillator (31A2 Coin Chassis is available wired and tested for DTF service)	1AA Coin Relay Consist of 1A Coin Relay and 811557172 (P-15E717) Coin Hopper Assembly	811557305 (Current return chute assemblies are made of plastic instead of diecasting)	812165462	1B	2A-03 or 2B-03 (Optional)
818512444 (P-85A244)							2A-44 or 2B-44 (Optional)
818512519 (P-85A251)							2A-51 or 2B-51 (Optional)
818512036 (P-85A203)							2A-03 or 2B-03 (Optional)
818512444 (P-85A244)							2A-44 or 2B-44 (Optional)
818512519 (P-85A251)							2A-51 or 2B-51 (Optional)
							5A-67
	840152219	1D	5A-84				
	812165462		5A-67				
	840152219		5A-84				
840656037	20A10A Consist of 20A Chute and 10A Totalizer		30B with DF Oscillator	51A or 50A (MD) Hopper Assembly	812165462	1B	2A-03 or 2B-03 (Optional)
840656441		2A-44 or 2B-44 (Optional)					
840656516		2A-51 or 2B-51 (Optional)					
840657035		2A-03 or 2B-03 (Optional)					
840657449		2A-44 or 2B-44 (Optional)					
840657514		2A-51 or 2B-51 (Optional)					

‡ A G13D amplified handset can be used. Refer to Section 501-211-102 for complete information.

**TABLE C**  
**COMPONENTS AND COLOR SELECTION**  
**(1D/2D-TYPE SETS)**

COIN TEL SET	COIN COVER UNIT	COIN DIAL UNIT*	DIAL†	NUMBER PLATE ASSY	INFOR- MATION PLATE	HANDSET (NOTE)
1D1-03 (Black)	70A3-03	60A3-44	8W (MD) or 8WA	818418527	840156327	G3AH, G3AK, G3AHF, or G3AKF
1D1-44 (Chrome)	70A3-44					
1D1-51 (Moss Green)	70A3-51					
1D2-03 (Black)	71A3-03	61A3-44	70A (MD) or 70B			
1D2-44 (Chrome)	71A3-44					
1D2-51 (Moss Green)	71A3-51					
2D1-67 (Brushed Stainless)		60A3-44	8W (MD) or 8WA	818720526		
2D1-84 (Bronze)				818720039		
2D2-67 (Brushed Stainless)		61A3-44	70A (MD) or 70B			
2D2-84 (Bronze)						

*Note:* A G13D amplified handset can be used with a 1D/2D coin telephone set. Refer to Section 501-211-102 for complete information.

\* These coin cover unit and coin dial unit codes are ordering information to obtain the unit, wired, tested, and equipped for the correct mode of operation. Since the coin-first and dial-tone-first coin cover units and coin dial units shown in Table B (Part 1-5) of the manual may be field converted from one type to another, maintenance, and installation should be based on the first three (3) characters of the code only. It is important therefore to ensure that the unit being used is wired properly and that the coin cover unit has the proper information plate and instruction cards for the type of service with which it is being used. All rotary coin cover units are equipped with 8W (MD) or 8WA dials and all TOUCH-TONE coin cover units are equipped with 70A (MD) or 70B dials.

† 70A (MD) dials manufactured before May, 1977 do not meet the same manufacturing electrical requirements as the D-type set. Upon conversion to D-type sets or during coin cover unit or coin dial unit replacement check the date of the dial on the dial front face-plate. Do not use a pre-May, 1977 70A dial unless the later vintage is not readily available.

**TABLE C (Contd)**  
**COMPONENTS AND COLOR SELECTION**  
**(1D/2D-TYPE SETS)**

CHUTE	COIN CHASSIS	COIN RELAY AND HOPPER ASSY	RETURN CHUTE ASSY	COIN RETURN ASSY	COIN RECEPTACLE	CASH COMPT DOOR
20A47A (MD) or 20A47A2 Consists of a 20A Chute and a 47A (MD) or 47A2 Signal	32A	1AA Consists of a 1A Coin Relay and 811557172 Coin Hopper Assy	811557304	812165462	1B	
						5A-67
				840152219		5A-84
				812165462	1D	5A-67
				840152219		5A-84

## KS-21250, LIST 1 (MD) AND LIST 2 COIN CRAFTS TEST SETS

### 1. KS-21250, LIST 2

**1.01** Use of the new KS-21250, List 2 test set is described in detail in Section 105-250-100. Abbreviated operating instructions are also provided with the test set and in the Public Services Maintenance Check Booklet and Section 506-900-503.

### 2. KS-21250, LIST 1

**2.01** The KS-21250, List 1 portable test set may be used to check certain features of the coin telephone set when a central office coin station test line is not available or when dial long line equipment is used in the CO.

***Danger:*** High voltages on leads when test buttons are operated.

***Note:*** The timing circuit in this test set is designed to time a 450 ms 1A coin relay.

**2.02** Perform following pretest set-up.

- (a) On 1-type sets, remove cover unit assembly and hang it on a KS-20950 parking tool or connect a P11C patch cord between P1 and J1.

- (b) On 2-type sets, open door and faceplate assembly and connect a P11C patch cord between P1 and J1.

***Warning:*** Disconnect CO tip and ring from set.

- (c) Connect the test set to TB1 terminals in telephone set, Red to R, Green to T, and Yellow to G.

**2.03** Perform the following tests.

(a) ***Telephone Tests:***

***Note 1:*** The table and step numbers referenced in the test are found in Section 506-900-503 or the Public Services Maintenance Check Booklet.

***Note 2:*** In these tests, only the ***possible cause*** and ***remedial action*** entries apply in the referenced tables and steps.

***Note 3:*** When test set is ***on***, it supplies battery to the telephone set and sidetone is available except when COLLECT or REFUND/TIME button is depressed.

**DTF MODE (C/D-TYPE SETS ONLY)**

	<u>Test</u>	<u>Table</u>	<u>Step</u>
(1)	Handset on hook. Test set ON. Deposit quarter.  <ul style="list-style-type: none"> <li>• Totalizer steps back (C-type sets only)</li> <li>• Beep tones heard in test set (C-type sets only)</li> </ul>	B	6
(2)	Refund money using REFUND/TIME button	B	6
(3)	Handset off-hook. Deposit nickel less than initial rate.  <ul style="list-style-type: none"> <li>• Totalizer does not step back (C-type sets only)</li> <li>• No beep tone(s) heard, except in 1D/2D sets beep tones will be heard</li> </ul>	B	7
(4)	Operate dial  <ul style="list-style-type: none"> <li>• Clicks/TT signals heard in test set</li> </ul>	B	7
(5)	Go on-hook  <ul style="list-style-type: none"> <li>• Totalizer steps back (C-type sets only)</li> <li>• Beep tone(s) heard except in 1D/2D sets beep tone(s) will not be heard.</li> </ul>	B	8
(6)	Refund coin(s)		
(7)	Go off-hook. Reverse Red and Green test set leads. Deposit nickel.  <ul style="list-style-type: none"> <li>• Totalizer steps back (C-type sets only)</li> <li>• Beep tone heard</li> </ul>	B	12 and 14
(8)	Refund nickel		

**CF MODE (A/C-TYPE SETS ONLY)**

(1)	Handset on-hook. Test set ON. Deposit quarter.  <ul style="list-style-type: none"> <li>• Totalizer steps back</li> <li>• Beep tones heard in test set</li> </ul>	A	5
(2)	Refund coin using REFUND/TIME button	A	5

## CF MODE (Cont)

	<u>Test</u>	<u>Table</u>	<u>Step</u>
(3)	Handset off-hook; test set OFF. Deposit nickel less than initial rate. Turn test set ON. <ul style="list-style-type: none"><li>• Totalizer does <i>not</i> step back</li><li>• No beep tone(s) heard</li></ul>	A	7
(4)	Go on-hook <ul style="list-style-type: none"><li>• Totalizer steps back</li><li>• Beep tone(s) heard in test set.</li></ul>	A	6
(5)	Go off-hook; operate dial <ul style="list-style-type: none"><li>• Clicks/TT signals are <i>not</i> heard</li><li>• Sidetone present in handset.</li></ul>	A	6
(6)	Refund coin(s) using REFUND/TIME button		
(7)	Test set OFF. Deposit initial rate. Turn test set on. <ul style="list-style-type: none"><li>• Totalizer steps back</li><li>• Beep tones heard in test set</li></ul>	A	8
(8)	Operate dial <ul style="list-style-type: none"><li>• Clicks/TT signals heard</li><li>• Sidetone present</li></ul>	A	9
(9)	Refund coin(s) using REFUND/TIME button		

## POSTPAY MODE (E-TYPE SETS ONLY)

(1)	Handset off-hook. Test set ON. <ul style="list-style-type: none"><li>• Sidetone present in handset</li></ul>	E	4
(2)	Rotate dial and release <ul style="list-style-type: none"><li>• Clicks heard</li></ul>		
(3)	Insert KS-14995, L3 tool between coin chute and hopper to prevent loss of deposited coins		
(4)	Deposit nickel less than initial rate <ul style="list-style-type: none"><li>• Totalizer does not step back</li><li>• No beep tones heard</li></ul>	E	14

POSTPAY MODE (Contd)

	<u>Test</u>	<u>Table</u>	<u>Step</u>
(5)	Hang-up <ul style="list-style-type: none"> <li>● Totalizer steps back</li> <li>● Beep tone(s) heard</li> </ul>	E	17
(6)	Handset off-hook — Deposit initial rate <ul style="list-style-type: none"> <li>● Totalizer does not step back</li> <li>● In a 1E1 set, a click is heard in test set speaker</li> </ul>	E	15
(7)	Reverse Red and Green leads of test set. <ul style="list-style-type: none"> <li>● Totalizer steps back</li> <li>● Beep tones heard in speaker</li> </ul>	E	17
(8)	Deposit quarter <ul style="list-style-type: none"> <li>● Five beeps heard</li> </ul>	E	6
(9)	Disengage chute locking spring; slowly pull top of chute forward while holding KS-14995, L3 tool. Lift chute and tool out of set and retrieve coins.		

(b) **Timing Test**—Coin relay (CF and DTF sets only). Remove coin chute assembly. Connect test set Red to No. 3 on coin relay. Yellow to G relay terminal. Black to top lead of relay resistor.

(3) Release and lift return chute assembly out. Operate COLLECT button. Observe in hopper that coin vane moves to collect position.

- (1) Deposit coin (or trip hopper trigger).
- (2) Press and hold REFUND/TIME button. Relay operates. Timing light(s) can be read. Refer to Table A.

(4) Reassemble disconnected components.

TABLE A

ADJUSTMENT OF COIN RELAY USING KS-21250L2 TEST SET

BELOW -20°F	-20°F TO 20°F	20°F TO 60°F	60°F TO 100°F	ABOVE 100°F
Test set indicator lights will indicate SLOW after adjustment	Test out indicator lights will indicate SLOW after adjustment			*JUST FAST then 1/4 turn CCW
				*JUST FAST then 1/2 turn CCW
		*JUST SLOW. then 1/4 turn CCW	*JUST SLOW then 1/4 turn CW	
*JUST SLOW then 1/2 turn CCW				

\* Adjust coin relay timing screw in 1/4 turn increments until the KS-21250L2 test set just indicates fast or slow as specified for the temperature range at time of adjustment. Then turn the relay timing screw the specified amount as indicated above in the table.



(c) **Coin Relay Operate Margin** (CF and DTF sets only). **Check**—with a working central office line connected to coin telephone set.

(2) Deposit initial rate.

- (1) Connect Yellow lead of test set to 3 on coin relay and Black lead of test set to top of relay resistor, lift handset. (Test Set Off.)

(3) Dial any digit but 0. Hang up. Relay should operate despite added shunt load built into the test set. If coin relay fails to operate, have test deskperson assist in determining loop and ground resistance measurements.

2.04 Return coin telephone set to normal operation.

**CRAFTS MANUAL 1-6**

**2.05** When finished with test set, **turn it "OFF."**

**2.06** Replacement batteries for the KS-21250, List 1 test set are:

<b>Quantity</b>	<b>Type</b>
2	KS-14369—48 volt
12	KS-14368—1.5 volt or 1.5 volt Alkaline for operation below 0°F (Eveready No. E91 or RAY-O-VAC No. 815)

## COIN STATION TEST LINE CIRCUIT

### 1. GENERAL

**1.01** The Coin Station Test Line is usable on coin lines *not* equipped with dial long line units or subscriber loop carrier systems. Lines equipped with 8A range extenders can be tested. It allows the installation or repair forces to make the following operational tests without tying up local test desk facilities or requiring services of an operator:

- Coin Detection and Ground Removal
- Ground Circuit Foreign EMF (ZK Option)
- Loop Foreign EMF (ZK Option)
- Ground Circuit Check
- Loop Resistance
- Marginal Loop Resistance (ZX option)
- Loop Leakage
- Coin Collect
- Coin Return
- Coin Collect and Return Marginal Tests (ZO option)
- Coin Relay Operating Time
- Resistance Test Self Diagnostics (ZO option).

**Note:** All test lines are not equipped with ZO option at the time.

**1.02** While performing the preceding tests, proper functioning of the following can be determined:

- Coin Chute
- Dial
- Totalizer

- Ringer
- Transmitter and Receiver
- Automatic Coin Local Overtime (DTF).

**1.03** The referenced tables are found in the Public Services Maintenance Check Booklet or Section 506-900-503. Example: (B-4) indicates Step 4 in the Trouble Analysis, Table B.

**1.04** Initial rate must be deposited to access the test line. After the test line has been seized CF stations require a single coin deposit equal to or greater than initial rate to dial additional tests; example: initial rate is 15 cents, a quarter must be deposited. For DTF stations nickel, dime, or quarter can be deposited for additional tests except when Automatic Coin Overtime Test is made.

**1.05** Tests should be made in a sequential manner as shown in the Test Line Procedure. Tests may be repeated by dialing the assigned digit when the test line is in the "Test Selection Mode" (interrupted dial tone). Once the Relay Time test has been dialed (digit 5), the test can be recycled as often as necessary by tripping hopper trigger or redepositing a coin. The switchhook must be momentarily operated before disconnect can occur or new test can be dialed. The Coin Detection and Ground Removal tests require disconnect and reseizure of the test line if retest is desired.

**1.06** If no action is taken for approximately 60 seconds after the reception of the "Test Selection Tone" (interrupted dial tone) during any phase of the sequence, the test line will automatically disconnect and restore the circuit to normal.

**1.07** Tones are used to indicate a required action by the craftsperson as follows:

- Alternating high and low tone (Tone C)—requires deposit of coin or operation of hopper trigger.

- Steady high tone (hang-up tone)—request to restore handset to on-hook condition. Steady high tone is also used as a test answer in coin relay timing test.
- Interrupted dial tone (test selection tone)—proper digit should be dialed depending on test desired.

**Note:** In some ESS offices the high tone may be too low to hear clearly in noisy background locations. In this case the BT lead should be removed from the HT terminal on the ring and tone bay and connected to the MT2 terminal (busy verification tone), if available. For additional information, refer to SD-1C297-01, Issue 16B.

**1.08** Test results are returned to the craftsperson in the form of coded beeps or rings which are repeated three times. When rings are called for the handset should be taken off-hook before the 3rd group of rings to prevent test line disconnect.

**1.09** The Coin Station Test Line is capable of testing rotary or TOUCH-TONE® dial stations.

**1.10** Recommended procedure is outlined in Part 3. However, individual tests can be made for each of the dialed tests.

## 2. PREPARATION

**2.01** The following apparatus is required:

- P11C cord—Used to connect cover unit assembly or door and faceplate assembly to coin chassis

- KS-20950, L2 parking tool (Fig. 1)—Used to hang cover unit assembly of 1-type set on side of housing, eliminating the need for a P11C cord

- 146B bias margin gauge—Collect and Return Test

- 1013-type hand test set—Connect to receiver circuit when upper housing or cover unit assembly is on floor or to verify coin signals

- KS-14995, L3 tool—Placed between coin chute and hopper during Collect test to prevent collection of coins (Fig. 2)

- Two dimes, one nickel, one quarter.

**2.02** Prepare coin station as follows.

- (1) Remove cover unit assembly of 1-type sets or open door and faceplate assembly of 2-type sets.
- (2) If P11C cord is used, invert handset on switchhook of 1-type sets to prevent armored cord pushing handset off-hook when cover unit assembly is set aside.
- (3) Where possible, install cover unit assembly on a KS-20950, L2 cover parking tool (Fig. 1).
- (4) When testing, ensure that totalizer CF-DTF mode switch (C-type sets only), is in the proper position.

## 3. COIN TEST LINE PROCEDURE

**3.01** Perform test per following flow charts:

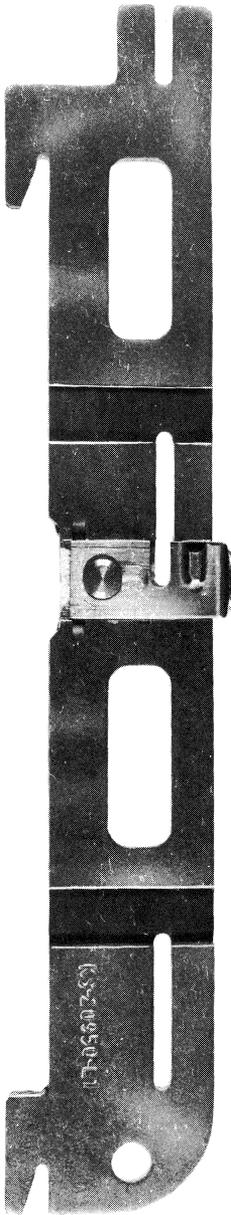


Fig. 1—KS-20950, List 2 Cover Parking Tool

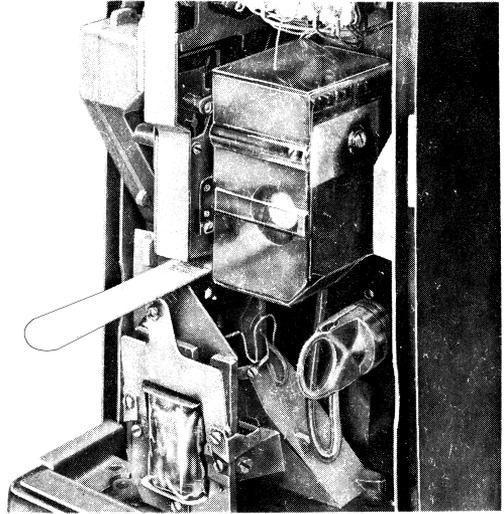
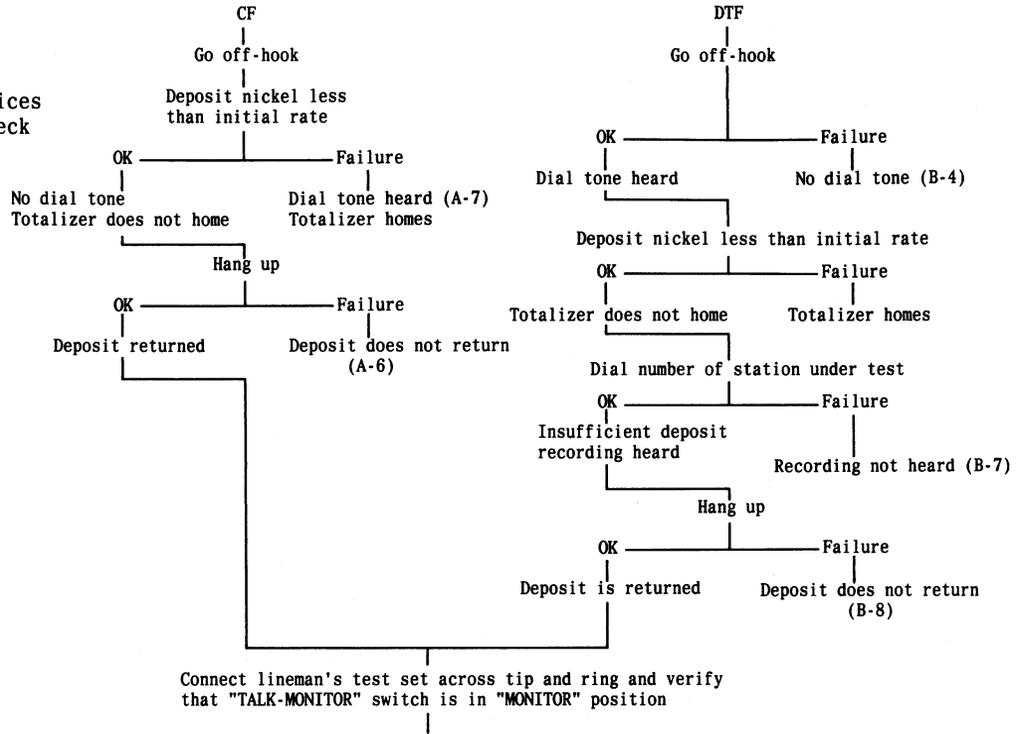


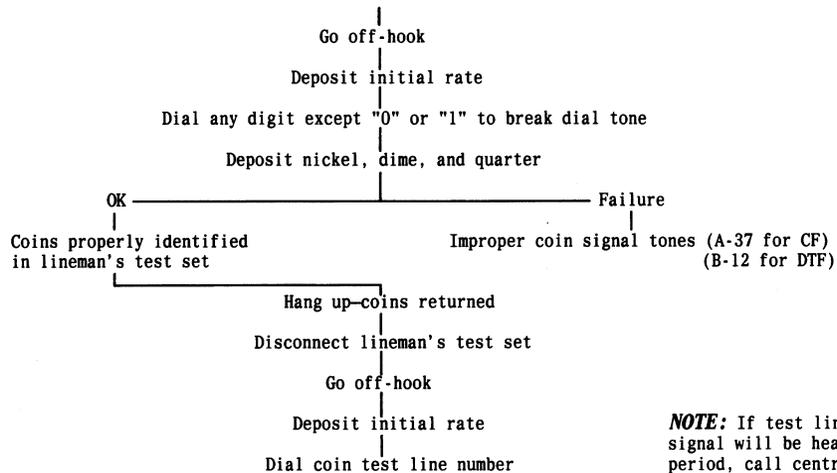
Fig. 2—KS-14993, List 3 Tool—In Position for Collect Test

**LEGEND**

CF—Coin First  
 DTF—Dial Tone First  
 (A-7)—Table A  
 Step No. 7  
 In Public Services  
 Maintenance Check  
 Booklet,  
 (Typical)

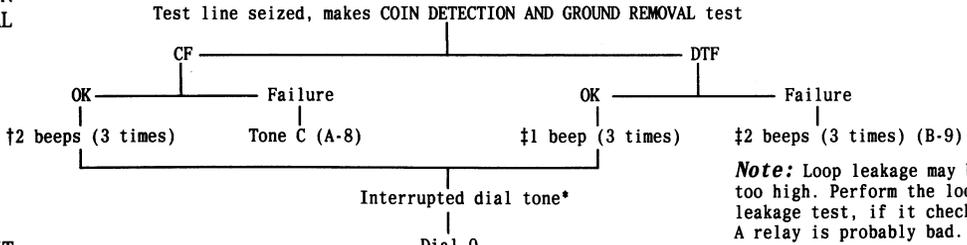
**COIN TEST LINE TESTS**





**NOTE:** If test line is in use, busy signal will be heard. If busy for long period, call central office.

**COIN DETECTION  
GROUND REMOVAL  
TEST**



**Note:** Loop leakage may be too high. Perform the loop leakage test, if it checks OK, A relay is probably bad.

**GROUND CIRCUIT  
AND LOOP  
FOREIGN EMF**

\*Tones time out in 60 sec., test line disconnects

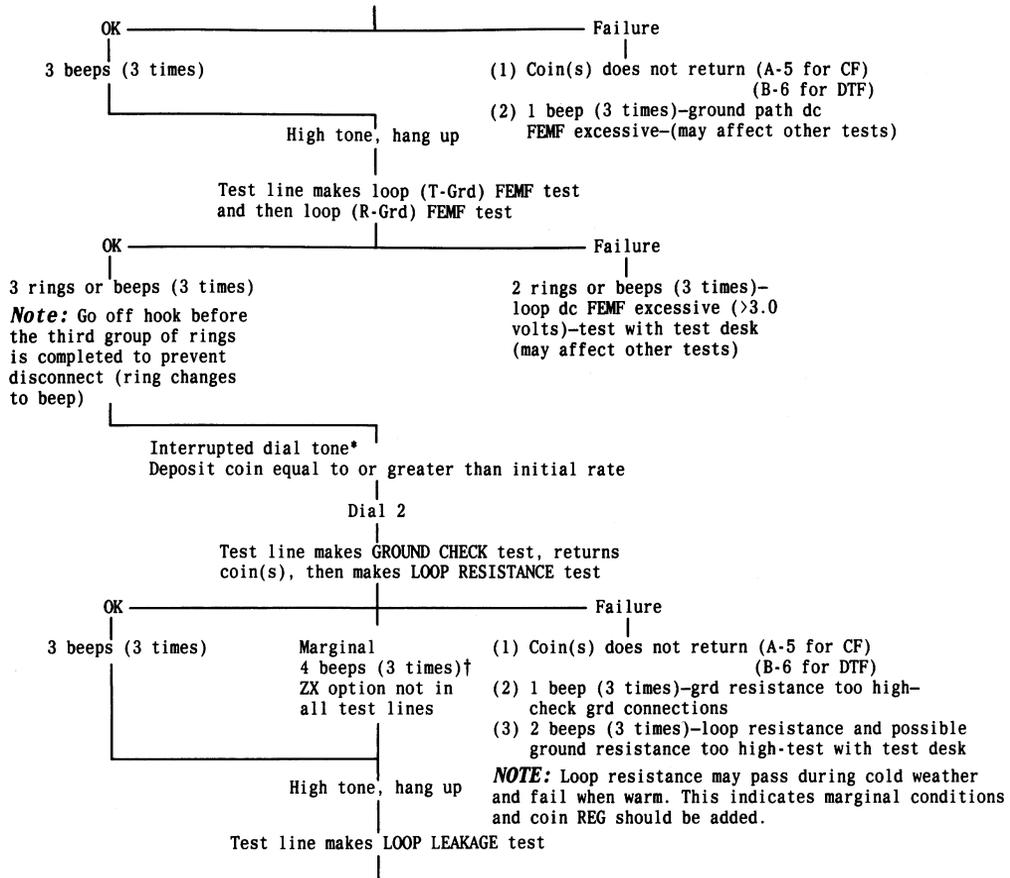
†1 beep, OK when 8A range extender (REG) is used in CO.

†2 beeps, OK when 8A range extender (REG) is used in CO.

**Note:** This is the ZK option and cannot be performed in all systems. If dial tone not broken with CF station deposit a single coin equal to or greater than initial rate and dial. If coin tone heard after dialing a DTF station, deposit initial rate or greater.

Test line makes Ground Path FEMF test and returns coin(s)

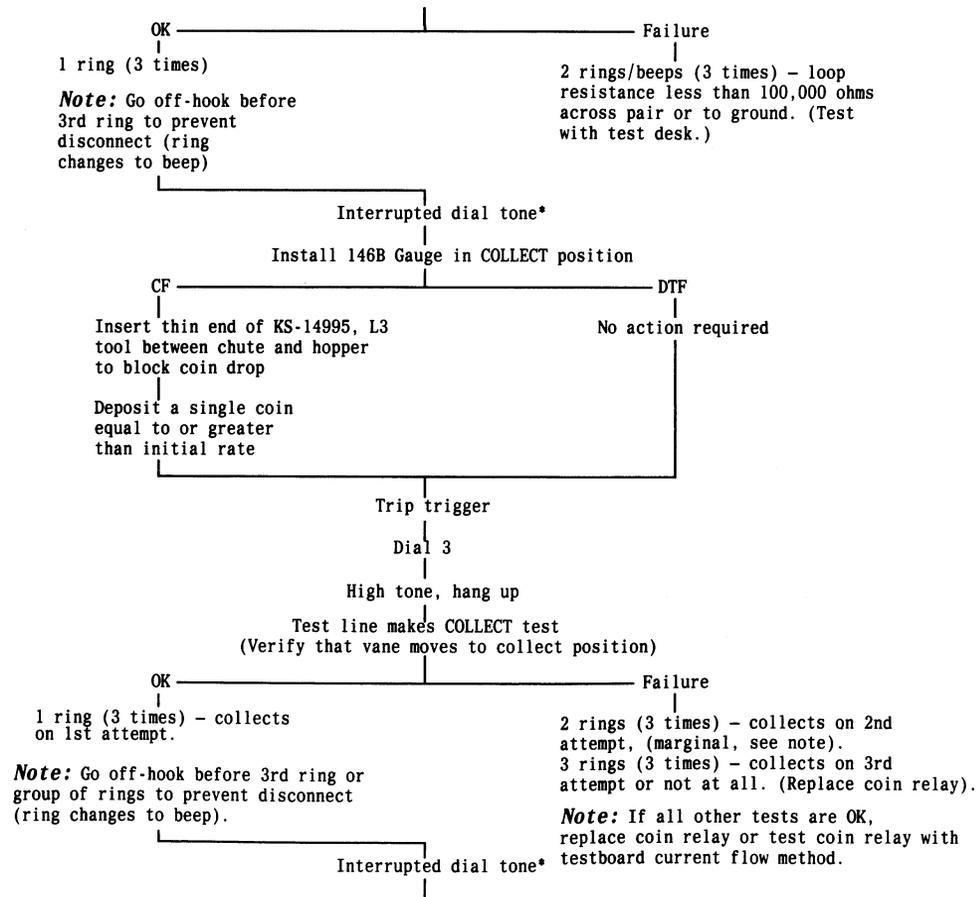
**GROUND CHECK, LOOP RESISTANCE, AND LOOP LEAKAGE TESTS**



\*Tones time out in 60 sec., test line disconnects

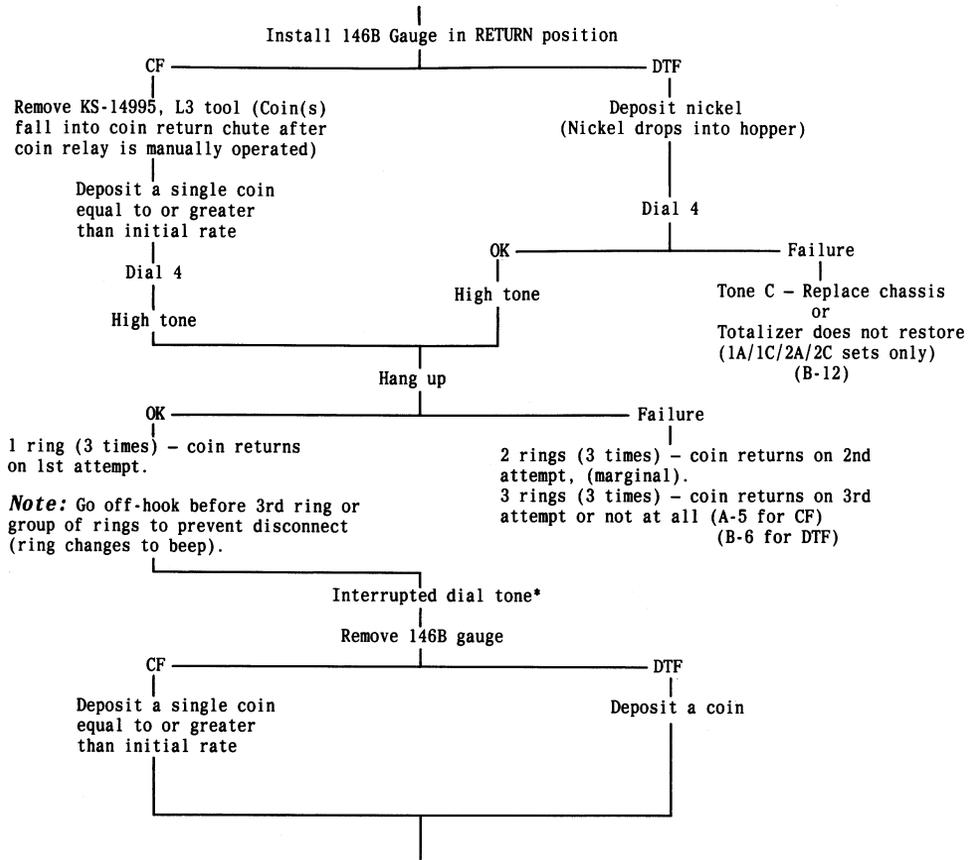
†Loop is within 8 percent of maximum requirement. If cable makeup is all underground, loop is OK. However if any aerial cable is used and outside temperature at time of test is less than 80°F, range extension may be required.

COLLECT TEST



\*Tones time out in 60 sec., test line disconnects

RETURN TEST  
(AND AUTOMATIC  
NICKEL LOCAL  
OVERTIME TEST  
DTF only)



\*Tones time out in 60 sec.,  
test line disconnects

COIN RELAY  
TIMING TEST

Dial 5

Test line makes COIN RELAY TIME test

Redeposit a single coin equal to or greater than initial rate to recycle test

SIGNAL (Coin relay operate time)	TEMPERATURE of Coin Relay			
	Below 20°	20-60°	60-100°	Above 100°
4 Beeps (Above 500 milliseconds)	Refer to Adjust Chart	TOO SLOW - Refer to Adjust Chart		
3 Beeps (475-500 milliseconds)	OK		OK	
STEADY TONE (425-475 milliseconds)				
2 Beeps (400-425 milliseconds)	TOO FAST - Refer to Adjust Chart			
1 Beep (Below 400 milliseconds)	TOO FAST - Refer to Adjust Chart			

Adjust Chart

Temperature	Adjusting Procedure
Above 100°	Adjust to steady tone and turn armature screw clockwise until first indication of 2 beeps is acquired
60 to 100°	Adjust to 3 beeps and turn armature screw clockwise until first indication of steady tone is acquired
20 to 60°	Adjust to 4 beeps and turn armature screw clockwise until first indication of 3 beeps is acquired
Below 20°	Adjust to 3 beeps and turn armature screw counterclockwise until first indication of 4 beeps is acquired - then turn screw counterclockwise an additional 1/4 turn

Go on hook momentarily (flash switchhook), see note.

Interrupted dial tone heard\*

**NOTE:** If switchhook flash is not executed the test line will not disconnect for 60 seconds and no new test can be dialed.

Hang up. test line disconnects

Go off-hook to assure test line is disconnected

CF

No tone heard

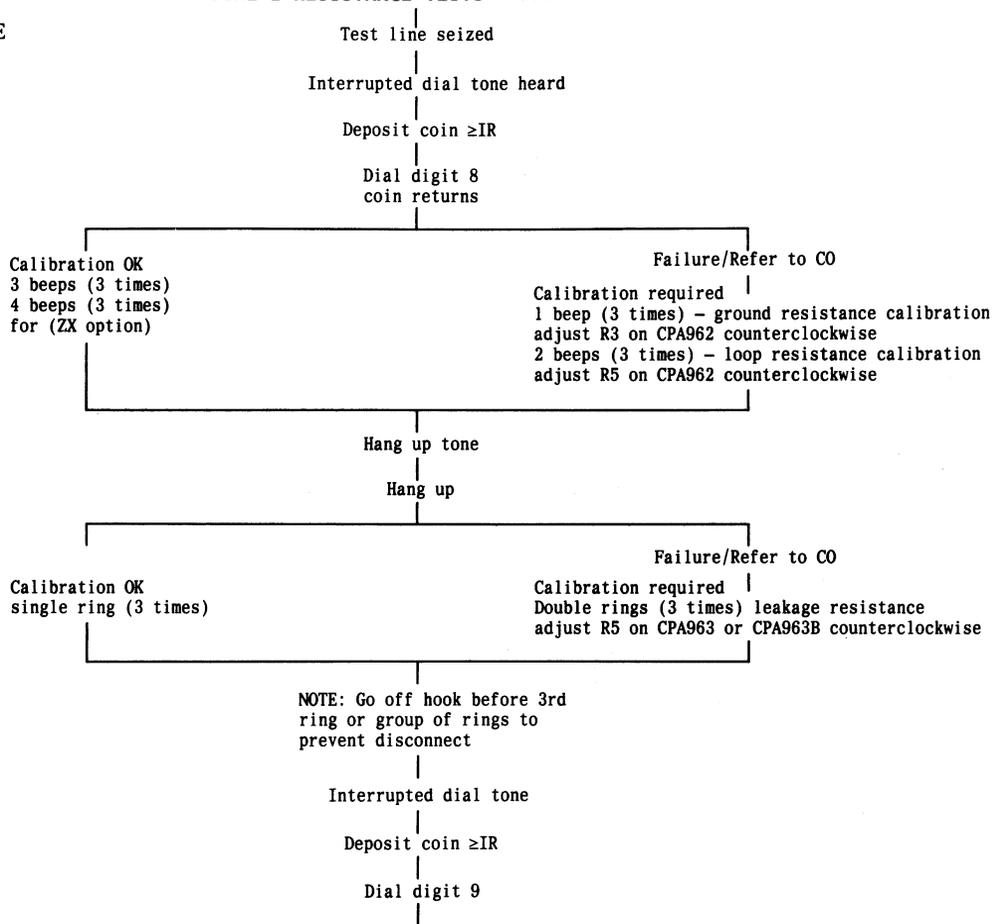
DTF

Steady dial tone heard

\*Tones time out in 60 sec., test line disconnects

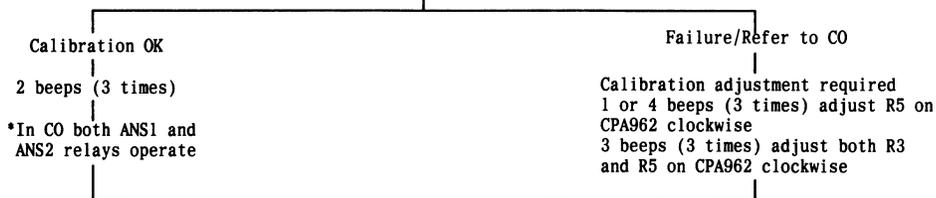
TO CHECK THE TEST LINE CALIBRATION  
FOR DIAL 2 RESISTANCE TESTS - PROCEED AS FOLLOWS

IR - INITIAL RATE



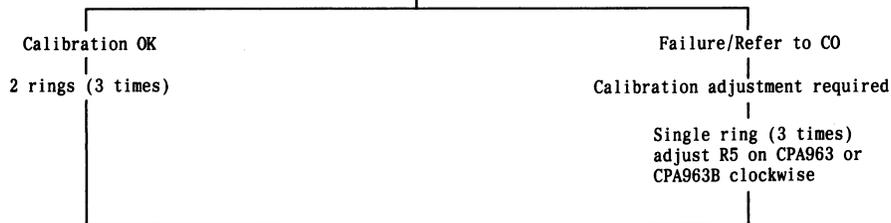
(Dial digit 9, cont)

Coin returns



Hang up tone

Hang up



NOTE: Go off-hook before 3rd ring or group of rings to prevent disconnect

Interrupted dial tone

Deposit coin  $\geq$  IR

Dial new test or hang up if no further tests are to be made

After several seconds check for disconnect

CF  
No tones heard

DTF  
Steady dial tone heard

## OPERATING INSTRUCTIONS

### 177A TEST SET

**1.01** The 177A test set is designed to monitor the voltage polarity and levels provided to the coin telephone set from any type central office, test desk, test console, test cabinet, LSV, MLT, etc.

**1.02** The 177A test set light emitting diodes (LED's) respond to negative or positive potentials applied to the loop or across either side of the loop to ground. A third wire is also provided with diodes for tip to ground tests. The FEMF potentials can be determined and identified without fear of burning the trouble conditions clear. The 177A test set can be used for monitoring an in-service set without interfering with circuit operation. It can also be used to determine trouble conditions when circuits are in the idle state.

**1.03** A jumper lead when connected between the chassis ground and the tip access point supplies ground to the tip side of the line and is used for ground start applications. This connection may also be used to represent a coin ground when testing coin control recycle applications, stuck coin alarms, registers, identifiers, and visual indicators.

**1.04** Listed are sample test procedures and the signaling threshold required for dial-tone-first service. From this the signaling application to be monitored can be determined. The test set can be connected at the station, central office terminal locations, or any location where tip, ring, and ground can be accessed.

**1.05** The LED indicators operate as follows:

No. 3	Lights on negative dc voltages across TIP and GRD (-70 volt threshold)
No. 4	Lights on positive dc voltages across TIP and GRD (+70 volt threshold)
No. 5	Lights on TIP to GRD voltage (+24 volt threshold)
No. 6	Lights on TIP to GRD voltage (-24 volt threshold)

Typical test set use for FEMF tests and DTF operational checks are shown below.

#### FEMF Test

1. Request the loop to be disconnected at the CO.
2. With the green, red, and yellow leads connected to tip, ring, and station ground, respectively, the following light conditions should be noted:

Light	FEMF CONDITION
No. 1	- DC across TIP and RING
No. 2	+DC across TIP and Ring
No. 1 and 2	AC across TIP and RING
No. 5 or 6	DC from TIP to GRD

LED	DC OPERATION
No. 1	Lights on negative dc voltages across TIP and RING (-6 volt threshold)
No. 2	Lights on positive dc voltages across TIP and RING (+6 volt threshold)

#### SIGNALING THRESHOLD FOR DIAL-TONE-FIRST

- (1) Coin present test for initial deposit: -48 volt battery on the tip side with the ring side open.
- (2) Stuck coin or 5-cent overtime test: +48 volt battery on the tip side with the ring side open.

- (3) Transmission and coin deposit readout on local call: -48 volt battery on the ring side of line and ground on the tip side.
- (4) Transmission and coin deposit on toll call and totalizer homing before coin control has been applied: +48 volt on the ring side of the line and ground on the tip.
- (5) Coin return: -130 volt battery on the tip side of the line with the ring side open.

- (6) Coin collect: +130 volt battery on the tip side of the line with the ring side open.

***Sample Test Procedures Using the 177A Test Set***

Connections: Green and Red from the 177A test set connecting cord to the tip and ring of the line. Yellow lead from the connecting cord to the station ground.

**DIAL-TONE-FIRST MODE**

***Local Overtime Call - Test set connected to a DTF line appearance at the station.***

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
1	With handset on hook	-48 volt (No. 1) diode lights brightly indicating battery and ground from the line relay. (No. 5 may light dimly on lines equipped with DDL or SRE's)
2	Go off-hook	-48 volt (No. 1) diode goes dim indicating current flow (dial tone) from the Orig. Reg., Sub Sender, Sel, etc.
3	Dial local charge number with initial rate	No. 1 diode follows rotary dial pulses. At completion of dialing -48 (No. 6) diode lights momentarily, indicating initial rate ground tests. (Test occurs after third digit in SXS)
4	Call answered	-48 volt (No. 1) diode now lighted.

***Automatic 5-Cent Overtime***

1	30 seconds before end of initial period.	+300 volt (No. 4 and 5) diodes light and go dark, indicating a coin was collected.
2	Simulate local OT deposit. Trip HT	
3	At the end of initial period.	+48 volt (No. 2) diode lights indicating totalizer homing battery has been applied.  +48 volt (No. 5) diode flashes indicating coin present test.

***Dial "0" and Call (TSP, TSPS, Cord Board)***

1	With handset on hook	-48 volt (No. 1) diode lights brightly.
2	Go off-hook	

STEP	ACTION	VERIFICATION
3	Dial "0" +	Just prior to operator answer, Nos. 3 and 6 diodes flash, representing coin refund.
4	Operator Answer	+48 volt (No. 2) diode lights indicating positive talking battery for totalizer homing.
5	Simulate deposit by manually operating totalizer and request operator to collect	Nos. 4 and 5 diodes flash once, indicating +130 volt coin collect pulse.
6	Request operator to ring back and hang up	Nos. 1 and 2 diodes glow following 20 cycle ringing supply, indicating ringing current applied.
7	Request operator to refund.	Nos. 3 and 6 diodes flash once, indicating -130 volt coin refund pulse.

### ***Incoming Toll***

1	Have cordboard operator initiate call to coin test station.	Diodes Nos. 1 and 2 light and respond to 20 cycle ringing supply.
2	Go off-hook	Nos. 1 and 2 diodes go dark.  No. 2 diode lights indicating +48 volt talk battery on line.
3	Request operator to identify deposit. Deposit less than initial rate.	No. 2 diode remains lighted totalizer homes, operator can identify deposit.
4	Request operator to refund.	No. 2 diode goes dark.  Nos. 3 and 6 diodes flash, indicating a -130 volt coin refund pulse.  No. 2 diode lights.
5	Deposit initial rate and request operator to collect.	No. 2 diode goes dark.  Nos. 4 and 5 diodes flash, indicating +130 volt coin collect pulse.
6	Request operator to disconnect circuit.	No. 2 diode lights.
7	Hang up.	No. 2 diode goes dark.  No. 1 diode lights.

### ***Recycle***

1	At coin station, block coin relay armature nonoperate.
2	Lift handset.

STEP	ACTION	VERIFICATION
3	Deposit initial rate and dial a local test number for audible ring.	No. 1 diode lights, follows dial pulses. Audible ringing heard.
4	Hang up.	No. 1 diode goes dark, Nos. 3 and 6 diodes flash indicating -130 volt coin refund pulse.  No. 5 diode lights indicating +48 volt stuck coin test.  Nos. 3 and 6 diodes flash indicating a second coin refund pulse.
5	Remove blocking tool	No. 1 diode lights.
6	Go off-hook, then hang up.	No. 1 diode goes dark momentarily.  Nos. 3 and 6 diodes flash once, indicating a refund pulse.

## RANGE CHARTS AND COIN RELAY OPERATE VALUES

TABLE A

**MAXIMUM ALLOWABLE CONDUCTOR LOOP RANGE  
WITHOUT RANGE EXTENSION – EXCLUDES NOMINAL  
300-OHM ALLOWANCE FOR COIN TELEPHONE**

CO TYPE	COIN-FIRST OFFICE	DIAL-TONE-FIRST OFFICE	NOTE
SXS	1050Ω	—	1
SXS	1200Ω	1200Ω	2
Panel	1200Ω	—	3
No. 1 XBR	1200Ω	1200Ω	3
No. 5 XBR	1300Ω	1300Ω	3, 6
No. 1 ESS	1300Ω	1300Ω	4
No. 2 ESS	1300Ω	1300Ω	5
No. 3 ESS	1300Ω	1300Ω	—

*Notes:*

*General* — Transmission requirements dictate a minimum transmitter current of 23 ma with totalizer in the home position.

- \*1. This value assumes the use of SD-31592-02 (Issue 32B or later) coin trunks which are useable in Coin-First offices only. For older trunks refer to Step-by-Step key sheets, as some loop ranges may be as low as 750 ohms.
  - \*2. This value of loop assumes use of SD-32539-01 coin trunk.
  - 3. This value is for offices arranged to operate with up to 1500-ohm external circuit resistance. For other applications refer to key sheets.
  - 4. This value assumes a minimum CO voltage of 48 volts and office wiring of 100 ohms.
  - 5. This value assumes a minimum CO voltage of 47 volts and office wiring of 50 ohms.
  - 6. The 1300 ohm loop limit applies on offices equipped with a 48 volt battery or greater.
- \*Notes 1 and 2 assume that line relay equipment is of compatible range.

TABLE B

## CONDUCTOR LOOP RESISTANCES IN OHMS WITH RANGE EXTENSION

TYPE OFFICE EQUIP.	2A RANGE EXTENDER OR DK1		SD-32053-01 DLL <sup>8</sup>		SD-26130-01 DLL <sup>8</sup>		SD-96592-01 DLL <sup>8</sup>		NS-02517-01 SRE <sup>1,8</sup>		8A RANGE EXTENDER COIN REG <sup>9</sup>		NOTES
	CF	DTF	CF	DTF	CF	DTF	CF	DTF	CF	DTF	CF	DTF	
SXS	1300 <sup>7</sup>	—	1800	1800 <sup>5</sup>	—	—	2700	2700	2100 <sup>7</sup>	2400 <sup>7</sup>	2800	2800	2, 3
No. 5 XBR	—	—	—	—	2800 <sup>6</sup>	—	3100	3100	2400	2400	2800	2800	3, 4
No. 1 XBR	—	—	—	—	—	—	2700	2700	2400	2400	2800	2800	2, 3
No. 1 ESS	—	—	—	—	—	—	3100	3100	2400	2400	2800	2800	3, 1
No. 2 ESS	—	—	—	—	—	—	3100	3100	2400	2400	2800	2800	3, 4
No. 3 ESS	—	—	—	—	—	—	3100	3100	2400	2400	2800	2800	3, 4
RSS	—	—	—	—	—	—	—	—	—	—	2800	2800	

*Notes:*

*General* — The dial Long Line circuits and range extender listed are the only approved range extension equipment for coin lines.

1. Signaling range extender (SRE).
2. Minimum coin collect and coin return voltages are assumed to be  $\pm 116$  volts. 1A coin relays (operate current of 41 ma) are assumed at coin telephone. For other coin voltages consult the SD working limits section.
3. Maximum ground resistance of 50 ohms and maximum DC earth potentials of  $\pm 3$  volts are assumed. Values in excess of these limits will reduce ranges.
4. Minimum coin collect and coin return voltages are assumed to be  $\pm 130$  volts. 1A coin relays (operate current of 41 ma) are assumed at coin telephone. For other coin voltages consult the SD working limits section.
5. Dial-tone-first operation is possible with circuits modified per drawing Issue 29D.
6. Coin-first operation in No. 5 Crossbar offices is possible if DLL circuit is modified per drawing Issue 7B. Not usable by TOUCH-TONE<sup>®</sup> equipment stations. All 1A stations must be modified to 1C equivalent.
7. SD31592-01 longitudinal voltage limit remains 4 volts with SRE or 2A.
8. Resistance shown includes dc resistance of any E-type repeaters used (73 through 180 ohms).
9. 8A REG contains its own internal repeater and no external repeater is required.

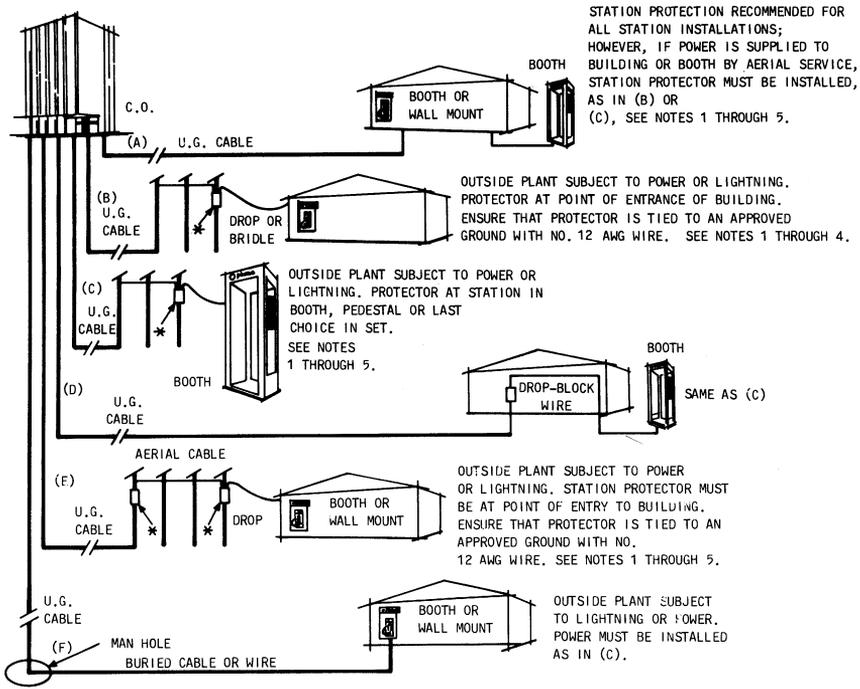
**TABLE C**  
**OPERATE VALUES OF COIN RELAYS**

MAKING ON RELAY	OPERATING TIME	OPERATE CURRENT	NON-OPERATE CURRENT
P-15E687 (Note 1)	Remove from service		
1A*	450 ± 50 milliseconds (20° to 100° F)	41 milliamps	30 milliamps
1A (Note 2)			

*Note 1:* On all routing and maintenance visits, replace the existing P-number relay with a 1A-type. P-number relays (650 ms) will not operate properly with No. 5 XBR, ESS, and SXS served by TSPS offices and are incompatible with the coin station test line and the KS-21250 test set. P-type relays may be identified by the smaller 5/32-inch diameter restoral spring as compared to the larger 9/32-inch restoral spring on 1A relays as shown in Fig. 7 and 8 of the public services maintenance check booklet.

*Note 2:* Coin relays marked 1A without the asterisk symbol have bifurcated rather than solid contact springs.

# PROTECTION



\*CROSS CONNECT BOX

NOTES:

1. FOR ADDITIONAL INFORMATION ON STATION PROTECTOR AND SIGNALING GROUNDS, REFER TO SECTION 460-100-400 AND FOR D-TYPE SETS REFER TO TOP-506-410-402.
2. HOUSINGS OF ALL OUTSIDE STATIONS MUST BE GROUNDED. IF SET IS NOT MOUNTED IN A GROUNDED ENCLOSURE, RUN A NO. 12 AWG WIRE FROM STATION TO NEAREST APPROVED GROUND.
3. CARBON BLOCKS THAT BREAK DOWN PREMATURELY CAN CAUSE FAILURES OF COIN COLLECT OR REFUND. CARBON BLOCKS SHOULD BE REPLACED BY GAS TUBE PROTECTORS (123E1A) OR 11B1A PROTECTOR UNITS IN 123-TYPE PROTECTOR BASE. SEE SECTION 506-100-100.
4. WHEN THE PROTECTOR IS MOUNTED IN AN ENCLOSURE SUCH AS A BOOTH OR SHELF, BOND THE ENCLOSURE AND PROTECTOR GROUND TOGETHER WITH NO LESS THAN NO. 12 AWG WIRE, SEE SECTION 508-100-100.
5. WHEN PROTECTOR IS MOUNTED INSIDE SET, CONNECT WIRING PER VIEW A OR B BELOW.

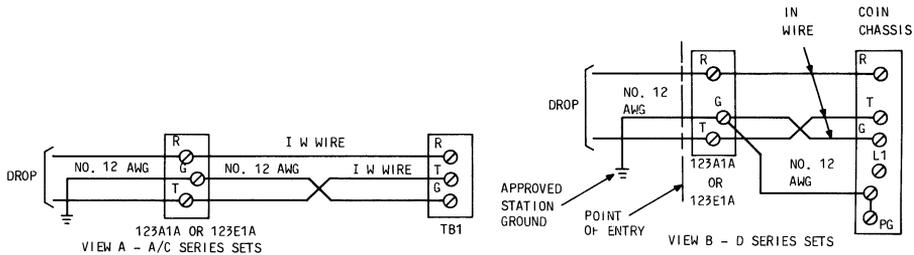


Fig. 1—Special Protection Requirements

## DIAL-TONE-FIRST FACTORS FOR THE COIN STATION

### 1. DTF CONSIDERATIONS

**1.01** All 1A/2A-type coin telephone sets must be converted to 1C/2C-type or 1D/2D-type before the central office switchboard trunks and coin handling units (i.e., coin supervisory circuits) are equipped for positive (+48 volt) battery.

**1.02** Conversion of 1A/2A coin telephones to 1C/2C or 1D/2D should include change of P coded coin relays to 1A equivalent as covered in EL 553 (GL 70-05-177).

**1.03** Stations changes required at cutover include changing the permanent information plate,

the two plastic (or metal) customer instruction cards, wiring changes on the chassis and dial housing assembly, and moving the totalizer switch to the DTF mode.

**1.04** A check should be made to insure that a 1A totalizer and a 31A chassis is used in a 1C/2C set.

**1.05** Verification of the correct wiring and coin telephone operation should be made by using the Eight Step Routine shown in the Public Service Maintenance Check Booklet or Section 506-900-503.

# **CHAPTER II**

## **CENTRAL OFFICE**

## CENTRAL OFFICE COIN SERVICE

### GENERAL

**1.01** This section is provided to give a basic overview of how various central offices handle coin service. The following is not a comprehensive or detailed circuit description and should be used as an aid to existing technical documents, i.e., Bell System Practices, CDs, PDs, etc. For central office checking with a coin test station, see the Public Service Review Guides referenced at the end of each subsection. The following new AT&T letters should be referenced in addition to the letters cited in this section:

- RL 79-09-413—Enablement of TOUCH-TONE® Dials
- GL 78-09-401—Coin Improvements in No. 1, No. 2, and No. 3 ESS
- RL 79-08-311—Coin Station Test Line Enhancements
- EL 6271—Dial-Tone-First Conversion
- GL 78-08-005—Local Coin Overtime in ESS Offices
- IL 79-12-074—Test Board Modifications.

**1.02** The section will address the two basic methods of handling coin service (Dial-Tone-First and Coin-First) a third method Postpay will not be covered due to its rapid replacement by dial-tone-first.

#### **1.03 General—Coin Service:**

(a) Coin service is always segregated from other services by a special class of service. Note, all coin lines are to be essential service, except as detailed in the Traffic Facilities Practice. All switching systems provide -48 volt battery toward the customers coin phone, on the ring side of the line. Coin-first lines have an open tip during a normal receiver on-hook condition. When a customer goes off-hook, the central office takes no action and in fact cannot detect

the off-hook condition due to the lines conditioning for ground start. When the customer deposits the initial rate (controlled by the coin station totalizer) the coin ground (through the hopper trigger in the coin station) is extended to the ring side of the line. The ground operates the line equipment in the central office as a signal to provide dial tone. Dial-tone-first offices provide both battery and ground toward the coin station and therefore provides dial tone the same as for a POTS phone. All coin service is very current sensitive in that the central office must provide at least 23 ma of line current and 41 ma of coin control current to the farthest (longest loop) coin station (see Range Extension Chart). At this point the switching systems vary in their handling of the call.

#### **1.04 No. 5 Crossbar:**

(a) The No. 5 crossbar coin-first offices require a dual wound line relay with both windings in series when serving coin-first service (SD-26030 V option removed, SD-25554 option K removed). If any coin-first lines are served in a No. 5 crossbar office the originating registers must have the ability to desensitize the (pulsing) L relay by providing a resistive ground through its tertiary winding via the coin class of service relay.

(b) Dial-tone-first offices require that the dual wound Line Link Frame L relays be equipped as follows: SD-26030 V option provided, SD-25554 option K provided, these options effectively strap out one of the two windings of the relay. The line relay now will prevent originations from the coin station when the loop substantially exceeds the offices design parameters.

(c) The No. 5 crossbar offices can provide coin return from the following equipment: Originating Registers, TSPS/Cordboard trunks, Ring and Tone trunks, Announcement trunks, and Coin Supervisory circuits. Coin Collect

current is only provided from TSPS/Cordboard trunks and Coin Supervisory circuits. The only circuit that provides for a stuck coin test (Recycle Feature) is the coin supervisory circuit.

(d) The No. 5 crossbar offices handle coin actions on locally completed calls in the coin supervisory circuit (CS). All trunks must have access to the CS circuit (including ring and tone trunks) or use coin junctors or coin IAO trunks that have such access. The use of coin junctors or coin IAO trunks negates the need to have every other trunk hardwired to the Coin Supervisory Link (access to coin supervisory circuit). When the trunks supervisory relays indicate a coin action is required the trunk bids for an idle coin supervisory circuit through the Coin Supervisory Link. The bridged connection allows the coin supervisory circuit to apply the proper collect or return current toward the coin phone and test to determine if the action was successful.

(e) The No. 5 crossbar offices handle coin actions required by DDD calls or TSPS operators in the No. 5 crossbar TSPS trunk. The TSPS base unit signals the No. 5 office (coin collect, return, or ring back) by either frequencies or multiwinks. The No. 5 office receives these signals and the trunk applies *one* pulse of coin collect or return (approximately 425 ms) or ring back. The No. 5 crossbar TSPS trunk does not make a test to determine if the required coin action is successful. If the coin is still present the call is abandoned and the coin remains on the trap.

(f) **No. 5 crossbar Typical Coin Troubles:**

- GT5 (Ground Test Failures)
- Permanent Signals—
- ALIT—arranged to test coin lines and report them by telephone number to the LTD.
- CSTR—are the register readings excessive.
- RC & RCF—are the register readings excessive.
- Are there any trunks falsely held up in the Coin Supervisory Link Frame?—(falseground on the BL lead)

- TSPS trunks—do they provide Coin Collect, Coin Return, Ring Back, what is the duration of coin control voltage
- TSPS signaling to the No. 5 crossbar office
  - (1) Dual Frequency—Coin Collection/Coin Return/Ring Back
  - (2) Multiwink—Operator Attached, Coin Collect, Coin Return, Ring Back, and Operator Released.
- Originating Register—option to desensitize L relay (CF only)
- Originating Registers ability to return coins
- Coin Junctor & IAO trunks—proper supervision, ability to signal the coin supervisory circuit for coin collect and return
- Line Link Frame Line relay option
- Coin Control Voltage measurements (130V):
  - (1) Coin Supervisory Circuits
  - (2) Coin Station Test Line equipment
  - (3) TSPS/Cordboard trunks
  - (4) Miscellaneous trunks
- Positive 48V battery on TSPS/cordboard trunks and Coin Supervisory Circuits—DTF only
- Proper duration (time) of coin control voltage from Coin Supervisory Circuits
- LT & CB relay adjustment—Coin Supervisory Circuit
- Recycle feature—Coin Supervisory Circuit GL-7109013
- Immediate coin return (during call set up) provided for toll information and service codes including 911.
- Burnt and/or powdered carbons
- Traffic blockages or overflow

- (1) Originating Registers
- (2) Coin Supervisory Circuits
- (3) Operator trunk groups
- (4) Coin junctors
- (5) Coin 1A0 trunks
- (6) Recording trunks
- (7) Load balance (lines and coin junctors).

Trouble Identification procedures for the previously listed conditions may be found in the No. 5 crossbar Public Services Review Guide (select code 500-714 and 500-719). These may be ordered on a standing order basis from the Western Electric Co., Indiana Publication Center (see RL 80-01-278).

#### 1.05 **ESS:**

- (a) ESS offices use a ferrod to service subscriber requests. The saturation value (operate) is 10 ma. When saturated the ferrod signals the system that a customer is requesting dial tone. The system connects a Customer Dial Pulse or TOUCH-TONE® Receiver; thereby providing dial tone. The receiver is more critical when it checks for a customer's short (receiver off-hook) than the line ferrod. Note, we earlier stated the coin station requires 23 ma of current to properly operate. If the customer loop is only drawing 12 ma of current the customer receiver will abandon the call, but the line ferrod will reoperate. This is a showering line condition and it is reported to the LTD via the Automatic Line Insulation Teletype (ALIT).
  - (b) ESS offices provide all coin control actions from the coin control circuit. The coin control circuit is switched to a customer's line under program control. The coin control circuits always make a stuck coin test at the end of a call (recycle).
- Note:** All ESS offices provide coin control actions in a dial-tone-first manner (coin control current on tip, ring open rather than current on both sides of the line).
- (c) ESS offices handle coin actions required by DDD calls or TSPS operators by scanning the TSPS trunk (50 ms scan rate), looking for any control signals from the TSPS base unit. When the ESS office sees a request on the TSPS trunk the ESS office momentarily opens the talking path, and attaches a multifrequency (MF) receiver. The MF receiver looks at the tones being sent from the TSPS base unit transmitter and determines if the signals request coin collect, coin return, ring back, or operator attached (operator attached or released signals are only available with Expanded Inband Signaling in Generic Program 1E6. This allows the trunk to switch battery polarity, +48V talk battery during operator attached and -48V talk battery during operator release). DTF offices not equipped with Expanded Inband Signaling provide +48V talk battery for the duration of the call. If the TSPS signal is for coin return the ESS office will again open the talk path, release the MF receiver and switch the customer's line to the coin control circuit which applies the -130V coin return potential. (The coin control potentials are applied for a maximum of 600 ms.) After the coin control function is complete the system will make one recycle attempt if the coin ground is still present.
  - (d) Local calls are handled wholly within the ESS machine. When a coin control function is required the program momentarily opens the talk path and switches the customer's line to a coin control circuit which applies the required current.

#### 1.06 **ESS Typical Coin Troubles:**

- Coin Control Voltage Measurements (130V)
  - (1) Coin Control Circuit
  - (2) Coin Station Test Line
- Excessive stuck coin indicators—faulty coin control circuits
- MF Receiver troubles
- TSPS trunks not scanned at 50 ms
- Excessive switch failures (FCGF and SUPF)
- Reversals in the Network

- Traffic blockages or overflow
  - (1) Customer Dial Pulse receivers
  - (2) Customer TOUCH-TONE® receivers
  - (3) Multifrequency receivers
  - (4) Coin Charge registers
  - (5) Load Balance (lines)
  - (6) Coin Control Jr. registers
  - (7) Coin Control Hardware circuits
- LT Relay adjustment and burned contacts in the Coin Control Circuits
- Lack of +48V talk battery on TSPS trunks (DTF only)
- Burnt and/or powdered carbons
- Lack of immediate coin return on all service codes and directory assistance calls

Trouble Identification Procedures for the previously listed conditions may be found in the ESS Public Services Review Guide (select code - common section 500-714, No. 1 ESS 500-715, No. 2 ESS 500-716, and No. 3 ESS 500-717). These documents may be ordered on a standing order basis from the Western Electric Co., Indiana Publication Center (see RL 80-01-278).

### 1.07 *Step-by-Step*

- (a) Coin lines in step-by-step are served on dedicated Line Finder groups. The Line Finders are hardwired to a coin box trunk and then cabled to a first selector appearance.
- (b) Step-by-step offices can provide coin return from the following pieces of equipment: coin box trunks, TSPS/cordboard trunks, and miscellaneous trunks.
- (c) Step-by-step offices handle coin actions on local calls in the coin box trunk. The coin box trunk applies the coin control current through the winding of a relay to the coin station hopper trigger ground. When the coin station ground disappears, the coin box trunk relay releases

and allows the connection to restore to normal. Some step-by-step offices have a timed release circuit that will time out after about eight attempts of coin control action (about 60 interruptions per minute), peg the stuck coin register, then release. If the timed release circuit is not provided and a coin ground cannot be removed, the circuit must be manually released. Note, there are many types of coin box trunks with loop limits between 750 to 1050 ohms.

Step-by-step offices handle coin actions required by DDD calls or TSPS operators in the step-by-step TSPS trunk. The TSPS base unit signals (Coin Collect, Return, or Ring Back) to the step office by either frequencies or multiwinks. The step office trunk receives these signals and trunk applies *one* pulse of coin collect or return (approximately 425 ms) or ring back. The trunk does not make a test to determine if the required coin action was successful. If a DDD call was completed to a busy number the step-by-step TSPS trunk will apply one quick pulse of coin return toward the coin station, then the coin box trunk will check and determine if the coin ground has disappeared. If the coin ground is still present the coin box trunk will repeatedly attempt to *collect* the coin.

#### (d) *Step-by-Step Typical Coin Troubles*

- Excessive Stuck coin alarms
- Switch maintenance - cords, wipers, banks, von springs, etc.
- Improper adjustment of coin box trunk relays, P, P1 R, J
- Lack of proper stuck coin alarms - coin box trunk, Isle pilot, major alarm
- Coin box trunk, timed release circuit, and register troubles
- Improper coin control duration (timing in TSPS trunk)
- Traffic blockages or overflow
  - (1) Line Finder Group
  - (2) Operator Trunk Groups

- Lack of routines in TSPS trunk signaling receivers
- Line relay options in line finders
- Improper coin control voltages
- Burnt or powdered carbons

- Lack of immediate coin return on all service codes and directory assistance calls.

Trouble Identification procedures for the previously listed conditions may be found in the Step-by-Step Public Services Review Guide (select code 500-714 and 500-720). These documents may be ordered on a standing order basis from Western Electric Co., Indiana Publication Center (see RL 80-01-278).

## DIAL-TONE-FIRST FACTORS (DTF) FOR THE CENTRAL OFFICE

**Note:** The implementation of dial-tone-first (DTF) service and the Coin Service Improvement program highlighted new changes and new objectives.

### 1. BASIC OBJECTIVES

**1.01** To enable customers to dial certain calls without an initial coin deposit, such as calls to the operator for assistance, NPA Directory Assistance calls, station-to-station toll calls, person-to-person calls, collect calls, credit card calls, and three digit service code calls including the 911 emergency code.

**1.02** To give the customer greater assurance that the DTF system is working before a coin deposit is made. Coincidentally, the customer would be able to report a trouble condition without depositing a coin.

**1.03** To permit DTF service operation in all types of central office—except panel—with all types of traffic switchboards and systems.

**1.04** To improve transmission characteristics and reduce noise by removing the unbalancing ground at the station during conversation. An improvement of 12 to 34 db in 180 Hz balance can be expected when ground removal is employed. Ground removal also substantially reduces corrosion caused by ground currents.

### 2. FUNCTIONAL CHANGES

**2.01** The DTF requires new screening of dialed digits by the central office to determine whether an initial rate is required to complete the call.

**2.02** With present-day methods of coin station operation and with the need to handle both initial deposit-and subsequent deposits of less than initial rate, it is necessary for the central office to generate and send to the station a signal which conditions the station to read out deposits of less than initial rate. In coin-first (CF) service application

of loop current serves this signal function. But with DTF, loop current is applied before a coin is deposited. Thus a new signal must be provided. This new signal is a reversal of talking battery, specifically, **positive 48 volts** on the ring conductor and ground on the tip conductor. Tip and ring battery reversal is employed in remote switching system (RSS) rather than positive 48 volts.

**2.03** To effect ground removal during conversation, changes are necessary in the central office coin control and coin testing arrangements as well as at the station.

**2.04** Positive battery is fed to the coin station on calls placed through TSPS. A new method accomplishes this by a change in signaling procedure from TSPS equipment to the local office (which applies a positive 48 volt talk battery when an operator or ACTS equipment is connected). A less elaborate arrangement is used with older TSPS arrangement (prior to 1T10) and cord switchboards, in which local office trunks to a TSPS or cord switchboard are arranged to supply positive battery to the coin station as long as the station is connected to the trunk.

**2.05** On dial-tone-first application of positive 48 volt talking battery permits readout of less than initial rate deposit on toll calls.

### 3. CENTRAL OFFICE CONSIDERATIONS

#### 3.01 *No. 1 ESS:*

- (a) The following AT&T Letters describe dial-tone-first arrangements for No. 1 ESS:
  - GL 70-02-061, EM 1735
  - GL 70-06-059, Supplement 1 to EM 1735
  - GL 72-02-046, EL 1674
- (b) Feature Document FD 231-090-095 covering coin service in No. 1 ESS has been released.

This document will include additional dial-tone-first information.

(c) **Corrections to GL 70-02-061, EM 1735:** The following changes should be made to GL 70-02-061, EM 1735:

- Paragraph 3.4.1 — Reference to stuck coin operator should be removed.
- Paragraph 3.4.2 — Reference to stuck coin operator should be removed.
- Paragraph 4.1 — Refer to Station Section for coin station set modifications. (Section 4 of this document.)
- Paragraph 4.2.6 — Refer to GL 71-06-015, EL 1279 for local test desk modifications.
- Paragraph 7.2 — Delete Step SC4.
- Paragraph 7.3 — Delete Plan (B).

(d) **Combined Coin and Noncoin Operator Trunk Groups:** Coin and noncoin traffic should not be combined on the same operator or TSPS trunk group, unless Expanded Inband Signaling is fully operational. Positive battery supervision must be provided for coin lines and normal negative battery for noncoin lines. If noncoin lines are served by trunks with positive battery, end-to-end TOUCH-TONE signaling is not possible, and toll diverted lines will be disconnected.

(e) **Conductor Loop Range:** The only approved circuits for extending the range of DTF coin lines in No. 1 ESS are the [8A range extender (Coin REG)] signaling range extender, NS-02517-01 the coin dial long line, SD-96592-01, and SLC-40. Refer to the General Section for ranges obtainable with these circuits.

(f) **Insufficient Initial Deposit Announcement:** A special "Insufficient Initial Deposit" announcement should be provided. The recommended wording of this announcement is given in the General Section. If all of the trunks

to this announcement are busy, reorder tone should be connected.

**3.02 No. 2 ESS:**

(a) **Engineering:**

(1) Refer to TFP, Div D, Section 12-C for engineering of circuits required for dial-tone-first. Be sure to allow for the increased holding time of dial-tone-first lines on customer digit receivers, coin supervisory control circuits, permanent signal equipment and the switching network.

(2) Paragraph 4.4.1 of the TFP suggests the use of a 5-second holding time for the "Insufficient Initial Deposit" announcement if actual data is not available. This is incorrect. The suggested holding time should be 18 seconds.

(b) **Line Assignment:** If coin lines are being transferred from other switching machines at this time, care should be exercised in assigning these lines so that network blockage does not result.

(c) **Polarity on TSPS Trunks:**

(1) TSPS trunks SD-2H112-01 and SD-2H144-01 must be modified to provide positive battery on calls from coin lines and negative battery on calls from noncoin lines. The fix covered by TC 82393 and TC 83410 (Broadcast Warning No. 361) for EF generics and TC 23552 and TC 25332 (Broadcast Warning No. 354) for LO generics must be provided to maintain positive battery after coin collect, coin return, or ringback.

(d) **Polarity on Operator Trunks:**

(1) All operator trunks including TSPS, recording completing, coin overtime, and coin zone must be modified to provide positive battery on calls to or from coin lines. Trunks requiring modification include the following:

- Outgoing to TSPS — Loop SD-2H144-01
- Recording Completing — Loop SD-2H110-01

- Recording Completing — E&M SD-2H112-01
- Coin Overtime SD-2H113-01
- Coin Zone SD-2H151-01
- Outgoing Switchboard SD-2H105-01.

(e) **Conductor Loop Range:** The only approved circuits for extending the range of dial-tone-first coin lines in No. 2 ESS are the (8A range extender) signaling range extender, NS-20517-01, the coin dial long line, SD-96592-01, and SLC-40. Refer to the General Section for ranges obtainable with these circuits.

### 3.03 No. 3 ESS:

(a) The following AT&T Letters/Documents describe dial-tone-first arrangement for No. 3 ESS:

- GL 78-04-097, EL 5749
- FD 233-190-112.

### 3.04 No. 5 Crossbar:

(a) The following AT&T Letters describe dial-tone-first arrangements for No. 5 crossbar:

- GL 69-08-132, EM 1425
- GL 72-05-006, EL 1829.

(b) **“Insufficient Initial Deposit” Announcement:** The dial-tone-first arrangement of intercept trunk circuit SD-26121-01 (J23057CH) should be used to provide the “Insufficient Initial Deposit” announcement from either the 6A or 7A announcement system. Issue 14B of this circuit provides for the return of a partial deposit when the customer hangs up.

(c) **Originating Registers:**

(1) In considering whether or not to modify all originating registers (OR) for dial-tone-first service, the following quotation from Traffic Facilities Practices, Division D, Section 8-e(1), Paragraph 4.54 should be noted:

“From a circuit capability standpoint, the No. 5 Crossbar System can be equipped

with up to six Originating Register Groups (ORGs). The effects, however, of interaction between dial tone markers and ORs are such that if an insufficient quantity of ORs is provided in one ORG, the dial tone service of customers assigned to the other ORGs in the office will be adversely affected. In general, as the number of ORGs in an office is increased, the possibility of poor dial tone service due to a forecasting error on one of these groups is increased. Coin traffic characteristics are frequently volatile and therefore more difficult to forecast than other types of traffic. Consequently, provision of a separate group of ORs for Dial-Tone-First should be avoided.”

(2) In addition, essential lines and coin lines are assigned to the same vertical group. This means that if a separate dial-tone-first originating register group is provided, in case of a disaster, all essential lines and all coin lines will be limited to this separate group of originating registers.

(3) Refer to TFP, Division D, Section 8-e(1), for further discussion on the equipping of originating registers for dial-tone-first service.

(d) **Coin Supervisory Test Circuit:** Offices equipped with the coin supervisory test circuit should have this circuit modified for dial-tone-first operation.

(e) **Recycle:** If the automatic recycle feature for coin disposal has not previously been provided, it is recommended that it be added at the same time dial-tone-first is provided. The recycle feature is described in GL 71-09-013, EL 1398.

### 3.05 No. 1 Crossbar:

(a) The following AT&T Letter describes dial-tone-first arrangements for No. 1 Crossbar:

- GL 70-03-176, EL 447.

(b) **Subscriber Senders:** Page 3 of GL 70-03-176 discusses the modification of only a portion of the subscriber senders for dial-tone-first rather than a modification of all the senders. In so doing, care should be exercised to insure that

the traffic generated by lines served by the modified senders will not be so great that service may be adversely affected. Sender holding time on dial-tone-first lines will be increased due to coin deposits being made after receipt of dial tone and to a larger number of permanent signals.

(c) **Recycle:** If the automatic recycle feature for coin disposal has not previously been provided, it is recommended that it be added in connection with the conversion to dial-tone-first. The recycle feature is described in EL 2451.

**3.06 Step-by-Step:**

(a) The following AT&T Letters describe dial-tone-first arrangements for step-by-step:

- GL 72-05-108, EL 1484

- GL 73-03-078, EL 2299.

(b) **Local Connectors:** The DTF operation requires the use of either toll transmission selectors or coin connectors for incoming calls from an operator. These are the only arrangements that provide the proper battery polarity for dial-tone-first service.

(c) **Auxiliary Line Circuit Coin Operation:**

The DTF operation is not compatible with the auxiliary line circuit method of coin operation used in some 355 and 35E97 type offices.

(d) **Conductor Loop Range:** The only approved circuits for extending the range of DTF coin lines in step-by-step are the signaling range extender, NS-02517-01, coin dial long lines, SD-32053-01 and SD-96592-01, and SLC-40. Refer to the General Section for ranges obtainable with these circuits.

## DTF CIRCUIT MODIFICATIONS

1.01 The following circuits have been modified or provided new to reflect coin improvement items including Dial-Tone-First)

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>FIG.</u>	<u>OPTIONS</u>
<b>No. 5 CROSSBAR</b>				
Incoming Trunk	SD-25911-01	12D		ZH
Incoming Trunk	SD-26083-01	8D		ZM
Incoming Trunk	SD-26123-01	4D		J
Incoming Trunk	SD-26149-01	3D		ZC
Outgoing Trk or Junctor	SD-26078-01	12D		ZQ
Outgoing Trk to TSP(S) (Loop)	SD-27547-01	10AC, 13B, 7D		Note 1
Outgoing Trk to TSP(S) (E&M)	SD-27551-01	8AC, 4D		Note 2
Outgoing Trk to TSP(S) (E&M)	SD-28062-01	1		Note 3
Outgoing Trk to TSP(S) (Loop)	SD-28063-01	1		Note 4
Recording Completing Trk	SD-25923-01	10D		A
Recording Completing Trk	SD-25923-02	8D		A
Recording Completing Trk	SD-25923-03	12D		A
Recording Completing Trk	SD-25923-04	12D		A
Recording Completing Trk	SD-26091-01	11D		G
Recording Completing Trk	SD-26093-01	7D		F
Recording Completing Trk	SD-26099-01	7D		E
Toll Switching Trk	SD-25712-01	12D		H, ZA
Toll Switching Trk	SD-26081-01	8D		A
Toll Switching Trk	SD-26082-01	6D		ZC
Toll Switching Trk	SD-25854-01	13D		G
Coin Supervisory	SD-25736-01	26D		Note 5
Concentrating Ckt for Perm. Sig. Holding Trks	SD-25766-01	21D		Note 6
Toll Swbd. 3C or 3CL Manual Subs. Line	SD-56317-01	6D		Z, K
Toll Swbd. No. 1 Manual Subs. Line	SD-56318-01	4D		Z, K
Completing Marker	SD-25550-01	58D		EY
Completing Marker	SD-26002-01	37D		DK
Originating Register	SD-26040-01	38D		Fig. 33
Originating Register	SD-25551-01	55D		Fig. 30
MTF Auto. Monitor	SD-25680-01	78D		Note 7
MTF Voltmeter Test	SD-25792-01	13D		B or remove A
Intercept Trk	SD-26121-01	14B		App. Fig. 7
MTF Trunk Test	SD-25918-01	48D, 50D, 56D		Note 8
Office Test Frame	SD-27633-01	17D		App Fig. 38, XG
Off Tst Fr Trbl Ind	SD-27634-01	14D		ZB

**CRAFTS MANUAL 2-3**

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>FIG.</u> <u>(Note)</u>	<u>OPTIONS</u> <u>(Note)</u>
<b>No. 1 CROSSBAR</b>				
Subscriber Sender	SD-25012-01	126B	<u>22, B, AI,</u> <u>BH, BJ,</u> <u>BK, BM,</u> <u>BN, CB</u>	<u>GP, HH, MA, MB,</u> <u>MC, NT</u>
Subscriber Sender	SD-27810-01	28B	21, 22	ZH
Originating Marker	SD-25016-01	119B	O, BC	BV
Originating Marker Conn.	SD-25035-01	48B	14*	
Incoming Trk (Mfr Disc)	SD-25026-01	18A		B, ZE, ZC or ZH
Incoming Trk	ES-25723-01	6A		ZB, ZD
Incoming Trk	SD-25876-01	17A		ZJ, ZL, ZQ, ZS
Incoming Trk	SD-25937-01	11A		B, F, J, ZB
Incoming Trk (Mfr Disc)	SD-25263-01	17D		E
Incoming Trk	SD-25303-01	18D		E
Incoming Trk (Mfr Disc)	SD-25308-01	13D		E
Incoming Trk	SD-25883-01	15D		G
Applique Unit	SD-27886-01	3A	1, 2, 3	<u>Y, Z</u>
Outgoing Trk (Mfr Disc)	SD-27555-01	9B	3, 4	N
Outgoing Trk	SD-27814-01	9D	5, 6, 7	
Outgoing Trk	SD-27816-01	8B	5, 6, 7	<u>W</u>
Outgoing Trk (Mfr Disc)	SD-27557-01	10AC	3, 4	<u>J, L</u>
Coin Zone Trk	SD-96518-01	7D	10	G
Vacant Code Trk (Mfr Disc)	SD-25125-01	11D	<u>D</u>	<u>M, R</u>

\* SD-25035-01 Fig. 14 required for non-dial-tone-first senders

*Note:* Underscored figure and options are conditionally required — see SD drawing.

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>FIG.</u> (Note)	<u>OPTIONS</u> (Note)
<b>No. 1 CROSSBAR (Contd)</b>				
Vacant Code Trk (Mfr Disc)	SD-25134-01	18D	G†	H, <u>S</u> , <u>ZA</u>
Vacant Code Trk (Mfr Disc)	SD-25467-01	10D	<u>B</u>	K, <u>M</u>
Perm. Sig. Holding Trk	SD-25418-01	24B		ZN
Perm. Sig. Holding Trk	SD-25126-01	18B	C	
Perm. Sig. Holding Trk (Mfr Disc)	SD-25425-01	11B	A	M
Coin Supv. Ckt.	SD-25061-01	29B	H, K†	E, ZB
Coin Supv. Ckt.	SD-25061-02	32B	D, Q, S†	W, ZS, <u>ZT</u> , <u>ZU</u>
Coin Supv. Ckt.	SD-25444-01	19B	F†	ZK
Coin Sup. Conc. Ckt.	SD-27153-01	6A		E, H
Coin Sup. Overtime Mon. Ckt.	SD-56000-01	9B		N remove M
Talking Battery Filter	SD-27899-01	2D	1	
Orig. Sdr. Test Ckt.	SD-25221-01	107B	17D	<u>NA</u> , <u>NB</u> , <u>NE</u> , <u>PX</u> , <u>49</u> , <u>PZ</u> , <u>QB</u> , <u>QD</u> , <u>QE</u> , <u>QF</u> , 50, SM, SN, YS, RMV B, <u>SW</u> , <u>VS</u> or <u>VT</u>
District Junctor Test	SD-25158-01	65A	<u>AH</u> , <u>AI</u> , <u>AK</u>	<u>VF</u> , WY, <u>WZ</u>
ANI Trunk Test	SD-95889-01	22B		XL, YA, YF, YI, <u>YK</u> , YL, <u>YM</u> , <u>YN</u> , YO, <u>ZD</u> , <u>ZE</u> , <u>ZF</u> , <u>ZV</u> , <u>ZW</u> , ZX, <u>ZZ</u>
LAMA Trunk Test	SD-27587-01	8D		V, X
Outgoing Trunk Test Frame	SD-25177-01	72A		UG
Station Ringer Test	SD-96218-01	22D		ZM
Coin Zone Trunk Test	SD-96372-01	13D	F	F
Perm. Sig. Holding Trk	SD-55870-01	14B		ZA
Toll Link Ckt.	SD-55779-01	5B	<u>A</u> , B, C	<u>H</u> , K, <u>S</u>
Special Service Trk.	SD-56278-01	3AC	F, <u>G</u>	Q, R
Sender Make Busy Test	SD-21697-01	14B		M
Orig. Trouble Indicator	SD-25018-01	63B	48	

† The supply for coin collection and coin return must be CC+ and CR-, respectively.

Note: Underscored figures and options are conditionally required — see SD drawing.

**CRAFTS MANUAL 2-3**

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>SD NOTE</u>	<u>OPTIONS‡</u> (Note)
<b><u>STEP-BY-STEP</u></b>				
Recording Completing Trk	SD-30953-01	4D	109	Fig. 3 & J, M, G* (N)
Recording Completing Trk	SD-31750-01	11D	110	Fig. 2 & S, T, W
Recording Completing Trk	SD-31888-01	13D	110	Fig. 2 & A, ZB, ZE ZC* (ZA)
Recording Completing Trk	SD-32042-01	15D	110 & 111	Fig. 6 & ZH
Recording Completing Trk	SD-32168-01	11D		G, J
Recording Completing Trk	SD-32300-01	4D	111	ZA, ZC, ZE, ZF* (ZD)
Recording Completing Trk	SD-32301-01	2D		J, M
Outgoing Trk to Operator	SD-31146-01	11D		H, K
Outgoing Trk to Operator	SD-31315-01	19D		ZT, ZW
Outgoing Trk to Operator	SD-31752-01	11D	115	Fig. 3, ZG, ZI, ZJ* (ZF)
2-Way Trk to Toll Office	SD-30900-01	10D		Fig. 2, ZL, ZN
2-Way Trk to Toll Office	SD-30901-01	11D		Fig. 2, W, ZA
2-Way Trk to Toll Office	SD-31747-01	21D	114	Fig. 2, ZM
2-Way Trk to Toll Office	SD-31775-01	23D	111	Fig. 2, W, ZR, ZV, ZW, ZT* (ZS)
2-Way Trk to Toll Office	SD-31874-01	11D		Fig. 2, ZF
2-Way Trk to Toll Office	SD-32340-01	4D		Fig. 2, V, ZF
ANI Trunk	SD-32344-01	13B		B, ZV, <u>ZU</u> , <u>ZW</u>
ANI Trunk	SD-32542-01	1		X
ANI Trunk	SD-35023-01	1		N
ANI Trunk	SD-35024-01	1		X
ANI Trunk	SD-32551-01	1		S, X, Z
Incoming Trunk	SD-31703-01	9D		Fig. F, N, K
Incoming Trunk	SD-31887-01	14D	107 & 109	Fig. C, 2A, ZE, ZI, ZH, ZK, ZL, ZO, ZS*
Toll Transmission Sel.	SD-30949-01	7D		Fig. D, ZA, ZE
Toll Transmission Sel.	SD-31723-01	24D		Fig. N, <u>ZA</u> , ZF, ZH, A
Toll Transmission Sel.	SD-31745-01	17D		ZL, ZN
Toll Transmission Sel.	SD-31841-01	22D	102	ZP, <u>ZK</u> , <u>ZL</u> , <u>ZO</u> , <u>ZQ</u> , <u>ZR</u> , <u>YG</u> , <u>YH</u> , <u>T</u> , <u>V</u>
Line Circuit	SD-31531-01	28D	111 & 303	Fig. 1, 2, <u>ZD</u> , <u>ZE</u> , <u>ZF</u>
Line Circuit	SD-31777-01	35D	107	Fig. 1, 2, X
Line Circuit	SD-32133-01	19D	110 & 305	Fig. 2, 9, 10, A, B, E
Line Finder	ES-30427-01	41D	126 & 303	Fig. 1A, 1B, 5A, 5B <u>ZD</u> , <u>ZE</u> , <u>ZF</u>
Primary Line Switch	SD-31644-01	28D		Q
Coin Control Trunk	SD-32288-01	5D		E
Coin Control Trunk	SD-32289-01	4D		Q
Coin Control Trunk	SD-32298-01	7D		ZD
Aux. Coin Trunk	SD-32538-01	1		Fig. 1

‡ Options followed by \* are new units. Options enclosed with ( ) are field modifications.

Note: Underscored figures and options are conditionally required — see SD drawing.

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>SD NOTE</u>	<u>OPTIONS</u> (Note)
<b>STEP-BY-STEP (Contd)</b>				
Coin Trunk	SD-31592-02	30D		ZW, ZY
Aux. Line Ckt.	SD-32024-01	9D		W, T
Aux. Line Ckt.	SD-32166-01	7D	301	Fig. <u>1</u> , <u>2</u> , T
Aux. Line Ckt.	SD-95607-01	4D		T
Coin Connector	SD-33022-01	12D		ZD
Dial Long Line	SD-32053-01	29D	109 & 110	Fig. <u>A</u> , ZL, ZN, ZO, ZR
Misc. Alarm Ckt.	SD-31980-01	30B, 29D	119 & 122	Fig. 35, 36, YO, YH
Misc. Alarm Ckt.	SD-32193-01	7D		W
+48 Volt Battery Filter	SD-32537-01	2D		Fig. 1
Alarm Checking Term.	SD-31835-01	19D		Fig. 13, ZM
Rotary Line Circuit	SD-31259-01	23D		ZB
Misc. and Fuse Alarm Ckt.	SD-31209-01	43D	172 & 173	Fig. 8, 11
Misc. and Fuse Alarm Ckt.	SD-31558-01	34D		Fig. 21, PU9 & A9 Leads
Misc. and Fuse Alarm Ckt.	SD-31613-01	24D	125	Fig. 7, 8, N
Misc. and Fuse Alarm Ckt.	SD-31974-01	20D	110	Fig. 36, 37
Misc. and Fuse Alarm Ckt.	SD-32192-01	22D		Fig. 13A
Misc. and Fuse Alarm Ckt.	SD-31035-01	16D	108	Fig. 6, 16, 17
Common Timing Circuit	SD-31310-01	29D		Fig. 16, PU9 & A9 Leads
Common Timing Circuit	SD-30303-01	40D		Fig. 14, PU9 & A9 Leads
Trunk Test Line	SD-31636-01	14D	114	Fig. G, A
Coin Box Trunk Test Set	SD-31858-01	15D		ZH, ZK
Trunk Test Set	SD-90469-02	17D		ZH, ZK
ANI "B" Trunk Test Circuit	SD-32315-01	12D		<u>YA</u> , <u>YF</u> , <u>XE</u>
ANI "C" Test Circuit	SD-32379-01	11D		ZD
Conv. Trunk Circuit	SD-32326-01	7B		V
TOUCH-TONE Conv. Circuit	SD-32328-01	21B		Fig. 14 & 15, <u>ZU</u> , <u>ZV</u> , <u>ZT</u>
Conv. Test Circuit	SD-32329-01	8B		Fig. 4, Z
Conv. Test Circuit	SD-32330-01	10B, 12B		E, F
Orig. Reg. and Outpulsing Cont.	SD-32351-01	29D	102	Fig. 12, <u>13</u> , <u>YY</u> , <u>YX</u> , <u>YU</u> , <u>XF</u> , <u>XG</u> , <u>XH</u>
Register Trunk and Line	SD-32353-01	24D		ZI
Translator Conn. Decode	SD-32354-01	10D		R, S, T, V
Translator Circuit	SD-32355-01	13D	106	Fig. 8, M
Decoder Circuit	SD-32356-01	13D		Fig. 14, J
Manual Test Circuit	SD-32362-01	12D		Fig. 7, 8
Manual Test Set	SD-32363-01	8D	107	R, S
Trouble Ticketer	SD-32364-01	6D	102	W, <u>N</u>
Automatic Test	SD-32365-01	15D	102	Fig. 16, 17, 18, 19, <u>ZA</u> , <u>ZB</u> , <u>ZC</u> , <u>ZJ</u>
Aux. Trunk Circuit	SD-30806-01	5D	105 & 302	Fig. 4, 5, <u>Q</u> , <u>R</u> , V
Aux. Trunk Circuit	SD-32025-01	7D	106 & 302	Fig. 4, <u>Q</u> , <u>M</u> , <u>N</u> , <u>E</u>
Coin Box Trunk	SD-32539-01	1	102	Fig. 1, 2, <u>4</u> , 5, <u>7</u> , 8, <u>ZE</u>

Note: Underscored figures and options are conditionally required — see SD drawing.

**CRAFTS MANUAL 2-3**

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>	<u>OPTIONS</u>
<b><u>SWITCHBOARDS</u></b>			
3CF — Recording Comp. Trunk	SD-55120-01	6B	B, G
3CF — Toll Switching Trunk	SD-55122-01	10A	G, J
3, 3C, 3CL — Toll Switch Trk.	SD-55341-01	27AC	ZW, ZY
3, 3C, 3CL — Toll Switch Trk.	SD-55352-01	13AC	ZB, ZD
3, 3C, 3CL — Recording Comp. Trunk	SD-55946-01	11AC	Fig. G, ZA
3, 3C, 3CL — Recording Comp. Trunk (Mfr. Disc)	SD-56008-01	17D	ZB, ZD
1 — Toll Switch Trunk	SD-56204-01	9AC	ZE, ZG
3, 3C — Recording Comp. Trunk (Mfr. Disc)	SD-62441-01	31AC	ZN, ZS, ZU
1 — Recording Comp. Trunk	SD-62496-01	18B	ZF, ZH
3, 3C, 3CF, 3CL — Subs. Line Ckt.	SD-64502-01	14B	H, J
1 — Toll Switch Trunk	SD-64875-01	11B	ZB, ZD
13C, 13D, 14C, 14D, 15C, 15D — Special Service Trunk	SD-1B067-01	3B	Fig. 2
3C — Special Service Trunk (Mfr. Disc)	SD-55183-01	8AC	Fig. G, H, J, Q

*Note 1:* Option H for coin only trunks.  
Option ZB and ZE for coin — noncoin trunks.  
Option ZI and ZJ for trunks — restricted ringback.

*Note 2:* Option N for coin only trunks.  
Option Q and E for coin — noncoin trunks.

*Note 3:* Apparatus Fig. 3 and 4 and Option Q with multiwink coin control.  
Apparatus Fig. 2 and Option R for inband coin control.  
Apparatus Fig. 2 and Option R for coin only with inband coin control.

*Note 4:* Apparatus Fig. 3 and 6 with multiwink coin control.  
Apparatus Fig. 2 and Option R for coin only with polar marginal coin control.  
Apparatus Fig. 2 and 6 for coin and noncoin trunks with polar marginal coin control.

*Note 5:* Option YC and YD without coin overtime.  
Apparatus Fig. 5 and Options YC and YE with coin overtime.

*Note 6:* Add Option ZC or remove Option ZE.

*Note 7:* Options ZZG, ZZH, ZZK, and ZVN where any registers are modified for DTF plus Options WG and ZZI where both loop start and ground start in some register groups or Options WG and ZZJ where separate loop start and ground start register groups are provided.

*Note 8:* Apparatus Fig. J and Options RO, TF, TI, TH, UF, UJ, and UZ plus Option TD if coin overtime is provided.

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE FOR DTF/OPTION</u>	<u>LATEST ISSUE (DATE)</u>
<b><u>No. 1 ESS</u></b>			
Outgoing Trk. Ckt. to Swbd. No. 3CL	SD-1A169-01	11B/M	11B(3-3-69)
Outgoing Trk. Ckt. To Swbd. No. 3CL in Distant Bldg. High-Low Supervision Rev. Batt. Ringback Coin Cont. on T & R	SD-1A169-05	1/§	2A(1-17-78)
Incoming Trk. Ckt. From Swbd. No. 3CL	SD-1A184-01	9B/§	9B(5-20-70)
Incoming Trk. Ckt. From Swbd. No. 3CL in Distant Bldg. Third Wire Coin Control Simplex Ringing Signal	SD-1A184-05	1/§	2D(2-11-77)
2-Way Trk Swbd. No. 3CL	SD-1A192-02	1/§	6B(10-12-73)
Swbd. No. 3CL In Distant Bldg. Reverse Batt. Supervision Inband Coin and Rering Signal	SD-1A192-05	1/§	2D(2-3-76)
Outgoing Trk. Ckt. to Crossbar Tandem Office or TSPS No. 1 Sys. High-Low & Reverse Batt. Supervision	SD-1A203-01	1/§	10B(6-27-77)
Outgoing Trk to X-BR Tandem or TSPS	SD-1A203-05	1/§	2B(6-14-76)
Outgoing Trk. Ckt. to Swbd. No. 3C or 3CL in the Same Bldg.	SD-1A223-01 SD-1A223-05	5B/T 1/§	7B(1-18-77) 1(4-29-77)
Incoming/Trk. Ckt. to Swbd. No. 3C or 3CL in the Same Bldg.	SD-1A224-01	6B/T	9B(2-5-76)
Incoming Trk. Ckt. from Swbd. No. 3C or 3CL in the Same Bldg.	SD-1A224-05	1/§	1(6-9-77)
2-Way Trk. Ckt. E&M Lead Supervision MF Pulsing 4-Wire Term. Set	SD-1A236-01	5B/X	9D(12-12-75)
2-Way Trk. Ckt. E&M Lead Supervision MF Pulsing	SD-1A252-01 SD-1A252-05	1/§ 1/§	7D(1-5-78) 2D(2-11-78)

§ No option designation. Wiring shown as strapping on frame or at master scanner.

**CRAFTS MANUAL 2-3**

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE FOR DTF/OPTION</u>	<u>LATEST ISSUE (DATE)</u>
<u>No. 1 ESS (Contd)</u>			
Outgoing Trk. Ckt. Coin Zone Dialing to Swbd. No. 3CL in Distant Bldg. Polar Double — Duplex Supervision	SD-1A254-01	4B/Y.	5B(9-7-71)
Outgoing Trk. Ckt. Local Coin Overtime and Stuck Coin to Swbd. No. 3CL in Distant Bldg.	SD-1A255-01	3B/Y	5B(10-5-72)
Incoming Trk. Ckt. E&M Leads Super- vision MF Pulsing	SD-1A312-01	1/§	2D(5-16-77)
Incoming Trk. Ckt. E&M Lead Supervision	SD-1A312-05	1/§	2D(2-11-77)
§ No option designation. Wiring shown as strapping on frame or at master scanner.			

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE FOR DTF/OPTION</u>	<u>LATEST ISSUE (DATE)</u>
<b><u>No. 2 ESS</u></b>			
Two-Way Trk. Ckt. E&M Lead Supervision	SD-2H112-01	1/W, V	13B(10-26-76)
Two-Way Trk. Ckt. Swbd. No. 3CL in Distant Bldg. Reverse Batt. Supervision Inband Coin and Rering Signal	SD-2H110-02	1/W	1(3-23-78)
Outgoing Trk. Ckt. Local Coin Overtime and Stuck Coin to Swbd. No. 3CL in Distant Bldg.	SD-2H113-01	1/Y	3B
	SD-2H110-01	1/W	8B(11-21-78)
Outgoing Trk. Ckt. to Swbd. No. 3CL in Distant Bldg. High-Low Supervision Rev. Batt. Ringback Coin Control on T&R	SD-2H105-01	2A/Z, X	4D(6-10-75)
Outgoing Trk. Ckt. Coin Zone Dialing to Swbd. No. 3CL in Distant Bldg.	SD-2H151-01	1/Y	7B(12-31-75)
Outgoing Trk. Ckt. to X-BR Tandem CAMA or TSPS, SXS, CAMA, or TSPS No. 1 High-Low and Rev. Batt. Supervision	SD-2H144-01	5AC/S	6AR(2-27-75)

**No. 3 ESS ¶**

Dial-Tone-First Coin Line Circuit	SD-3H205-01	1	1
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**RSS No. 10A ¶**

Ground Start Applique Ckt.	FE108	1	2
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¶ Dial-tone-first option is provided per line applique.

## CENTRAL OFFICE BATTERY POLARITY FOR DIAL-TONE-FIRST (DTF) SERVICE

- 1.01** Coin present test for initial deposit:
- -48 volt battery on the tip side with ring side open.
- 1.02** Coin present test for 5 cent overtime or stuck coin test.
- +48 volt battery on the tip side with the ring side open.
- 1.03** In 1C/2C sets, totalizer homing for deposits of initial rate or more:
- $\pm 48$  volt battery on the ring side of line to ground on the tip side.
- 1.04** In 1C/2C sets, totalizer homing for a deposit less than initial rate or after coin control has been applied:
- +48 volt battery on the ring side of the line to ground on the tip.
- 1.05** The application of coin control battery ( $\pm 130$  volts) on tip with ring open.
- This is to prevent false operation of the station "A" relay.
- 1.06** Talking battery on all operator trunks; +48 volts on ring with ground on tip:
- This is required to read out coin tones less than initial rate.

## TROUBLE ANALYSIS CHART FOR COIN STATION TEST LINE

TROUBLE	ACTION
1 Unable to seize Coin Station Test Line (CSTL).	Check TJ jack for plug. If in No. 5 Crossbar office, check position of MB switch. Check all power sources and fuses. Check seizure relay sequence, SC1 of SD-1C29701.
2 No CSTL intermittent coin and/or dial tone.	Check tone sources from office. If steady tones are heard, check INTR relay, 120 IPM source, and -48 volt source. ON relay should be operated for dial tone and released for coin tone. CT relay should be operated for coin tone and released for dial tone. Check Circuit SD-1C297-01-B3 and Section 201-833-501, Step A.
3 Two beep answer for DTF ground removal test rather than one beep answer, with no 8A range extender (Coin REG) in circuit.	Check A relay operation in the coin station. Check SCR(Q1) on CA7 for short. Check relay sequence per SC1. Check CPA 962 for constant current output.
4 One beep answer for CF ground removal test rather than two beeps, with no 8A range extender (Coin REG) in circuit.	Check wiring on coin station for CF service. Check Q1 on CA7. Should turn on during test. If it does, check answer generating relay sequence per SC5. Check CPA 962. Check + 48 volt supply voltage.
5 Wrong test is registered or unable to dial test.	Check dial pulse registration (P) relay sequence per SC2 for various digits. Check for dirty contacts on P relays. If ON relay is operated, check illegal number gating circuit per FS3. Check dial on coin station.
6 Erroneous ground, loop, and leakage test answers.	Calibrate CSTL resistance tests per Section 201-833-501. Check calibration box SD-1C395-01 resistors and changes. Check trimpots on CPA 962 and 963 for damage. Check that all circuit packs are connected. Check to assure that coin station used for calibration procedures is not grounded except through the calibration box. Option Z0-check calibration circuits per FS6 and SE4. Check AUX4 relay operation per SC4 if all fail answers occur, for leakage test.
7 No ringing answer with receiver on-hook.	Check ringing voltage source. Check 60 IPM source. Check relay sequence chart, SC5.

TROUBLE	ACTION
8 No coin disposal.	Check station ringer. Check for totalizer off-normal.
9 CSTL fails to disconnect about 60 seconds after hang up.	Check the return and collect coin control voltage sources. Check A relay operation in coin station if DTF. Check relays operation. relay sequence chart, SC3. Check ground path between station and CSTL.
10 Circuit fails to disconnect with on-hook condition in less than 60 seconds.	Check the CPD3 circuit. Check relay sequence with chart S6.
10 Circuit fails to disconnect with on-hook condition in less than 60 seconds.	Check that handset is placed on-hook only with interrupted dial tone. Switchhook must flash after dial 5 test to obtain interrupted dial tone.
11 No answer forthcoming during coin relay time test. All other tests OK.	Check 4 volt power supply per Section 201-833-501. Check CPA 964, 966, and 973. Check relay sequence per chart, SC7.
12 Consistent 4 beep answer for coin relay time test regardless of coin relay time adjustment.	Check diode CR4 on CPA 964 for short. Check CPA 964, 966, and 973. Check ICGD and CGD diodes.
13 Rotary dial seizes CSTL OK but TT does not.	Check TOUCH-TONE dial and receiver. Check wiring between receiver and CSTL. Check battery supply to TOUCH-TONE receiver. Check for excessive loop resistance.
14 CSTL coin disposal problems in step-by-step office.	Check option S. For CF service, option S is necessary but for DTF service option S will cause the coin station A relay to operate and interfere with coin disposal operations.
15 Timing difficulties on any test.	Check plug in D3 cords associated with TM1, TM2, TM3, and DISC by substitution.
16 Loop FEMF test (option ZK) gives false fail answers on long loops, or false fail answers on dial 2 leakage tests.	Check AUX4 and AUX5 operation per SC8 or SC4, if AUX4 does not operate momentarily when TM2 relay operates, number 2 break contact of TM2 relay could be defective.
17 Dial 8 and 9 tests (option ZO) give wrong answers.	Check calibration procedure per Section 201-833-501, Issue 6. Check standard resistors on CA 20-22, check operation of CAL1 and CAL2 and other relays.

## COIN SUPERVISORY

### TEST SETS

**1.01** Three test sets are available for performing functional tests on the coin supervisory circuit in No. 1 and No. 5 crossbar offices. These tests require the efforts of only one craftsperson.

(1) ***CMC 732 (MD) Test Set:***

- This test set can be used with the 733 test set to eliminate the need for assistance from the switchboard operator while making certain tests.

(2) ***CMC 733 Test Set:***

- This test set is used to perform tests on the coin supervisory circuits in No. 5 crossbar offices.

(3) ***CMC 734 (MD) Test Set:***

- This test set is used to perform tests on the coin supervisory circuits in No. 1 crossbar offices.

The test sets can be purchased from and installed by Western Electric Co. Detailed information on the operation and use is furnished with each test set. For further information on these test sets, refer to EL-892/PL-2433.

# **CHAPTER III**

## **TEST DESK**

## FOREIGN ELECTROMOTIVE FORCE (FEMF) TEST

STEP	ACTION	VERIFICATION
1	Operate FEMF key	
2	Connect to subscriber line with the primary test circuit	
3	Observe VMA meter. If meter deflects past zero volts in a reverse direction, proceed to Step 5.	A steady deflection on the meter indicates FEMF on the ring.
4	Operate the reverse key. If meter deflects past zero volts in a reverse direction, proceed to Step 5.	A steady deflection on the meter indicates FEMF on the tip.
5	Operate VM REV key. (Use this test on either ring or tip)	Meter reads on-scale, indicating a cross with a positive potential.
<b><i>If no further testing is required:</i></b>		
6	Release from primary test circuit and restore all operated lever keys.	LTD restored to normal

## LOOP AND GROUND RESISTANCE TESTS

### 1. GENERAL

#### POTENTIOMETER METHOD—16-TYPE TEST DESK (FIG. 1)

**Note:** This test is for accurate measurements of resistance less than 3100 ohms.

STEP	ACTION	VERIFICATION
1	Observe that potentiometer SW1 is in the OFF position.	
2	Operate the FEMF key.	
3	Connect to line to be measured with primary test circuit.	
4	Test for FEMF or leakage.	All FEMF greater than 3 volts and leakage less than 100K ohms should be cleared before making resistance tests.
<b><i>If resistance to be measured is from tip to ground (ground resistance):</i></b>		
5	Operate REV key.	VMA meter circuit connected to tip of test circuit.
	(a) Ask station technician to place a strap from tip to ground being measured.	
	(b) Proceed to Step 7.	
<b><i>If resistance to be measured is from tip to ring (loop resistance):</i></b>		
6	Operate G key.	Ground connected to tip of test circuit.
	(a) Ask station technician to place strap from tip to ring.	
7	Operate 24MA key.	
	(a) Operate scale change key if required so that VMA meter deflects to nearest midscale.	

STEP	ACTION	VERIFICATION
8	Observe reading on VMA meter.	Meter indicates current in external circuit. Record this reading for use in Step 11.
9	Operate S/C key.	S/C lamp lighted.
10	Operate potentiometer SW1 to the 0, 1K, or 2K position. Adjust to proper position as described in Step 11.	VMA meter connected to test circuit in series with potentiometers R, SW1, and SW2.
11	Adjust potentiometers R, SW1, and SW2 to obtain same reading on VMA meter obtained in Step 8.  <i>Note:</i> The resistance of the test trunk used must be subtracted from the total resistance determined in Step 11 to provide the true resistance for the line being measured.	Total accumulated readings of potentiometers equal the resistance of external circuit, including the test circuit.
12	Restore potentiometer SW1 to the OFF position.	Potentiometer circuit restored to normal.
13	Release S/C key. Recheck that VMA reading is unchanged from that found in Step 8.	S/C lamp extinguished.
<b>Ground resistance determination:</b>		
14	To compute actual ground resistance, subtract the tip-ground resistance previously found from one-half (1/2) of the loop resistance previously determined. This difference is the ground resistance. It must be 50 ohms or less.	
<b>If no further testing is required:</b>		
15	Operate DIS key for proper control group and release all operated lever keys.	

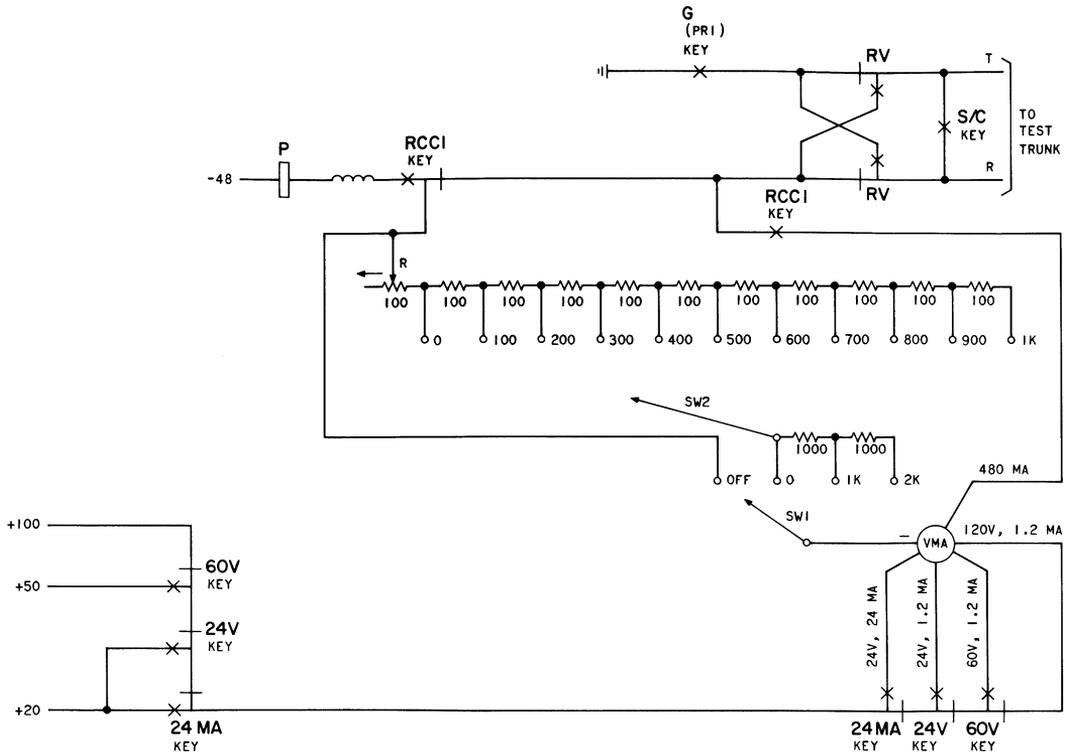


Fig. 1—Potentiometer Circuit for Determining External Circuit Resistance—16-Type Test Desk

**RHOESTATE METHOD—14-TYPE TEST DESK (Fig. 2)**

*Note:* This test is for accurate measurements of resistance of less than 3100 ohms.

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
1	Operate the FEMF key.	
2	Connect to the line to be measured with primary test cord.	
3	Test for FEMF or leakage.	All FEMF greater than 3 volts and leakage less than 100K ohms should be cleared before making resistance tests
<i><b>If resistance to be measured is from tip to ground (ground resistance):</b></i>		
4	Operate REV key.	VMA meter circuit connected to tip of test circuit.
	(a) Ask station technician to place a strap from tip to ground being measured.	
	(b) Proceed to Step 6.	
<i><b>If resistance to be measured is from tip to ring (loop resistance):</b></i>		
5	Operate G key.	Ground connected to tip of test circuit.
	(a) Ask station technician to place strap from tip to ring.	
6	Operate 24 MA key.	
	(a) Operate scale change key if required so that VMA meter deflects to nearest midscale.	
7	Observe reading on VMA meter.	Meter indicates current in external circuit. Record this reading for use in Step 10.
8	Remove primary cord from test trunk and insert into SC jack.	Tip and ring of test circuit connected together eliminating external circuit from VMA meter path.
9	Operate RHE key.	VMA meter connected to test circuit in series with rheostats R and R1.
10	Adjust rhoestats R and R1 to obtain the same reading on VMA meter as obtained in Step 7.	Total accumulated readings of potentiometers equal the resistance of external circuit, including the test circuit.

STEP	ACTION	VERIFICATION
10	(a) For measurements in excess of 1100 ohms use 1000 $\Omega$ or 2000 $\Omega$ key as required.  <i>Note:</i> The resistance of the test trunk used must be subtracted from the total resistance determined in Step 10 to provide the true resistance for the line being measured.	
11	Release the RHE key.	Rheostat circuit restored to normal.

***Ground resistance determination:***

- 12 To compute actual ground resistance, subtract the tip-ground resistance previously found from one-half (1/2) of the loop resistance previously determined. This difference is the ground resistance. It must be 50 ohms or less.

***If no further test is required:***

- 13 Disconnect primary test cord and restore all operated lever keys.

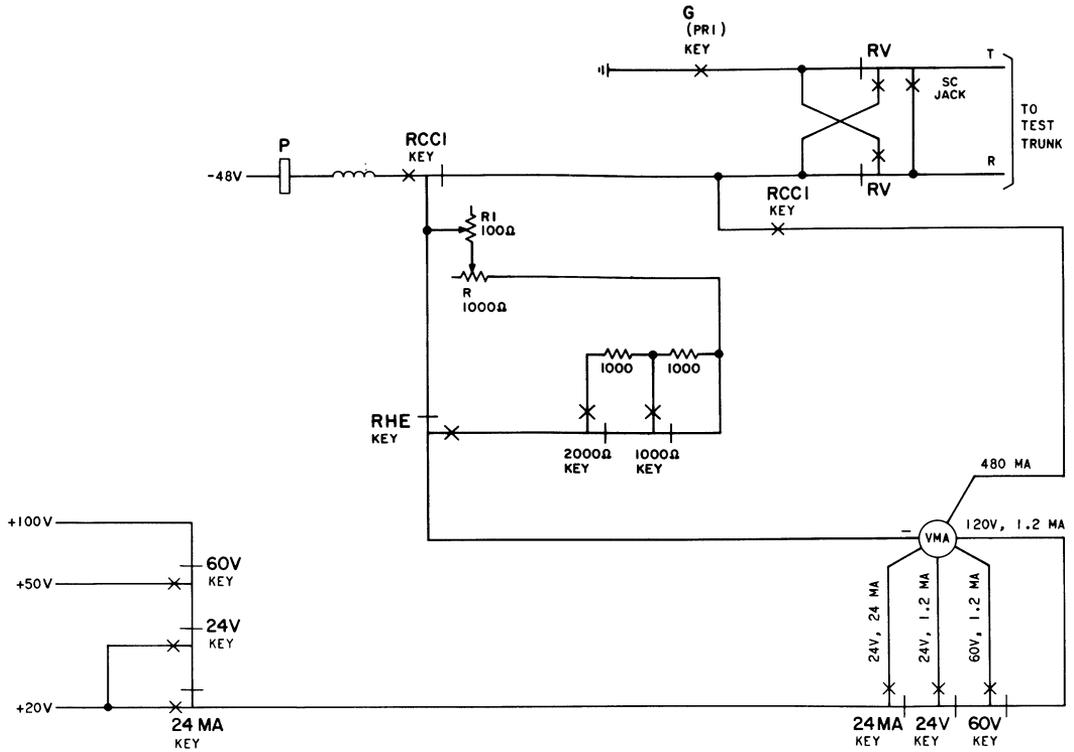


Fig. 2—Rheostat Circuit for Determining External Circuit Resistance—14-Type Test Desk

## COIN RELAY CURRENT FLOW TEST

**Notes:**

1. This test must be conducted with a craftsperson at the coin station. Use Fig. 1, 2, 3, and 4.
2. The purpose of this test is to ensure that the coin relay operates properly.
3. Perform an FEMF test (Chapter 3-1) prior to the current flow test.

STEP	ACTION	VERIFICATION
1	Connect to subscriber line with the primary test cord.	
2	Operate RCCI and T keys.	Talking battery (48 volts) and ground applied to test circuit.  <b>Note:</b> In 1A/2A/1C/2C-type sets, the 48-volt talking battery insures the totalizer is in the <b>home</b> position. However, applying 48 volts talking battery from the LTD may not reset the totalizer if the test trunk and loop resistance exceeds the limits for 48-volt operation of the totalizer.
3	Signal the station.	Answering party takes station handset off-hook.
4	Request craftsperson to:  (a) Remove cover unit assembly (1-type set) or open door and faceplate assembly (2-type set).  (b) On 1-type set, hang cover unit assembly on a KS-20950 cover parking tool.  (c) On 2-type set, use a P11C test cord.  (d) Manually trip hopper trigger.  (e) Identify type of coin relay and use Table C, Chapter 1-9 for requirements.	
5	Request that station be left off-hook.	

STEP	ACTION	VERIFICATION
<b>A. Nonoperate Tests—All Type Relays</b>		
6	Operate RHE key. (On 16-type test desk, operate SW1 to 2K position)	Rheostat circuit connected to line in series with VMA meter.
7	Adjust rheostat for maximum resistance (maximum clockwise rotation).	
8	Operate and hold operated the nonlocking CR key.	Coin return potential applied to tip of line in series with VMA meter.
9	Adjust rheostat to obtain nonoperate current value of relay under test as shown in Table C, Chapter 1-9.	VMA meter indicates nonoperate current value.
10	Release and then reoperate the CR key.	The VMA meter indicates the nonoperate current value each time the key is operated. No deflection indicates that the coin relay has operated on the previous application of nonoperate current.
11	Operate and hold operated the nonlocking CC key. (CC and CR keys are controlled by the same key lever.)	VMA meter indicates nonoperate current value.
12	Release and reoperate the CC key several times.	The VMA meter indicates the nonoperate current value each time the key is operated. No deflection indicates the coin relay has operated on the previous application of nonoperate current.
<b>B. Operate Tests—All Type Relays</b>		
13	Signal the station.	Answering station goes off-hook.
14	Request answering party to:  (a) Use orange stick and block the coin relay armature in the nonoperate position.  (b) Trip hopper trigger.  (c) Stay off-hook during test.	
15	Operate and hold operated nonlocking CR key.	Talking battery removed. Coin return voltage applied.
16	Adjust rheostat for operate current value of relay under test as shown in Table C, Chapter 1-9.	VMA meter indicates operate current value.

STEP	ACTION	VERIFICATION
17	Release CR key.	Talking battery restored to line.
18	Request person at coin station to remove blocking tool from the coin relay.	
19	Operate and release CR key.	Coin relay operates at coin station. VMA meter momentarily indicates coin return current.
20	Request person at coin station to trip hopper trigger.	
21	Operate and release CC key.	Coin relay operated at coin station. VMA meter momentarily indicates coin collect current.
22	Verify that coin relay operated properly.	

**If all tests have been completed:**

23 Return coin telephone set to normal.

**If no further testing is required:**

24 Disconnect from test trunk and release all operate lever keys.

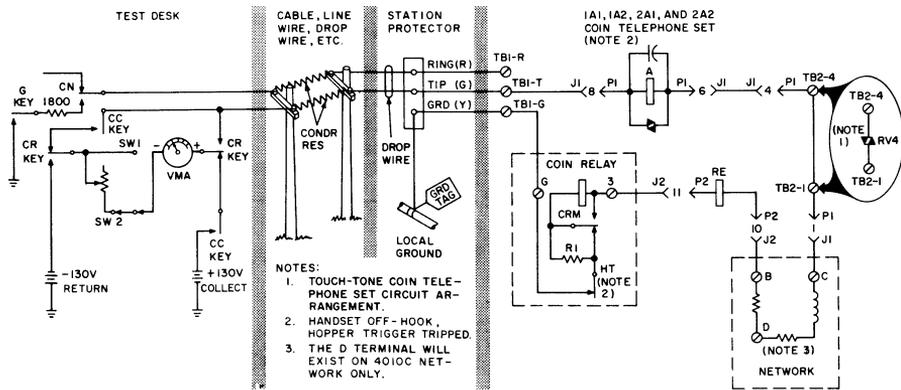


Fig. 1—Coin Relay Current Flow Test—1A/2A-Type (Coin-First)

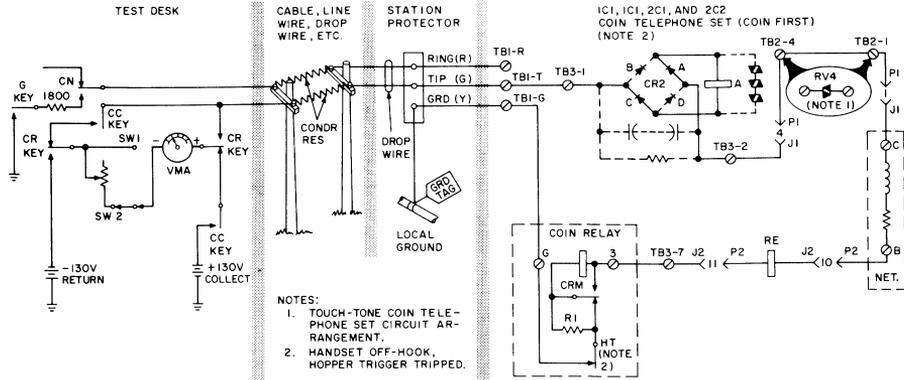


Fig. 2—Coin Relay Current Flow Test—1C/2C-Type (Coin-First)

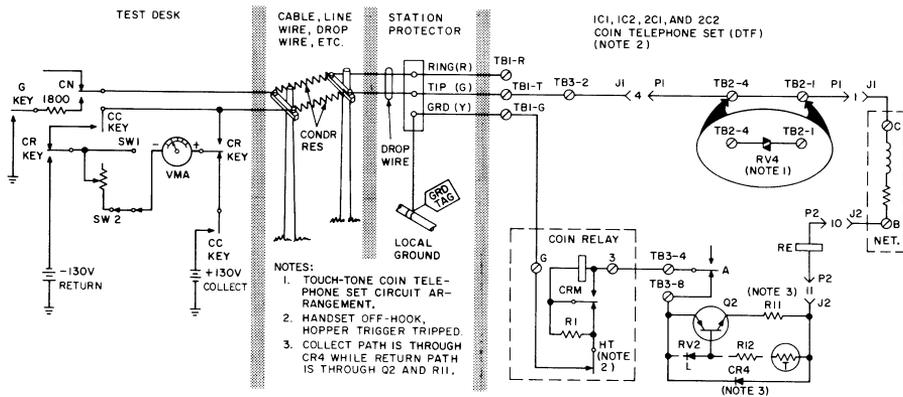


Fig. 3—Coin Relay Current Flow Test—1C/2C-Type (Dial-Tone-First)

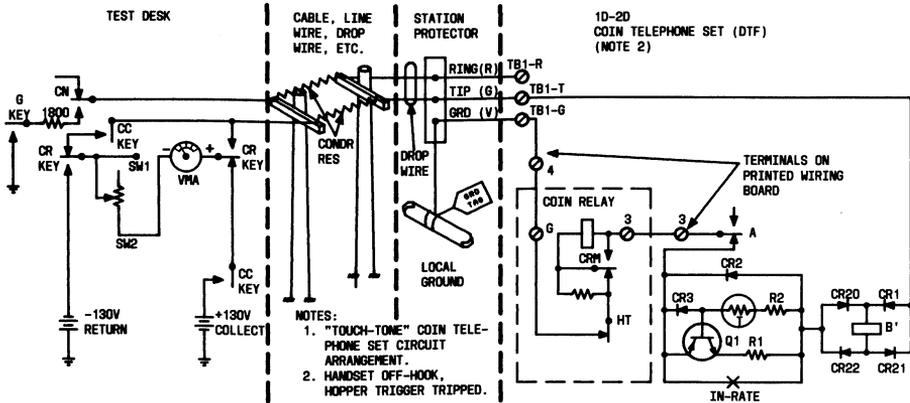


Fig. 4—Coin Relay Current Flow Test—1D/2D-Type (Dial-Tone-First)

## TOTALIZER CURRENT FLOW TEST

**Notes:**

1. This test must be conducted with a craftsperson at the coin station. Use Fig. 1, 2, and 3.
2. The purpose of this test is to ensure the totalizer operates properly and can be reset to the home position by applying 23 ma of current. On D series sets the 47-type signal should be tested to ensure that coin tones are read out at 23 ma loop current.
3. Perform an FEMF test (Chapter 3-1) prior to the current flow test.

STEP	ACTION	VERIFICATION
1	Connect to the subscriber line with the primary test cord.	
2	Operate the RCCI and T key.	Talking battery (48 volts) and ground applied to coin line.
3	Signal the station.	Answering party takes station handset off-hook.
4	Request answering party to:  (a) Remove cover unit assembly (box type coin station) or open the door and faceplate assembly (panel type coin station). Use a KS-20950 parking tool or connect a P11C cord between P1 and J1.  (b) Operate RHE switch and adjust potentiometers until meter registers 23 ma.  <b>Note:</b> On coin REG loops, measure circuit at the station. Circuit should read 23 ma or more. Potentiometer at test desk cannot be used to adjust current to 23 ma.  (c) Listen for RCCI and T keys being released at the local test desk (LTD). (Talking circuit to LTD is disconnected.)  (d) Deposit a minimum of 35 cents to step the totalizer off normal the required steps.  (e) Keep handset off-hook during current flow tests.	Check that totalizer is in home position.

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Bell System except under written agreement

STEP	ACTION	VERIFICATION
	(f) Observe that totalizer resets when 23 ma of current is applied from LTD by operating RCCI and T keys.	
5	Restore the RCCI and T keys.	Talking battery and ground removed from coin line.
6	Allow sufficient time for person at coin station to step totalizer off normal as instructed in Step 4(d).	
7	Operate T key.  <b>Note:</b> Operate T key before operating RCCI key so totalizer readout tone may be heard.	
8	Operate RCCI key.	<p><b>At the LTD</b></p> <p>(a) 23 milliamperes of current applied to coin line with 48 volts of talking battery.</p> <p>(b) Listen for totalizer readout. Tone heard momentarily and stops.</p> <p><b>Note 1:</b> A steady tone that cannot be removed indicates a jammed totalizer arm or full money box.</p> <p><b>Note 2:</b> A continuous series of beep tone indicates an open T2 totalizer contact.</p>
<b>If totalizer does not reset:</b>		
10	Operate REV key	<p>If totalizer resets to home position while RCCI, T, and REV keys are operated, indicates the loop to an "A" series coin station is reversed.</p> <p>For a "C" series station a malfunction in the totalizer polarity protection circuitry is indicated.</p>
<b>If coins were deposited in Step 4(d):</b>		
	<b>Note:</b> Do not operate CC or CR keys if totalizer is not homed.	
11	Operate and release CR key.	Coins returned to person at coin station.
<b>If no further testing is required:</b>		
12	Request person at coin station to restore station for normal service.	

## STEP

## ACTION

## VERIFICATION

13

Restore RCCI and T keys.

Talking battery disconnected from coin line.

**Note:** Upon completion of testing the totalizer from the LTD, the person at the coin station should attempt to reset the totalizer from the coin station. The totalizer may be stepped off normal by depositing coins amounting to more or less than the initial rate. If coins deposited amount to initial rate or more, the totalizer should home immediately. If less than initial rate is deposited the totalizer will not home until handset is on-hook. A totalizer which may be made to operate properly from the LTD but cannot be reset from the station indicates a defective coin trunk or associated central office circuit.

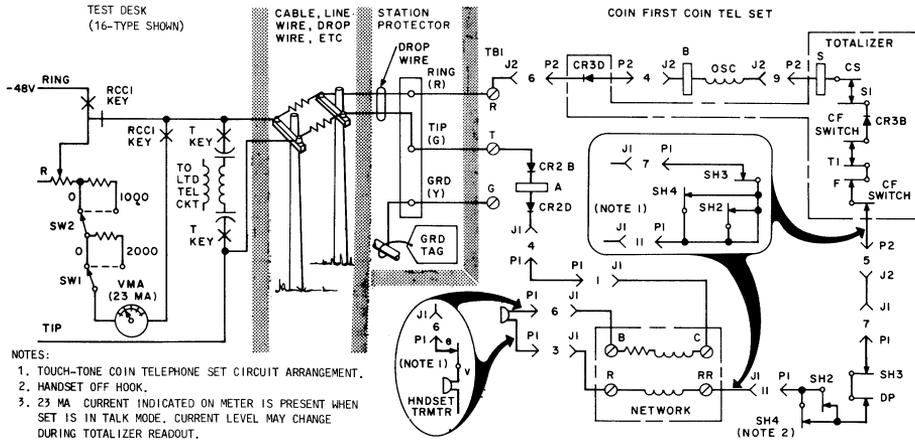


Fig. 1—Totalizer Current Flow Test (Coin-First)

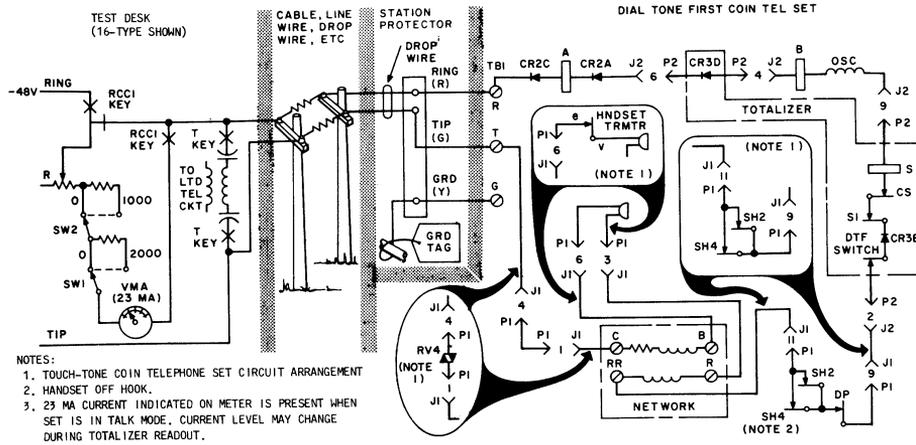


Fig. 2—Totalizer Current Flow Test (Dial-Tone-First)

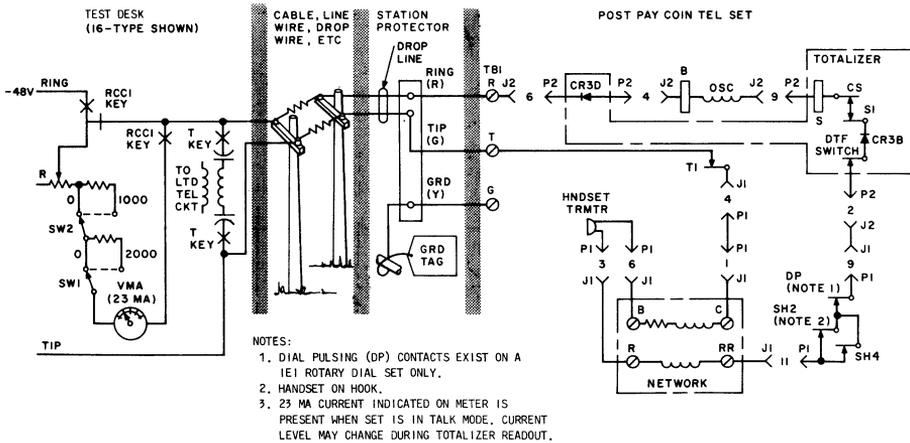


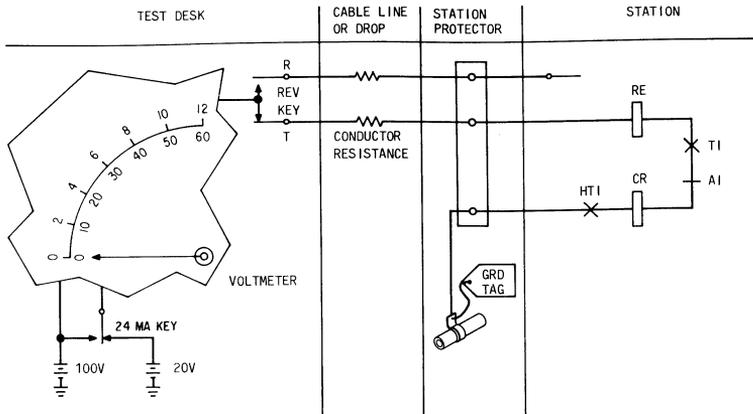
Fig. 3—Totalizer Current Flow Test (Postpay)

## **MISCELLANEOUS TESTS**

### **1. GENERAL**

**1.01** Miscellaneous tests include the following.

- (1) Coin Ground Closure Test, Fig. 1.
- (2) Coin Ground Removal Relay Test, Fig. 2.
- (3) Silicon Controlled Rectifier Test, Fig. 3.

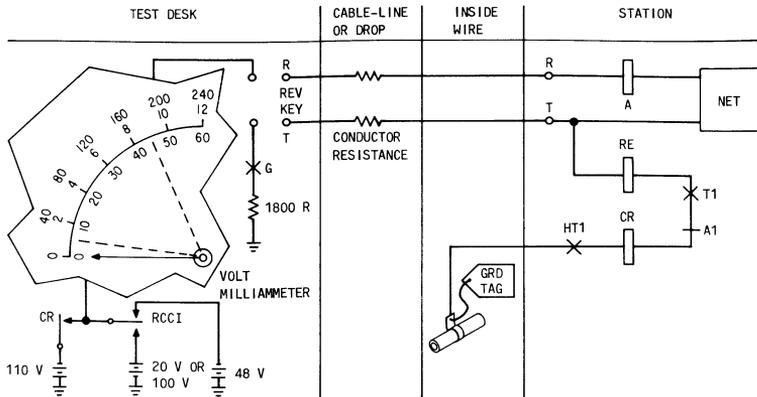


TO DETERMINE THAT A DEPOSITED COINS OPERATE A COIN GROUND CONTACT ON THE COIN RELAY, PROCEED AS FOLLOWS:

1. CONNECT TO THE LINE TO BE TESTED. LINE SHOULD TEST CLEAR OF CROSSES AND FEMF.
2. SIGNAL STATION, OPERATE T AND RCCI KEYS AND REQUEST DEPOSIT OF INITIAL RATE OR GREATER. LISTEN FOR COIN TONES TO ASSURE TOTALIZER IS HOMED.
3. AFTER DEPOSIT OF COIN, RESTORE ALL KEYS AND OPERATE REV KEY.
4. VOLTMETER SHOULD DEFLECT TO NEARLY FULL SCALE, INDICATING OPERATION OF COIN HOPPER TRIGGER BY DEPOSITED COIN.
5. OPERATE 24 MA KEY. METER SHOULD DEFLECT BETWEEN 7.0 AND 9.5 VOLTS ON THE 0-24 VOLT SCALE.
6. RESTORE REV KEY AND OPERATE CR KEY TO REFUND COINS.
7. RELEASE ALL TEST CONNECTIONS AND RESTORE ALL KEYS TO NORMAL.

- BSP REFERENCES:
- 662-400-500
  - 662-410-500

Fig. 1—Coin Ground Closure Test (DTF)



THE GROUND REMOVAL RELAY IS USED TO REMOVE THE COIN GROUND DURING A CONVERSATION TO REDUCE LINE NOISE. THIS TEST SHOULD BE MADE IN CONNECTION WITH ALL TROUBLE REPORTS INVOLVING "HUM", NOISE AND TRANSMISSION DIFFICULTIES. TO PERFORM THIS TEST, PROCEED AS FOLLOWS:

1. MAKE CONNECTION TO THE LINE TO BE TESTED.
2. SIGNAL STATION AND OPERATE T AND RCCI KEYS.
3. WHEN STATION ANSWERS RELAY A (GROUND REMOVAL) SHOULD OPERATE THROUGH ROH, CONTACT A1 BREAKS AND OPENS COIN GROUND CIRCUIT.
4. REQUEST ATTENDANT OR CRAFTSMAN TO WAIT A FEW SECONDS AND THEN DEPOSIT 10¢, KEEPING RECEIVER OFF HOOK.
5. DURING THE PAUSE, OPERATE CR AND G KEYS APPLYING REFUND CURRENT TO THE TIP AND 1800 OHM GROUND TO THE RING.
6. RELAY A SHOULD EITHER REMAIN OPERATED OR RELEASE AND REOPERATE, KEEPING THE COIN GROUND PATH OPEN.
7. MILLIAMMETER SHOULD READ 20 MA OR BETTER.
8. WHEN COIN DEPOSITED, GROUND IS CONNECTED TO THE COIN RELAY. MILLIAMMETER READING SHOULD NOT CHANGE PROVING THAT THE GROUND REMOVAL RELAY IS OPERATED AND CONTACT A1 IS OPEN.
9. RESTORE CR AND G KEYS AND OPERATED REV KEY. RELAY A SHOULD NOW RELEASE AND CLOSE CONTACT A1, COMPLETING COIN GROUND PATH.
10. MILLIAMMETER SHOULD NOW READ THE COIN GROUND ON THE TIP SIDE.
11. RESTORE REV KEY AND OPERATE CR KEY TO RETURN COIN. RESTORE ALL OTHER KEYS TO NORMAL.

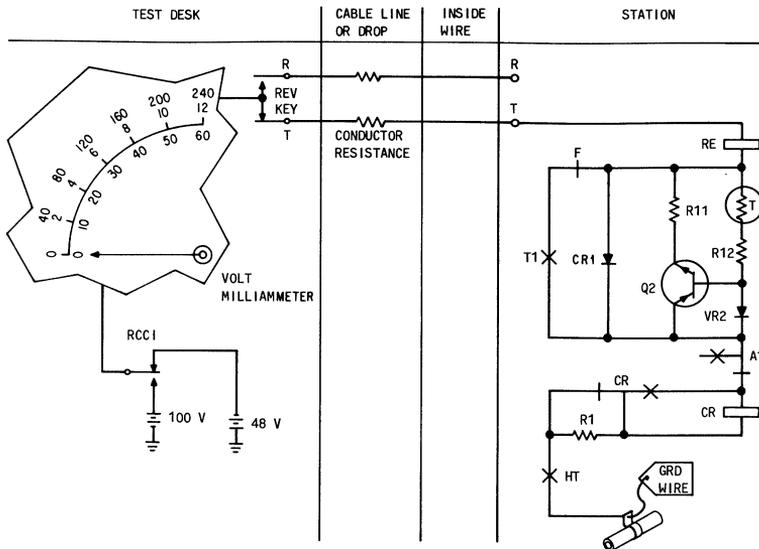
IF RELAY A FAILS TO OPERATE AS DESCRIBED IN STEP 8, FOLLOWING WILL TAKE PLACE:

- (A) MILLIAMMETER CURRENT WILL INCREASE MOMENTARILY TO 45 MA OR BETTER WHEN THE COIN IS DEPOSITED.
- (B) WITH COIN GROUND PATH NOW CLOSED, THE COIN RELAY SHOULD OPERATE AND RETURN THE COIN, SINCE THE CR AND G KEYS ARE OPERATED.
- (C) WHEN THE COIN RELAY RESTORES, COIN GROUND IS REMOVED AND THE MILLIAMMETER READING SHOULD RETURN TO ABOUT 20 MA.
- (D) IF IN (B) ABOVE, THE LOOP IS NEAR MAXIMUM LENGTH, THE COIN RELAY MAY NOT OPERATE, SINCE IT IS PARALLEL WITH THE STATION TRANSMITTER CIRCUIT.
- (E) IF THE COIN RELAY FAILS IN (D) ABOVE, ADVISE ATTENDANT OR CRAFTSMAN TO HANG UP RECEIVER SO THAT COINS MAY BE RETURNED IN A NORMAL MANNER.

BSP REFERENCES:

- 662-400-500
- 662-410-500

Fig. 2—Coin Ground Removal Relay Test (DTF)—Not Applicable to Loops Equipped With 8A Range Extender



THE SILICON CONTROLLED RECTIFIER IS USED TO PROVIDE A PATH FOR THE COIN RETURN SIGNAL FOR A SINGLE 5¢ DEPOSIT LESS THAN INITIAL RATE. THIS TEST SHOULD BE MADE IN CONNECTION WITH ALL TROUBLE REPORTS OF CAN'T REFUND SINGLE NICKEL DEPOSIT LESS THAN INITIAL RATE. TO TEST THIS CIRCUIT OPERATION, PROCEED AS FOLLOWS:

1. CONNECT TO THE LINE TO BE TESTED.
2. WITH CONNECTION ESTABLISHED, SIGNAL ATTENDANT OR CRAFTSPERSON AT STATION AND OPERATE T AND RCCI KEYS.
3. REQUEST A 5¢ DEPOSIT AND THE RECEIVER LEFT OFF HOOK.
4. RESTORE ALL KEYS AND OPERATE REV KEY - METER READS THE COIN GROUND ON THE TIP.
5. THIS INDICATES EITHER DIODE CR1 OF VR2 IS CONDUCTING WITH POSITIVE TEST BATTERY.
6. RESTORE REV KEY AND OPERATE CR KEY TO RETURN COIN.
7. FAILURE TO RETURN COIN INDICATES A DEFECTIVE SCR OR ONE OF ITS PARALLEL COMPONENTS.
8. RELEASE ALL TEST CONNECTIONS AND RESTORE ALL KEYS TO NORMAL.

BSP REFERENCES:  
 • 662-400-500  
 • 662-410-500

**Fig. 3—Silicon Controlled Rectifier Test (DTF)**

# **CHAPTER IV**

## **MISCELLANEOUS**

## THE COIN STATION TOTALIZER— A TROUBLE INDICATOR

### 1. GENERAL

**1.01** The single slot coin first station is critical to sequential testing. Tests performed out of sequence can leave the coin station in an off normal condition and the next customer will experience an out of service condition.

**1.02** The totalizer, described in detail in Chapter 1-1, is a primary component in the coin telephone set for indicating troubles from the test desk.

**1.03** The “A” series coin station is polar and operation of the RCCI and T keys should **home** the totalizer. A reversal of tip and ring on the line to the coin station will result in a failure to **home** the totalizer. The totalizer on “C” series coin station will restore to the **home** position when applying -48 volts to either tip or ring side of the line when initial rate or greater has been deposited.

**1.04** Refer to Fig. 1 for “homing” the totalizer.

**1.05** The conditions caused by a totalizer left **off-normal** in a coin first station may result in a trouble report. (No dial tone, can't break dial tone, or can't be called.) The first attempt to originate a call after the totalizer is left off-normal may result in not receiving dial tone (“C” series station) or not being able to break dial tone (“A” series station). A customer will not be aware that even though the attempt to originate a call was unsuccessful, the action taken cleared the trouble condition. This could result in a trouble report which will test clear.

**Note:** The state of the totalizer can be determined in most cases from the test desk with no one at the station by following standard test sequence.

**1.06** Observing the state of the totalizer can afford valuable trouble locating information. It can generally isolate the trouble to the CO equipment, station or loop plant. It can be used to great advantage by the CO switchperson to detect the exact piece of CO equipment causing a trouble condition and also indicate to the switchperson what the cause is.

**1.07** Observations can be made by the repairperson as follows.

(a) Totalizer off normal-in fraud:

(1) Observation:

- Totalizer off normal
- Rate latch down
- Fraud latch set.

(2) Cause:

- This condition is generally caused by the failure of the CO equipment to apply a 48-volt battery on the loop prior to applying coin control (100- to 130-volt) battery, or customers depositing coins during any coin action.

(3) Verification test from RSB:

- Tester will observe a short circuit.
- Operate T and RCCI keys and monitor the oscillator tones of totalizer
- Tones stop indicating totalizer has reached **home** position
- Test for short circuit. Short circuit is removed. If short circuit is not removed,

operate REV key and listen for coin tone.  
Recheck for short circuit.

- Release test circuit
- Station now back in service.

(b) Totalizer off normal—not in fraud:

(1) Observation:

- Totalizer off normal beyond 10 degrees
- Rate latch up
- Fraud latch normal.

(2) Cause:

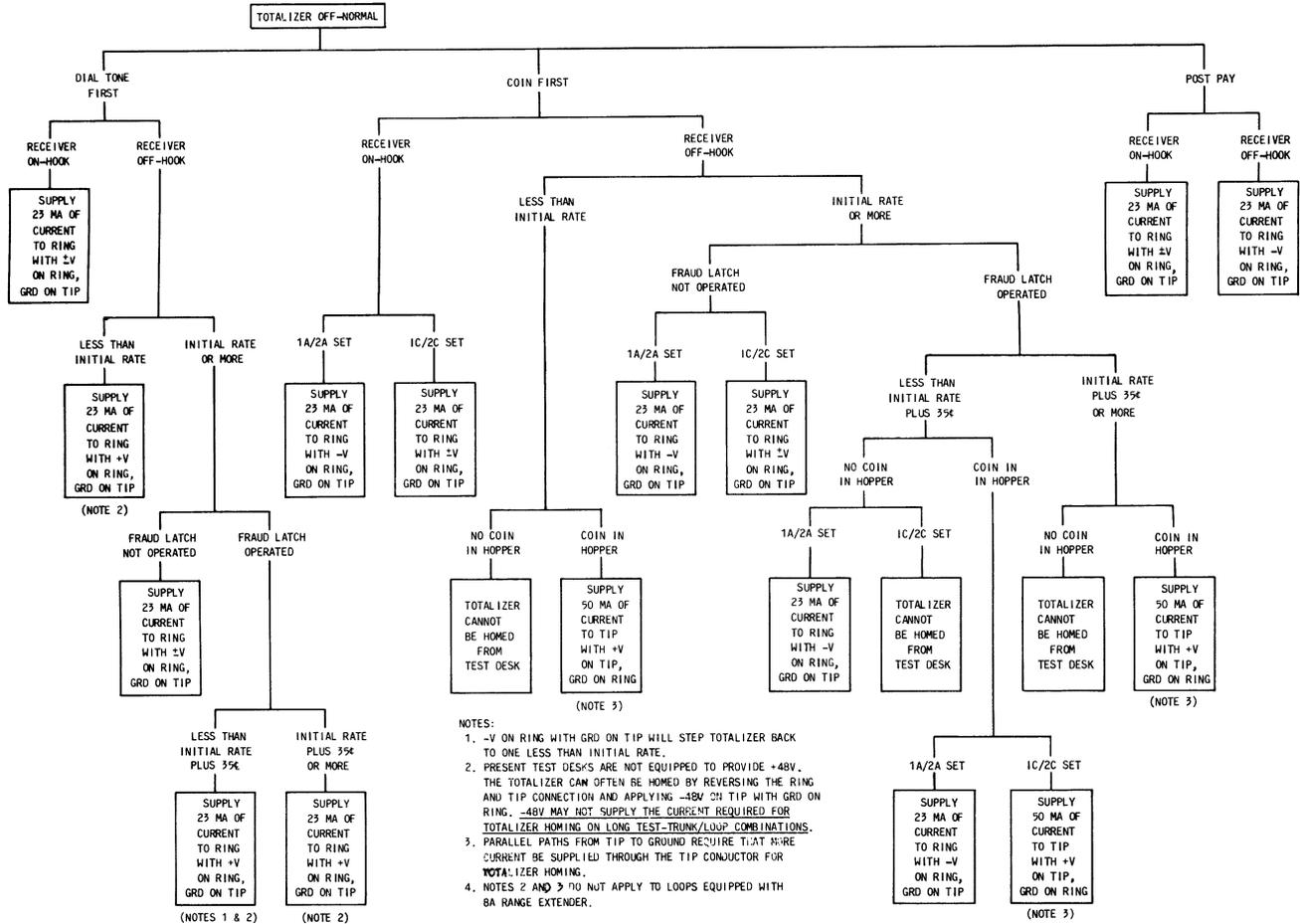
- Long loop
- This condition is generally caused by an open both sides or ring side open. A reversal will also cause this condition with an “A” series coin station.

(3) Verification test from RSB:

- Tester will observe ground on both sides
- Operate T and RCCI keys and monitor the oscillator tones of totalizer
- Tone stops
- Tester will now observe ground tip side
- Operate CC key and release
- Tester will now observe O.K. circuit
- Release test circuit
- Station now back in service.

**Note:** On an “A” series coin telephone set, if totalizer fails to home when operating RCCI and T key, operate the REV key as well. If oscillator tone is heard and stops, it is an indication that the station loop is reversed.

**Fig. 1**  
**TOTALIZER HOMING**



## BLOCK DIAGRAM OF ACTS

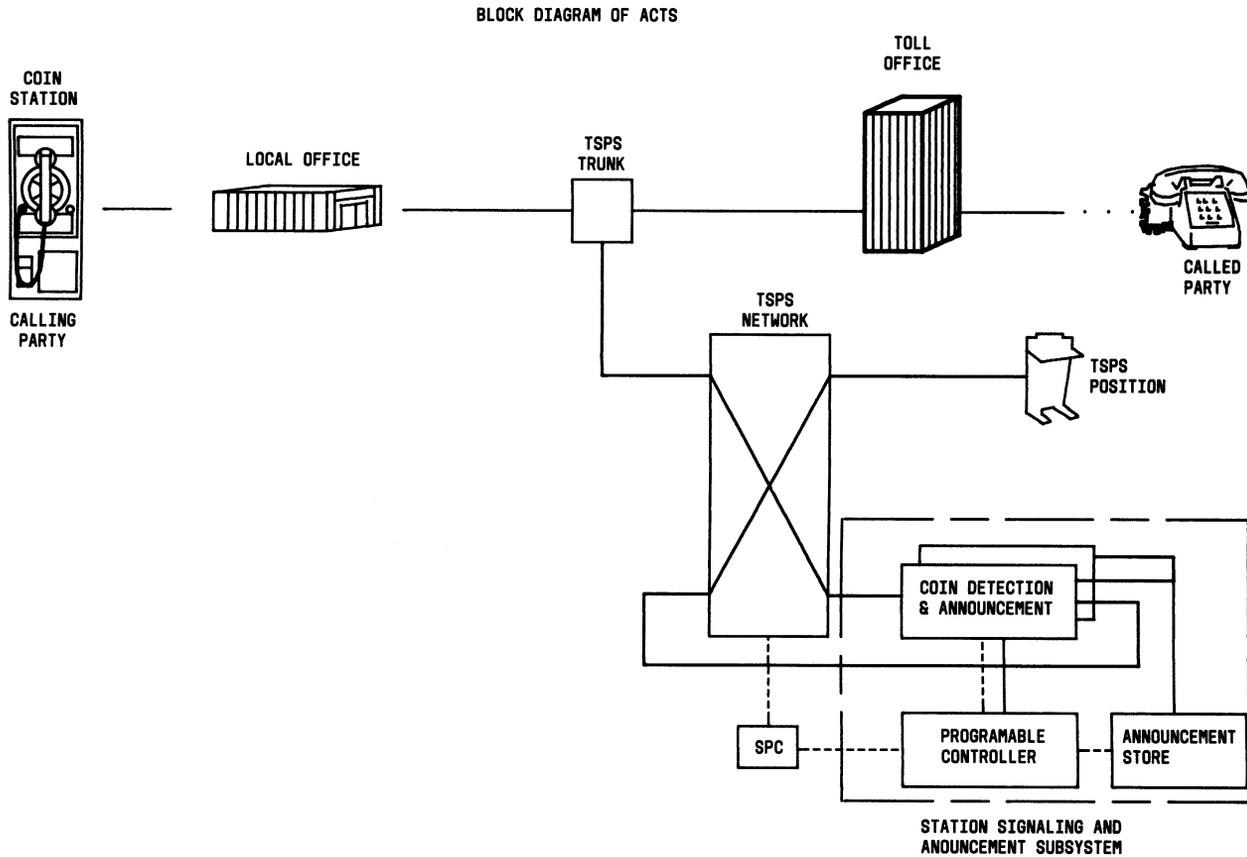


Fig. 1—Block Diagram of ACTS

## CIRCUIT MODIFICATIONS

1.01 The following circuits have been modified or provided new to reflect coin improvement items including Dial-Tone-First.

<u>TITLE</u>	<u>CIRCUIT</u>	<u>ISSUE</u>
<b><u>TEST DESKS</u></b>		
12B – Test Circuit	ES-20563-01	24B
12B – Primary & Secondary Test Circuit	ES-20629-01	19B
12B – Test Circuit	ES-239388	35B
12C – Test Circuit	ES-254581	24B
12B – Suppl. Test Features	ES-359373	15B
14 – Primary and Secondary Test Circuit	SD-90053-01	33D
14 – Primary and Secondary Test Circuit	SD-90497-01	50AR
14 – Primary and Secondary Test Circuit	SD-95612-01	17AR
14 – Testboard	SD-90497	48B
	(Note 202, add option YS and remove options YR and ZO)	
3 – Telephone & Test Circuit	SD-96181-01	26B
Remote Testing Ckt.—Far End	SD-99311-01	21B
12B – Test Circuit	ES-261158	24B
12C – Suppl. Testing Features	ES-254607	14B
Coin Station Test Line	SD-1C297-01	13B and 14BU
16 – Primary and Secondary Test Circuit	SD-1C379-01	9B
14 – Primary and Secondary Test Circuit	SD-95612-01	24B
<i>Note:</i> All test circuits that apply coin disposal battery on both tip and ring should be modified to apply coin disposal on tip only.		
16 – Type	SD-1C370-01 (ZP option)	7B

1.02 Following list is a reference to letters pertaining to DTF service.

<u>REFERENCE</u>	<u>GL's</u>	<u>EL's</u>
Local Test Desk	GL71-06-015	EL1279

1.03 Bell System Practices for maintenance of Remote Service Bureau Equipment — Local Test Desks (LTD), Local Test Cabinets (LTC), and Remote Test Systems (RTS/RTS-E) are as follows:

No. 14 LTD, Maintenance	Section 201-828-503
No. 16 LTD, Maintenance	Section 201-828-504
No. 3 LTC, Maintenance	Section 201-828-505
RTS/RTS-E Far End, Maintenance	Section 201-828-501
RTS/RTS-E Near End, Maintenance	Section 201-828-502
ETL (Equipment Test List)	Section 201-001-025
CSTL (Coin Station Test Line), Maintenance	Section 201-833-501