

SOUTHERN CALIFORNIA TELEPHONE COMPANY
GENERAL TRAFFIC ENGINEERING DEPARTMENT
LOS ANGELES

METHOD OF OPERATION
FOR
NORTH ELECTRIC COMPANY
CX-30, CX-60 AND CX-100
DIAL OFFICES

METHOD OF OPERATION NO. 229
JANUARY, 1946

PREPARED BY:

Feb. 1946

Engineer

CONCURRED:

Feb. 1946

General Traffic Engineer

RECOMMENDED:

Feb. 1946

Traffic Planning Engineer

APPROVED:

Feb. 1946

General Traffic Manager

HCA:MK

INDEX

I GENERAL

II NUMBERING PLAN

- A. Subscribers' Directory Numbers
- B. Ringing Codes
- C. Trunks to Other Offices
- D. P.B.X. Trunks

III LINE CAPACITY

IV CLASSES OF SERVICE

V EQUIPMENT

VI METHOD OF OPERATION

- A. Line Circuit
- B. Auxiliary Coin Box Line Circuit
- C. Grounded Line Adapter Circuit
- D. Link Circuit
- E. Line Finder
- F. Connector
- G. Operator Office Trunks (PEL 2773)
- H. Automatic Trunk Selection Circuit
- I. Verifying
- J. Reverting Calls
- K. Time Release and Line Lock-out Features
- L. Intercepting Service
- M. Traffic Registers
- N. Alarms

I. GENERAL

The North Electric Company CX-30, CX-60 and CX-100 community dial offices are of the all relay type. In these offices the switching operations are performed entirely by relays grouped into basic circuits called line finders and connectors, each with functions usually associated with such circuits. The combination of a line finder and a connector is called a link.

Master or non-master office trunks may be provided for connection to any type of local, manual or toll office or to any type of DSA board. Two-way dialing trunks may be provided between two CX type of offices. Trunks for outgoing service are assigned to connector terminals. For incoming service the trunks are assigned to line finder terminals in the same manner as subscriber lines. Therefore, in general, the subscriber line capacity will be reduced by one for each trunk equipped.

In these offices it is necessary that dial tone be received on a trunk before dialing the subscriber number. Therefore, where these offices are reached on an intertoll dialing basis or where the master office is a No. 1 loop dialing toll board with modified toll cord circuits, the originating toll operator or master office operator is unable to hear the dial tone and a special trunk circuit arranged to operate a lamp signal must be employed.

II. NUMBERING PLAN

A. Subscribers' Directory Numbers

The original design of the CX-30, CX-60 and CX-100 offices provided for four-digit directory numbers for all subscribers. Arrangements have subsequently been provided for three digit numbers where party line service is not offered for more than ten parties per line.

Under the four digit arrangement all subscribers' directory numbers consist of an initial digit "2" or "3" to indicate whether the ringing code is in the first or second set of ten codes, followed by the two digit terminal number (tens and units digits) and then a single digit to indicate the ringing code.

On the three digit arrangement the initial digit "2" or "3" is not used. The three digits used represent the terminal number (tens and units digits) and the ringing code.

The following is the numbering of line terminals:

CX-30	20-49
CX-60	20-79
CX-100	00-99 (Four digit arrangement)
CX-100	20-99 (Three digit arrangement)

B. Ringing Codes

Ringing codes are as follows:

Code (Final Digit)	Side of Line	Code Ringing Signal	
		First Set	Second Set
1	Ring t	1 long	a 1 short 1 long
2	Tip i	2 shorts	s 3 shorts
3	Ring h	4 shorts	5 5 shorts
4	Tip m	2 longs	wt 1 short 2 longs
5	Ring g	2 longs 1 short	k 1 short 2 longs 1 short
6	Tip n	2 shorts 1 long	v 3 shorts 1 long
7	Ring f	2 shorts 1 long 1 short	sw 3 shorts 1 long 1 short
8	Tip u	1 long 1 short	~ 1 short 1 long 1 short
9	Ring d	1 long 2 shorts	l 1 short 1 long 2 shorts
0	Tip b	1 long 3 shorts	wait 1 short 1 long 3 shorts

II. NUMBERING PLAN (Cont'd)

C. Trunks to Other Offices

The codes available for trunks to other offices are as follows:

<u>Office</u>	<u>Codes Available</u>	<u>Connects to Line Terminal Number</u>
CX-30, CX-60 and CX-100 (Four digit arrangement)	0 9 8	20, 21, etc., as req'd. 30, 31, etc., as req'd. 40, 41, etc., as req'd.
CX-100 (Three digit arrangement)	0 9 8 etc.	00, 01, etc., as req'd.) Any number whose unit digit is "0" except "10" or "00", such as 20, 21, etc. 30, 31, etc.

*We use 9 on 3 digit ex 60
 caused for busy line ext in (Section 10)*

D. P.B.X. Trunks

The first trunk of a P.B.X. group must have a units digit of "0". Trunk hunting is effective only with the zero units digit. This permits P.B.X. trunks other than the first to be used for night listing service.

The following terminals in each line group may be used for P.B.X. trunks:

20, 21, etc. (unless used for operator trunks)
 30, 31, etc.
 40, 41, etc.

CX 60 Op. 0 20 21 etc
 9
 38 alarm checking ton
 60

III. LINE CAPACITY

The following are the maximum capacities in terminals for lines and trunks for the various offices:

<u>Type</u>	<u>Capacity</u>
CX-30	29
CX-60	59
CX-100 (4-digit arrangement)	99
CX-100 (3-digit arrangement)	79

Terminal No. 38 is used for the alarm checking terminal.

The capacity of the CX-100 office is reduced by the 3-digit arrangement since terminals 00 to 09 and 10 to 19 are unavailable because of the "0" operator code and the preliminary pulse absorption feature, respectively.

IV. CLASSES OF SERVICE

All lines are served on a terminal per line dial basis with provision for the following general classes of service:

A. Metallic Lines

1. Individual
2. P.B.X. Trunk
3. Two-Party Full Selective
4. Four-Party Semi-Selective
5. Ten-Party Bridged or Divided Ringing
6. Twenty-Party Bridged or Divided Ringing *
7. Post-Payment Coin Box

B. Ground Return Lines - Code Ringing With Maximum of 20 Stations *

- * The four digit numbering plan arrangement must be used if more than 10 parties per line are to be served.

V. EQUIPMENT

The switching equipment is comprised of the following basic elements:

Subscriber Line Circuits
Auxiliary Coin Box Line Circuits
Grounded Line Adapter Circuits
Connectors
Links (Line Finder and Connector Combinations)
Operator Office Trunk Circuits
Automatic Trunk Selection Circuits
Alarm Signalling and Checking Equipment
Tone and Training Circuits

VI. METHOD OF OPERATION

A. Line Circuit

This circuit is associated with subscriber lines. It performs the functions usually performed by such a circuit. If dialing is not started within a timed interval of from two to four minutes after the receiver has been removed from the switchhook, or if trouble of a certain kind exists on the line, the circuit will lock itself out and release the line finder to handle other calls.

A local lamp signal is lighted when a line is in the locked out condition. When the receiver is replaced on the switchhook, or when the trouble is cleared, the line will restore itself to service and the lamp signal will be extinguished.

Operator office trunks also, are assigned to line circuits. On incoming calls from the operator office the circuit functions to accomplish results similar to those obtained in its association with subscriber lines.

B. Auxiliary Coin Box Line Circuit

This circuit is associated with postpayment coin box lines. No deposit is required to reach an operator. The operator on plug in, in answering a call from a coin box customer will receive a momentary identifying tone. The operator may cause the tone to be repeated by replugging. Coin collection is handled in the usual manner.

Three types of coin tones are available:

1. Tick Tone
2. Single Spurt Dial Tone (Recommended)
3. Interrupted Dial Tone

It is recommended that coin box lines be assigned in the "4" tens group; i.e., 40 to 49.

To call a station served by the community dial office, the customer will dial the listed number. When the ringing signal stops, a distinctive tone will be heard on the line indicating that the called party has answered and that a coin should be deposited. The talking circuit will remain open, and conversation cannot take place until a coin is deposited. The called party should recognize from the absence of dial tones that he should wait on the line. When deposit is made, the tone will be removed and the connection will be cut through.

C. Grounded Line Adapter Circuit

This circuit is used as an intermediate circuit between grounded lines and the line circuit.

The lockout feature of a line operated through a grounded line adapter is effective and will operate in the usual manner.

D. Link Circuit

The link circuit permanently associates a line finder with a connector. It functions to find a calling line, completes the connection to the called station, and supplies talking battery to the connection.

E. Line Finder

The function of the line finder is to find a calling line and to extend it to a connector. In these offices each line finder is permanently connected to a connector.

Line finders are provided with a guard circuit which prevents double connections when two or more calls are originated at the same instant. They are arranged so that successive calls will engage different line finders in rotation. If trouble is experienced in making a call the next attempt will be routed to a different line finder and connector.

The distributing relays are arranged so that idle finders and connectors are assigned in rotation and successive calls will take different paths. Another feature is the provision of different first choice outlets from lines with different units digits, i.e., if a call is originated from line 11, (21, 31, etc.) line finder 1, if idle, will pick up line 11. (If line finder 1 is busy and line finder 2 is idle, line finder 2 will pick up line 11 and so on) but if a call is originated from line 12 (22, 32, etc.) line finder 2, if idle, will pick up line 12 (if line finder 2 is busy and line finder 3 is idle, line finder 3 will pick up line 12 and so on). Thus a calling line will always have access to an idle finder unless all line finders are busy.

When the receiver is removed from the switchhook at a calling station, the switchhook of the telephone closes a circuit through the line relay associated with the calling line causing it to operate and associate itself with a line finder. In order to select the particular line which may be calling, the ten-line group in which the calling line is associated is selected by the operation of a TENS relay and the calling line itself is selected in the ten-line group by the operation of a UNITS relay.

Obviously there must be as many TENS relays in each line finder as there are groups of ten lines. A 100 line group requires ten TENS relays in each line finder, a 30 line group, three TENS relays, etc.

The selection of the calling line in a group of ten lines requires ten UNITS relays in each line finder.

Thus, of all the lines in the 100 line group, only ten are connected to the UNITS relays of a line finder when a TENS relay is operated and of these ten lines, only one is connected when a units relay is operated, e.g., line 31 is selected by the operation of TENS relay 30 and UNITS relay 1. Thus any line in a line group may be selected by the operation of the TENS digit and UNITS digit of the calling line.

If it is desired to ascertain which line is calling over a certain

line finder it is only necessary to find which TENS relay and which UNITS relay are operated in the line finder, their designations indicating the number of the calling line.

When the calling customer restores the receiver to the switchhook the line finder will release. If the calling customer removes the receiver from the switchhook and does not commence dialing within two to four minutes, the line finder will release and the calling station will be locked out until the receiver is replaced on the switchhook.

When a calling customer restores his receiver to the switchhook before the called customer hangs up, the called line will be locked out until the called customer restores the receiver to the switchhook.

A customer attempting to originate a call when all line finders are busy will receive no dial tone or busy tone.

F. Connector

The purpose of the connector is to return dial tone to the calling line, to select the called line and station in a group of lines, to supply ringing current to the called station if the called line is idle, or to return the audible busy signal to the calling line if a busy condition is encountered.

The connector is engaged by its associated line finder when a call is originated as described in the paragraphs headed "Line Finder".

The selection of the desired line is accomplished, in the connector, by means of connector TENS and UNITS relays in a manner similar to that described for the line finder.

When the customer dials the tens digit of the called number, a relay "counting chain", of "register", records the number dialed and then causes the selection of the 10-line group containing the called line, by operating the connector TENS relay associated with that group. After the selection of the TENS relay the counting chain is restored preparatory to the reception of the UNITS digit of the called number.

When the UNITS digit is dialed by the calling customer, the counting chain again records the digit dialed and causes the selection of the desired line in the previously selected 10-line group, by operating the proper UNITS relay. The counting chain is again restored and the digit which indicates the ringing code is recorded when dialed.

If it is desired to ascertain which line is being called on a certain connector, it is only necessary to find which TENS relay and which UNITS relay are operated in the connector, their designations indicating the number of the called line. The called station can be determined by noting the number of the ringing code selection relay operated.

As soon as the line finder TENS and UNITS relays are operated, the connector will hold itself in an engaged position by closing the loop

to the calling line and will actuate its own delayed release circuit so that it will not release during dialing.

The connector returns dial tone to the calling customer indicating that the circuit is ready for dialing. After the line selection digits have been dialed the connector tests the called line to determine if it is busy. If the called line is busy, busy tone is returned to the calling line. If the called line is idle, the connector will ring the called station.

The connector will continue to ring the called station until the called station answers, the calling party restores the receiver to the switchhook, or the time disconnect feature releases the connection. The calling customer will receive the audible ringing signal.

The connector is arranged to trip the ringing only during the silent interval, i.e., between rings.

The connector is arranged to absorb a preliminary pulse.

The release of an established connection between two dial lines is controlled by the calling party.

G. Operator Office Trunk Circuit

This circuit is arranged for two-way operation.

When a customer dials "0" the audible ringing signal is returned on the trunk until the operator answers.

The calling customer can recall the operator by flashing. If the operator disconnects while the receiver is off the switchhook, the connection will not be released, the trunk lamp will relight, or the line signal will operate, and the audible ringing signal will again be returned to the calling station.

When a trunk is taken up at the operator office on an incoming call, the trunk will become busy to outgoing calls and when a link becomes associated with the trunk, dial tone will be returned to the calling operator as a signal that she should start dialing.

The release of the trunk is under joint control of the operator's cord circuit and the switchhook of the called station. Both the customer and operator must disconnect in order to release the connection. The called customer can recall the operator by flashing. Switchhook supervision will be received at the operator office.

In case a call in either direction over the trunk is not answered and the customer in the dial office does not restore his receiver to the switchhook, the connection will be released by the incomplete call disconnect feature in the link, within a timed interval of from two to four minutes. The dial line will go on lockout until the receiver at the dial station is restored to the switchhook. Further, if the operator fails to disconnect after the termination of a conversation, the incomplete call disconnect feature will release the link after a lapse of two to four minutes. The

line or trunk which held the connection will go on lockout, while the other line or trunk will be restored to service.

An all trunk busy register will be associated with these trunks.

H. Automatic Trunk Selection Circuit

The purpose of the automatic trunk selection circuit is to select an idle trunk in a group of two or more trunks when a trunk call is made.

Each successive trunk call is routed to the next idle trunk in sequence. If the last trunk in the group is busy, the sequence will change to the first trunk in the group.

If all the trunks in a group are busy, the audible busy signal will be returned to the calling station.

I. Verifying

To verify a busy condition or to establish connection to a busy line under emergency conditions, the operator will dial "6" and then the called number as listed. The dialing of an initial "6" prepares the connector circuit to disregard the busy condition and to establish connection to the called line without ringing.

Should the called line become idle during the interval the connection is being established the called station will be rung and the call will be completed in the usual manner.

J. Reverting Calls

Party line customers will be notified of the numbers of other stations on their own line. To call another station on the same line, the customer will dial the listed number of the desired station. As soon as dialing is completed, the calling customer will hear the busy tone and should hang up. On divided ringing lines, the called customer's ring will be sent out on both sides of the line. On bridged ringing lines, the called customer's code will ring all bells. Ringing will continue until someone on the line answers, whereupon the connector will restore to normal. The line circuit will then hold the line in the locked-out condition. When both customers hang up, the line circuit will restore to normal. If no answer is received, the calling customer should take his receiver off the switchhook momentarily to stop the ringing. (See also the paragraphs on "Time Release and Lock-Out Features").

K. Time Release and Line Lock-Out Features

The time release feature automatically releases a connection under the following conditions:

1. When a permanent signal or incompletely dialed number condition exists for more than two to four minutes on a link.

2. If a call is not answered within two to four minutes after start of ringing.

3. If the calling customer fails to release within two to four minutes after the called customer hangs up or the operator disconnects.

4. Reverting calls left in the ringing position without answer for two to four minutes.

After release of a connection under these conditions, the released line is held by the line circuit in the locked-out condition until the receiver is restored to the hook or in the case of a trouble condition, until the trouble is cleared.

If the called customer fails to hang up after the calling customer has hung up, the connection is immediately released and the called line is locked out.

L. Intercepting Service - Disconnected and Changed Numbers

Intercepting service will not be given. If a vacant connector terminal is dialed the audible ringing signal will be heard, and the call will result in an apparent "don't answer".

M. Traffic Registers

A peg count register is operated on each originating call. This register will operate each time a receiver is removed from the switchhook at the calling station and a link is seized, regardless of whether the connection is completed or not.

An overflow register is operated each time an all links busy condition exists and one or more customers attempt to originate a call. The overflow register operates on the first attempt made to complete a call when all links are busy. Additional overflows will not be recorded until after the register has been unlocked by a link becoming available.

N. Alarms and Alarm Checking Terminal

In case of trouble in the dial equipment of a nature that will cause a major alarm, the alarm sender automatically establishes a connection with the last equipped operator office trunk. Should the last trunk be busy when the trouble occurs, the alarm sender will wait until the trunk has been released, and then establish the connection.

When the operator answers, the presence of busy tone on the trunk indicates a major trouble condition in the dial office.

A condition of minor alarm (line-lockout) will not cause a trunk to be seized to signal the operator.

When the operator disconnects, the trunk is automatically released from the alarm circuit and restored to service.

For local supervision in the dial office alarm lamps and a common alarm bell are provided to indicate major and minor alarm trouble conditions.

A red signal lamp (major alarm) is lighted to indicate blown fuses, call blocked conditions, and power alarms (power failure, low voltage and blow power fuses). A green signal lamp (minor alarm) is lighted when any line is in the locked-out condition to assist in locating permanent signal conditions.

Alarm lamps and bell are under the control of a cut-off key which should be operated to the cut-off position when the office is unattended.

An alarm checking terminal, assigned to line terminal number 38, is provided to enable an operator or plant employee to determine whether an alarm condition exists in the office. The alarm indications received after dialing the alarm checking terminal will be as follows:

- Major Alarm - Busy Tone - Fuse blown, call blocked, or power alarm.
- Major Alarm - No Tone - Tone, ringing, or interrupter equipment trouble.
- Minor Alarm - Dial Tone - Line lock-outs, either permanent signals or reverting calls.

If no out-of-order condition exists, the audible ringing tone will be received when the alarm checking terminal is dialed.