

Community Dial Offices - Changes to Improve Operation of Common Circuits -
North Electric CX-Type Offices.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY NEW YORK

EXCHANGE 3-9800

April 9, 1941

HAROLD S. OSBORNE
PLANT ENGINEER

P.E.L. 3405
Supplements P.E.L. 3236

Mr. COUSINS

Mr. Chamberlain
Mr. [unclear]

P.E.L. 3236 outlined a number of changes found desirable to improve the operation of North Electric Manufacturing Company's CX-type Community Dial Offices. As a result of further experience with these types of equipments, certain additional changes have been made available which it is felt will improve the reliability of operation of the common circuits.

As indicated in the detailed description in the attached set of notes, several of these changes have been placed in effect on new shipments and the others will be applied on all new jobs for which orders were received by the manufacturer after February 1.

To assist in making the circuit change on existing equipment, the manufacturer is preparing MR drawings (Modification Records) as discussed in P.E.L. 3236. The date on which these MR drawings and any other required material will be available is given in each item discussed in the notes.

In general, the manufacturer, who has drawing records of all offices, will be in the best position to determine the drawings and material required to make the changes in specific offices and to assure that drawings adequate for maintenance records are provided. It is suggested, therefore, that requisitions on the Western Electric Company for drawings and material be worded as illustrated by the following example.

"Drawings and material necessary to change ringing code interrupter circuits in CX 200 office at _____ as described in P.E.L. 3405."

Where drawings are required for information purposes without reference to specific orders, the method of ordering suggested in the following example should be used:

- (Quantity) Copies, Drawing BC-4861 (latest issue will be provided)
- (Quantity) Copies, MR Drawing covering changes in ringing code interrupter circuit BC-4861, as described in P.E.L. 3405.

The Western Electric Company advise that they are now in a position to accept orders for the modification of these circuits in existing offices, or to furnish modification information and the necessary material to incorporate the changes included in the attached notes.

If you should desire additional copies of the notes, you may obtain them from the Western Electric Company by specifying:

- (Quantity) Notes "Changes to Improve the Operation of Common Circuits North Electric Manufacturing Company's CX-Type Community Dial Offices."

Yours very truly,

H. S. Osborne

Plant Engineer.

Attached:
(To addressed copies only)
Notes.

To all Chief Engineers
(Copies included for
General Plant Managers.)

Community Dial Offices - Changes in Circuits of North Electric Manufacturing Company's CX-Type Offices.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY NEW YORK

EXCHANGE 3-9800

HARRY P. CHARLESWORTH
ASSISTANT CHIEF ENGINEER

April 9, 1940

P.E.L. 3236

STOCK

As a result of field experience, a number of changes have been found desirable in the circuits used with North Electric Manufacturing Company's CX-type community dial offices in order to provide improved operation and guard against trouble, particularly types which might interrupt service to all lines in an office. These changes have been discussed with the North Electric Manufacturing Company, and a set of Notes is attached covering suggested corrective measures.

As indicated in the Notes, the more important of these changes have been in effect on new shipments, and the others will be applied on all jobs shipped hereafter.

As all the changes are relatively simple, it is anticipated that the Telephone Companies will wish to order the necessary apparatus on a miscellaneous basis and arrange for its installation.

To assist in making the circuit changes on existing equipment, the manufacturer is preparing a new series of drawings having an MR prefix and known as "Modification Records." A sample MR drawing is attached, and a drawing of this type will be prepared for each circuit change applicable to existing equipment. In general, each MR drawing will contain a schematic of the portion of the circuit involved and will describe the nature of the change, the changes made in the corresponding circuit description, the material required, and the detailed procedure for effecting the change. The date on which revised drawings and any required material will be available for this purpose is given under each item discussed in the Notes.

Usually each change will bring the equipment into full agreement with a later issue of the circuit schematic (BC or CC drawings), and, in that case, the

MR drawing may be discontinued after the change has been made and the later issue of the schematic used for maintenance reference. In some cases, however, it may be desirable to make only a part of the changes shown on new issues of circuit schematic drawings. In such instances, the MR drawings involved may be retained for maintenance use as modification records to supplement the old issues of the circuit drawings. In this connection, it should be noted that new copies of old issues of North Electric circuits are obtainable at all times.

In general the manufacturer, who has drawing records of all offices, will be in the best position to determine the drawings and material required to make changes in specific offices and to assure that drawings adequate for maintenance records are provided. It is suggested, therefore, that requisitions on the Western Electric Company for drawings and material be worded as illustrated by the following example:

"Drawings and material necessary to change type of MD relay in CX-200 office at _____, as described in P.E.L. 3236."

Where drawings are required for information purposes without reference to specific offices, the method of ordering suggested in the following example should be used.

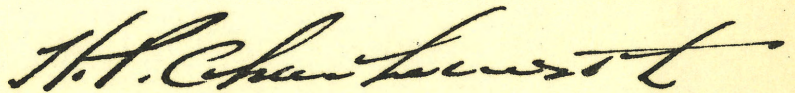
(Quantity) copies, Drawing BC-3941 (latest issue will be provided)

(Quantity) copies, MR drawing covering change in type of MD relay for circuit BC-3941, as described in P.E.L. 3236.

If you should desire additional copies of the notes, they may be obtained from the Western Electric Company by specifying:

(Quantity) copies, Notes - Improvements in North Electric Manufacturing Company's CX-Type Community Dial Offices.

Yours very truly,



Assistant Chief Engineer.

Attached:
 (To addressed copies only)
 Notes.
 Sample MR Drawing.

To all Chief Engineers
 (Copies included for
 General Plant Managers.)

Community Dial Offices - North Electric Company CX Type - Field Adjustment of Relays.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7, N.Y.

EXCHANGE 3-9800

August 25, 1944

J. J. PILLIOD
ASSISTANT CHIEF ENGINEER

P.E.L. 3861

Supplements P.E.L. 2568

STOCK

In P.E.L. 2568 which describes the North Electric Company CX type community dial office, it was recommended that no adjustment of relays be performed in the field and that relays that are out of adjustment or become defective be replaced and returned to the manufacturer for credit. During the past several years, it has become necessary to replace a considerable number of relays for various causes. A large number of the relays have been replaced as a result of operational failure, loss of adjustment, or contact wear. As these troubles have affected an increasing number of relays as their age in service increases, some Companies have questioned the practicability of continuing to replace relays in all cases rather than providing methods for their readjustment in the field.

Information was obtained from the Companies as to the reasons for replacing relays and these data were reviewed with the North Electric Company. Since readjustment in the field would permit retaining in service many of the relays now being replaced, the North Electric Company agreed to prepare facilities to be used by the Bell System for adjusting relays. Accordingly, tools and gauges were designed and instructions prepared covering their use. A field trial was conducted in a working office with satisfactory results. The tools and gauges have been listed as a tool kit and this kit will include a complete set of tools and gauges for adjusting the relays as covered in the instructions.

No change has been made in the criteria for determining the acceptability of new equipment and for making inspections on working equipment, either because of operating irregularities or on a routine inspection basis. These requirements are covered in the General Field Inspection Sheets, CS-4661, CS-4571, CS-4572, CS-4573 and General Test Sheets, CS-4660 and Associated BI and CI Sheets. When readjustment is determined to be necessary, the readjust requirements and methods are covered in the new instructions.

We are attaching for your information, a preliminary copy of the instructions. The North Electric Company has advised that the instructions will be numbered BO-9500 and the kit of tools and gauges BL-9500.

The introduction of procedures, tools and gauges for readjusting relays will permit retaining in service relays which formerly would have been returned to

the manufacturer for replacement. However, in connection with initial installations or working offices, there will still be cases where relays are or become defective and cases where relays cannot be readjusted to meet the electrical and mechanical requirements covered in the CS, BL, BI and CI sheets. In these instances it will, of course, be necessary to replace the relays and return them for replacement.

Under the arrangements established with the North Company, it will replace defective material without charge, or in the instances where it is necessary to order new material and return the defective material later, it will render billing in the usual way at the time the new material is shipped, and will render equivalent credit on receipt of the defective material, provided in both cases the guarantee period for the particular office for which the material is required has not expired. Also under both conditions the North Company will absorb transportation charges in both directions.

At the time it is desired to return relays or other equipment under the first condition above, North form SF-144, obtainable from the Western Electric Company, should be originated and sent to the Western Electric Company. The use of this form will provide permission from the North Company for the return of the defective material when claims are allowed or otherwise will disallow claims.

When claims are allowed, the defective material should be returned to the Western Electric Company's local Distributing House with the customary returned material notices ("RMN") with which copies of North's allowances of claim should be furnished. At the same time requisitions covering the replacing material should be originated on which the following notation should be made: "To be billed no charge in accordance with North's allowance of claim dated _____." Both the requisitions and the RMN's should be appropriately cross-referenced. Arrangements have been made with the Western Electric Company to transcribe the above notation to their purchase orders placed on the North Company.

When material must be retained until replacements are received, orders for the desired material should be entered in the usual way except that the following notation should appear: "Required to replace defective material to be returned later." The customary billing will be rendered in these cases to be followed, however, by equivalent credits on claims allowed by the North Company after its receipt of forms SF-144 and the defective material.

Returns under this condition should likewise be made to the Western Electric Company with the customary "RMN" accompanied by copies of North's allowances of claims.

Materials removed from an office on which the guarantee period has expired or on which claim has been disallowed should be returned to the Western Electric Company in the usual manner for salvage allowance.

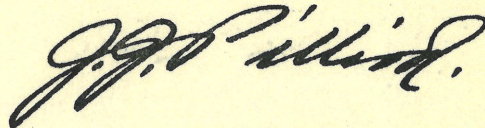
The Western Electric Company advises that the North BL-9500 Tool Kit, with each of which a copy of Instruction BO-9500 will be furnished, will be available from factory stock about December 1, 1944, at an approximate price of \$213.00 each, f.o.b. point of supply. Extra copies of Instruction BO-9500 will be furnished on order. Orders for the Tool Kit and orders for extra copies of the Instruction should be worded as follows:

(Quantity) Kit, Tool, North BL-9500.

(Quantity) copies Instruction, North BO-9500.

At the request of Mr. Waidlich, we are including copies for the General Plant Managers.

Yours very truly,

A handwritten signature in cursive script, appearing to read "J. G. Pilling".

Assistant Chief Engineer.

Attached:

(To addressed copies only)
North Electric Relay Maintenance -
Instructions for Field Adjustment
of Relays.

To all Chief Engineers
(Copies included for General
Plant Managers.)

Community Dial System - Improvements in North Electric Manufacturing Company's CX Type Equipment.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY NEW YORK

EXCHANGE 3-9800

September 17, 1937

HARRY P. CHARLESWORTH
ASSISTANT CHIEF ENGINEER

P.E.L. 2773
Supplements P.E.L. 2568

STOCK

This is to advise that several improvements have been made in the North Electric Manufacturing Company's CX type community dial equipment described in the notes accompanying P.E.L. 2568. These improvements are described below and the traffic aspects of this type of equipment are covered in the attached Traffic Engineering Notes.

Trunk Codes

Single digit codes have been made available for non-master office trunk groups in place of the three-digit codes listed in the notes. The three-digit codes have accordingly been replaced with the following arrangement of single digit codes:

<u>Type of Office</u>	<u>Codes Available</u>	<u>Connects to Line Terminal Number</u>
All except CX-200 and CX-1000	0	20, 21, etc. as required
	9	30, 31, " " "
	8	40, 41, " " "
CX-200	0	220, 221, " " "
	9	230, 231, " " "
	8	240, 241, " " "
	7	420, 421, " " "
	6	430, 431, " " "
CX-1000	0	
	9	
	8	Selector and Line Finder Terminals as Required
	etc. as vacant	

Any of the above listed connector terminals not used for trunks may, as previously, be used for subscriber lines.

Selectors and connectors are now normally arranged so that the wiring may be expanded to a maximum access of 10 trunks per group in place of the smaller number of trunks previously permissible. Where the number of trunks in a group exceeds ten a relay may be added to each selector or connector involved to increase the access to a maximum of 20 so that no sub-grouping of trunks will be required.

Where offices of this type are reached on an intertoll dialing basis, or where the master office is a No. 1 loop dialing toll board with modified cord circuits, the originating toll operator or the master office operator will be unable to hear dial tone. A lamp signal is, therefore, contemplated for this purpose which will require additional equipment in the master office trunk. It is planned to provide wiring for this feature in the future master office trunk circuits in CX type offices and equip when specified.

Reverting Calls

The connector circuits have been rearranged so that on reverting calls on divided ringing party lines the connector short-circuits the tip and ring and applies the called party's ringing code to both sides of the line. The calling and called parties' bells are thus rung with the code of the called party even though the two parties are on opposite sides of the line and the calling party will obtain an indication of the called party's answer by cessation of ringing. The operation on non-reverting calls is not affected by this new feature.

In so far as the subscribers are concerned, the operation on reverting calls is the same for divided ringing and bridged ringing lines. The connector, however, must distinguish between the two types of lines, for bridged ringing lines must, of course, be rung by the application of ringing current on one side of the line and ground on the other. The party lines in any given office may all be of the bridged ringing type, all of the divided ringing type, or a mixture of divided ringing lines and bridged ringing lines. To take care of these various possibilities the connectors have been arranged with three options: (1) for operation with bridged ringing party lines only; (2) for operation with divided ringing party lines only; (3) for operation with both divided ringing party lines and bridged ringing party lines in the same office.

In case (3) a discriminating relay functions to give the proper operation on reverting calls with each of the two types of party lines. It is necessary in this case to segregate the two different types of party lines into separate tens groups. The order blanks are arranged so that the tens groups to be used for each type of party line can be indicated in the order.

Assignment of Line Numbers

The provision of the previously described reverting call signal feature necessitates the assignment of party lines in the proper tens groups where both bridged and divided ringing party lines are provided in the same office.

Individual lines may be assigned in either type of ringing group unless revertive ringing is required for ringing extension stations or for test purposes when such lines must be assigned in bridged ringing groups.

The coin box line circuit arrangements which were developed after the issuance of P.E.L. 2568 require that coin box lines arranged for collection on local calls be segregated by tens groups. The tens groups to be equipped for coin line operation of this type should be indicated when ordering this equipment. Where wiring only is ordered for an entire tens group, the Western Electric Company advise that a small additional charge per link will be made.

The Western Electric Company also advise that the improvements described above will be incorporated in all future orders for this equipment and that this will not result in any price changes except as noted above and in those cases where additional apparatus or equipment is required on optional arrangements.

Current Drain Data

Experience has indicated that it is advisable to furnish current drain information for the CX type offices on the basis of equipment quantities, rather than on the basis of the amount of traffic handled. Accordingly, the attached current drain information has been prepared and replaces similar information in the notes attached to P.E.L. 2568.

These tables were prepared from data obtained by laboratory measurements. The computations were made on the assumptions that the equipment would be engineered on the basis of the probabilities recommended by the Traffic people and that an average amount of reverting call traffic would be encountered.

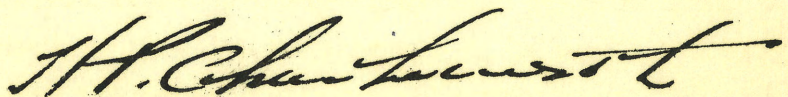
It will be noted that the total drains are higher than the original estimates made before the circuit design had been completed. It may be desirable, therefore, to make a check of existing installations of this type equipment to determine whether or not the power plants would require relief earlier than anticipated.

Attached:

Current Drain-
Tables I and II
Traffic Eng. Notes.

To all Chief Engineers
(Copies included for General Plant
and Traffic Managers.)

Yours very truly,



Assistant Chief Engineer.

TABLE I

CX-30, CX-60, CX-100, CX-200Current Drains

Obtain total current drain for the office by adding the current drain for the number of links involved and the current drain for each group of trunks.

No. of Links	Links	No. of Trunks in Group	Trunks
	Drain in Amp. Hrs. Per Busy Hr. for All Links		Drain in Amp. Hrs. Per Busy Hr. for Trunk Group
3	.9	1	.1
4	1.5	2	.2
5	2.1	3	.4
6	2.8	4	.7
7	3.5	5	1.0
8	4.3	6	1.3
9	5.2	7	1.7
10	6.0	8	2.1
11	6.8	9	2.4
12	7.7	10	2.8
13	8.6	11	3.2
14	9.4	12	3.6
15	10.3	13	4.1
16	11.1	14	4.5
17	12.1	15	5.0
18	13.0	16	5.4
19	13.9	17	5.8
		18	6.2
		19	6.7

TABLE II

CX-1000Current Drain

Obtain total current drain by adding the drain for each group of line finders, selectors, connectors and trunks.

<u>LINE FINDERS</u>		<u>SELECTORS</u>		<u>CONNECTORS</u>		<u>TRUNKS</u>	
No. of Line Finders in Group	Drain in Amp. Hours Per Busy Hr. for Group	No. of Selectors in Group	Drain in Amp. Hours Per Busy Hr. for Group	No. of Connectors in Group	Drain in Amp. Hours Per Busy Hr. for Group	No. of Trunks in Group	Drain in Amp. Hours Per Busy Hr. for Group
3	.2	3	.2	3	.4	1	.1
4	.4	4	.4	4	.7	2	.2
5	.7	5	.6	5	1.1	3	.4
6	.9	6	.8	6	1.5	4	.8
7	1.2	7	1.0	7	1.9	5	1.1
8	1.4	8	1.2	8	2.4	6	1.5
9	1.7	9	1.4	9	2.8	7	1.9
10	2.0	10	1.7	10	3.3	8	2.3
11	2.3	11	1.9	11	3.8	9	2.7
12	2.6	12	2.2	12	4.3	10	3.2
13	2.9	13	2.4	13	4.8	11	3.7
14	3.2	14	2.7	14	5.3	12	4.1
15	3.5	15	2.9	15	5.9	13	4.6
16	3.8	16	3.2	16	6.4	14	5.1
17	4.2	17	3.5	17	6.9	15	5.6
18	4.5	18	3.7	18	7.5	16	6.1
19	4.8	19	4.0	19	8.0	17	6.6
20	5.2	20	4.3	20	8.6	18	7.0
						19	7.6
						20	8.1

TRAFFIC ENGINEERING NOTES
FOR
THE NORTH ELECTRIC COMPANY COMMUNITY DIAL OFFICE EQUIPMENT

General

These Traffic Engineering Notes have been prepared for the community dial office equipment manufactured by the North Electric Manufacturing Company which was described in P.E.L. 2568. This P.E.L. and the notes attached thereto should be referred to for a more detailed description of the equipment.

The practices outlined in these notes should be considered as a general guide for the Traffic Engineer rather than as fixed rules in estimating the quantities of equipment. The engineer's experience and knowledge of the present equipment required and conditions at the office should be taken into account and advantage should be taken of economical equipment arrangements even though this may result in some deviation from these practices. Table B of the "Trunk Capacity Tables" has been included along with Tables C and D to serve as a guide where some departure from the outlined practices is felt to be warranted.

As pointed out on page 3 of P.E.L. 2568 additions to this equipment may be more difficult to make and expensive than for certain other types of community dial equipment. It is, therefore, suggested that the amount of equipment in excess of the actual requirements, particularly for links and frames be determined in conjunction with the Equipment Engineer.

This equipment is of the all relay type composed of line finders and connectors in the CX-30, CX-60, CX-100 and CX-200 and in the CX-1000 selectors are required between the line finders and connectors. Trunks for outgoing service are assigned to connector terminals except in the CX-1000 where they are assigned to selector terminals. For incoming service the trunks are assigned to line finder terminals in the same manner as subscriber lines. Therefore, the subscriber line capacity will be reduced by one for each trunk equipped.

In those community dial offices where line circuit termination is used for trunks, including these CX type offices, it is necessary that dial tone be received on the trunk before dialing the subscriber number. Where offices of this type 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 the master office operator is unable to hear dial tone and, therefore, a lamp signal is contemplated for this purpose. To obtain the lamp signal indication requires some cost for additional equipment in the master office trunks. This type of trunk will need to be specified where required. It will, no doubt, be desirable to keep this in mind when considering for specific projects the relative merits of the several types of community dial office equipments.

Capacities and Classes of Service

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

<u>Type</u>	<u>Capacity</u>
CX-30	29
CX-60	59
CX-100	99
CX-200	199
CX-1000	899 or less, depending on trunking

Terminal number 38 in the first hundred group is used for the alarm checking terminal, unless otherwise specified.

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

No provision is made for intercepting service or for manual or message rate lines. Normal operation is on a common battery basis, but local battery talking may be used if necessary.

Numbering Plan

Subscribers' Directory Numbers

In the CX-30, CX-60 and CX-100 systems all subscribers directory numbers are four digit numbers consisting 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 and then a single digit to indicate the ringing code.

In the CX-200 system the subscribers directory numbers are four digit numbers consisting, first of a digit indicating the hundreds group and code set, then the tens and units digits and finally the ringing code number. The numbers used for initial digits are as follows:

2 -	first hundred and first code set
3 -	" " " second " "
4 -	second " " first " "
5 -	" " " second " "

In the CX-1000 system all subscribers directory numbers are five digit numbers consisting of an initial digit to indicate the hundreds group, followed by the digit "2" or "3" to indicate whether the ringing code is in the first or second set of ten codes, then the tens and units digits of the line terminal number and finally the ringing code number.

The following is the numbering of line terminals:

CX-30	20-49
CX-60	20-79
CX-100	00-99
CX-200	00-99 in each 100 line group
CX-1000	00-99 in each 100 line group

Codes for Trunk Groups to Other Offices

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

<u>Type of Offices</u>	<u>Codes Available</u>	<u>Connects to Line Terminal Number</u>
All except	0	20, 21, etc. as req'd
CX-200 &	9	30, 31, " " "
CX-1000	8	40, 41, " " "
	0	220, 221, " " "
	9	230, 231, " " "
CX-200	8	240, 241, " " "
	7	420, 421, " " "
	6	430, 431, " " "

<u>Type of Offices</u>	<u>Codes Available</u>	<u>Connects to Line Terminal Number</u>
	0	
	9	
CX-1000	8	Selector and Line Finder
	etc.	terminals as Required
	as vacant	

Any of the above listed connector terminals not used for trunks may be used for subscriber lines.

Assignment of Trunks and P.B.X. Trunks

The following terminals in each line group may be used for trunks and P.B.X. trunks in all types of offices:

20, 21, 22, 23, etc. as required
30, 31, 32, 33, " " "
40, 41, 42, 43, " " "

Terminals in a series beyond those assigned to a trunk group may be used for regular subscribers' numbers. As an example, a P.B.X. is assigned to terminals 30, 31 and 32, terminals 33 to 39 may be assigned to regular subscriber lines.

The first trunk of a P.B.X. group should have a units digit of zero. 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.

CX-1000

In addition to the above instructions, the following should be observed in assigning trunks in the CX-1000 equipment:

The connector terminals corresponding to the line finder terminals assigned to trunks from other offices are not available for assignment to subscriber lines. For outgoing service these trunks are assigned to terminals on the selectors instead of connector terminals.

Trunks should be assigned as evenly as possible over the line groups. The preferred choice for trunk terminals in each hundred line group is in the lowest numbered line unit, as 121, 221, 321, etc. These terminals are in the series required for assignment to P.B.X. trunk groups, but ordinarily there should be a sufficient number of P.B.X. series of numbers remaining to care for P.B.X. groups.

Coin Box Lines

The line terminal numbers to be equipped for coin box service should be specified in the traffic order. Installations having ten or less coin lines

should have these lines assigned to the same tens (level) group and if more than ten lines are to be equipped for coin service they should be assigned to consecutive tens groups.

Ground Return Lines

Ground return lines may be operated by providing a grounded line adapter for each line. Metallic links are used in that case.

All offices except the CX-1000 are arranged so that it is possible to operate these lines without adapters by providing universal line finders and connectors which are arranged to operate with either ground return or metallic lines. In this case the ground return lines must be segregated by tens groups and a slight change made in the wiring of the line circuits. With this segregation the links convert themselves for grounded line operation on calls to or from these groups. Such tens groups may contain metallic lines with bridged ringing, but this should be avoided, if possible, as the metallic signaling range is reduced somewhat by the link conversion.

Reverting Calls

On reverting calls, the directory number of the called party is dialed. The calling party receives busy tone and hangs up and the link circuit then rings the called party. On divided ringing lines the called party's ring is sent out on both sides of the line. On bridged ringing lines, different codes being used for the two sides of the line, the called party's code rings all bells. Upon the answer of the called party, the connector restores to normal and the line circuit holds the line in the locked-out condition and supplies talking battery to both parties. When both parties hang up, the line circuit restores to normal.

Preliminary Pulse

A preliminary pulse caused by the calling party accidentally operating his switchhook upon removing the receiver will be ineffective as the equipment is arranged to absorb the digit "1."

Engineering Period

It is felt that in general the initial period for which the dial office is engineered may be somewhat greater than the two-year period which is ordinarily used for central office dial equipment. This slightly longer engineering period

may be justified by the fact that these small offices will ordinarily have a slow rate of growth and the somewhat higher cost of additions to this equipment as compared with certain other types will also tend to justify a longer period. The ultimate period may be assumed to be about 15 to 20 years as is generally used for central office equipment.

Lines and Stations

The number of working lines and stations for each class of service, classified as outlined under "Capacities and Classes of Service" page 2, for both the initial and ultimate periods, should be obtained from estimates prepared by the Commercial Engineer. This information should be included as part of the traffic order.

Fundamental Traffic Information

The traffic records available for these small offices may not be of any great value in engineering dial equipment and the plan of obtaining plug count records in the existing manual office to obtain data may be employed. However, in many cases the engineer's experience and knowledge of the present equipment and conditions at the office may be sufficient to satisfactorily estimate the equipment. In this connection it should be borne in mind that the switches are held on reverting calls only until the ringing is tripped by either party removing his receiver.

Busy Hour Calls and Holding Times

Where it seems feasible to use calls and holding times in engineering this equipment, the busy hour calls with the corresponding holding times should be subdivided into the following classes for the initial and ultimate period.

A - Originating

- Calls per line
- Calls to the master office
- Calls to other offices

B - Incoming

- Calls from the master office
- Calls from other offices

Trunk Capacity Tables Recommended

The following trunk capacity tables are suggested for use where they seem warranted in engineering for the North Electric type of dial offices.

- | | |
|--|--------------|
| 1. Line Finders - Connectors (links) | Table D or C |
| 2. Line Finders - Selectors (CX-1000) | Table C |
| 3. Connectors from Selectors (CX-1000) | Table C |
| 4. Master Office Trunks | Table C or D |
| 5. Local Trunks to Free Service Points | Table D or C |

See page 12 for tables.

The above list is set up on a basis consistent with that ordinarily used for step-by-step central office engineering but the degree of liberality to be used in engineering these small offices, and the trunks particularly, varies considerably depending upon local conditions such as the cost of interoffice trunks involved, grade of service at present furnished and the type of community to be served.

FRAME ARRANGEMENTS AND CAPACITIES

Line and Connector Frame Capacities

The equipment capacity is as follows:

	<u>CX-30</u>	<u>CX-60</u>	<u>CX-100</u>	<u>CX-200</u>	<u>CX-1000</u>
Lines plus Trunks	30	60	100	100	100 per frame
Line Finders and Connectors	5	6	10 ✓	10	10 per frame

Line finders and associated connectors known as "links" are used for all the units above except the CX-1000. Therefore, the link capacity is indicated in the above table by the line finder and connector capacity. In the CX-1000 the ten trunks from each line group terminate in selectors.

Supplementary Line and Connector Frames - CX-60, CX-100 and CX-1000

Where the number of line finders and connectors required in the CX-60, CX-100 or CX-1000 systems exceeds the capacity of the regular frames, the additional equipment is installed in these supplementary frames. The construction is similar to that of the regular frame. The capacity is six line finders and six connectors. Equipment and associated wiring is provided as specified. No wiring is included for growth.

CX-200 Frame Combinations

The following combinations of frames are used in the CX-200 office to obtain various maximum capacities:

Total Max. Capacity	Initial Frame Terminals Links	Supplementary Frames					
		Second Unit		Third Unit			
		Terminals	Links	Terminals	Links		
100	10	100	10	None	None		
130	13	100	10	30	3		
150	16	100	10	50	6		
200	19	100	10	50	6		
						50	3

Supplementary Line and Connector Frames - CX-200

These frames are used as the second and third units of the CX-200 system to expand the system above 100 lines and the links are arranged to operate in a common group with a maximum of 19 links. They are constructed like the regular line and link frame and are equipped as specified. Also the wiring is provided only for equipment specified.

Two sizes are available. The first, 36" wide, has capacity for 30 line circuits and three links. The other, 72" wide, has capacity for 50 lines and six links, if used as a second unit, or for 50 lines and three links, if used as a third unit.

Selector Frames (CX-1000)

The selector frames are associated with their respective line group frames. This type of frame is available in two sizes, one with a maximum capacity of ten selectors, the other with a maximum capacity of 20 selectors.

The selectors are provided as specified. No wiring is provided for growth.

METHODS OF ENGINEERING DIAL EQUIPMENT

Line Equipment

The following information should be included in the traffic order:

For offices other than the CX-1000

Total line circuits required in multiples of ten including those used for trunks.

Number of coin box auxiliary lines and type.

Number of grounded line adapters or groups of ten to be arranged for operation of grounded lines without adapters.

For the CX-1000 office

Total line circuits required for the initial and ultimate periods in multiples of ten. Include those used for trunks.

Number of coin box auxiliary lines and type.

Links (Except for CX-1000)

The line finders and associated connectors, which are known as "links," may be ordered as required for any particular installation. However, where the link requirements exceed the capacity of the initial frame, it is suggested that the decision as to whether it is more economical to provide the supplementary frame or a larger unit having a greater link and line capacity be decided in conjunction with the Equipment Engineer. In the case of the CX-200 where the initial line and link requirements will be cared for with the 30-line size supplementary unit but there is some possibility that growth may exceed the 130 lines or 13 links, the use of the 50-line size supplementary unit should be considered for the initial installation. Additions to the 130-line arrangement of the CX-200 may involve appreciable expense.

Where satisfactory traffic data are available, the number of links required may be estimated on the basis of the total office busy hour originating plus incoming trunk traffic and Table D, of the trunk capacity tables. An allowance should be made in the links for reverting calls on the basis of a 30-second holding time since the links are held on these calls only until ringing is tripped by either party removing his receiver. A common group of links will be used in all cases.

The type of line finders and connectors, whether metallic or universal as described under "Ground Return Lines," should be specified in the Traffic order.

Line Finders (CX-1000)

The line finders and associated selectors in the CX-1000 office may be ordered as required for each line group of 100 lines (subscriber lines plus incoming trunks). Where satisfactory traffic data are available, the number of links required may be estimated on the basis of the total office busy hour originating plus incoming trunk traffic and Table C, of the trunk capacity tables. An allowance should be made in the links for reverting calls on the basis of a 30-second holding time since the links are held on these calls only until ringing is tripped by either party removing his receiver. A common group of links for each line group will be used in all cases. Where the number of line finders required to serve 100 lines exceeds ten, the capacity of the

initial frame, a cost comparison should be made between the provision of additional links on a supplementary frame and the use of the initial frame only with the number of lines reduced below 100 sufficiently to load the ten line finders.

The incoming trunks should be assigned as evenly as possible to the line groups so that the load in each full group will be approximately equal. Also in case of equipment trouble in the links the interference to incoming trunk traffic will thus be minimized. Since the incoming trunks are assigned to the line groups as evenly as possible, it can generally be assumed that the full groups will originate the same amount of traffic.

Selectors (CX-1000)

A selector is required for each line finder trunk and the selector frames are associated with their respective line finder frames by line groups. Usually of 10 size line finder frames are provided the associated selector frames should also be 10 size, and with 11 to 16 line finders per group a 20 size selector frame will be required with the number of selectors equipped to correspond to the number of working line finders. For equipment reasons it may be desirable in certain cases to use one 20 size selector frame for the selectors associated with two line frames where the number of line finders in each of the two groups is ten or less. However, before specifying this arrangement the Equipment Engineer should be consulted as it would be rather expensive to add selectors with this plan.

Connectors from Selector Multiple (CX-1000)

The number of connectors required for each hundred group should be estimated on the basis of the incoming traffic and Table C. A maximum of 20 connectors in a common group can be provided for the connectors serving a group of 100 terminals. An allowance should be made in the connectors for reverting calls, as in the line finders, on the basis of a 30-second holding time. The line capacity of each connector group will be reduced by the number of trunks assigned to the corresponding line finder group terminals.

Trunks to Other Offices

The various types of trunks available for use with the North Electric Company offices are described in T.C. 296, Division 6 and P.E.C. 799.

The two-way trunks to other offices may be engineered on the basis of the estimated outgoing and incoming busy hour equivalent 100" calls and the desired table, as mentioned on page 7. Selectors and connectors are normally equipped for a maximum access of ten trunks. Where the number of trunks in a group exceeds ten a relay is added to each selector or connector involved to increase the span of access to a maximum of 20 so that no subgrouping of trunks will be required.

Party Line Ringing

Specify in the traffic order the type of ringing desired on party lines. Specify if divided only, bridged only or both types of ringing. In case both types are desired the tens (levels) groups to be arranged for the two types should be specified. Where both types are used, individual lines can be assigned, of course, in the tens groups having either type of ringing. However, if the reverting call feature is required to ring back on individual lines for test purposes or to ring extension stations, these lines must be assigned to bridged ringing groups.

Trunk Rotation Selecting Circuits

Each group of two or more trunks to other offices and to P.B.X.'s must be equipped with one of these circuits. This equipment assigns idle trunks in rotation so that successive calls have different channels. The number of trunk groups to other offices and P.B.X. trunk groups with the number of trunks in each group, as well as the terminal assignments for outward and inward service, should be specified in the traffic order. Provision for spare trunk rotation circuits to care for growth and new groups should be included.

Traffic Registers

One line group peg count register should be specified for each installation.

One overflow register for the line groups should be specified for each installation.

Where the expense is justified one peg count and one overflow register for each line group can be furnished.

The peg count register will record all cases where a subscriber removes his hook a sufficient length of time for the line to be seized by a link. Also registrations will usually occur when the called party hangs up after the calling party. One overflow registration is obtained each time all links are busy and one or more subscribers attempt to originate calls during the period all links are busy.

TRUNK CAPACITY TABLES

Based on Equivalent 100" calls and Tables B, C and D
of the Average and Average Plus Deviation Tables

<u>Trunks</u>	<u>Cap.-Equiv. 100" Calls</u>		
	<u>Table B</u>	<u>Table C</u>	<u>Table D</u>
1	.360	.720	1.44
2	5.36	7.92	11.52
3	15.7	20.5	27.0
4	29.6	36.7	45.7
5	46.1	55.8	66.6
6	64.4	76.0	89.3
7	83.9	96.8	112
8	105	119	137
9	126	142	162
10	149	166	188
11	172	191	214
12	195	216	240
13	220	241	267
14	244	267	295
15	269	293	323
16	294	320	350
17	320	347	378
18	346	374	407

TABLE 2-A
NORTH ELECTRIC CO. EQUIPMENT
COMMUNITY DIAL SYSTEMS
PRINCIPAL FEATURES

	CX-1000 All-relay	CX-200 All-relay	CX-100 All-relay	CX-60 All-relay	CX-30 All-relay
Capacity Subs. Lines	Estimated limit not over 400 lines.*	199, less actual number of trunks used.	99, less actual number of trunks used.	59, less actual number of trunks used.	29, less actual number of trunks used.
Trunks	As required	As required	As required	As required	As required
Terminals	Not over 400*	200	100	60	30
Usual Field of Use	180 to 400 lines	80-190 lines	40-90 lines	20-55 lines	Under 25 lines
Classes of Service					
Flat Rate Lines - Ind., 2-pty.	1,2,4-pty. lines operate as unfilled multi-party lines.	1,2,4-pty. lines operate as unfilled multi-party lines.	1,2,4-pty. lines operate as unfilled multi-party lines.	1,2,4-pty. lines operate as unfilled multi-party lines.	1,2,4-pty. lines operate as unfilled multi-party lines.
P.B.X. Hunting	Yes-Max. 10 trunks per group.	Yes-Max. 10 trunks per group.	Yes-Max. 10 trunks per group.	Yes-Max. 10 trunks per group.	Yes-Max. 10 trunks per group.
Multi-Party Lines	10 or 20 pty.term./line, bridged or divided ring.	10 or 20 pty. term./line, bridged or divided ring.	10 or 20 pty.term./line, bridged or divided ring.	10 or 20 pty.term./line, bridged or divided ring.	10 or 20 pty.term./line, bridged or divided ring.
Coin Lines	Postpay dial.	Postpay dial.	Postpay dial.	Postpay dial.	Postpay dial.
Ground Return Lines	Yes	Yes	Yes	Yes	Yes
Local Battery or Com. Bat. as Required	Yes	Yes	Yes	Yes	Yes
Manual Originating	No	No	No	No	No
Numbering Plan					
Subscriber Lines	5 digits	4 digits	4 digits	4 digits	4 digits
Trunk Codes Available	Usual 1-digit codes	1 digit	1 digit	1 digit	1 digit

* The limit determined by economic and other considerations rather than actual capacity.

TABLE 2-A
NORTH ELECTRIC CO. EQUIPMENT
COMMUNITY DIAL SYSTEMS
PRINCIPAL FEATURES

	CX-1000 All-Relay	CX-200 All-Relay	CX-100 All-Relay	CX-60 All-Relay	CX-30 All-Relay
Switching Equipment					
Line Finders	100-pt. all-relay. Capacity 10 trunks to selectors.(1)	100 to 200-pt. all-relay. Capacity 10 to 19 links.	100-pt. all-relay. Capacity 10 links.(1)	60-pt. all-relay. Capacity 6 links.(2)	30-pt. all-relay. Capacity 5 links.
Connectors	100-pt. all-relay.	100 to 200-pt. all-relay.	100-pt. all-relay.	60-pt. all-relay.	30-pt. all-relay.
Selectors	Frames 10 or 20 selector capacity.	None required.	None required.	None required.	None required.
Trunk Types					
Master Office - 2-Way	In general same types as for 375-A office.	In general same types as for 375-A office.	In general same types as for 375-A office.	In general same types as for 375-A office.	In general same types as for 375-A office.
Non-Master Office - 2-Way	To manual and other CX type offices.	To manual and other CX type offices.	To manual and other CX type offices.	To manual and other CX type offices.	To manual and other CX type offices.
Trunk Rotation	Yes	Yes	Yes	Yes	Yes
Trunks Joint Control, Calls to Operator	Yes	Yes	Yes	Yes	Yes
Toll Grade Transmission	No	No	No	No	No
Traffic Registers					
	To record: (1) Originating calls (2) Overflow calls	To record: (1) Originating calls (2) Overflow calls	To record: (1) Originating calls (2) Overflow calls	To record: (1) Originating calls (2) Overflow calls	To record: (1) Originating calls (2) Overflow calls
Alarms					
	Alarm ckg. term. which may be dialed for periodic check.	Alarm ckg. term. which may be dialed for periodic check.	Alarm ckg. term. which may be dialed for periodic check.	Alarm ckg. term. which may be dialed for periodic check.	Alarm ckg. term. which may be dialed for periodic check.
Height of Frames					
	80 inches	80 inches	80 inches	80 inches	54 inches
Operating Features					
Intercepting	No	No	No	No	No
Verification	No	No	No	No	No
Preliminary Pulse Absorption	Yes	Yes	Yes	Yes	Yes
Control of Ringing by Toll Opr.	No	No	No	No	No
Reverting Calls	Directory number	Directory number	Directory number	Directory number	Directory number
Coin Line Indication on M.O.Trunks	Tone	Tone	Tone	Tone	Tone
Vacant Selector Levels	Dial tone	-	-	-	-
Vacant Terminals, Unequipped	Open-no indication	Open-no indication	Open-no indication	Open-no indication	Open-no indication
Vacant Terminals, Equipped	Ringing induction	Ringing induction	Ringing induction	Ringing induction	Ringing induction

(1) Normal capacity 10 but can be increased to 16.
(2) " " " 6 " " " " " 12

Community Dial Systems - Improved Numbering Plan for North Electric
Manufacturing Company's CX Type Community Dial Offices.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY NEW YORK

April 4, 1938

EXCHANGE 3-9800

P.E.L. 2888

Supplements P.E.L. 2568

HARRY P. CHARLESWORTH
ASSISTANT CHIEF ENGINEER

STOCK

This is to advise that improvements have been made in certain of the North Electric Manufacturing Company's CX type community dial offices whereby a reduction of one digit can be obtained in subscriber directory numbers, subject to the limitations described below:

In the numbering plan which has been employed with the CX type community dial offices subscriber numbers have the same number of digits in ten-party arrangements as in twenty-party arrangements. The digit preceding the tens digit indicates whether the desired ringing code is in the first or second set of ten codes. If only ten codes are used, this indication is not required and in this case a numbering plan could be employed which, in general, would have subscriber numbers with one digit less than the corresponding twenty-code numbering plan. Arrangements have accordingly been made with the manufacturer to apply such a plan where desired on orders placed hereafter on an optional basis.

The equipment and circuit changes required to introduce this optional plan are of a minor nature. Drawings will be changed by the manufacturer as orders for the new arrangement for each of the various types of offices are received. The initial orders, on which these drawing changes will be made and on which special tests will be required, may involve delivery intervals somewhat longer than usual. In this connection, you may wish to take into consideration the question of obtaining satisfactory delivery schedules from the Western Electric Company before placing your first orders for CX type offices having the new features. Pending revision of the order blanks the new numbering plan may be obtained in CX type offices by making a suitable statement in the order.

Certain limitations in capacities, as explained later, are in some instances introduced where the new numbering plan is used. The present numbering plan will be retained for use in twenty-code installations and for use in ten-code installations where the capacity limitations of the new plan may be undesirable, or where it is desired to retain uniformity of numbering in the ten and twenty-code systems.

The following is a brief description of the effect of the optional numbering plan on each of the various types of offices:

CX-30 and CX-60

All subscriber numbers will have three digits, the first indicating "tens", the second "units", and the third the "ringing code".

The capacity of these systems is not changed and lines will be equipped as specified within the following limits:

<u>Type</u>	<u>Line Nos.</u>
CX-30	20 - 49
CX-60	20 - 79

An initial digit "1" is absorbed as a preliminary pulse. The trunk codes and the line numbers associated with trunk groups are not changed.

CX-100

All subscriber numbers will have three digits, the first indicating "tens", the second "units", and the third the "ringing code".

An initial digit "1" is absorbed as a preliminary pulse and lines 10-19 are, therefore, not available. Line circuits 20-99 may now be equipped as specified for subscriber lines since they are not used for "0" trunks as formerly. Line circuits 00, 01, etc., as required, are used for code "0" trunks. The line circuit numbers for use with trunk codes other than "0" are not changed. The capacity is, therefore, limited to 80 lines and is further reduced by ten lines for each trunk group required in addition to the code "0" trunks.

CX-200

Subscriber lines in the first hundred group will have three digit numbers, the first indicating "tens", the second "units", and the third "ringing code". The capacity of this group is limited to 70 subscriber lines (30-99), as initial digit "1" is absorbed as a preliminary pulse, initial digit "2" is used to select the second hundred group and "0" is used as a code for trunks to the master office.

The second hundred group of lines may be fully equipped, all subscriber numbers having four digits. The first digit is always "2", to select the second hundred group, the second digit indicates "tens", the third digit indicates "units", and the fourth digit indicates the "ringing code".

The total capacity of the CX-200 is thus reduced to 170 lines and only 70 of these lines can be operated on a three-digit basis. If additional trunk codes are required the capacity is further reduced by ten lines for each code, the reduction being in the three-digit group.

The line circuit numbers associated with trunk codes remain unchanged.

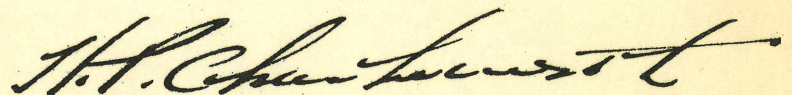
CX-1000

All subscriber numbers have four digits, the first digit indicating "hundreds", the second "tens", the third "units", and the fourth the "ringing code". The trunk codes and capacities of the CX-1000 are not affected by the use of this optional numbering arrangement.

The Western Electric Company advise that there will be no material change in the overall prices of the CX type equipments having the features described above.

We should be glad to discuss any questions which may arise regarding the application of these improved arrangements in your area.

Yours very truly,



Assistant Chief Engineer.

To all Chief Engineers
(Copies included for
General Traffic Managers)

