

INSTALLATION PROCEDURE ALL-RELAY SWITCHBOARDS

CX-30, CX-60, CX-100

1. GENERAL

This instruction is intended for the use of installers in the field. It describes the apparatus units comprising a complete switchboard of the CX-30, CX-60 and CX-100 types, and gives information required to install the switchboard. It contains points to be observed with regard to the exchange quarters.

2. POINTS TO BE OBSERVED REGARDING THE EXCHANGE QUARTERS

The installer should inspect the quarters provided for the exchange equipment in order to ascertain that the switchroom is in a suitable condition for the housing of equipment. If anything is found which seems to require attention, he should immediately take the matter up with the customer company before proceeding with the installation.

While it is advantageous from the standpoint of cleanliness and freedom from dust to close up the room as much as possible, it should be kept in mind that stagnant, damp air entails some danger of corrosion of the equipment. Proper means of ventilation should therefore be provided if the exchange quarters are not, already, provided with such facilities.

The All-Relay equipment will operate satisfactorily under any climatic conditions; heating or cooling of the switchroom is, therefore, not necessary.

The equipment should not be installed where the odor of paints or floor wax may be detected, without investigation, as all electrical contacts are susceptible to damage from certain paint vapors. Paints or floor waxes containing turpentine or other similar volatile solvents should be used with caution in switchrooms or any place where the fumes may reach the telephone equipment. Paints and floor waxes containing non-active solvents and residues should be used, preferably.

3. INFORMATION AND RECORDS

The following information will be furnished with each order:

1. A loose set of information for the installer consisting of:
  - a). Installation procedure
  - b). Summary sheet of the equipment furnished
  - c). Such supplementary instructions as may be required for the specific installation
  - d). Floor plan and equipment drawings
  - e). Wiring diagrams
  - f). Circuit drawings

2. Two sets of information consisting of:
  - a). Installation procedure
  - b). Maintenance notes
  - c). Summary sheet of equipment furnished
  - d). Such supplementary installation instructions as may be required for the specific installation.
  - e). Circuit descriptions
  - f). Circuit drawings
  - g). Relay adjustment data
  - h). Floor plan and equipment drawings
  - i). Wiring diagrams

Items "2a" to "2g" will be bound in folders, and items "h" and "i" will be contained in manila envelopes.

All material listed under 2 is to be delivered to the customer company for permanent record.

The installer should check all information received. If any items are missing, Galion should be advised.

Drawings illustrating the standard wiring diagram and circuit conventions are attached to the Installation Procedure and the Maintenance Notes. The conventional drawings contain such information as may be required to read the wiring diagrams and circuit schematics.

#### 4. CHECK OF FLOOR-PLAN

Immediately after checking the received job information, the installer should examine the exchange quarters to see that they conform to the floor plan supplied and if there should be any material difference, the customer company should be advised. If a rearrangement of the equipment should be necessary the installer should suggest to the customer company such rearrangement as he considers suitable and a copy of the suggested layout should be sent to Galion for comment.

If additional cable or modification of the equipment is involved to adapt the equipment to the quarters, excepting cable rack changes, or supports for the equipment, Galion should be notified before any work is done.

#### 5. EQUIPMENT UNIT SIZES

The CX-30 Switchboard unit is contained in a cabinet 54" high, 36" wide and 12" deep. An auxiliary frame 14-1/2" wide by 54" high on which is

mounted the power panel, one or more relay cases and the battery charger if not above 2 ampere capacity, is permanently attached to it. The whole assembly is mounted on a base 1-1/2" in height.

The CX-60 Switchboard unit consists of a cabinet 81" high, 36" wide and 12" deep.

Permanently attached to it is an auxiliary frame on which is mounted the power panel and certain miscellaneous circuit equipments. The auxiliary unit is 76" high and 14-1/2" wide.

The switchboard and the first auxiliary frame in the same line-up are usually mounted on a common base 1-1/2" in height.

The CX-100 Switchboard consists of a cabinet 81" high, 72" wide and 12" deep. The switchboard unit is mounted on a base 1-1/2" in height.

The auxiliary frames containing the power panel, miscellaneous circuit equipment and battery charger for a CX-100 switchboard is not attached to the switchboard unit at the factory. It is shipped separately and is bolted to the switchboard unit on location. It has the same dimensions as the auxiliary frame of the CX-60 switchboard.

## 6. SUPPLEMENTARY FRAMEWORK

Whenever the number of miscellaneous circuits or the size of the charger is such that the space on the first auxiliary frame is insufficient one or more additional auxiliary frames as required will be furnished.

The auxiliary frames will not be attached, usually, to the switchboard unit. They will be shipped separately bolted to other auxiliary frames, whenever convenience in packing, and the floor-plan permit.

Whenever more links are required in a certain application than can be accommodated on a single line and link frame, the additional links will be mounted on one or more supplementary frames. Ordinarily, a supplementary frame for additional links will not be required for a CX-30 type board.

The link multiple and link chain circuits will be extended suitably to the supplementary frames. The job supplementary instructions will contain any further information that may be required regarding this.

If composite equipment is required a special auxiliary frame which will accommodate 19" wide mounting plates will be used. This will, usually, be shipped separately.

## 7. PACKING FOR SHIPMENT

The switchboard units, auxiliary frames, battery charger, etc., are packed in wooden packing cases.

All packing cases will be marked with the destination given on the purchase order.

The shipping papers will be contained in a small manila envelope placed in a conspicuous location on the outside of one of the packing cases.

The line, line-finder and connector units and the selector units will usually be shipped singly, with no other equipment units in the cases.

The method employed in shipping the auxiliary frames will depend upon the layout of the equipment. When two or more frames are to be installed in the same line-up, and some interconnecting is involved, they will be shipped assembled in their relative positions, with the cabling in place.

Occasionally, two or more auxiliary frames of different line-ups will be shipped in the same case, bolted together.

The main frame equipment and battery rack will usually be shipped knocked down in separate cases.

### 8. UNPACKING THE SWITCHBOARD

The switchboard cases should be unpacked as near to the location in which the switchboard is to be installed as is convenient.

Before unpacking a switchboard unit case, care should be taken to see that the packing case is right side up. First unpack the switchboard units.

The packing cases should be taken apart by removing the top of the case. This will permit the front and back to be removed easily. In no case should attempt be made to remove the sides of the packing cases before the front and back. The sides of the packing case are bolted to the switchboard unit proper with shipping bolts.

The sides of the packing case should be unbolted, a side at a time, replacing the removed shipping bolts by the cabinet bolts, which will be found in a sack tied to the framework inside of the switchboard cabinet.

After unpacking as described above, the switchboard units may be moved into position in the switchroom, as the base of the packing case is not attached to the switchboard unit.

If the switchboard units have to be moved any considerable distance from the place of unpacking, some form of roller should be used to roll the unit. (Two or more lengths of iron pipe will be suitable for this purpose).

The auxiliary units should now be unpacked and brought into the switchroom.

### 9. ERECTING

The switchboard units and the auxiliary framework units should be placed in position in accordance with the floor plan.

All of the frameworks and cabinets have bolts and details which permit the bolting of auxiliary frames and cabinets in the same line-up together. When

the equipment units in a line-up are bolted together the line-up should constitute a rigid unit. It will usually not be found necessary to bolt adjacent line and link units together as the 36" and 72" wide units are self-supporting on a level floor.

If it is found that the floor is too irregular to permit a good horizontal alignment of the units, shimming of the base of the switchboard unit should be resorted to. The shims required may be made up locally of thin strips of wood slightly wedge shaped, or of thin sheet metal strips. If it is found that the result of shimming is unsightly, the shims may be concealed by a quarter-round wood strip nailed or glued to the floor. Light finishing nails or cabinet-makers glue should be used for this. The material required will be purchased locally.

The auxiliary units should be erected as shown on the floor plan, bolting them to the auxiliary frames adjacent or the adjacent switchboard unit itself as the case may require. The apparatus layout drawing furnished with the job, which shows the equipment units in each line-up, may be used to identify the various cabinets and frameworks.

The end bolts which are in position on the auxiliary frame on the switchboard units are used to attach the auxiliary frames. The bolts are removed and passed thru the drilled holes in the framework of the auxiliary frame.

A separate floor type main frame will be installed in accordance with the floor plan, and fastened to the floor with expansion bolts or lag screws.

If a wall type distributing frame is used, wooden cleats to support the frame should be attached to the wall by lag screws or expansion bolts. The framework of the distributing frame should be screwed to the cleats.

If the distributing frame is mounted on the end of the switchboard unit, the frame work should be bolted to the switchboard framework using the cabinet end bolts.

After assembling the battery rack and placing it in accordance with the floor plan the battery should be mounted on it. Care should be taken that the indicators of the pilot cell can be easily seen.

#### 10. CABLE RACK, RUNWAYS, ETC.

With the equipment there will be shipped loose lengths of strap iron, rack, or cable running boxes to be used for cable support. Usually, the cable rack or running boxes will be cut to length in accordance with the floor plan. The supplementary instructions will give information on this point.

The cable supporting details or running boxes should be run between the switchboard line-ups, the main frame and the battery rack, as shown on the floor plan and as described in the supplementary instructions.

No supports will be furnished for the leads from the power service entrance to the battery charger. When a support is required it will be made up locally.

## 11. SUPPORTING SWITCHBOARD AND FRAMEWORK

If it is found, on completion of the work up to this point, that the switchboard line-ups, the main frame, battery rack, or isolated units of equipment are not sufficiently rigid, it will be necessary to provide additional supports.

It will be found that the need for auxiliary support will be relatively infrequent. The cable supports will usually, if installed properly, ensure the necessary rigidity of the equipment units.

Additional supports for rigidity may be made of lengths of strap-iron formed and drilled suitably to permit attachment to the switchboard units or auxiliary frames. The following types of supports for this purpose may be found necessary:

- a). Brace between line-ups
- b). Brace from one or more line-ups to nearest wall
- c). Brace to ceiling
- d). Braces to floor

Care should be taken to see, in the use of supports for bracing, that they are formed so that there is head-room for convenient passage under them.

No difficulty will be found in attaching supports to the switchboard units or to the auxiliary framework. However, some problems may be met with in attaching to walls and ceilings.

## 12. ATTACHING TO WALLS OF BUILDING OR ROOMS

In attaching supports or framework to the wall, the installer should satisfy himself that the work to be done will not be objectionable from the standpoint of appearance to the customer company. If there is any doubt on this point a representative of the customer company should be consulted. If the wall should be covered with a hard surface plaster that cannot be easily replastered, or bricks with a vitreous surface are involved, the customer company should always be consulted.

## 13. SWITCHBOARD GROUND

The customer company will ordinarily have provided the switchboard ground and will have brought the connections of the switchboard ground into the building. If the installer is to provide the ground connection, a special notice to this effect will be shown in the job specifications and in the installer's instructions.

If the supplementary instructions do not include an instruction to make the ground connection, and the installer upon inspection finds that the switchboard ground has not been made, or the connection to the switchboard ground has not been brought into the switchroom, the customer company must be notified at once.

#### 14. INTER-UNITS CABLING AND WIRING

As much of the interconnection as can be permanently done at the factory will be in place. The installer need not concern himself with this.

Lengths of switchboard cable for the purpose of interconnecting will be connected to the terminals of the various units at one end, the loose ends coiled up suitably for shipping. When possible, the loose ends will be formed out at the factory.

It may be noted that when units are shipped bolted together to be erected in the same relative position, the interconnection of the two units will be completed at the factory.

When neither end of a connection can be made at the factory, loose lengths of wire or cable will be shipped.

All cables, forms, and wires, one end or both ends of which have to be connected on the job, will be tagged to show the terminals to which connection should be made. These tags should not be removed until final inspection is made.

The installer should, after making a first inspection of the equipment to assure himself that everything is in place, and that everything is ready to start interconnection, cut the laces with which the free ends of the cables are tied to the various units.

The cabling, forms, leads and the tags attached to them should be checked against the interconnecting diagrams furnished with the switchboard. If there is any discrepancy, it should be investigated, reference being had to the supplementary installation instruction for explanation. If one or more cable tags should have fallen off during shipment, the interconnecting diagrams will usually give sufficient information to permit making out a new one.

If the installer should decide that one or more cables, forms or leads are missing, Galion should be informed at once.

After completion of the checking of the inter-unit cabling, the installer should lay in place on the runways or in the running boxes the cables, forms and leads.

The installer should then run such leads as are required to be run on the job. The following is a list of those generally required:

1. Positive and Negative lead covered battery leads between battery and power panel. (See Power Board Wiring Plan)
2. Lead covered lead from entrance of the ground connection to the positive pole of the battery and to the main frame bus bar. In case the ground lead-in wire enters the room nearest the main frame, the connection may be run to the main frame bus-bar first and from there to the battery.

Spliced and soldered connections or solderless connectors may be used to splice to the incoming ground lead.

The ground connection should be sweated to the lug on the main frame bus bar.

3. A lead covered cable or a rubber covered wire in BX conduit from the battery charger to the power service entrance. This wire and conduit are not furnished with the installation material.

The installer should then lace, suitably to the racks or supporting details, all cables, etc.

#### METHOD OF REMOVING AND REPLACING SWITCHBOARD TOPS

To remove the top of a switchboard cabinet, the rear of the top should be lifted from its guide first. (The front of the cabinet top is free to move while this is done and will pivot in its guides.) After lifting the rear of the top several inches, it should be moved forward to unseat the front. A slight movement forward is all that is necessary.

The top may now be lifted off in any direction.

To replace a switchboard top, hold it on an angle above the switchboard and first seat the front. The rear will then drop into position in its guides without difficulty.

If a closed cable runway is used which is run over the junction of two cabinets, it will be necessary to remove the collar which is placed around the cable support and which is placed over top of the cabinets. This can be easily done by unscrewing the plates which make up the collar.

#### 15. CONNECTING SWITCHBOARD

(Reference should be made to the drawings involved and supplementary installation instructions to obtain details for this work. The following information is a general summary only, of the usual items of work in a CX-200 board)

After butting and forming or fanning all cables, connect as follows:

1. Connect the loose ends of the cables to the power board.
2. Connect the loose ends of the cables to the trunk frame.
3. Connect the loose ends of the cables to the main frame.
4. Connect the power, charger and battery leads.
5. Connect the service entrance leads.

#### 16. INSPECTION

The installer should make a complete inspection of the equipment before proceeding to test out the switchboard. He should satisfy himself that all the equipment called for on the summary sheet, and required by the circuits has been furnished. If any items of equipment appear to be missing he should immediately report this fact to Galion.

The installer should make a visual inspection of the relays to determine that no damage has occurred in shipment.

The installer should inspect the battery to see that the level of the electrolyte is such that the plates are at least 1/2" below the surface.

Note: If the battery plates have been exposed to the air for a considerable length of time, they should be considered defective. The matter should be referred for decision at once before placing the batteries in service.

## 17. TEST

The installer should check the battery voltage, to determine the condition of the battery.

The installer should put in the charger and battery supply fuses as shown on the power circuit drawings and turn on the charger switch if one is supplied.

### BATTERY CHARGER

The following refers to a self-regulating charger with copper oxide rectifying stacks. If any other type is furnished the supplementary instructions will contain information regarding it.

If the battery is not fully charged, the charger will immediately start to deliver current to the battery to bring it up to full charge. The amount delivered will depend upon the condition of the battery and the rating of the charger.

The charger will continue to deliver current to the battery until it is fully charged, when its output will drop to an amount just sufficient to maintain the battery at full charge. This amount will be a fraction of an ampere.

As the tests proceed, as outlined below, with varying load conditions imposed upon the battery supply, the installer should check to see that the charger functions properly. The instructions covering the battery charger should be read in this connection.

It may be pointed out that the charger is designed to keep the battery as near to full charge as is practicable without overcharging. Consequently, by a constant check of the battery voltage and current drain, the output of the charger is increased or decreased, as may be required, to bring this about.

As the load on the battery increases, a point will finally be reached when the charger will not increase its output materially, unless a substantial drop in the battery voltage occurs by reason of a sustained load. A condition of this sort, in which the charger delivers beyond its rating, should not be permitted to continue for a period lasting more than six hours, and in no event should the charger be permitted to deliver more than thirty percent in excess of its rating.

The full load voltage and no load voltage of the charger are shown on the rating sheet included in the information supplied with each equipment.

Note: The overcharge switch on the charger should be used with caution, when the battery is partially discharged. The operation of the overcharge switch removes a part of the control from the circuit. If the battery is partially discharged, the charger may deliver a current which is considerably in excess of its rating.

The overcharge switch may be used to bring a partially discharged battery up to full charge if it is not left on longer than six hours at a time, with an interval between periods, when overcharging, of at least twelve hours. The limitation regarding over loading of the charger beyond its rating must be observed.

The installer, after checking in accordance with the foregoing to see that the battery is brought up to full charge, should insert the discharge cartridge fuses on the power board.

The installer should, using lengths of 1 amp fuse wire or other temporary fusing, fuse all of the individual circuits on the switchboard.

If none of the fuses blow the installer may proceed with the tests. If any individual circuit fuses or common cartridge fuses should blow, the installer should correct the trouble before proceeding.

The circuit tests will be conducted in the order shown:

1. Landing-in test on all lines.

The landing in test should be made from the end of the multiple, this will require that the last equipped link be used. The other links should be busied out by means of their make busy switches.

The installer will, using a test set, short each equipped line in succession at the main frame, testing for dial tone, observing the line-finder used for test seizes the proper line. The line-finder should release when the short on the line is removed.

2. A test should be made to see that the links are allotted in sequence (link rotation scheme). With all links in service, land calls and release. Observe that when a link has been engaged once, it remains out of service until all lines have been in use, when it, together with the other free links, are again made available for seizure. (Note that the links restored do not include the last link which was engaged. This link will be restored on the next cycle).

3. A test should be made for all group and unit selections on each link. This may be made by dialling Tens and Units digits on each link accompanied by the prefixed digit if there should be one, without dialling the ringing digit. The selection should be checked and immediately after the selection is checked, the call should be disconnected.

This test may be made with two line conditions on the test line:

- a). 0 ohm loop, 5000 ohms leak across line.
- b). 1000 ohms loop, 0 ohm leak across line.

In the CX-100 type switchboard the following test numbers (with proper prefixes) may be used, following the sequence shown:

221, 232, 243, 254, 265, 276, 287, 298, 209 and 210

On the 30 and 60 line boards or units partially equipped suitable combinations of TENS and UNITS digits can be worked out by the installer so that all TENS and UNITS are checked.

4. A test should be made on all codes and frequencies or other character of ringing used on the switchboard. This test should be made on the last equipped link on the switchboard.
5. A test call should be made over each link dialling a test number, observing that ringing tone is received and on answering at the called station, during ringing, that tripping is instantaneous or in the next succeeding silent period, as specified.
  - 5A. A check of transmission can be made in connection with this test. If the aid of another person can be obtained a talking test can be made in both directions. If the test is made in both directions. If the test is made by one person, the test may be made by tapping the transmitters of the test telephones.
6. A test should be made on all links for reverting call. This test is made by dialling the line number on which the call is being made, receiving the busy signal, hanging up, ringing the calling line and tripping the connection. On tripping the ringing it should be observed that the link is dismissed and the line put on lockout.
7. When considered advisable, a test of all lines in the connector multiple may be made at this point. Test all lines for ringing, tripping and transmission. This test should be made from the main frame, with a subset arranged to connect to the terminals or protectors as required. Test all lines in succession, starting with the first equipped.

8. A check of trunks should now be made. This check should include calls to and from the switchboard. The connecting office equipment should be in place and included in this test. This test should include making all trunks in a group busy and then make an additional call to this group to verify that the busy tone is obtained. Joint control and other features in connection with trunk service should also be checked during this test.

(When all trunks busy meters are used, registration of the busy condition of the trunk group in connection with this test should be made).

9. A test of automatic trunk selection, if equipped, should now be made on all trunk and PBX groups so equipped checking that the calls land successively on the trunks in rotation.
10. A test of all miscellaneous features should now be made. This will include fuse alarm, grounded line alarm and line lockout.
11. Test the alarm checking circuit and associated alarms by dialling the line test number simulating the various alarm conditions, one after another and checking to see that the various alarm indications are received.
12. Test all outside lines for grounds and shorts by means of the voltmeter test circuit on the power board and record the result.

(This test should only be made by the installer, when requested to do so by the customer company and such request is confirmed by the supplementary instructions for the job.)

This test can be made before the cutover when dial phones are installed prior to the cutover. If new phones are installed line by line during the cutover the test must be done immediately after the new phones have been installed, before the line is placed in service.

Sketch SK-787 gives the relation between voltmeter reading and line insulation.

## 18. LINE CROSS CONNECTIONS

The installer will, ordinarily, not be required to run the line cross connections at the main frame. If the installer should be required to run the cross connections he should assure himself that his cross connection list is complete before starting.

## 19. CUTOVER

Two methods of cutover are employed in small exchanges. If new telephones are not installed prior to the cutover, but installed line by line during the cutover, the cutover must be done line by line. In such a case the new switchboard must have one or more temporary trunk lines to the old switchboard for interconnection during the period of cutover.

When the new phones are all installed prior to the cutover, or the instruments have all been modified for dial operation, it is possible to make the cutover of all lines simultaneously. In such a case, the installer will, immediately before cutover, place all cutoff relay armatures in the operated position by inserting toothpicks under the armatures, thus opening the line to the dial switchboard. The heat coils will then be inserted in the protectors. The cutover operation consists simply of the pulling of the heat coils on the old main frame and the removal of the toothpicks on the cutoff relays at the new switchboard. No temporary trunk lines between the old and new office will, in this case, be required.

Note: It is not the North Electric Mfg. Company's practice to have relays adjusted in the field which are found, on inspection or test, to require readjustment, unless an emergency due to a scheduled cutover or a serious delay of test should require it.

In the event that one or more relays should be found to require readjustment, Galion should be advised. If readjustment has been made by the installer, Galion should be advised of this fact with the reason for doing so.

Relays for replacement will be sent out or specific instructions as to changes will be issued in each case by Galion.

COLOR CODE FOR CABLES

## Pairs 1-20

	<u>Color</u>	<u>Abbreviation</u>	<u>Mate</u>	<u>Abbreviation</u>
Pair 1	Blue	1C	White	1M
2	Orange	2C	"	2M
3	Green	3C	"	3M
4	Brown	4C	"	4M
5	Slate	5C	"	5M
6	Blue-White	6C	"	6M
7	Blue-orange	7C	"	7M
8	Blue-green	8C	"	8M
9	Blue-brown	9C	"	9M
10	Blue-slate	10C	"	10M
11	Orange-white	11C	"	11M
12	Orange-green	12C	"	12M
13	Orange-brown	13C	"	13M
14	Orange-slate	14C	"	14M
15	Green-white	15C	"	15M
16	Green-brown	16C	"	16M
17	Green-slate	17C	"	17M
18	Brown-white	18C	"	18M
19	Brown-slate	19C	"	19M
20	Slate-white	20C	"	20M

## Pairs 21-40

<u>Color</u>	<u>Abbreviation</u>	<u>Mate</u>	<u>Abbreviation</u>
As in pairs 1-20	21C to 40C	red	21M to 40M

## Pairs 41-60

<u>Color</u>	<u>Abbreviation</u>	<u>Mate</u>	<u>Abbreviation</u>
As in pairs 1-20	41C to 60C	red - White	41M to 60M

## Pairs 61-80

<u>Color</u>	<u>Abbreviation</u>	<u>Mate</u>	<u>Abbreviation</u>
As in pairs 1-20	61C to 80C	blue- red	61M to 80M

## Pairs 81-100

<u>Color</u>	<u>Abbreviation</u>	<u>Mate</u>	<u>Abbreviation</u>
As in pairs 1-20	81C to 100C	orange - red	81M to 100M

## Note 1 -

All other wires appearing in cables are spares.

## Note 2 -

On inter-unit cross-connecting plans, the abbreviations shown will be used to indicate the sequence in which the conductors of the cables used are connected.

COLOR CODE FOR CABLES

## Triples 1-10

	<u>Color</u>	<u>Abbreviation</u>	<u>Color with Tracer</u>	<u>Abbrev.</u>	<u>Note</u>	<u>Abbrev.</u>
Triples 1	Blue	1C	Blue & red	1T	White	1M
" 2	Orange	2C	Orange & red	2T	"	2M
" 3	Green	3C	Green & red	3T	"	3M
" 4	Brown	4C	Brown & red	4T	"	4M
" 5	Slate	5C	Slate & red	5T	"	5M
" 6	Blue-white	6C	Blue-white & red	6T	"	6M
" 7	Blue-orange	7C	Blue-orange & red	7T	"	7M
" 8	Blue-green	8C	Blue-green & red	8T	"	8M
" 9	Blue-brown	9C	Blue-brown & red	9T	"	9M
" 10	Blue-slate	10C	Blue-slate & red	10T	"	10M

## Triples 1-20

Triples 1 to 10 Same as shown for above cable Triples 1 to 10

Triple 11	Orange-white	11C	Orange-white & red	11T	White	11M
" 12	Orange-green	12C	Orange-green & red	12T	"	12M
" 13	Orange-brown	13C	Orange-brown & red	13T	"	13M
" 14	Orange-slate	14C	Orange-slate & red	14T	"	14M
" 15	Green-white	15C	Green-white & red	15T	"	15M
" 16	Green-brown	16C	Green-brown & red	16T	"	16M
" 17	Green-slate	17C	Green-slate & red	17T	"	17M
" 18	Brown-white	18C	Brown-white & red	18T	"	18M
" 19	Brown-slate	19C	Brown-slate & red	19T	"	19M
" 20	Slate-white	20C	Slate-white & red	20T	"	20M

## Note 1 - -

All other wires appearing in cables are spares.

## Note 2 - -

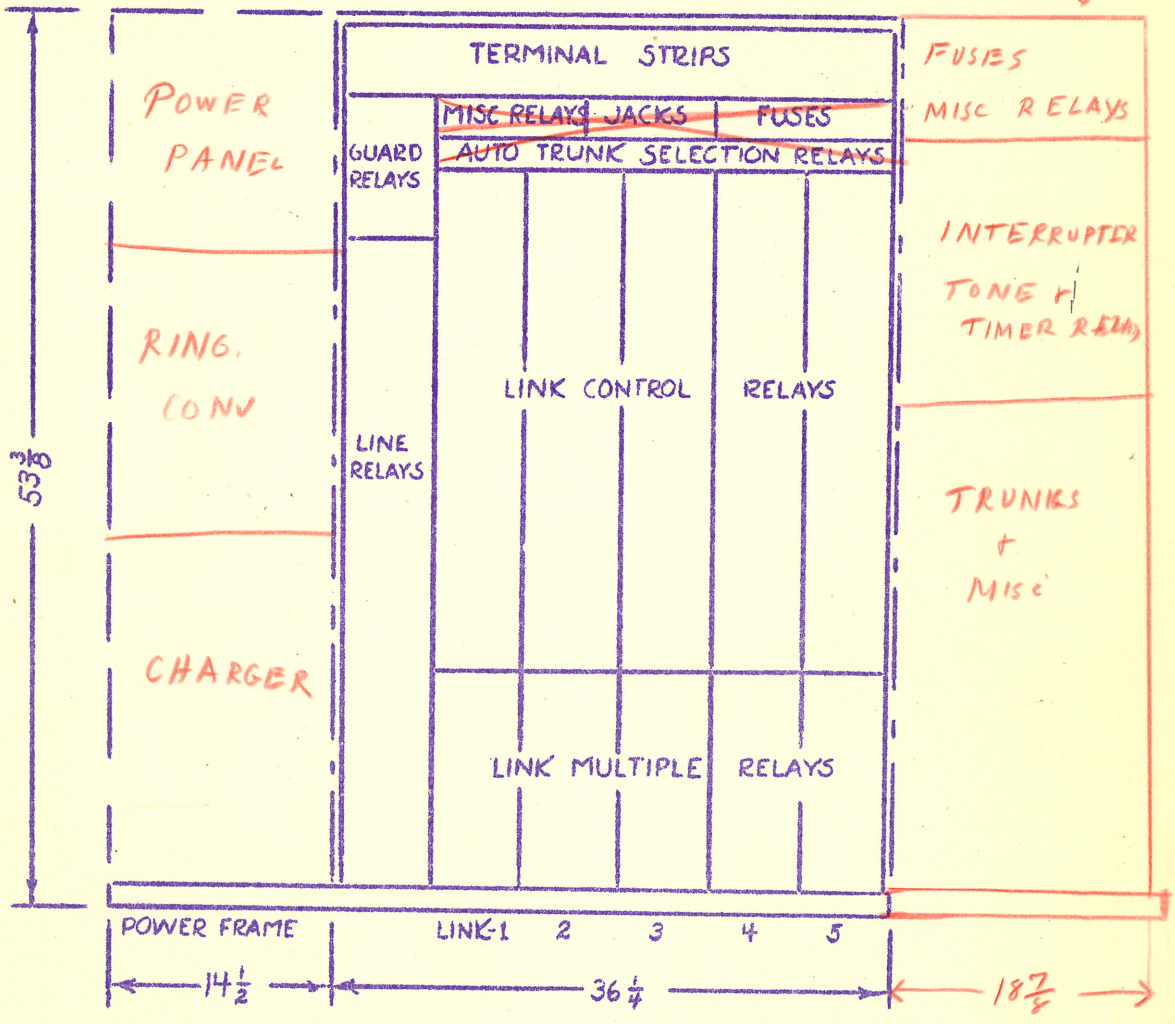
On inter-unit cross-connecting plans, the abbreviations shown will be used to indicate the sequence in which the conductors of the cables used are connected.

TABLE ALINE TEST CIRCUIT (BC-4291 or BC-4677)

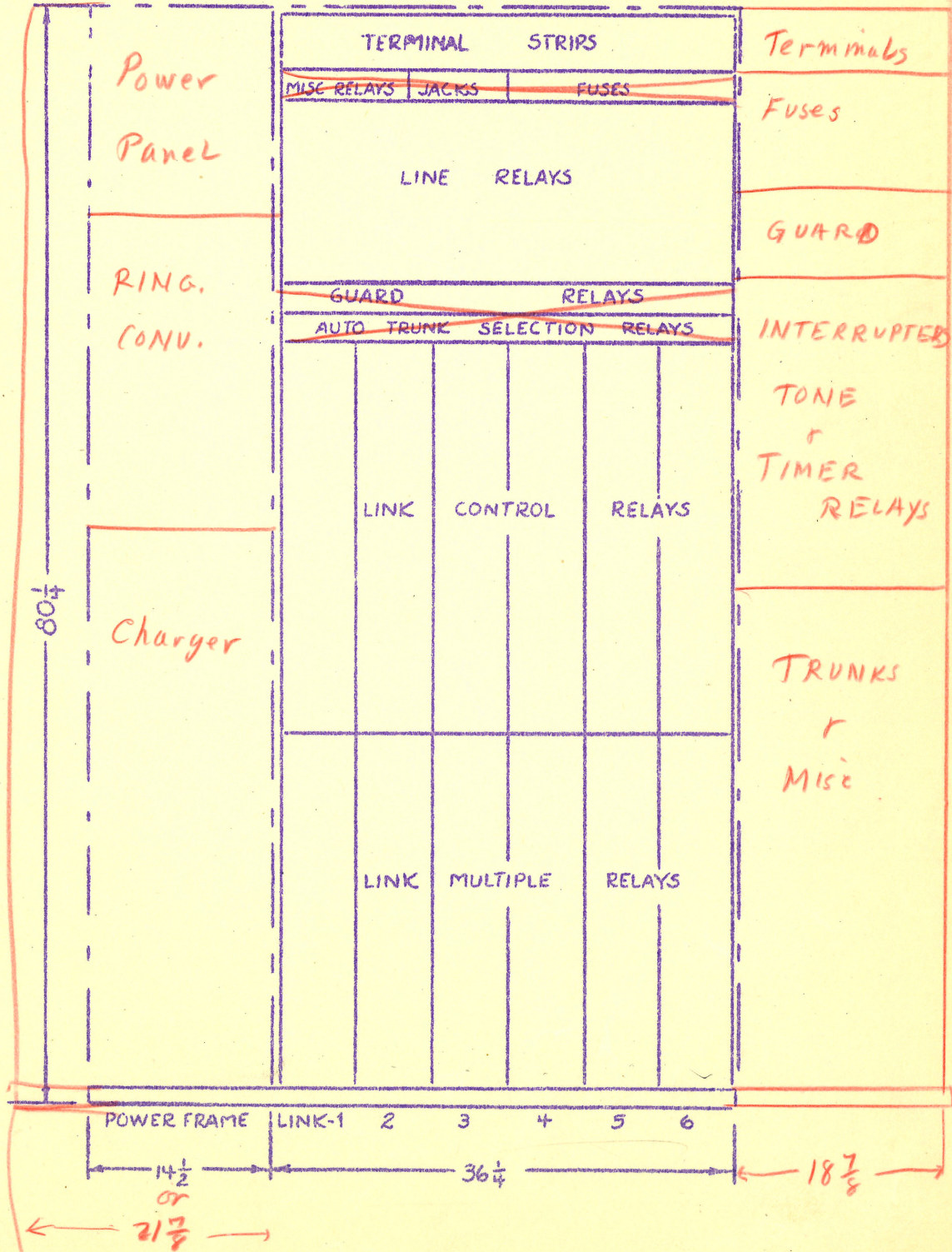
<u>TO TEST FOR:</u>	<u>PULL OUT KEYS:</u> (Leave Other Keys in)			<u>REMARKS</u>
Test Line direct	L		V	Read Voltmeter
Test line thru heat coils	H	L	V	Read Voltmeter
Ground on Tip	L		V	Read Voltmeter
Ground On Sleeve	L	R	V	Read Voltmeter
Battery on Tip	L	B	V	Read Voltmeter
Battery on Sleeve	L	R B	V	Read Voltmeter
Short on Line	L	S B	V	Read Voltmeter
Cond. Kick-Metallic	L	S B	V	Work Key R Out & In
Cond. Kick on Tip	L		V	Work Key B Out and In
Cond. Kick on Sleeve	L	R	V	Work Key B Out and In
Test Inward to Swbd.	T	L		Dial from Test Phone
Call Test man on line		Push all keys in		Dial line from test phone
Ring Test Bells		Push all keys in		Dial reverting call from test phone

ALL-RELAY CX-30  
 LINE-FINDER-CONNECTOR UNIT  
 30 LINES - 5 LINKS

THIS Unit  
 on either end  
 ↓

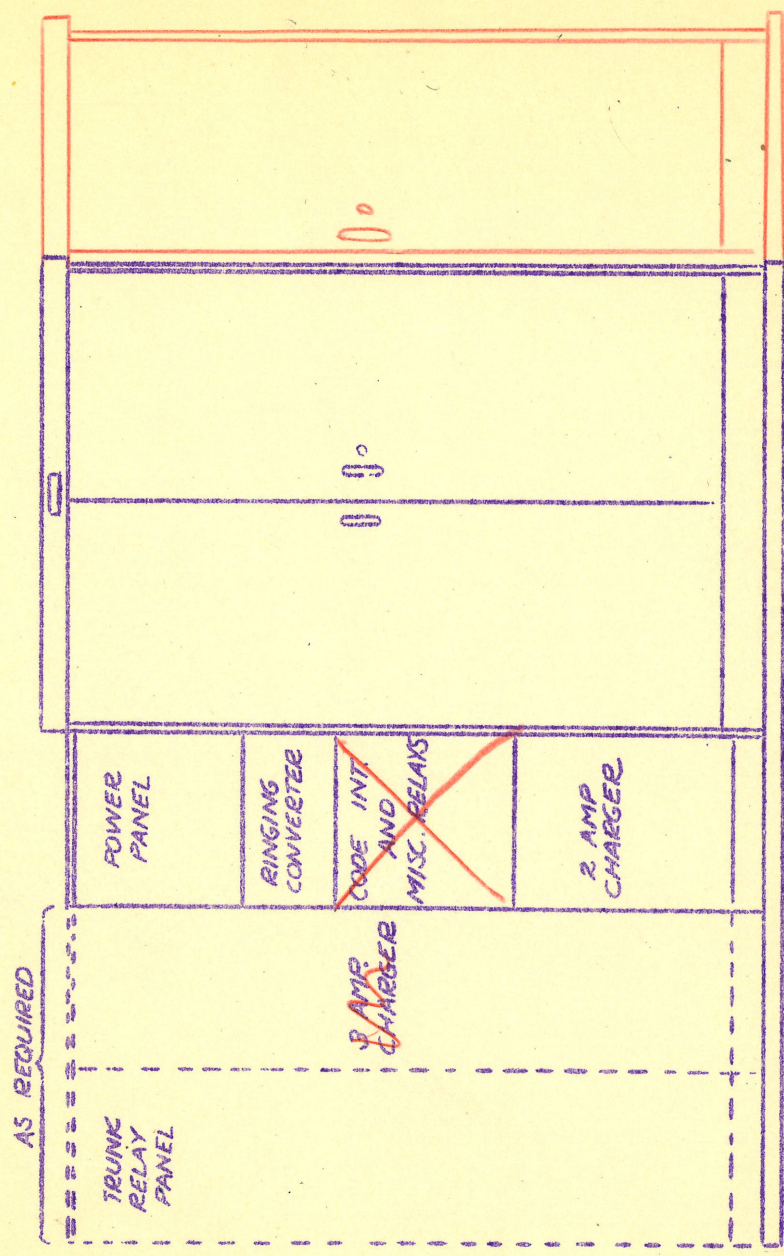


ALL-RELAY CX-60  
LINE-FINDER-CONNECTOR UNIT  
60 LINES - 6 LINKS

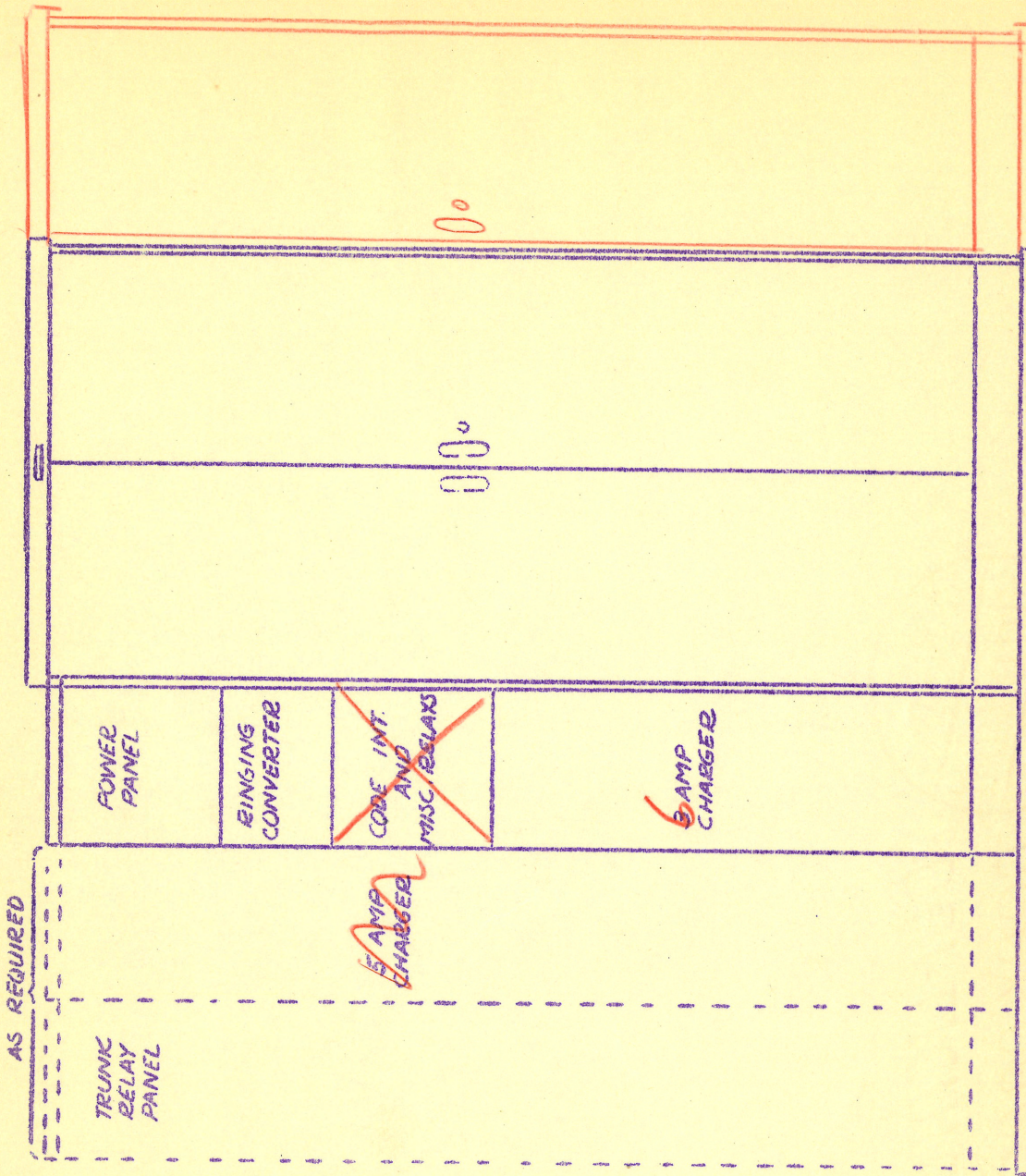




BO-9930  
BO-9931  
SKETCH-D  
REV. 6-1-39



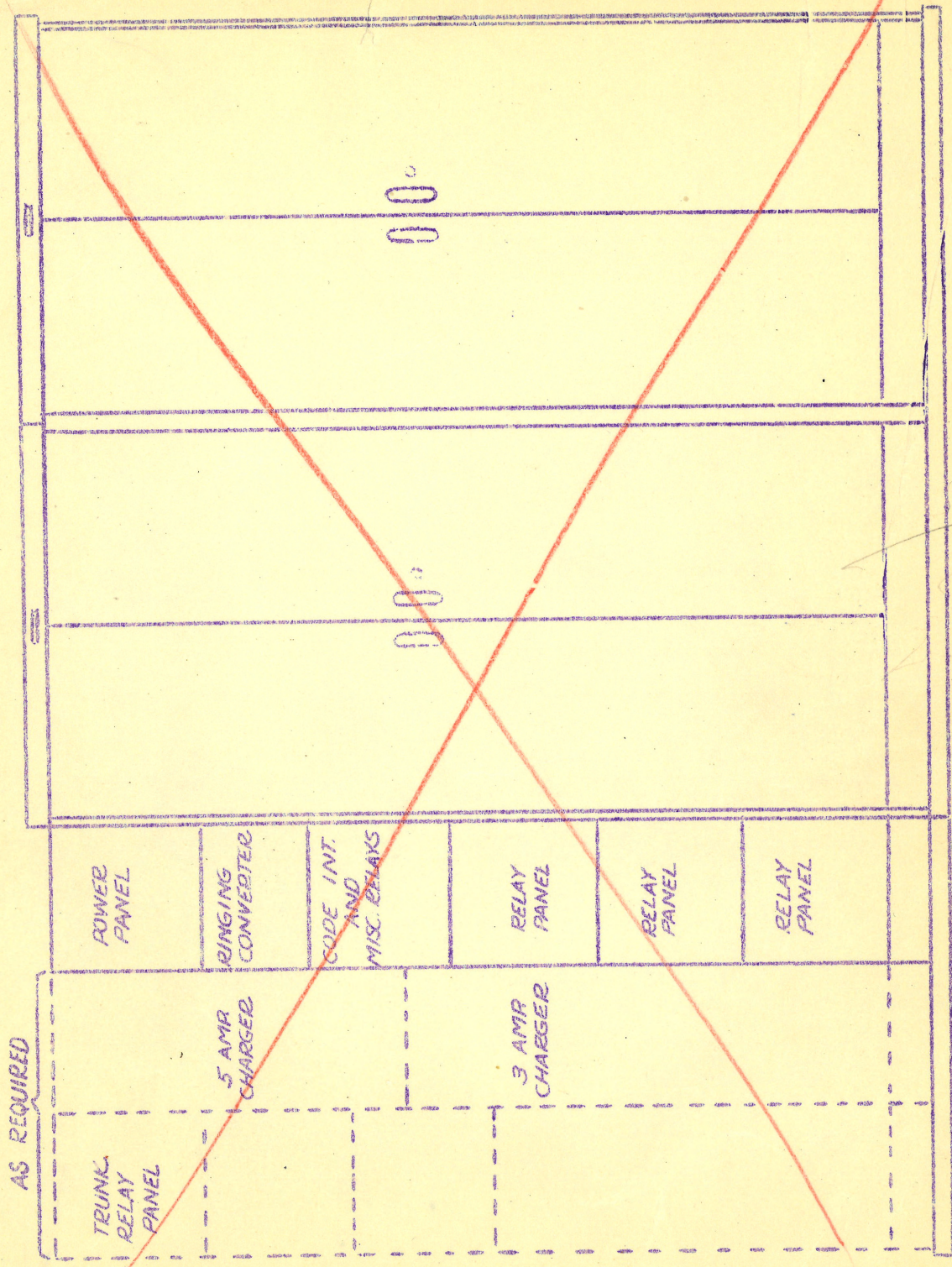
ALL RELAY CX-30  
EXCHANGE UNIT  
FRONT VIEW



ALL RELAY CX-60  
EXCHANGE UNIT  
FRONT VIEW

E. J. NONNEMACHER

80-9930  
80-9931  
SKETCH-F  
REV. 6-1-39



ALL-RELAY EXCHANGE UNIT  
FRONT VIEW



