INSTALLATION PROCEDURE ALL-RELAY SWITCHBOARDS

CX-10

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-10 type and gives information required to install the switchboard. It contains points to be observed with regard to the exchange quarters.

The equipment for the CX-10 type switchboard is provided with two mounting arrangements, one for interior use, the other for mounting on a pole fixture. The switchboard framework and cabinet and the battery rack arrangement are the same for both the interior type unit and for the unit arranged for mounting on a pole fixture. Space has been provided on the equipment layout to provide for a cross-connect terminal arrangement, together with the mounting arrangement for the protectors.

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 not be used 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.

The above descriptive material covers generally the arrangement for the CX-10 type switchboard, but it applies more specifically to the unit arranged for an interior installation. In the event that the unit is to be mounted on a pole fixture all of the regular precautions pursuant to good judgment should be used in order to avoid subjecting the switchboard equipment to adverse conditions such as climate or rough handling.

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). Equipment drawings and/or floor plan

   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

   e). Circuit descriptions

   f). Circuit drawings

   g). Relay adjustment data

   h). Equipment drawings and /or floor plan

   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 The North Electric Mfg. Company should be advised.

Drawings illustrating the standard wiring diagram and circuit conventions are attached to the Installation Procedure and the Maintenance Notes. The convention 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 in the case of an interior installation, to see that they conform to the floor plan supplied and if there should be an 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 The North Electric Mfg. Company 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, The North Electric Mfg. Company should be notified before any work is done.

5. EQUIPMENT UNIT SIZES

The CX-10 Switchboard Unit is contained in a cabinet 54" high, 36" wide, and 12" deep. An auxiliary frame 18" wide and 12"deep is mounted on the side of the switchboard unit with four separate shelves, with space thereon for mounting the switchboard battery. The auxiliary battery rack just described may be located on either the right or left hand side of the switchboard unit and it is arranged that in addition to the regular height of 51" for the battery rack, space is also allowed for the line terminals and the protectors to be mounted thereon.

For the pole mounting arrangement all of the equipment is enclosed in a weather-proof metal cabinet 60" high, 60" wide and 18" deep. The auxiliary battery frame, together with the line terminal and protectors, are included within the metal cabinet. Space is allowed within the weather-proof metal cabinet for removing the switchboard cover in order to gain access to the terminals on the top of the regular switchboard unit.

Both the front and rear of the pole mounted cabinet are equipped with a metal drop leaf which may be raised when the doors are open. This leaf, in combination with the open doors, forms a port for protection from rain or snow if it is necessary to open the cabinet during inclement weather.

6. ARRANGEMENT OF THE EQUIPMENT

The main switchboard unit for the CX-10 is arranged for, as the name applies, ten lines of equipment including trunks. Space is provided for an ultimate of three links. The charger, the power panel together with the various meters, the time switch, and the vibrating type ringing generator are also mounted on the framework within the regular switchboard cabinet.

In addition to the tone equipment and the code interrupter relays, space is provided for mounting limited amount of auxiliary equipment on the regular switchboard frame, with this equipment being in the form of trunks, paystations, or grounded line equipment as specified.

7. PACKING FOR SHIPMENT

The switchboard unit, auxiliary battery frame, 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.

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.

9. ERECTING

The switchboard unit and the auxiliary framework unit should be placed in position in accordance with the proposed equipment layout. Bolts are provided for accurately fastening the auxiliary framework to the switchboard unit.

In the case of an interior installation, if it is found that the floor is too irregular to permit a good horizontal alignment of the units, the base of the switchboard unit should be shimmed in order to accomplish the desired alignment. 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 purpose. The material required will be purchased locally.

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. SUPPORTING SWITCHBOARD AND FRAMEWORK

If it is found, on completion of the work up to this point, that the switchboard is 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 unit or auxiliary frame.

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.

11. 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.

12. 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 or at a point easy accessible to the installation. 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 made accessible, the customer must be notified at once.

13. INTER-UNIT 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 inter-connecting will be connected to the terminals of the unit at one end, the loose ends coiled up suitably for shipping. When possible, the loose ends will be formed out at the factory.

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

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, N.E.M. Co. should be informed at once.

The installer should 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 positive lug on the battery.

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

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.

14. 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 N.E.M. Co.

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.

15. 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
Self-regulating Type

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.

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.

When the batteries and charger equipment are first installed, the condition of the batteries should be checked. If the terminal voltage of the batteries has fallen much below 2 volts per cell, care should be taken in starting the charger to see that it is not too heavily loaded. If necessary the charger should be set for minimum charge voltage by setting at "1 Yr.", "New - Low - 1" and with the A.C. Line tap at "125 V." until the battery is partially charged. In case of extreme discharge of the battery it may even be necessary to charge thru some resistance such as several lamp bulbs in parallel. The charger should not be operated at more than 30% over its rated capacity for a period greater than 3 hours. After the batteries have been charged to 2 volts per cell or better, the charger can be readjusted to its proper setting and any charge limiting resistances removed.

The operation of the charger under two separate settings is shown on the test sheet accompanying the charger. The first of these setting is recommended for normal operation.

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 line terminals, 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 the Units digits on each link accompanied by the prefixed 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.

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 is made in both directions. If the tests 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 released and the line put on lockout.

7. 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 line terminals, with a subset arranged to connect to the terminals. 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 all miscellaneous features should now be made. This will include fuse alarm, grounded line alarm and line lockout.

16. 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.

17. 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, N.E.M. Co. should be advised. If readjustment has been made by the installer, N.E.M. Co. 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 N.E.M. Co.

HGD:MH

COLOR CODE FOR CABLES

Pairs 1-20

		Color	Abbreviation	Mate	Abbreviation
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

Color	Abbreviation	Mate	Abbreviation
As in pairs 1-20	21C to 40C	red	21M to 40M

Pairs 41-60

Color	Abbreviation	Mate	Abbreviation
As in pairs 1-20	41C to 60C	red-white	41M to 60M

Pairs 61-80

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

Pairs 81-100

Color	Abbreviation	Mate	Abbreviation
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

	Color	Abbreviation	Color with Tracer	Abbreviation	Note	Abbreviation
Triple 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 wire appearing in cables are spares.

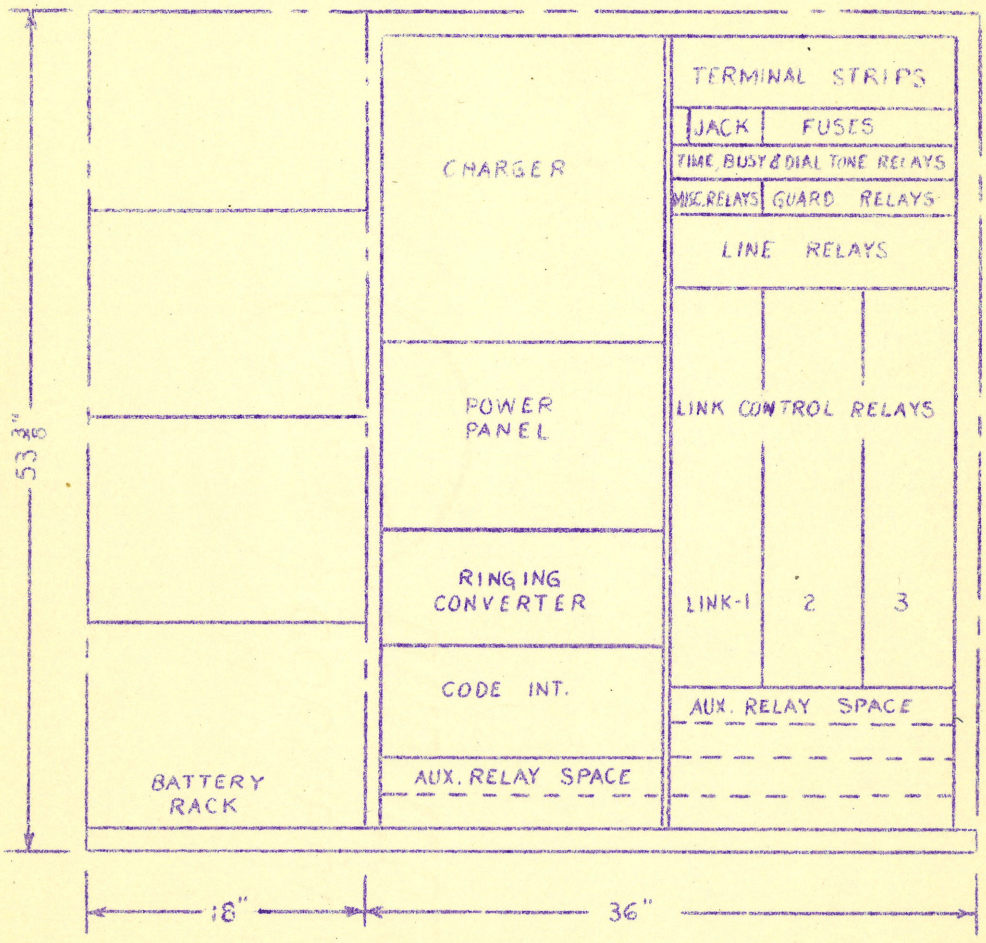
Note 2 - -

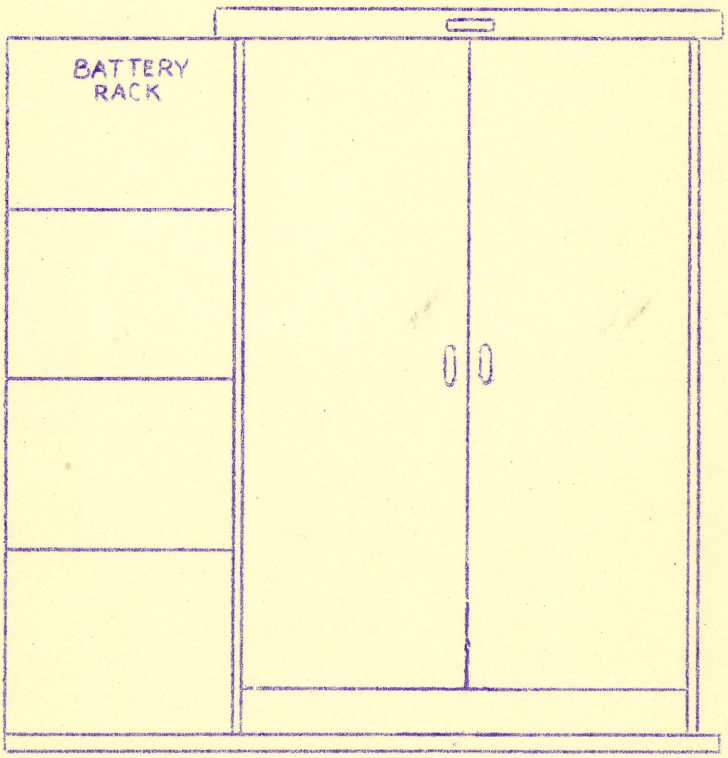
On inter-unit cross-connecting plans, the abbreviations shown will be used to indicate the sequence in which the conductors of the cables used are connected.

HGD:MH

BO - 9940
BO - 9941
SKETCH - A

ALL RELAY CX - 10
SWITCHBOARD UNIT
10 LINES - 3 LINKS





ALL-RELAY CX-10
EXCHANGE UNIT
FRONT VIEW

80-9940
80-9941
SKETCH-C

ALL-RELAY CX-10
WEATHER PROOF METAL CABINET
FRONT VIEW