LINE DISTRIBUTING FRAME AND BLOCK RELAY FRAMES
CROSS CONNECTIONS
NO. 1 CROSSBAR OFFICES

1. GENERAL

1.01 This section covers general information relative to the placing of cross-connections on line distributing frames and block relay frames and removal of cross-connections on block relay frames in No. 1 crossbar offices.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Supplementary Information: Information concerning cross-connections is also covered in Bell System Practices as follows:

(a) Sections 069-120-801 and 069-140-811 covering general information regarding running of cross-connections and soldering.

(b) Section 216-719-301 covering the functions of various terminals and the methods of changing cross-connection assignments for the block relay and line distributing frames.

2. TOOLS AND MATERIALS

2.01 Soldering Tools and Materials as required.

2.02 P-Long-Nose, 6-1/2" Pliers.

2.03 R-2291 Short Nose Skinning Pliers. (For K-type wire.)

2.04 5" Diagonal, "V" Notch Pliers.

2.05 The following colors of 22-gauge Type "K" Wire as required.

Black	(P-357221)
Red	(P-357222)
Green	(P-357223)
White	(P-357224)
Brown	(P-357225)

2.06 P-26991 Black 22-gauge Type "J" Sleeved Strap Wire.

2.07 L-20-S Brown Wire.

2.08 L-22-P Black and White Wire.

2.09 Table Type Wagon and Wire Spool Rack per ED-90595-01.

3. COLOR AND TYPE OF WIRE

3.01 Line Distributing Frame:

(a) Use L-22-P wire where paired cross-connections are required. Use white for S punchings in the front row (the row farthest from the fanning strip) and black for M punchings in the rear row (the row nearest the fanning strip).

(b) Use L-20-S wire where individual cross-connections are required.

3.02 For straps on terminal strips use black Type "J" sleeved strap wire as covered in Part 5, covering strapping of punchings.

3.03 Block Relay Frame: Use the No. 22 gauge Type "K" wire for cross-connecting between the NF and HF, XF, TF, RF or JF punchings and between the NC and HG or JC punchings:

Color	NF or NC Terminal Strip Nos. Ending in	Row
Brown	4 or 9	Top
Red	3 or 8	2nd
Black	2 or 7	3rd
Green	1 or 6	4th
White	0 or 5	Bottom

For cross-connections between NF and ANF punchings use the color wire indicated in the table above for the particular row of NF punchings. For cross-connections from the ALF to the proper HF, XF, TF or RF punchings use the same color of wire used for the cross-connection between the NF and corresponding ANF terminals.

4. METHOD OF RUNNING CROSS-CONNECTIONS

Line Distributing Frame

4.01 Single-Sided Frames - cross-connections shall be run in the following manner:

(a) Cross-connections Run from Vertical Terminal Strips to Horizontal Terminal Strips (Not Illustrated): Run the

cross-connections from the vertical terminal strip through the inverted V ring to the proper horizontal shelf, through the V ring on that shelf and then along the horizontal shelf behind the retaining pins to the proper horizontal terminal. In some cases it may be easier to run the cross-connection by starting at the horizontal terminal strip, along the horizontal shelf to the proper vertical and then to drop the cross-connection down to the vertical terminal strip, passing the cross-connections through the proper V rings.

(b) Cross-connections Run Between miscellaneous and Subscriber Line Horizontal Terminal Strips on the Same Shelf and Frame (Not Illustrated): Run the cross-connections through the fanning strip along the shelf behind the retaining pins to the other terminal strip, and through the fanning strip on that terminal strip.

(c) Cross-connections Run from a Miscellaneous Horizontal Terminal Strip to a Subscriber Line Horizontal Terminal Strip on Other Shelves on the Same Frame (See Fig. 1 Cross-connection 1): Run the cross-connection along the horizontal shelf behind the retaining pins through the nearest closed ring behind the miscellaneous horizontal terminal strip then up or down to the closed ring directly above or below, for the horizontal shelf having the proper

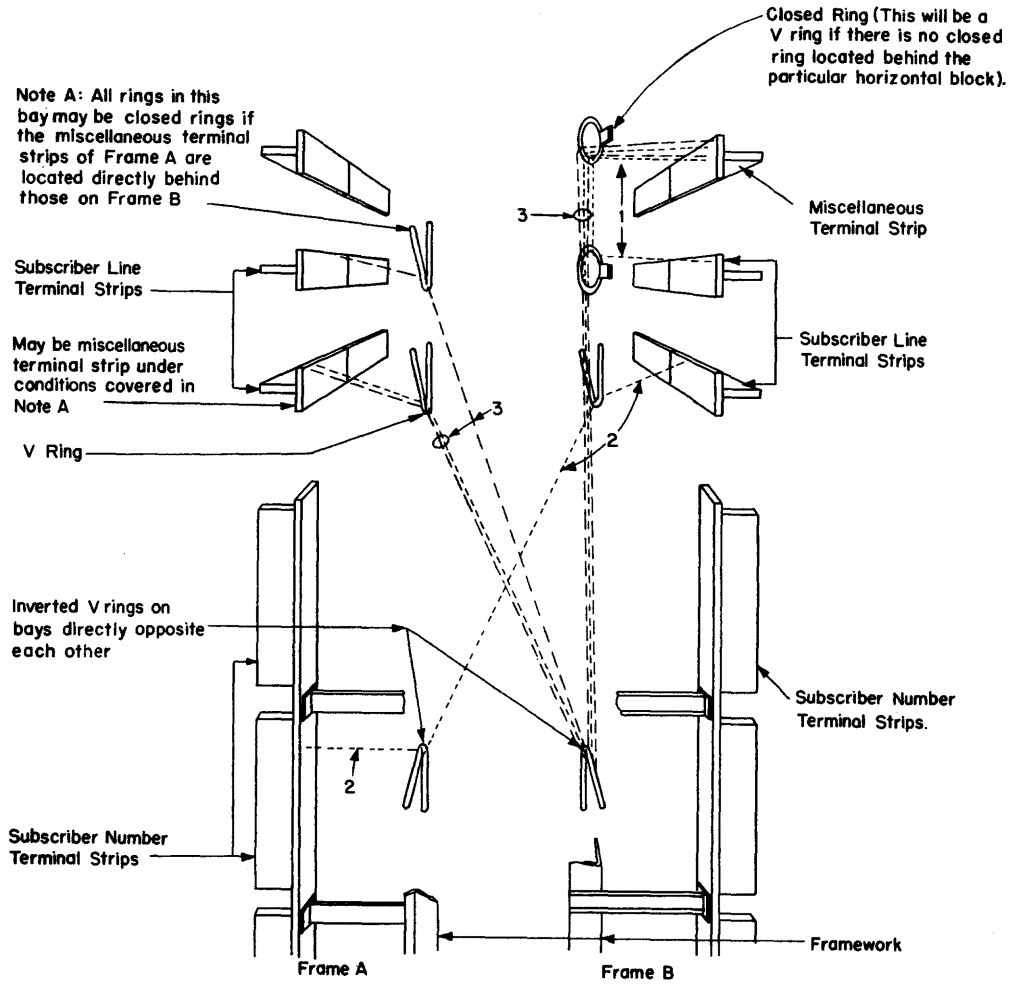


Fig. 1 - Line Distributing Frame - Method of Running Cross-connections from Miscellaneous Horizontal Terminal Strips to Subscriber Line Horizontal Terminal Strip on the Same Frame and on Two Back to Back Frames and from Subscriber Line Terminal Strip to Subscriber Number Terminal Strip on Two Back to Back Frames.

subscriber line terminal strip, through this closed ring and then along the shelf behind the retaining pins to the proper terminal strip.

4.02 Back to Back Frames - Run the cross-connections in the following manner:

(a) Cross-connections Run Between Terminal Strips on the Same Side of a Back to Back Frame: Run the cross-connections as covered in 4.01 (a), (b) and (c) for single-sided frames.

(b) Cross-connections Run from Vertical Terminal Strips on One of the Two Back to Back Frames to Horizontal Terminal Strips on the Other Frame. (See Fig. 1, Cross-connection 2): Run the cross-connections from the vertical terminal strip through the inverted "V" ring to the proper horizontal shelf, through the "V" ring on that shelf and then along the horizontal shelf behind the retaining pins to the proper horizontal terminal strip.

(c) Cross-connections Run from a Miscellaneous Horizontal Terminal Strip on One of Two Back to Back Frames, to a Subscriber Line Terminal Strip on the Other Frame. (See Fig. 1, Cross-connection 3): Run the cross-connections along the horizontal shelf behind the retaining pins through the closed ring (or V ring) behind the miscellaneous horizontal terminal strip down to the inverted V ring opposite the vertical subscriber number terminal strip in the same bay on the same frame as shown in Fig. 1, across and through the V ring (or closed ring if the miscellaneous terminal strips on frame A are located directly opposite those on frame B), on the horizontal shelf in which the subscriber line terminal strip on the other frame is located, then along the shelf behind the retaining pins to the proper terminal strip.

Caution: In no case run a cross-connection directly across or diagonally across from the horizontal terminal strip on the frame to the horizontal terminal strip on the other frame, since this may interfere with running cross-connection from vertical to horizontal terminal strips.

4.03 Double-Sided Line Distributing Frame: Except for the amount of slack the cross-connections shall be run as covered in Section 069-120-801.

4.04 Amount of Slack: Provide cross-connections with approximately two inches of slack and dress the slack straight back at the rear of the subscriber line horizontal terminal strips. In pulling through closed rings, provide enough slack to allow the cross-connections to lie flat on the shelf.

Block Relay Frame

4.05 In running cross-connections at the block relay frame run only one wire to any one punching. Where there are 10 or less line choices and the punchings are multipled to take care of this condition always run the shortest vertical lead. However, if no punching is available in a vertical row, run the cross-connection diagonally as shown in Fig. 2 to the nearest available punching in an adjacent or near-by row in the same number group. The limits of a number group are indicated by the red tipped pins and the red line stenciled on the fanning strip. Do not run cross-connection across this line.

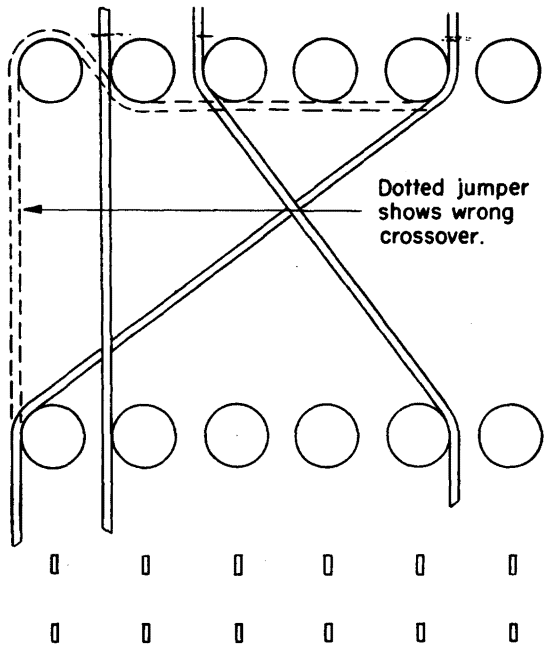


Fig. 2 - Block Relay Frame - Method of Running Cross-connections which Cross Over from One Vertical Row to Another Vertical Row of Punchings.

4.06 Cross-Connection Fields of Block Relay Frame:

(a) In running cross-connections from the common cross-connecting field to the terminal strip, directory number units digits 5 to 9, located above this field, connect to the NC and NF terminals first.

(b) In running cross-connections from the common cross-connecting field to the terminal strip, directory number units digit 0 to 4, located below this field, connect to the common field terminal first. The cross-connection wire should be held firmly in one hand to skin the wire in a downward direction. However, whenever possible, use the skinning hook.

(c) When working on the block relay frame use the R-2291 short nose skinning pliers and remove as little insulation as practicable to minimize the possibility of crosses with adjacent terminals. Removal of 5/8 inch of insulation for a soldered connection and 1-1/2 inches of insulation for a solderless connection will be sufficient. Engage the wire, at the point where the insulation is to be removed, in the notch back of knurling of pliers. Crush insulation by firmly closing pliers exercising care to avoid flattening of wire due to excess pressure. Also, keep surface of jaws in a plane parallel to wire to avoid nicking. Release pressure slightly, slide pliers toward end of wire, thereby removing insulation.

Caution: Always pull downward on the wire as a safety precaution in the event that a wire breaks or a tool slips unexpectedly.

4.07 Soldered Connections on Block Relay Frame: The following description covers the method of running the cross-connection starting at the top No. 220 type terminal strip. Determine the color of the "K" type wire to be used on NF or NC terminal strip from the table in 3.03.

4.08 Crush and remove the insulation from the end of the wire using the R-2291 short nose skinning pliers.

4.09 Bring the insulation up the left side of the terminal to the top notch, pass the wire through the top notch, down the right side, through the bottom notch, up the left side and through the top notch again where it is broken off by pulling out and downward. On twin notch terminals the top or bottom notch may be a back notch.

4.10 The connection as described in 4.09 should be sturdy enough without soldering at this time to permit skinning the lower end of the wire while it is held taut. Measure the length of skinner required and skin the wire as outlined in 4.11.

4.11 Always skin the wire in a downward direction. Pull the wire when removing insulation taut against the bottom rear edge of the skinning hook. (Where a lead is connected to a bottom punching first bring the lead behind the skinning hook, measure the length of wire required and pull the cross-connection taut around the top of the skinning hook.)

Note: The details mounted midway between the top and bottom of the common field and stenciled with the first number of the particular hundred series are known as skinning hooks. The skinning hook should be used to aid in skinning the longer cross-connections by bringing the wire behind the skinning hook and skinning in a downward direction in front of the skinning hook.

4.12 Draw the wire along the left side of the lower punching (without slack but not taut) under and through the bottom notch, up the right side and through the top notch and cut the wire end off using diagonal pliers. On No. 221 type terminal strips having twisted terminals, the wire ends should be cut off to prevent bending terminals. The insulation should end at the bottom notch. On twin notch terminals the top or bottom notch may be a back notch.

4.13 Solder cross-connection on both terminals.

4.14 Solderless Connections on Block Relay Frame: The following description covers the method of running the cross-connection starting at the top No. 220 type terminal strip. Determine the color of the "K" type wire to be used on the NF or NC terminal strip from the table in 3.03.

4.15 If the terminals to be used have been previously occupied by a soldered cross-connection, remove the excess solder from them before proceeding to run new cross-connections.

4.16 Remove the insulation from the end of the wire using the R-2291 short nose skinning pliers.

4.17 Bring the insulation up the left side of the terminal to the top notch, pass the wire through the top notch, down the right side, through the bottom notch, up the left side, through the top notch thereby completing one wrap around the terminal. Continue wrapping for another complete turn, placing each turn in the notch so that they are parallel on the terminal, maintaining a steady tension on the wire while wrapping around the terminal in order to insure a good contact between the edges of the terminal and the wire. After coming through the top notch on the completion of the second wrap, break the wire off by pulling out and downward. On twin notch

terminals the top or bottom notch may be a back notch. Exercise care to avoid crossing other terminals while placing wire.

> Caution: Do not attempt to make the wrapping tighter by squeezing the wire against the side of the terminal with pliers, as this procedure tends to release the grip of the wire in the notch.

4.18 Measure the length of skinner required and remove the insulation using the R-2291 short nose skinning pliers as outlined in 4.11.

4.19 Draw the wire along the left side of the lower terminal (without slack but not taut) under and through the bottom notch, up the right side and through the top notch, down the left side and through the bottom notch thereby completing one wrap around the terminal. Continue wrapping for another complete turn, placing each turn in the notch so that they are parallel on the terminal, maintaining a steady tension on the wire while wrapping around the terminal in order to insure a good contact between the edges of the terminal and the wire. After coming through the bottom notch on the completion of the second wrap, cut the wire end off using diagonal pliers. On No. 221 type terminal strips having twisted terminals, the wire ends should be cut off to prevent bending terminals. On twin notch terminals the top or bottom notch may be a back notch. The insulation should end at the bottom notch.

> Caution: Do not attempt to make the wrapping tighter by squeezing the wire against the side of the terminal with pliers, as this procedure tends to release the grip of the wire in the notch.

4.20 The procedures in 4.14 to 4.19 cover the method of running the cross-connection starting at the top terminal. If the connection is started at the bottom terminal it would be necessary to make 2-1/2 turns around the bottom terminal to insure breaking off the wire in a downward direction.

4.21 Crossovers: When it is necessary for cross-connections to cross over from one vertical row of punchings to another vertical row of punchings the crossover should be made between the rows of pins as shown in Fig. 2 or between fanning strips. Be sure to remain within the proper number group (the limits of the number group are indicated by red-tipped pins and by a red line stenciled on the fanning strip).

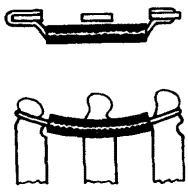
4.22 When placing or removing cross-connections perform the work of connecting the "F" and "C" cross-connections of each line as nearly simultaneously as possible. That is, place or remove the "F" cross-connection and the associated "C" cross-connection, at the same time rather than place or remove several "F" cross-connections before performing the same operation on the "C" cross-connections. This procedure is desirable because a marker testing a line with only one cross-connection brings in the trouble indicator.

4.23 Removal of Block Relay Frame Cross-connections: When removing either soldered or solderless cross-connections on block relay frames, trace the cross-connection from the directory number to a point midway between the NC or NF terminal and the common field terminal and cut the wire using diagonal pliers. Remove the cut wire by holding the free ends and unwrapping the wires from the terminals taking care not to bend terminals or, if located on the upper terminal strips, not to damage twenty block relays. Use soldering iron, if necessary, to heat soldered connections to facilitate removing the wire, taking precautions to prevent splashing solder. Remove excess solder from the terminals with the soldering iron.

5. STRAPPING OF PUNCHINGS ON INDIVIDUAL TERMINAL STRIPS

5.01 General: No attempt is made to cover in this section information for strapping of a permanent nature, such as straps at the base of the punching. The information is limited to strapping which is subject to frequent change after turnover.

5.02 Where two or more punchings are to be connected by "common wiring," use sleeved straps as shown in Fig. 3.



Strap at Notch
Nonadjacent Punching
in Same Line

Fig. 3 - Straps on Line Distributing Frame

5.03 Run sleeved straps so that:

(a) The strap in no case pulls tightly against other punchings.

(b) Sleeving extends as close to the terminal as necessary to prevent other punchings from coming in contact with the bare portion of the straps.