CROSS-CONNECTION METHODS MARKERS, TEST FRAMES AND TRAFFIC REGISTER DISTRIBUTING FRAMES NO. 1 CROSSBAR OFFICES

1. GENERAL

1.01 This section covers general information relative to the placing of cross-connections on markers, test frames and traffic register distributing frames.

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 jumpers and soldering.

(b) Division 216 sections covering the functions of various terminals and the methods of changing cross-connection assignments for markers, test frames and traffic register distributing frames.

2. TOOLS AND MATERIALS

2.01 Soldering Tools and materials as required.

2.02 Bell System 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 No. 275A, 298A or 322A (make-busy) Plugs as required.

2.06 P-314952 22-gauge Bare Strap Wire.

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

2.08 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)

2.09 L-20-S Brown Wire.

2.10 L-22-T White, Black and Red Wire.

2.11 Table-type Wagon and Wire Spool Rack per ED-90595-01.

3. COLOR AND TYPE OF WIRE

3.01 General: For straps on terminal strips use black type "J" sleeved strap wire as covered in Part 5 covering strapping of punchings. For cross-connections between punchings on different terminal strips use 22 gauge Type "K" wire.

3.02 Traffic Register Distributing Frame: Use L-22-T wire as follows:

White for MR or H punchings in the front row (the row farthest from the fanning strip).

Black for SOF or E punchings in the middle row.

Red for RT or B punchings in the rear row (the row nearest the fanning strip).

3.03 Originating Marker Cross-Connections: Use No. 22 gauge Type "K" wire as follows:

General

(a) Except for straps, and except for the terminal strips A and B (see (h) below) use the following color code for terminal strips having five rows of punchings and for the lower five rows of terminal strips having six rows of punchings.

Green for row 5 (top)
Brown for row 4
Red for row 3
Black for row 2
White for row 1 (bottom)

If two or more punchings ordinarily having different color codes are strapped together and served by one cross-connection, the color of the cross-connection wire shall correspond to the row to which it connects.

Route Relay Bay

(b) For all cross-connections on terminal strip OF-PC except straps, and on terminal strip TR use:

White for OF
Black for PC

(c) On the RA terminal strip of the route relay bay use:

White for row 1 punchings RA00 to 79 in bottom row.
White for punchings RA80 to 99 in the top row.
Black for punchings CG0 to 36 in the top row.
Red for INTC-RC punchings 0 to 19 or INTC-RC punchings 20 to 39 in the top row.

(d) For all cross connections from the RC and PRC punchings use:

Brown from RC punchings 00-99 on lower RC terminal strip to points on terminal strip J INTC.
Brown from PRC punchings 100-129 on upper and lower RC terminal strips to RC punchings 00-99.
White from RC punchings 100-119 on upper and lower RC terminal strips to code points.
Black from RC punchings 120-129 on upper and lower RC terminal strips to code points.
Red from PRC punchings 100-129 on upper and lower RC terminal strips to INTC RC.

(e) On terminal strips GC and upper RC of bay R8 cross-connections to CG0, CG1 and CG2 use colors as determined by the rows of cross-connection terminal strip C. Other cross-connections are the same as other route relay bays.

Common Bays

(f) For cross-connections from the sixth (top) row of terminal strip upper C to terminal strip CG use white. The color code for the bottom five rows of this terminal strip should be in accordance with (a) above.

(g) For cross-connections from D to SW on terminal strip D use bare strap wire when possible and otherwise white.

(h) For all cross-connections on terminal strips A and B, use white except for straps and except connection OP-A to PA which shall be green, and P to PC which shall be black.

(i) For all cross-connections on the G terminal strip use:

White for row 3 (top)
Green for row 2
Brown for row 1 (bottom)

If these rows are connected to rows on terminal strips GP in the same vertical row use colors according to the rows on terminal strip G, the multiple being made at the GP terminal strip.

(j) For all cross-connections on the GP terminal strip except straps use:

Red for row 3 (top)
Black for row 2
White for row 1 (bottom)

3.04 Incoming Trunk Test Connector Frame: Use No. 22 gauge Type "K" wire as follows:

Brown for row 4 (top)	PT Punchings
Red for row 3	CP Punchings
Black for row 2	VT Punchings
White for row 1 (bottom)	G Punchings

3.05 Incoming Trunk Test Frame: Use No. 22 gauge Type "K" wire for cross-connections between terminal strips on this frame as follows:

Color	Terminal	to	Terminal
Red	A Opr.		Misc. Comp. Res.
White	A Non-Opr.		" " "
Black	L " "		" " "
Brown	L " " R1		" " "
Brown	CTG		TL and BL
Green	L Opr.		L Opr. Comp. Res.

3.06 Terminating Marker Cross-Connections:

(a) In offices arranged for multi-office use, use the color of 22 gauge Type "K" wire as follows on terminal strip B, D, the left-hand section of F and the three right-hand sections of H.

Green for row 5 (top)
Brown for row 4
Red for row 3
Black for row 2
White for row 1 (bottom)

Note: The above color code also applies to the following terminal strips on single office arrangements not arranged for multi-office use: B, the ST and HB sections of D, H and the right-hand section of E.

(b) On terminal strips E and F use white for cross-connections from AB to LJ and black for cross-connections from AB to G.

(c) White shall be used for cross-connections not specified above.

3.07 Tandem Marker Cross-Connections: Use No. 22 gauge Type "K" wire as follows:

(a) With the exception of straps on the punchings, use the following color code for all connections on the two right-hand sections of terminal strip A; for all connections on terminal strips H, M, P and R; for all connections except the extreme left section of terminal strip K; for all connections on the bottom five rows on the extreme left section of terminal strip J; for all connections from terminal strip F to A, M, P and R and for all connections on terminal strip H, E, F, K, M and P on supplementary bay.

White for row 6 (top)
Green for row 5
Brown for row 4
Red for row 3
Black for row 2
White for row 1 (bottom)

(b) On the three left-hand sections of terminal strips A and B, use white except on connections O-PA to PA which shall be green, and P to PC which shall be black.

3.08 Terminating Sender Test Frame (Except Tandem which has no Cross-Connections): Use No. 22 gauge Type "K" wire for cross-connecting between the PF and P punchings as follows:

Color	Row in PF Terminal Strip
Green	5 (top)
Brown	4
Red	3
Black	2
White	1 (bottom)

4. METHOD OF RUNNING CROSS-CONNECTIONS

General

4.01 Not more than 2 wires shall be connected to any one punching.

Traffic Register Distributing Frames

4.02 The jumpers shall be run as specified for single-sided line distributing frames in the Division 216 section covering the cross-connection methods - line distributing frames and block relay frames - No. 1 crossbar offices.

Cross-Connection Fields of Originating and Terminating Markers and Incoming Trunk Test Connector

4.03 Cross-connection shall be run from the common cross-connecting field to the terminal strips located immediately above and below the common fields as follows. Connect the wire to the top terminal first. Bring the insulation up the left side of the punchings 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. Break it off by pulling out and downward. On twin notch punchings the top or bottom notch may be a back notch.

4.04 The connection as described in 4.03 should be sturdy enough without soldering at this time to permit skinning the lower end of the wire by pulling it taut downward. 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 the 209 type terminal strips having twisted terminals, the wire should be cut off to prevent bending terminals. Solder the cross-connection on both terminals. The insulation should end at the bottom notch. On twin notched terminals the top or bottom notch may be a back notch.

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

4.05 Terminating Marker Frames: Where the marker serves number groups having more than 20 HB relays, and it is necessary to run a cross-connection from the HB punching to one of the NG-HB20 to 24 punchings, or when the marker serves a multi-office terminating unit where there are more than 10 number group connectors in each office and it is necessary to run a cross-connection from the ST punching to an NG-ST punching above 9, the crossovers should be made between the rows of pins as shown in Fig. 1.

4.06 All Marker Frames: Where a group of adjacent punchings in the same vertical row (i.e. a row perpendicular to the fanning strip) are to be connected to one cross-connection point in the cross-connection field, run the cross-connection wire first to the farthest punching in the group, strip the end bare and connect as a strap to the remaining punchings of the group.

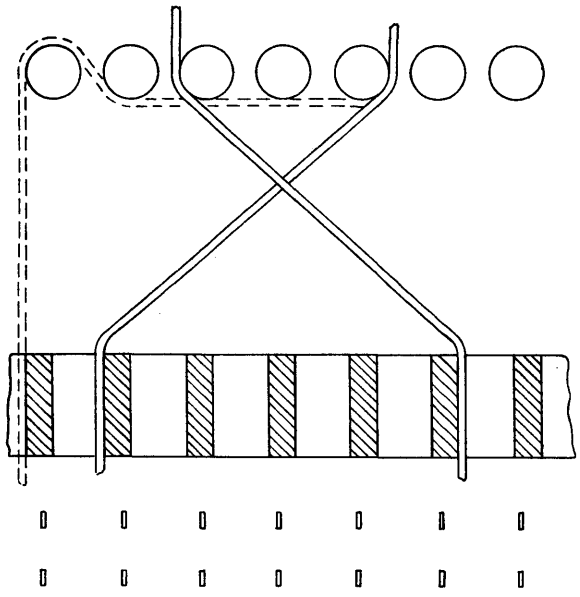

Fig. 1 - Terminating Markers - Method of Running Jumpers Cross Over Where the Marker Serves Number Groups Having More Than 20 HB Relays

4.07 Where two non-adjacent punchings in the same vertical row are to be connected to one cross-connection point in the field run separate cross-connections from the common punching in the field to each of the punchings to be connected.

4.08 Where more than two non-adjacent punchings in the same vertical row are to be connected to one cross-connection point in the field, run two separate cross-connections from the common punching in the field to the furthest and nearest punchings and strap these with bare or sleeved strap wire as shown in Fig. 2 to the other terminals to be connected. However, on non-adjacent terminals on terminal strip C of the originating marker, run separate cross-connections from the common punchings in the field to each of the punchings to be connected.

4.09 Where cross-connection is necessary between the field and terminals not in the same vertical row, cross-connections shall be run from the field to one of the terminals and from this terminal through the fanning strip to the other terminal as shown in Fig. 3. Where the number of cross-connections involved is such as to cause congestion if all wires are passed through the inner fanning strip holes, the outer set of holes also may be used. However, on adjacent or non-adjacent rows on terminal strip C of the originating marker, run separate cross-connections from the common terminals in the field to each of the terminals to be connected.

4.10 Test Frames: Cross-connections between punchings in different terminal strips shall be run from the punching on one terminal strip through the associated fanning strip and then through the fanning strip of the other terminal strip to the desired punching. Where the cross-connection is to be made to punchings in different vertical rows of a terminal block, the cross-connections between punchings in non-adjacent rows shall be run through the fanning strip as shown in Fig. 3. In the case of incoming trunk test connector frames, strapping is permitted with bare wire between adjacent punchings not in the same vertical row (Figs. 2 and 3).

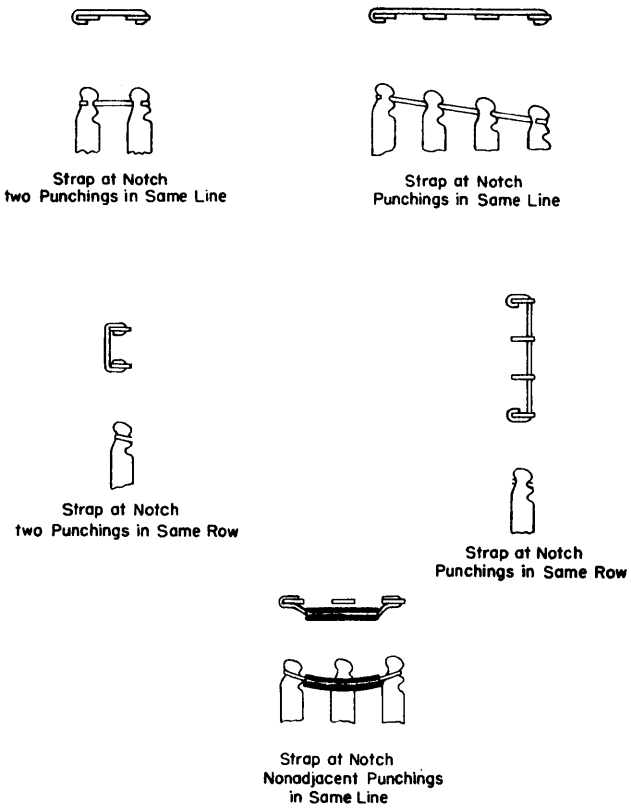

Fig. 2 - Straps on 208, 217 and Similar Type Terminal Strips

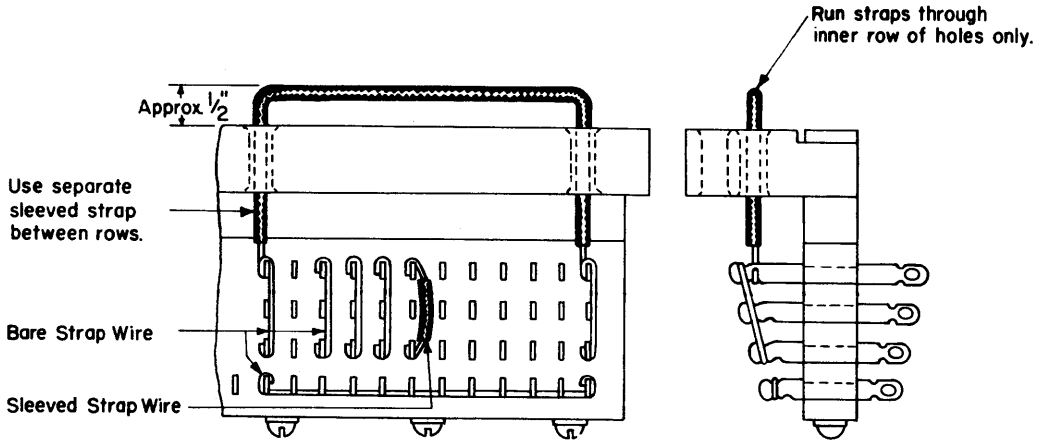

Fig. 3 - Straps Connecting Rows of Strapped Punchings

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 straps as shown on Fig. 2.

5.03 Bare strap wire may be used to connect any number of adjacent punchings in the same vertical row. Sleeved strap wire may be used to connect non-adjacent punchings when necessary to avoid more than two wires on one punching. (See exception 4.08.) On incoming trunk test connector frames bare strap may also be used for connecting adjacent punchings not in the same vertical row (see 4.10).

5.04 Run sleeved straps so that

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

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

6. CONNECTING WIRES TO PUNCHINGS

Notched Punchings

6.01 On single notch punchings (either with or without back notch for breaking off wires) draw the wires up into the connecting notch and bend over at an angle of 30° to 45° flat against the upper or right-hand side of the punching as shown on Fig. 4.

6.02 On double notch punchings, connect the wires as shown on Fig. 4, using one complete turn of bare wire where the wire approaches at right angles to the terminal and 1-1/2 turns where it approaches parallel to the terminal. When possible, wrap the wires around the punching in a clockwise direction.

6.03 On twin notch punchings, make connections as shown on Fig. 4. Where more than one set of leads are to be connected, supplementary information will specify which of the two notches is to be used for each set of leads. Where only one set of leads is required, connect them in the outer notches unless it is necessary to reserve these notches for strapping subject to change in service.

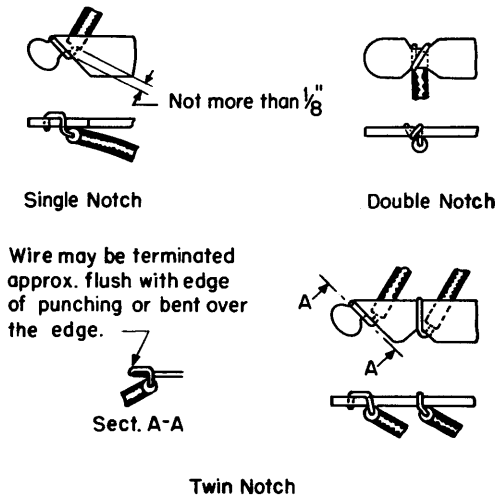

Fig. 4 - Connecting and Soldering Wires to Notched Punchings.