CIRCUIT DESCRIPTION

CD-3H120-01
ISSUE 2A
APPENDIX 3D1
DWG ISSUE 5D1
DISTN CODE 7T11

7

ELECTRONIC SWITCHING SYSTEMS

NO. 3

15A REMREED GRID
CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 Superseded	Superseded by
App Fig. 1	App Fig. 1 (Option W) and App Fig. 2 (Option X)

D. Description of Changes

D.1 The 296C-1D code switches used in the 15A remreed grid have been redesignated 296D-1D and redesigned to eliminate the external straps previously required to complete the PNPN connections. The redesign eliminates all front terminals associated with the control circuitry on each input switch.

D.2 Two rear terminals, R217 and R317, previously not connected to the circuit, have been activated and provide access to the cathodes of the PNPNs.

D.3 Ground-start and loop-start option designators have been added to FS 2 to clarify the strapping options. The reference to ground-start and loop-start options in Circuit Note 104 has been eliminated.

F. Changes in CD Section I

F.1 In 2.01 the designation "296C-1D" has been changed to "296D-1D."

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ELECTRONIC SWITCHING SYSTEMS

NO. 3

15A REMREED GRID CIRCUIT

CHANGES

D. Description of Changes

D.1 Separate node lead connections were established by bringing out the input node lead from each 296C-1D remreed switch to the rear terminal strip. This arrangement allows diodes to be connected in series with each input node lead to confine the effect of a false cross between a tip/ring path and a pulse path within the 15A grid. The diodes were added to Network Frame Circuit SD-3H901-01.

F. Changes in CD Section III

F.1 In 2, change Designation IN to INa and add to Meaning: a = (input switch) 01, 23, 45, 67.

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ELECTRONIC SWITCHING SYSTEMS

NO. 3

15A REMREED GRID CIRCUIT

CHANGES

D. Description of Changes

D.1 A lead, RPSP(0-7), has been connected from each input switch to the rear terminal strip. This enables the connection of a 533B diode between each lead and ground to provide protection from a false cross between a tip or ring and a pulse path lead within the 15A grid circuit.

F. Changes in Description of Operation

F.1 Add the following to Section I, 2.01:

The interrogate windings of 16 ferrods in a 6C switch are connected in series to form one row. The remaining 16 ferrods are arranged in a similar manner to form a second row. The readout windings of the two corresponding ferrods in each row are connected in series to form a column. Each 6C switch, then, has two interrogate rows and 16 readout columns. Corresponding columns of two 6C switches are connected in series to provide four interrogate rows and 16 readout columns per grid. The control windings of six ferrods in each 6C switch are arranged so that either ground-start or loop-start options may be used. The remaining 26 ferrods are internally arranged in the loop-start configuration.

F.2 Add the following after Section II, 2.05:

2.06 Each ferrod sensor in a 296-6C switch consists of a ferrite stick which is wound with a pair of control windings. The control windings are connected in series with the line circuit to

be supervised via the cutoff contacts. A single-turn interrogate winding and a single-turn readout winding are threaded through two holes in the center of the ferrite stick. The magnetic coupling between the interrogate and readout windings is determined by the magnetic state of the ferrite stick. When a subscriber goes off-hook a series loop is completed and current flows in the control windings of the ferrod, causing the ferrite stick to switch to a saturated magnetic condition. When no current flows in the control windings (subscriber on-hook), the ferrite stick is in a nonsaturated magnetic state.

2.07 To determine the state of a ferrod, a 500 mA bipolar pulse is applied to the interrogate winding. The negative half-cycle of the interrogate pulse is used to reset the ferrite stick to its maximum negative magnetic remanent state. The positive half-cycle of the interrogate pulse is used to readout the magnetic state of the ferrite stick.

2.08 When the control windings are not energized, the interrogate pulse changes the magnetic state of the ferrite stick near its center. This changing magnetic flux induces a nominal voltage of 200 millivolts in the readout winding. This readout is a logical 0.

2.09 When the control windings are energized, the interrogate pulse does not change the magnetic flux of the ferrite stick because it cannot overcome the state established by the control windings. Therefore, practically no voltage is induced in the readout winding (less than 25 millivolts). This readout is a logical 1. Thus, when an interrogate pulse is applied, the presence or absence of a readout pulse indicates whether there is current flow in the control windings.

F.3 Add the following to Section III, Functional Designations:

Designation	Meaning
RPSPa	Tip/Ring to Pulse Path Short Protection, a = (0, 1, 2, ... 7)

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ELECTRONIC SWITCHING SYSTEMS

NO. 3

15A REMREED GRID CIRCUIT

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The 15A remreed grid is the basic apparatus unit used to form the first stage of the No. 3 ESS switching network. Six 15A grids are mounted on the No. 3 ESS network frame (SD-3H901-01) and provide the means of establishing 2-wire metallic paths between lines/trunks and A-links. The 15A grids also provide ferrod sensors and remreed cutoff contacts for customer lines.

2. GENERAL DESCRIPTION OF OPERATION

2.01 A 15A grid contains four 296C-1D type and two 296-6C type remreed switch packs. Each 1D switch contains two 8-x-8 switches (e.g., 8-x-8 means eight inputs and eight outputs). Each 6C switch contains 32 2A-type ferrod sensors, 32 remreed cutoff crosspoints, and 32 contact-protection networks.

2.02 The 64 tip-ring outputs from the eight 8-x-8 switches are partially multipled within the 15A grid to form 44 tip-ring outputs. These outputs are partially multipled to the outputs from two other 15A grids to form 64 A-links which are cabled to the input terminals of the second-stage switches in the 15B grids. The pulse-path outputs from the first-stage switches are multipled in a manner identical to the tip-ring multiple and cabled to the pulse-path input terminals on the second-stage switches.

2.03 Control connections to the individual switches within a grid are made via a terminal field on the rear of the grid. Tip-ring terminals are accessed from front terminal fields on each switch.

2.04 Lines, trunks, and service circuits are the inputs to the 15A grid and A-links are the outputs.

2.05 To set up a 2-wire path through a grid, an input switch and an input level (stage I) must be selected. A selection of 1-out-of-8 levels on the A-link side of that switch is determined by the stage-II switch selection in the associated 15B grids. A high-current pulse is applied to the control path in order to close the remreed crosspoints in the talking path. Diodes, PNPNs, and node resistors are used to make the selections. The switch packages contain the switch-selection PNPNs, node resistors, and level-selection diodes. The remaining control circuitry is located on pluggable circuit packs separate from the grids.

2.06 Line ferrods in the 6C-type switches monitor the status of the lines via cutoff (CO) crosspoints connected across the tip-ring input paths. The ferrod is disconnected from the line during the talking phase of a call by the operation of the associated CO crosspoint.

SECTION II - DETAILED DESCRIPTION

1. PULSE PATH (FS 1)

1.01 The selection of a particular path through the 15A grid is a function of the selection of different PNPNs, both within the 15A grid and in the pulse selectors located in other parts of the network.

1.02 For example, if the lowest input level, lowest input switch, within a grid has been selected as an input and the lowest output switch in the corresponding stage-II 15B grid has also been selected as an output, the corresponding pulse path would enter switch IS0 on lead PA00, pass through the horizontal coils of eight crosspoints, then through a diode and switch select PNPN, through the vertical coils of eight crosspoints, and out of the switch on lead PC00. The path continues on this lead into COS0, through the coils of the cutoff crosspoint and the associated

diode, and exits on lead ILPN0 or ILP00, depending on whether the ferrod cutoff contacts are to be opened or closed. From there the path goes back through level and group selectors to the negative side of the pulser.

1.03 The selection of a particular switch within a grid is made by the selection of the PNPN within that switch. The selection of a particular PNPN is determined by the coincidence of a positive current source applied to a gate-select lead of the PNPN by decoder/drivers and by a near-ground potential applied to the 430-ohm node resistor from the node selector.

1.04 It is also possible for a current pulse to enter the grid on the same path (previously described in 1.02) and, upon leaving the cathode of the switch-select PNPN, to pass through a diode and exit the grid on lead F2GP.

1.05 To close a crosspoint there must be coincident current in the horizontal and vertical control windings. Current passing through only one winding will release that crosspoint. In the previous case, the current pulse passes only through the horizontal windings of eight crosspoints, thereby effectively releasing them. This special release path is used when FALSE CROSS AND GROUND or RELEASE 2 ORDERS are performed by the network. On these orders it is necessary to open stage-I crosspoints without affecting the cutoff crosspoints.

1.06 It is also possible for current to enter a stage-I switch through the PH lead. Current enters on this lead, goes through a diode and the switch-select PNPN, through the vertical coils of eight crosspoints, then through the coils of the cutoff crosspoint, and exists through one of the two diodes depending on whether the cutoff contacts are to be opened or closed. From there the current pulse passes through group and level selectors back to the negative side of the pulser. This path is used when the HI and DRY concentrator order is requested.

2. TALKING PATH (FS 2)

2.01 The talking-path schematics show symbolically the internal tip-ring wiring of the remreed switches. This symbolic representation indicates between which terminals a connection may be established.

2.02 The three 15A grids that constitute stage I of each concentrator have their control and tip-ring A-link terminals multipled using a random-slip pattern. Multiplying is the same in each grid and the multiples between grids are completed within the A-link cabling to stage II.

2.03 The 64 tip-ring outputs from the eight 8-x-8 switches are partially multipled within the 15A grid and brought out as 44 outputs. Thirty-two of these outputs are brought out directly from the switches without mulitplying, four outputs are formed from a double multiple of switch outputs (eight switch terminals), and eight outputs are formed from a triple multiple of switch outputs (24 switch terminals). The nonmultipled and double multipled outputs are further multipled with outputs from two other 15A grids to form 40 A-links. An additional 24 A-links are provided by the eight triple-multipled outputs from each of the three 15A grids. The 64 A-links are then cabled to the input terminals of the second-stage switches in the associated 15B grids.

2.04 The A-link multiple results in each A-link being wired to an output level on each of three first-stage switches. This provides a 192:64 or 3:1 concentration ratio in the first stage of the network.

2.05 Tip and ring input terminals are accessed at the front terminals of each 6C-type switch while tip and ring output terminals are accessed at the front terminals of each 1D-type switch. The tip and ring output multiples between switches within the same grid are wired on the rear terminals of the 1D-type switches.

SECTION III - REFERENCE

1. WORKING LIMITS

1.01 Outside Plant

(a) Loop-Start Origination:

(1) Maximum external circuit loop resistance - 2770 ohms.

(2) Minimum insulation resistance - 10,000 ohms.

(b) Ground Start Origination:

(1) Maximum earth potential - ±9 volts.

(2) Maximum external circuit ring-conductor resistance - 1770 ohms.

(3) Minimum insulation resistance - 10,000 ohms.

2. FUNCTIONAL DESIGNATIONS

Designation	Meaning
aNISb	Input-switch-select lead, controller a (0 or 1), switch b

Designation	Meaning
Ba	Battery lead, a = (0,1,2,3)
F2GP	FCG or RLS2 order pulse path
Ga	Ground level, a = (0,1,2,3)
ILPNa	Input level selection for level a for line ferrod cutoff contacts not operated
ILPOa	Input level selection for level a for line ferrod cutoff contacts operated
IN	Input node resistor ground lead
INTab	Interrogate lead of ferrod sensor, a = (A,B); b = (0,1,2,3)
PAab	Pulse-path output level a to stage-II switch a or level a on multipled IS switch
PCab	Pulse-path lead from COS switch a, level b to ISa switch, level b
Ph	HI and DRY order pulse path
RAab	Output talking path, ring lead level a, to stage-II switch a. b = (0,1,2...6)
Rab	Input talking path, ring lead, switch a, level b
RCab	Talking path, ring lead between COSa, level b and ISa, level b
RMab	Talking path, ring lead, A-link multiple, level a. b = (0,1,2...6)
Sabc	Readout lead of ferrod sensor, a = (A,B,C,D); b = (0,1,2...15)
TAab	Output talking path, tip lead, level a, to stage-II switch a. b = (0,1,2...6)
Tab	Input talking path, tip lead, switch a, level b
TCab	Talking path tip lead between COSa, level b and ISa, level b
TMab	Talking path, tip lead, A-link multiple, level a; b = (0,1,2...6)

3. FUNCTIONS

3.1 This circuit is capable of performing all functions described in Section II of this circuit description.

4. CONNECTING CIRCUITS

4.1 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

(a) Network frame circuit, SD-3H901-01.

5. MANUFACTURING TESTING REQUIREMENTS

Intermediate Requirements

5.01 None.

End Requirements

5.2 This circuit should be tested to verify that it is wired in accordance with the schematic and wiring drawings and that the circuit is capable of performing all functions stated in this circuit description.

5.3 Additional manufacturing testing requirements are specified in X-18271.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 Provided complete CD information.

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