

PRIVATE LINE TELEPHONE SERVICE
SC2 SELECTIVE CONTROL SYSTEM
SATELLITE STATION
MAINTENANCE

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1.00 INTRODUCTION

1.01 This section provides maintenance information on circuit features of satellite stations installed at locations where devices (customer-owned equipment) are to be controlled from a main station. Maintenance information is included for the power plant, but not for the signaling circuit per SD-1G061-01, common to the satellite and monitor station. Maintenance information on this equipment is covered in Section 310-435-303.

1.02 This section is being reissued to include changes in equipment arrangement, clearing reported troubles, and routine test procedure.

1.03 Due to extensive changes marginal arrows have been omitted.

2.00 GENERAL

2.01 This circuit is designed to control various types of customer-owned equipment in response to a signal received from the main station, and to transmit back information indicating the position of the devices. In general, customer's devices will be controlled in such a way that the satellite station operates the customer's interposer (intermediate) relays and receives the reply regarding the position of the device from the customer's indicating contacts.

2.02 Plug-in equipment units facilitate maintenance and service restoration.

2.03 The SC2 system requires 48-volt dc power and does not include a power plant as part of the system. Local arrangements must be made for the proper power supply. The power plant, if rectifier type, must be equipped with a standby 48-volt dc supply, as it is essential that the selective control system functions during primary power failures. Further, if ac-operated subscriber sets are required for transmission reasons, employing 130-volt telegraph battery, provisions must be made for these repeating devices to continue functioning during ac power failures.

2.04 A power plant meeting these requirements is being furnished on the initial SC2 installation. It makes use of the 105D power plant and utilizes the Lorain Products Corporation inverter-converter for the 130-volt power supply

to the 43A1 carrier channel or 128B2 substation repeater in case of power failures.

3.00 WORKING LIMITS

3.01 The maximum external loop resistance for leads to the device-indicating contacts is 50 ohms, and the minimum insulation resistance for these leads is 250,000 ohms.

3.02 The maximum current drain for each interposer relay, bell, or voltage-stepping device is 200 ma.

3.03 When a device lock relay is used, the interposer relay must be 250 ohms \pm 10 per cent. The 2T lamps must be used to indicate visually the ON and OFF conditions of the device lock relay.

4.00 FUNCTIONS

This circuit provides for:

- Receiving and registering information from the main station in the form of a 2- or 3-digit pulse length code signal.
- Performing the following functions in regard to 2-state devices: (A 2-state device is one where the SC2 system controls both the ON and OFF functions.)
 - (a) Causing the devices to become activated or nonactivated.
 - (b) Replying to the main station, indicating the condition of the device in response to an order or an inquiry.
 - (c) Signaling the main station, indicating a change in the condition of a device in response to an earlier order or to some local operation.
- Transmitting telemetering information to the main station using the same signaling channel in response to a code. Five-second, impulse-duration-type telemetering must be used.
- Transmitting telemetering information to the main station using a separate common channel in response to a code.

- Providing means for rheostat control at the satellite location using the same signaling channel in response to a code.
- Causing more than one device to be activated in response to a system or section code.
- Transmitting an attention signal to the main station.
- Providing means for registering some codes twice before taking action.
- Providing means for locking devices in the activated or deactivated condition.

5.00 EQUIPMENT ARRANGEMENT

5.01 The relay equipment is housed in a single 7-foot cabinet per ED-91981-01 (LJ-1G007BD rated Mfr Disc.) or ED-91981-01 (J-1G007DB rated AT&TCo Standard). ED-91981-01 (J-1G007DB and J-1G007DF rated AT&TCo Standard) serves as the second cabinet whenever job requirements provide for first and second cabinet satellites.

5.02 Pole-mounted satellite cabinets are contemplated.

5.03 Common equipment is placed in the cabinets as a standard arrangement per LJ-1G007 or J-1G007. The various control and device lock circuits are provided on an as-required basis and are mounted in vacant locations in the cabinet as shown on the drawing.

5.04 The demarcation strips for terminating leads to and from the customer's equipment are mounted externally on the cabinets. The screw terminal side of the demarcation strip is for connection of customer leads and for audible or visual indicators and miscellaneous strapping for individual job requirements.

5.05 Job requirements are met by the use of cross connections. These cross connections as well as code point cross connections are made on a common 234D terminal strip.

5.06 Relay circuits, other than certain common ones, are terminated on plug-in type connectors and are demountable for replacement with

like units. This is feasible mainly because wiring options are not made on the relay units. In the case of control circuits, two units are mounted on a common mounting plate and terminated in a common multi-point plug.

5.07 An A. W. Haydon timer (P-6423) is used for various timing purposes and is part of the sending and alarm circuit. The timer is terminated in a plug-in type connector and is demountable as a unit.

6.00 TESTING EQUIPMENT

6.01 The minimum testing equipment recommended for field use is the following:

- 1 — No. 5 Timing Test Set per J24753A.
- 1 — Dial Test Set per SD-1G111-01 when dc telegraph or *E* and *M* lead signaling is used.
- 1 — Standard Electric Time Clock or equivalent device with an accuracy of ± 0.01 second for measuring time intervals. A stop watch may be used only to approximate timing when a more accurate device is not readily available.

6.02 The following test sets are for shop use to meet manufacturing testing requirements, and may be used, if desired, for testing spare equipment units concentrated at a central location.

- 1 — Test Pulse Generator per ES-1G065-01.
- 1 — Pulse Length Code Generator per ES-1G064-01.

7.00 TOOLS AND MATERIAL

7.01 Standard Bell System tools should be used when working on this equipment.

7.02 The following tools are for use on solderless-type terminals:

- KS-16363 Wrapping Tool
- KS-16492 Unwrapping Tool
- 635A Wrapping Tool (connection must be soldered when using this tool)

KS-16346 Soldering Iron (for soldering wrapped connections)

8.00 REFERENCES

8.01 Refer to appropriate Bell System Practices to cover wire spring relay:

- Maintenance
- Adjustment
- Blocking
- Insulating
- Test connections
- Contact cleaning
- Contact replacement
- Piece part data
- Piece part replacement
- Winding designations
- Spring designations
- Educational information

8.02 Refer also to appropriate Bell System Practices to cover the 105D power plant and No. 5 timing test set.

9.00 POWER PLANT

9.01 The CS-1BC Flotrol inverter-converter is manufactured by the Lorain Products Corporation, 1122F Street, Lorain, Ohio. This power plant is designed to supply a constant 130-volt dc plate voltage (see Fig. 1). This power plant normally operates from a 115-volt 60-cycle power source but contains a relay to transfer it to a built-in vibrator in case of power failure. A time delay relay delays transfer back to ac operation approximately 30 seconds after restoration of ac power. The vibration is operated from the 48-volt battery of the 105D power plant.

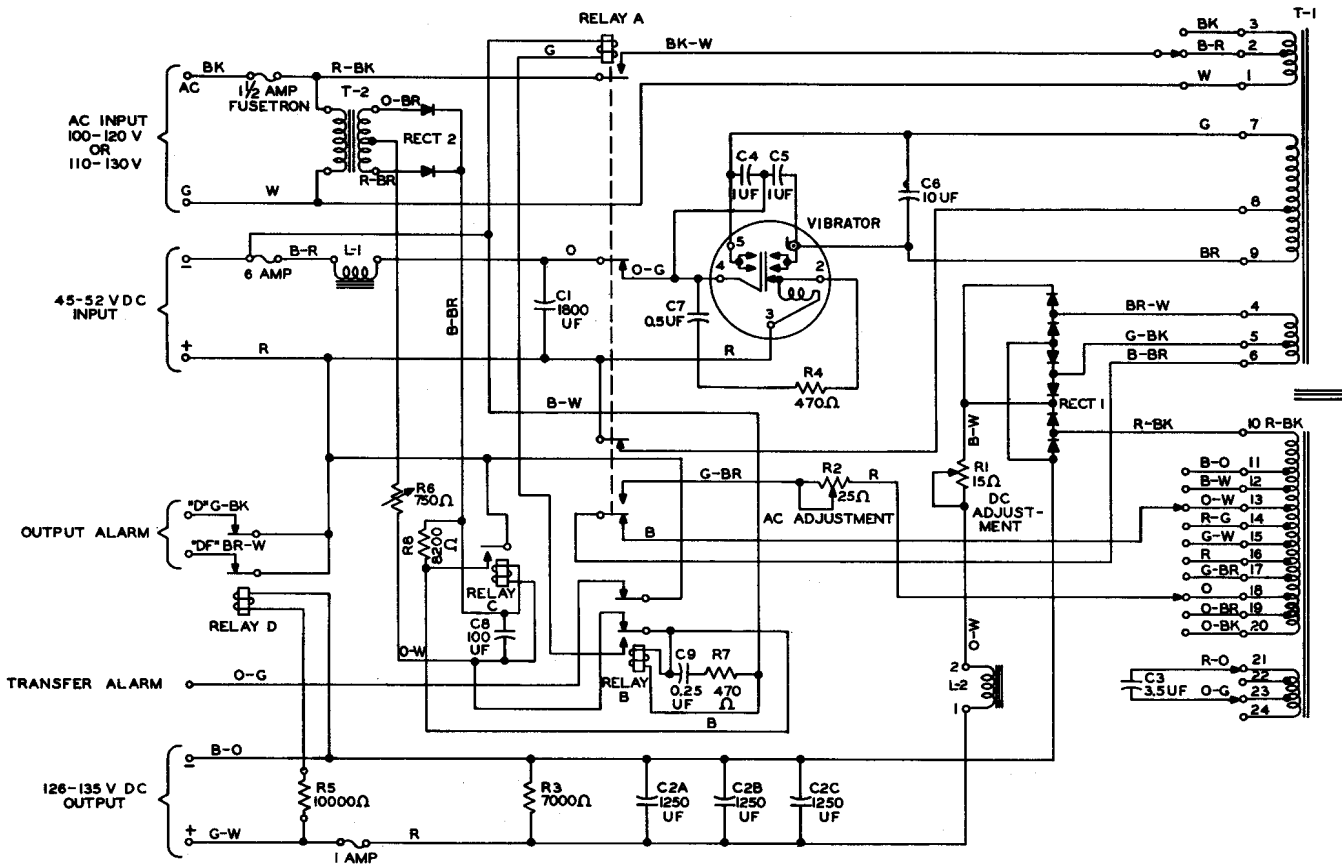
9.02 Two visual alarms are provided in the filament panel. When the unit transfers to battery operation, ground on the transfer alarm lead will light the INV TRANS ALM lamp in the filament supply panel. The INV OUT ALM lamp in the filament supply panel remains lighted as

long as the inverter output is available. When the output voltage is lost, release of the *D* relay removes ground from output alarm terminal D to extinguish the output alarm lamp.

9.03 Six taps are provided for setting the output voltage with ac operation and six taps are provided for setting the output voltage with dc operation. These taps change the output voltage in steps of about 1-1/2 volts. When a new vibrator is installed, the output voltage under dc operation will probably need to be reset. Resistors *R1* and *R2* affect the voltage regulation and should be readjusted when the rectifier has aged. To adjust these resistors proceed as follows:

- Operate from dc (battery source) and adjust the *R1* resistance until output voltage at 0.5-amp load is 5 volts less than the output at 0.05-amp load. In case the output voltage oscillates at this setting, increase *R1* until oscillation stops.
- Operate from the ac input source and adjust *R2* until output voltage is 3 volts less at 0.5-amp load than at 0.05-amp load. In case output voltage oscillates at this setting, increase *R2* until oscillation stops.

9.04 A spare vibrator is provided in an unwired socket for easy access in case of vibrator failure.



Note 1: *R1* and *R2* should be adjusted when rectifier has aged or when vibrator is replaced. To adjust *R1* and *R2*: First, operate from 48-volt dc source and adjust *R1* until output voltage at 0.5-amp load is 5 volts less than the voltage at 0.05-amp load. In case output voltage oscillates at this setting, increase *R1* until oscillation stops;

second, operate from 110-volt ac source and adjust *R2* until output voltage is 3 volts less at 0.5-amp load than at 0.05-amp load. In case output voltage oscillates at this setting, increase *R2* until oscillation stops.

Note 2: Vibrator: American Television and Radio Co., No. 5010.

Fig. 1 – Flotrol Inverter-Converter

9.05 Relays *A* and *B* are not adjustable in the field. Relays *C* and *D* are Western Electric Company 276A1 and U-1227, respectively, and are adjusted in accordance with Bell System Practices in the A and B series governing these relays.

9.06 Potentiometer *R* should be adjusted so that relay *C* will release when the ac line voltage drops to 85 volts.

9.07 The output of the rectifier is filtered with choke *L2* and capacitors *C2A*, *C2B*, and *C2C*.

9.08 In case of a power failure or in case the ac input voltage drops below 85 volts, the voltage-sensitive relay *C* will release, releasing relay *A* which in turn disconnects the ac line

10.00 A. W. HAYDON TIMER

10.01 The A. W. Haydon timer used in the satellite station for regular operation is coded P-6423 time delay relay. The A. W. Haydon timer used in the satellite station for special operation (military) is coded S-6403A time delay relay. Fig. 2 shows a partially disassembled unit. Simple schematic drawings of the timers P-6423 and S-6403A are shown in Fig. 3 and 5, respectively.

10.02 The operating requirements for the timer are as follows:

- P-6423 time delay relay
 - (a) Time delay shall be per Fig. 4 when operated on 40 to 50 volts dc.
 - (b) Maximum allowable variation in each time setting shall be ± 1.3 seconds.
- S-6403A time delay relay
 - (a) Time delay shall be per Fig. 6 when operated on 40 to 50 volts dc.

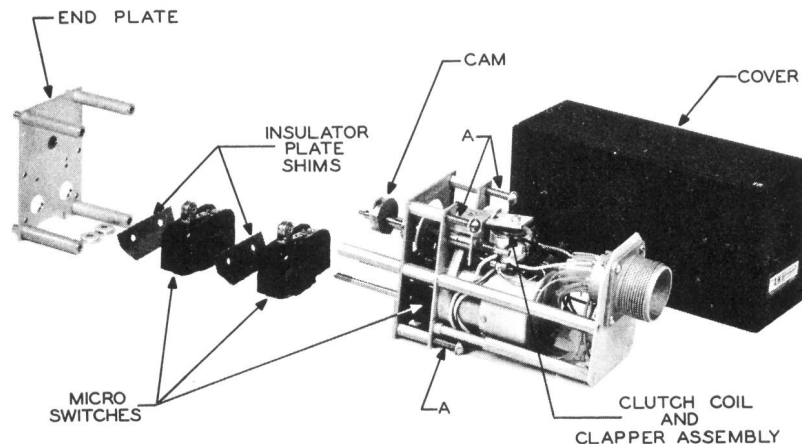


Fig. 2 — A. W. Haydon Timer

from *T1* and connects battery to the vibrator. The vibrator output is connected to the same regulating transformer *T1* as was used in ac operation, and from here on the circuit functions as it did previously. The battery input is filtered with choke *L1* and capacitor *C1* which keep the vibrator noise out of the battery. On restoration of ac power, marginal relay *C* will operate, supplying power to the time delay relay *B*, which after about 1/2 minute will operate relay *A*, restoring normal operation.

(b) Maximum allowable variation in each time setting shall be ± 5.5 seconds.

- Clutch coil to operate directly on above voltages.
- Switch ratings are 10 amps (inductive).

Testing

10.03 The following tools are required for testing the time delay relay:

- Stop watch for checking time setting.

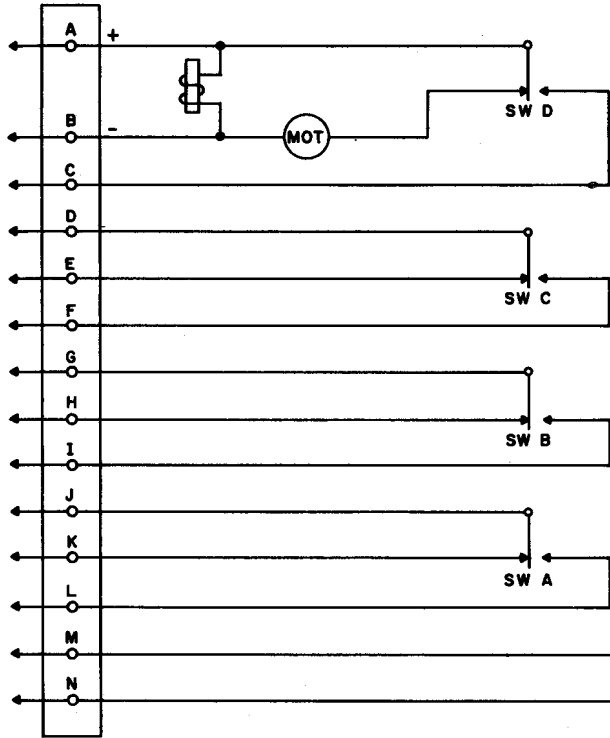


Fig. 3 — A. W. Haydon Timer — P-6423 Schematic Drawing

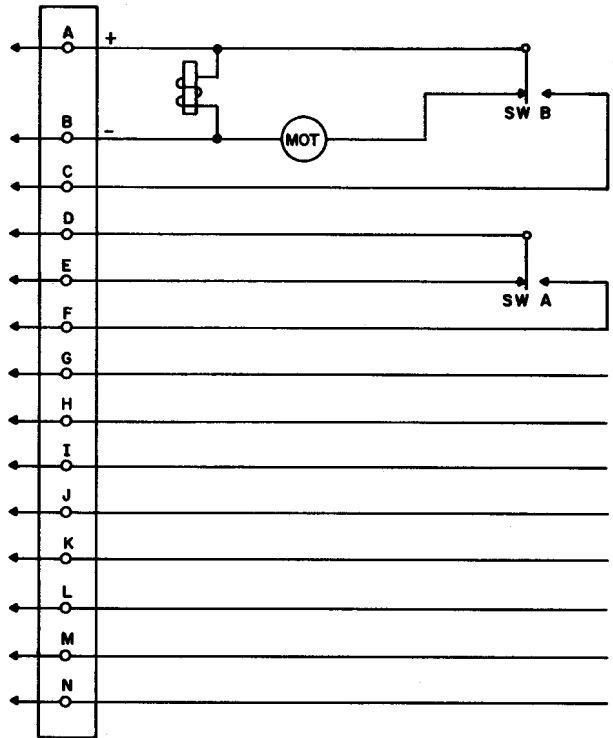


Fig. 5 — A. W. Haydon Timer — S-6403A Schematic Drawing

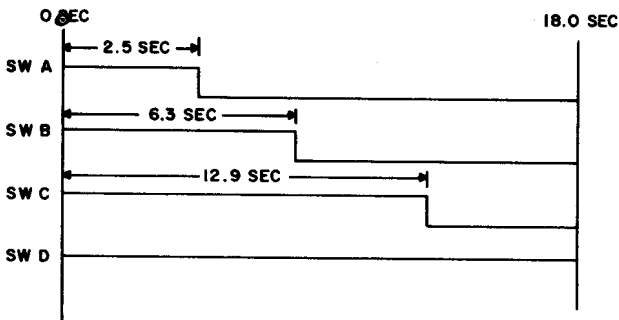


Fig. 4 — A. W. Haydon Timer — P-6423 Timing Chart

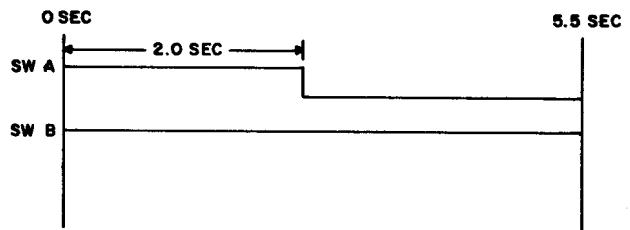


Fig. 6 — A. W. Haydon Timer — S-6403A Timing Chart

- Continuity test lamps or equivalent.
- Volt-ohmmeter.
- 24-ounce spring balance for testing clutch mechanism.

10.04 To test continuity of Micro Switches, connect positive battery to the common ter-

minial on the Micro Switch. Connect a continuity test lamp in series with the negative side of this battery and the normally closed terminal on the Micro Switch. The lamp should light. Depress the actuator arm on the switch and the light should be extinguished. If these results do not occur, replace the switch.

10.05 To test the over-all effectiveness of the clutch mechanism, hold the clapper assembly against the clutch coil, rotate the delay arm assembly until it touches the actuator arm of Micro Switch No. 1, and hook a spring balance under the end of the delay arm and exert an upward pull of 16 ounces, tending to pull the delay arm back toward the return stop. If the delay arm assembly moves, replace the connecting spring. After replacing the connecting spring, repeat the test. If the delay arm assembly again moves, the alternate clutch spring should be replaced.

10.06 Remove the spring balance and release the clapper assembly. Make certain that the delay arm assembly is resting against the return stop.

Caution: Do not exert more than a 16-ounce force in this test, or damage to clutch mechanism may result.

Repairs

10.07 In general, repair of the timer should be limited to replacement of faulty Micro Switches. For all major repairs, return the unit to the A. W. Haydon Company, 232 North Elm St., Waterbury 20, Connecticut.

10.08 The timing cams are set at the factory and their setscrews are sealed. Do not loosen these setscrews unless it becomes absolutely necessary to change the cam settings.

10.09 If a cam is reset, its setscrew should be tightened securely. Glyptal cement (a General Electric Company product) should be used on the head of the screw as a sealer.

Caution: In no case should the Glyptal cement be placed in the hole ahead of the screw as it would probably then be impossible to loosen the setscrew later.

10.10 To disassemble the unit, remove the two screws from the plug end of the unit, and remove cover (see Fig. 2).

10.11 Remove the end plate adjacent to the Micro Switches by removing the two screws on the face of the plate plus the four screws marked A in Fig. 2.

10.12 Remove the two nuts holding the Micro Switches on their mounting shafts. Before the Micro Switches can be removed, the wires must be disconnected from the terminals on each switch.

10.13 When reassembling, make sure the insulator plate shims are installed properly.

10.14 No lubrication is required, as the component parts are lubricated for life at time of manufacture.

11.00 CLEARING REPORTED TROUBLE

11.01 This circuit arrangement provides a means for remotely controlling customer-owned equipment, and it is imperative that no action be taken by telephone company employees which will interfere with the normal function of the customer's equipment. Therefore, before starting tests or doing work of any kind on the system, telephone company employees shall obtain the customer's permission to proceed. At this time, arrangements shall be made for the customer to disconnect any of his satellite station equipment which might be affected before starting the work.

11.02 The principal reason for the plug-in feature of the major apparatus units is to expedite the clearing of reported trouble resulting in dispatching a maintenance man to the satellite station. Sufficient visual supervision is available on the SC2 system to aid the serving test room in sectionalizing the trouble on the basis of customer reports.

11.03 It is therefore expected that only obvious minor equipment failures on major units, consuming minimum time, be cleared with equipment in its normal working position.

11.04 Failure of the following major equipment components shall be considered a major failure of the satellite station.

Power plant

Substation set

Receiving circuit

Signaling circuit per SD-1G061-01

Sending and alarm circuit

A. W. Haydon timer

11.05 If the reported trouble is of a general nature, such as occasional failure to receive the proper code, improper reply, etc, and signals to the satellite appear satisfactory as recorded in the serving test room, the following recommended trouble-clearing procedure should be followed:

- (1) Check to see if any fuses have operated.
- (2) Check the voltage of the power supply. It should read between -45 and -50 volts.

11.06 When the satellite is equipped for dc telegraph signaling, the following additional tests should be made:

- (1) Check the local dc circuit to the signaling circuit. The current reading should be between 60 and 62.5 ma.
- (2) Remove the cover from the 255A *L* relay in the signaling circuit and observe whether the armature is resting against the No. 4 contact.
- (3) Replace the 255A *L* relay in the signaling circuit with one known to be in good condition.
- (4) Insert an open plug in the *SET* jack of the 63C1 switchboard and observe whether the armature moves toward its No. 5 contact.
- (5) Remove the open plug from the 63C1 switchboard *SET* jack.
- (6) Check the signaling circuit with the serving test room for transmission limits.

11.07 When the satellite is equipped for *E* and *M* lead signaling, check that the *PF* relay is normal.

11.08 When the entire network uses dc signaling, the telegraph circuit shall have no more than an over-all distortion of 25 per cent at 60-speed teletype signals between the main station and any other point on the network. Transmission to and from the test room should be checked, using the 100A test distributor, 161A1 set, or portable transmission measuring set. When signals are sent with the 100A test distributor and measured in the test room with the 118 transmission, measuring set, the received bias reading must be multiplied by 2.

11.09 If no further tests are to be made, proceed as in 12.06 (7) through (9).

12.00 ROUTINE TEST PROCEDURE

12.01 If preliminary tests fail to locate the trouble condition, certain routine tests may be made to check the integrity of the internal circuit actions.

12.02 In these tests, the dial test set is connected to the satellite equipment so that it simulates the external loop. Dial pulses are transmitted from the dial test set to the satellite. Verification is made by observing relays or by means of the lamps on the test set. See Fig. 7 for the schematic diagram of the dial test set.

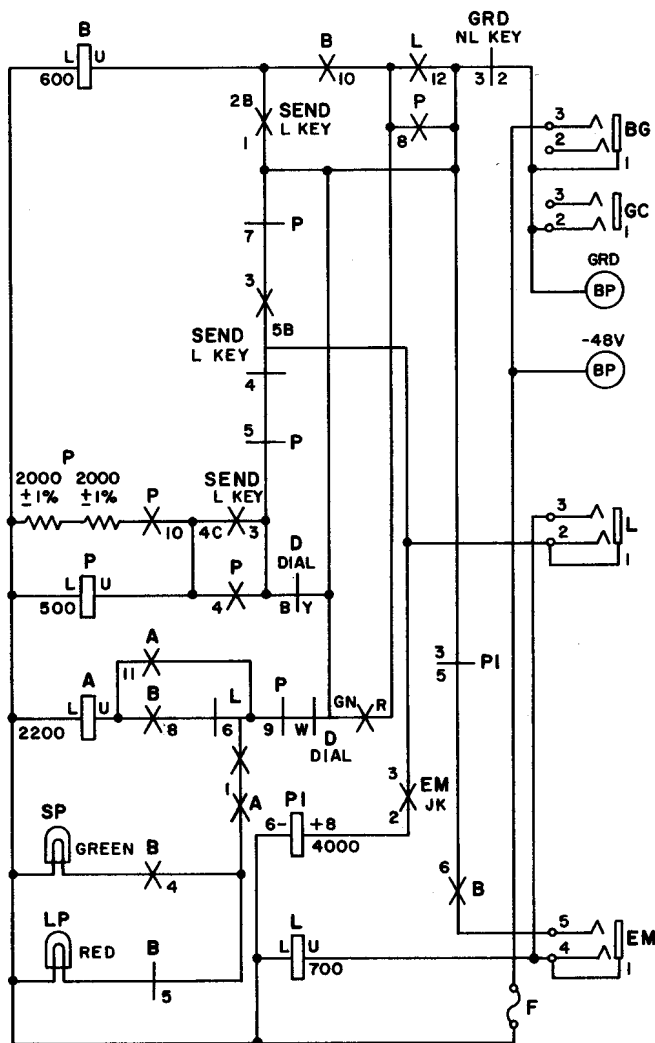


Fig. 7 — Dial Test Set Schematic Diagram

12.03 When making these tests, the satellite will be disconnected from the system; therefore, the normal procedure for taking the equipment out of service must be followed.

Preparation

DC Telegraph Signaling

12.04 When the satellite is equipped with dc telegraph signaling, the following preparation is made:

- (1) Insert an open plug into the 63C1 switchboard *SET* jack. This action removes the external loop from the satellite station.
- (2) Have the customer disconnect the leads to the device indicating contacts at the demarcation strip (if not done previously). It is at the demarcation strip where, later on, grounds must be placed to simulate indications from the customer's equipment.
- (3) With a 3P7A cord or clip leads, connect —48 volt battery and ground to the *BG* jack or —48V and GRD terminals, respectively, on test set.
- (4) With a 2W17C cord, equipped with a 360B and 360C tool, connect the *L* jack on test set to the satellite as follows:

White lead to terminal 6+ on relay *L*

Black lead to contact 5 on relay *S*

Note: If the 63C1 switchboard is located adjacent to the satellite, connections to the satellite may be made by using a 2P1D cord from the *L* jack in the test set to the *SET* jack in the 63C1 switchboard instead of the method described in Step (4).

- (5) Block relay *WT* operated.
- (6) Remove the *L* relay cover and check that the armature is operated to the No. 4 contact. This checks for proper polarity.

E and M Lead Signaling

12.05 When the satellite is equipped for *E* and *M* lead signaling, the following preparation is made:

- (1) Have the customer disconnect the leads to the device indicating contacts at the demarcation strip (if not done previously). It is at the demarcation strip where, later on, grounds must be placed to simulate indications from the customer's equipment.
- (2) With a 3P7A cord or clip leads, connect —48 volt battery and ground to the *BG* jack or —48V and GRD terminals, respectively, on the test set.
- (3) With a 3P7A cord, first connect the *GC* jack in the test set to the *LINE* jack of the satellite signaling circuit.
- (4) With another 3P7A cord, connect the *EM* jack in the test set to the *EQUIP* jack of the satellite signaling circuit.
- (5) Block relay *WT* operated.
- (6) Check that the *PF* relay is normal.

Method

12.06 When testing the satellite equipped for dc telegraph or *E* and *M* lead signaling, the following method is used:

- (1) To test for the proper operation of the counting, registering, translation, alarm, and sending circuits, complete preparations per 12.04 for dc telegraph signaling or 12.05 for *E* and *M* lead signaling. Dial the proper codes for a particular installation per Tables A and B. Table A covers 3-digit codes and Table B covers the 2-digit codes. To dial a double transmission code, it is necessary to repeat the dialing sequence within 2 seconds.
- (2) In order to receive the proper reply pulse, it will be necessary to connect an external ground to the proper terminal on the demarcation strip to substitute for the normal ground supplied by the customer's indicating device. Only one such ground should be applied at any one time for a particular test.
- (3) In order that the test results may prove conclusive, certain known references must exist at the beginning of the tests, such as:
 - Type of control circuit selected for test.
 - Initial position of certain relays, that is, operated or nonoperated.

- Immediate or delayed action devices.
 - Single or double transmission.
 - Type answer expected.
- (4) When dialing the various codes, observe the position of the relays in the proper circuit as dialing progresses. The short pulses will step the *P* relays in the counting chain, and the long pulses will position the registering relays. The progress of the code may thus be observed after each digit is dialed.
- (5) To receive an uninvited pulse on the dial test set:
- Operate key.
 - Release key.
 - Dial the digit 1.
- (6) The following tests are in connection with 2-state devices and are made to check the satellite for its response to various inquiry and order codes. All lamp indications are located on the dial test set.
- (7) Remove blocking tool from relay *WT*, and remove dial test set from equipment.
- (8) Remove the plug from the 63C1 switchboard set if the satellite is arranged for dc telegraph signaling.

(9) At this time, check with the customer as to the state of the devices and set the *LK* relays accordingly.

13.00 RELAY TIMING REQUIREMENTS

13.01 If the trouble diagnosis indicates improper timing of a relay, the relay should be tested with the No. 5 timing test set. This may be done with the equipment either in or out of the cabinet.

13.02 See the circuit requirement tables for connecting the test set and for timing requirements.

Note: Under no circumstances should timing limits be adjusted without the use of the No. 5 timing test set.

13.03 As a general rule, if a relay meets the mechanical and electrical requirements, it should also meet the timing requirements.

14.00 MAINTENANCE OF SPARE PARTS

The stocking of spare equipment such as A. W. Haydon timers, plug-in relay units, etc, should be determined by the telephone company involved.

TABLE A
3-DIGIT CODES

Code	Dial Number as Follows*	Code	Dial Number as Follows	Code	Dial Number as Follows
000	K414141R1	040	K411351R1	080	K412341R1
001	K414111R4	041	K411321R4	081	K412311R4
002	K414112R3	042	K411322R3	082	K412312R3
003	K414121R3	043	K411331R3	083	K412321R3
004	K414113R2	044	K411323R2	084	K412313R2
005	K414122R2	045	K411332R2	085	K412322R2
006	K414131R2	046	K411341R2	086	K412331R2
007	K414114R1	047	K411324R1	087	K412314R1
008	K414123R1	048	K411333R1	088	K412323R1
009	K414132R1	049	K411342R1	089	K412332R1
010	K411171R1	050	K412251R1	090	K413241R1
011	K411141R4	051	K412221R4	091	K413211R4
012	K411142R3	052	K412222R3	092	K413212R3
013	K411151R3	053	K412231R3	093	K413221R3
014	K411143R2	054	K412223R2	094	K413213R2
015	K411152R2	055	K412232R2	095	K413222R2
016	K411161R2	056	K412241R2	096	K413231R2
017	K411144R1	057	K412224R1	097	K413214R1
018	K411153R1	058	K412233R1	098	K413223R1
019	K411162R1	059	K412242R1	099	K413232R1
020	K411261R1	060	K413151R1	100	K117141R1
021	K411231R4	061	K413121R4	101	K117111R4
022	K411232R3	062	K413122R3	102	K117112R3
023	K411241R3	063	K413131R3	103	K117121R3
024	K411233R2	064	K413123R2	104	K117113R2
025	K411242R2	065	K413132R2	105	K117122R2
026	K411251R2	066	K413141R2	106	K117131R2
027	K411234R1	067	K413124R1	107	K117114R1
028	K411243R1	068	K413133R1	108	K117123R1
029	K411252R1	069	K413142R1	109	K117132R1
030	K412161R1	070	K411441R1	110	K114171R1
031	K412131R4	071	K411411R4	111	K114141R4
032	K412132R3	072	K411412R3	112	K114142R3
033	K412141R3	073	K411421R3	113	K114151R3
034	K412133R2	074	K411413R2	114	K114143R2
035	K412142R2	075	K411422R2	115	K114152R2
036	K412151R2	076	K411431R2	116	K114161R2
037	K412134R1	077	K411414R1	117	K114144R1
038	K412143R1	078	K411423R1	118	K114153R1
039	K412152R1	079	K411432R1	119	K114162R1

* K = Operate (K) Key
R = Release (K) Key

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
120	K114261R1	160	K116151R1	200	K126141R1
121	K114231R4	161	K116121R4	201	K126111R4
122	K114232R3	162	K116122R3	202	K126112R3
123	K114241R3	163	K116131R3	203	K126121R3
124	K114233R2	164	K116123R2	204	K126113R2
125	K114242R2	165	K116132R2	205	K126122R2
126	K114251R2	166	K116141R2	206	K126131R2
127	K114234R1	167	K116124R1	207	K126114R1
128	K114243R1	168	K116133R1	208	K126123R1
129	K114252R1	169	K116142R1	209	K126132R1
130	K115161R1	170	K114441R1	210	K123171R1
131	K115131R4	171	K114411R4	211	K123141R4
132	K115132R3	172	K114412R3	212	K123142R3
133	K115141R3	173	K114421R3	213	K123151R3
134	K115133R2	174	K114413R2	214	K123143R2
135	K115142R2	175	K114422R2	215	K123152R2
136	K115151R2	176	K114431R2	216	K123161R2
137	K115134R1	177	K114414R1	217	K123144R1
138	K115143R1	178	K114423R1	218	K123153R1
139	K115152R1	179	K114432R1	219	K123162R1
140	K114351R1	180	K115341R1	220	K123261R1
141	K114321R4	181	K115311R4	221	K123231R4
142	K114322R3	182	K115312R3	222	K123232R3
143	K114331R3	183	K115321R3	223	K123241R3
144	K114323R2	184	K115313R2	224	K123233R2
145	K114332R2	185	K115322R2	225	K123242R2
146	K114341R2	186	K115331R2	226	K123251R2
147	K114324R1	187	K115334R1	227	K123234R1
148	K114333R1	188	K115323R1	228	K123243R1
149	K114342R1	189	K115332R1	229	K123252R1
150	K115251R1	190	K116241R1	230	K124161R1
151	K115221R4	191	K116211R4	231	K124131R4
152	K115222R3	192	K116212R3	232	K124132R3
153	K115231R3	193	K116221R3	233	K124141R3
154	K115223R2	194	K116213R2	234	K124133R2
155	K115232R2	195	K116222R2	235	K124142R2
156	K115241R2	196	K116231R2	236	K124151R2
157	K115224R1	197	K116214R1	237	K124134R1
158	K115233R1	198	K116223R1	238	K124143R1
159	K115242R1	199	K116232R1	239	K124152R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
240	K123351R1	280	K124341R1	320	K213261R1
241	K123321R4	281	K124311R4	321	K213231R4
242	K123322R3	282	K124312R3	322	K213232R3
243	K123331R3	283	K124321R3	323	K213241R3
244	K123323R2	284	K124313R2	324	K213233R2
245	K123332R2	285	K124322R2	325	K213242R2
246	K123341R2	286	K124331R2	326	K213251R2
247	K123324R1	287	K124314R1	327	K213234R1
248	K123333R1	288	K124323R1	328	K213243R1
249	K123342R1	289	K124332R1	329	K213252R1
250	K124251R1	290	K125241R1	330	K214161R1
251	K124221R4	291	K125211R4	331	K214131R4
252	K124222R3	292	K125212R3	332	K214132R3
253	K124231R3	293	K125221R3	333	K214141R3
254	K124223R2	294	K125213R2	334	K214133R2
255	K124232R2	295	K125222R2	335	K214142R2
256	K124241R2	296	K125231R2	336	K214151R2
257	K124224R1	297	K125214R1	337	K214134R1
258	K124233R1	298	K125223R1	338	K214143R1
259	K124242R1	299	K125232R1	339	K214152R1
260	K125151R1	300	K216141R1	340	K213351R1
261	K125121R4	301	K216111R4	341	K213321R4
262	K125122R3	302	K216112R3	342	K213322R3
263	K125131R3	303	K216121R3	343	K213331R3
264	K125123R2	304	K216113R2	344	K213323R2
265	K125132R2	305	K216122R2	345	K213332R2
266	K125141R2	306	K216131R2	346	K213341R2
267	K125124R1	307	K216114R1	347	K213324R1
268	K125133R1	308	K216123R1	348	K213333R1
269	K125142R1	309	K216132R1	349	K213342R1
270	K123441R1	310	K213171R1	350	K214251R1
271	K123411R4	311	K213141R4	351	K214221R4
272	K123412R3	312	K213142R3	352	K214222R3
273	K123421R3	313	K213151R3	353	K214231R3
274	K123413R2	314	K213143R2	354	K214223R2
275	K123422R2	315	K213152R2	355	K214232R2
276	K123431R2	316	K213161R2	356	K214241R2
277	K123414R1	317	K213144R1	357	K214224R1
278	K123423R1	318	K213153R1	358	K214233R1
279	K123432R1	319	K213162R1	359	K214242R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
360	K215151R1	400	K135141R1	440	K132351R1
361	K215121R4	401	K135111R4	441	K132321R4
362	K215122R3	402	K135112R3	442	K132322R3
363	K215131R3	403	K135121R3	443	K132331R3
364	K215123R2	404	K135113R2	444	K132323R2
365	K215132R2	405	K135122R2	445	K132332R2
366	K215141R2	406	K135131R2	446	K132341R2
367	K215124R1	407	K135114R1	447	K132324R1
368	K215133R1	408	K135123R1	448	K132333R1
369	K215142R1	409	K135132R1	449	K132342R1
370	K213441R1	410	K132171R1	450	K133251R1
371	K213411R4	411	K132141R4	451	K133221R4
372	K213412R3	412	K132142R3	452	K133222R3
373	K213421R3	413	K132151R3	453	K133231R3
374	K213413R2	414	K132143R2	454	K133223R2
375	K213422R2	415	K132152R2	455	K133232R2
376	K213431R2	416	K132161R2	456	K133241R2
377	K213414R1	417	K132144R1	457	K133224R1
378	K213423R1	418	K132153R1	458	K133233R1
379	K213432R1	419	K132162R1	459	K133242R1
380	K214341R1	420	K132261R1	460	K134151R1
381	K214311R4	421	K132231R4	461	K134121R4
382	K214312R3	422	K132232R3	462	K134122R3
383	K214321R3	423	K132241R3	463	K134131R3
384	K214313R2	424	K132233R2	464	K134123R2
385	K214322R2	425	K132242R2	465	K134132R2
386	K214331R2	426	K132251R2	466	K134141R2
387	K214314R1	427	K132234R1	467	K134124R1
388	K214323R1	428	K132243R1	468	K134133R1
389	K214332R1	429	K132252R1	469	K134142R1
390	K215241R1	430	K133161R1	470	K132441R1
391	K215211R4	431	K133131R4	471	K132411R4
392	K215212R3	432	K133132R3	472	K132412R3
393	K215221R3	433	K133141R3	473	K132421R3
394	K215213R2	434	K133133R2	474	K132413R2
395	K215222R2	435	K133142R2	475	K132422R2
396	K215231R2	436	K133151R2	476	K132431R2
397	K215214R1	437	K133134R1	477	K132414R1
398	K215223R1	438	K133143R1	478	K132423R1
399	K215232R1	439	K133152R1	479	K132432R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
480	K133341R1	520	K222261R1	560	K224151R1
481	K133311R4	521	K222231R4	561	K224121R4
482	K133312R3	522	K222232R3	562	K224122R3
483	K133321R3	523	K222241R3	563	K224131R3
484	K133313R2	524	K222233R2	564	K224123R2
485	K133322R2	525	K222242R2	565	K224132R2
486	K133331R2	526	K222251R2	566	K224141R2
487	K133314R1	527	K222234R1	567	K224124R1
488	K133323R1	528	K222243R1	568	K224133R1
489	K133332R1	529	K222252R1	569	K224142R1
490	K134241R1	530	K223161R1	570	K222441R1
491	K134211R4	531	K223131R4	571	K222411R4
492	K134212R3	532	K223132R3	572	K222412R3
493	K134221R3	533	K223141R3	573	K222421R3
494	K134213R2	534	K223133R2	574	K222413R2
495	K134222R2	535	K223142R2	575	K222422R2
496	K134231R2	536	K223151R2	576	K222431R2
497	K134214R1	537	K223134R1	577	K222414R1
498	K134223R1	538	K223143R1	578	K222423R1
499	K134232R1	539	K223152R1	579	K222432R1
500	K225141R1	540	K222351R1	580	K223341R1
501	K225111R4	541	K222321R4	581	K223311R4
502	K225112R3	542	K222322R3	582	K223312R3
503	K225121R3	543	K222331R3	583	K223321R3
504	K225113R2	544	K222323R2	584	K223313R2
505	K225122R2	545	K222332R2	585	K223322R2
506	K225131R2	546	K222341R2	586	K223331R2
507	K225114R1	547	K222324R1	587	K223314R1
508	K225123R1	548	K222333R1	588	K223323R1
509	K225132R1	549	K222342R1	589	K223332R1
510	K222171R1	550	K223251R1	590	K224241R1
511	K222141R4	551	K223221R4	591	K224211R4
512	K222142R3	552	K223222R3	592	K224212R3
513	K222151R3	553	K223231R3	593	K224221R3
514	K222143R2	554	K223223R2	594	K224213R2
515	K222152R2	555	K223232R2	595	K224222R2
516	K222161R2	556	K223241R2	596	K224231R2
517	K222144R1	557	K223224R1	597	K224214R1
518	K222153R1	558	K223233R1	598	K224223R1
519	K222162R1	559	K223242R1	599	K224232R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
600	K315141R1	640	K312351R1	680	K313341R1
601	K315111R4	641	K312321R4	681	K313311R4
602	K315112R3	642	K312322R3	682	K313312R3
603	K315121R3	643	K312331R3	683	K313321R3
604	K315113R2	644	K312323R2	684	K313313R2
605	K315122R2	645	K312332R2	685	K313322R2
606	K315131R2	646	K312341R2	686	K313331R2
607	K315114R1	647	K312324R1	687	K313314R1
608	K315123R1	648	K312333R1	688	K313323R1
609	K315132R1	649	K312342R1	689	K313332R1
610	K312171R1	650	K313251R1	690	K314241R1
611	K312141R4	651	K313221R4	691	K314211R4
612	K312142R3	652	K313222R3	692	K314212R3
613	K312151R3	653	K313231R3	693	K314221R3
614	K312143R2	654	K313223R2	694	K314213R2
615	K312152R2	655	K313232R2	695	K314222R2
616	K312161R2	656	K313241R2	696	K314231R2
617	K312144R1	657	K313224R1	697	K314214R1
618	K312153R1	658	K313233R1	698	K314223R1
619	K312162R1	659	K313242R1	699	K314232R1
620	K312261R1	660	K314151R1	700	K144141R1
621	K312231R4	661	K314121R4	701	K144111R4
622	K312232R3	662	K314122R3	702	K144112R3
623	K312241R3	663	K314131R3	703	K144121R3
624	K312233R2	664	K314123R2	704	K144113R2
625	K312242R2	665	K314132R2	705	K144122R2
626	K312251R2	666	K314141R2	706	K144131R2
627	K312234R1	667	K314124R1	707	K144114R1
628	K312243R1	668	K314133R1	708	K144123R1
629	K312252R1	669	K314142R1	709	K144132R1
630	K313161R1	670	K312441R1	710	K141171R1
631	K313131R4	671	K312411R4	711	K141141R4
632	K313132R3	672	K312412R3	712	K141142R3
633	K313141R3	673	K312421R3	713	K141151R3
634	K313133R2	674	K312413R2	714	K141143R2
635	K313142R2	675	K312422R2	715	K141152R2
636	K313151R2	676	K312431R2	716	K141161R2
637	K313134R1	677	K312414R1	717	K141144R1
638	K313143R1	678	K312423R1	718	K141153R1
639	K313152R1	679	K312432R1	719	K141162R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
720	K141261R1	760	K143151R1	800	K234141R1
721	K141231R4	761	K143121R4	801	K234111R4
722	K141232R3	762	K143122R3	802	K234112R3
723	K141241R3	763	K143131R3	803	K234121R3
724	K141233R2	764	K143123R2	804	K234113R2
725	K141242R2	765	K143132R2	805	K234122R2
726	K141251R2	766	K143141R2	806	K234131R2
727	K141234R1	767	K143124R1	807	K234114R1
728	K141243R1	768	K143133R1	808	K234123R1
729	K141252R1	769	K143142R1	809	K234132R1
730	K142161R1	770	K141441R1	810	K231171R1
731	K142131R4	771	K141411R4	811	K231141R4
732	K142132R3	772	K141412R3	812	K231142R3
733	K142141R3	773	K141421R3	813	K231151R3
734	K142133R2	774	K141413R2	814	K231143R2
735	K142142R2	775	K141422R2	815	K231152R2
736	K142151R2	776	K141431R2	816	K231161R2
737	K142134R1	777	K141414R1	817	K231144R1
738	K142143R1	778	K141423R1	818	K231153R1
739	K142152R1	779	K141432R1	819	K231162R1
740	K141351R1	780	K142341R1	820	K231261R1
741	K141321R4	781	K142311R4	821	K231231R4
742	K141322R3	782	K142312R3	822	K231232R3
743	K141331R3	783	K142321R3	823	K231241R3
744	K141323R2	784	K142313R2	824	K231233R2
745	K141332R2	785	K142322R2	825	K231242R2
746	K141341R2	786	K142331R2	826	K231251R2
747	K141324R1	787	K142314R1	827	K231234R1
748	K141333R1	788	K142323R1	828	K231243R1
749	K141342R1	789	K142332R1	829	K231252R1
750	K142251R1	790	K143241R1	830	K232161R1
751	K142221R4	791	K143211R4	831	K232131R4
752	K142222R3	792	K143212R3	832	K232132R3
753	K142231R3	793	K143221R3	833	K232141R3
754	K142223R2	794	K143213R2	834	K232133R2
755	K142232R2	795	K143222R2	835	K232142R2
756	K142241R2	796	K143231R2	836	K232151R2
757	K142224R1	797	K143214R1	837	K232134R1
758	K142233R1	798	K143223R1	838	K232143R1
759	K142242R1	799	K143232R1	839	K232152R1

TABLE A (Cont)

3-DIGIT CODES

Code	Dial Number as Follows	Code	Dial Number as Follows	Code	Dial Number as Follows
840	K231351R1	880	K232341R1	920	K321261R1
841	K231321R4	881	K232311R4	921	K321231R4
842	K231322R3	882	K232312R3	922	K321232R3
843	K231331R3	883	K232321R3	923	K321241R3
844	K231323R2	884	K232313R2	924	K321233R2
845	K231332R2	885	K232322R2	925	K321242R2
846	K231341R2	886	K232331R2	926	K321251R2
847	K231324R1	887	K232314R1	927	K321234R1
848	K231333R1	888	K232323R1	928	K321243R1
849	K231342R1	889	K232332R1	929	K321252R1
850	K232251R1	890	K233241R1	930	K322161R1
851	K232221R4	891	K233211R4	931	K322131R4
852	K232222R3	892	K233212R3	932	K322132R3
853	K232231R3	893	K233221R3	933	K322141R3
854	K232223R2	894	K233213R2	934	K322133R2
855	K232232R2	895	K233222R2	935	K322142R2
856	K232241R2	896	K233231R2	936	K322151R2
857	K232224R1	897	K233214R1	937	K322134R1
858	K232233R1	898	K233223R1	938	K322143R1
859	K232242R1	899	K233232R1	939	K322152R1
860	K233151R1	900	K324141R1	940	K321351R1
861	K233121R4	901	K324111R4	941	K321321R4
862	K233122R3	902	K324112R3	942	K321322R3
863	K233131R3	903	K324121R3	943	K321331R3
864	K233123R2	904	K324113R2	944	K321323R2
865	K233132R2	905	K324122R2	945	K321332R2
866	K233141R2	906	K324131R2	946	K321341R2
867	K233124R1	907	K324114R1	947	K321324R1
868	K233133R1	908	K324123R1	948	K321333R1
869	K233142R1	909	K324132R1	949	K321342R1
870	K231441R1	910	K321171R1	950	K322251R1
871	K231411R4	911	K321141R4	951	K322221R4
872	K231412R3	912	K321142R3	952	K322222R3
873	K231421R3	913	K321151R3	953	K322231R3
874	K231413R2	914	K321143R2	954	K322223R2
875	K231422R2	915	K321152R2	955	K322232R2
876	K231431R2	916	K321161R2	956	K322241R2
877	K231414R1	917	K321144R1	957	K322224R1
878	K231423R1	918	K321153R1	958	K322233R1
879	K231432R1	919	K321162R1	959	K322242R1

TABLE A (Cont)**3-DIGIT CODES**

Code	Dial Number as Follows
960	K323151R1
961	K323121R4
962	K323122R3
963	K323131R3
964	K323123R2
965	K323132R2
966	K323141R2
967	K323124R1
968	K323133R1
969	K323142R1
970	K321441R1
971	K321411R4
972	K321412R3
973	K321421R3
974	K321413R2
975	K321422R2
976	K321431R2
977	K321414R1
978	K321423R1
979	K321432R1
980	K322341R1
981	K322311R4
982	K322312R3
983	K322321R3
984	K322313R2
985	K322322R2
986	K322331R2
987	K322314R1
988	K322323R1
989	K322332R1
990	K323241R1
991	K323211R4
992	K323212R3
993	K323221R3
994	K323213R2
995	K323222R2
996	K323231R2
997	K323214R1
998	K323223R1
999	K323232R1

TABLE B
2-DIGIT CODES

Code	Dial Number as Follows*	Code	Dial Number as Follows	Code	Dial Number as Follows
00	K4141R1	40	K1351R1	80	K2341R1
01	K4111R4	41	K1321R4	81	K2311R4
02	K4112R3	42	K1322R3	82	K2312R3
03	K4121R3	43	K1331R3	83	K2321R3
04	K4113R2	44	K1323R2	84	K2313R2
05	K4122R2	45	K1332R2	85	K2322R2
06	K4131R2	46	K1341R2	86	K2331R2
07	K4114R1	47	K1324R1	87	K2314R1
08	K4123R1	48	K1333R1	88	K2323R1
09	K4132R1	49	K1342R1	89	K2332R1
10	K1171R1	50	K2251R1	90	K3241R1
11	K1141R4	51	K2221R4	91	K3211R4
12	K1142R3	52	K2222R3	92	K3212R3
13	K1151R3	53	K2231R3	93	K3221R3
14	K1143R2	54	K2223R2	94	K3213R2
15	K1152R2	55	K2232R2	95	K3222R2
16	K1161R2	56	K2241R2	96	K3231R2
17	K1144R1	57	K2224R1	97	K3214R1
18	K1153R1	58	K2233R1	98	K3223R1
19	K1162R1	59	K2242R1	99	K3232R1
20	K1261R1	60	K3151R1		
21	K1231R4	61	K3121R4		
22	K1232R3	62	K3122R3		
23	K1241R3	63	K3131R3		
24	K1233R2	64	K3123R2		
25	K1242R2	65	K3132R2		
26	K1251R2	66	K3141R2		
27	K1234R1	67	K3124R1		
28	K1243R1	68	K3133R1		
29	K1252R1	69	K3142R1		
30	K2161R1	70	K1441R1		
31	K2131R4	71	K1411R4		
32	K2132R3	72	K1412R3		
33	K2141R3	73	K1421R3		
34	K2133R2	74	K1413R2		
35	K2142R2	75	K1422R2		
36	K2151R2	76	K1431R2		
37	K2134R1	77	K1414R1		
38	K2143R1	78	K1423R1		
39	K2152R1	79	K1432R1		

* K = Operate (K) Key
R = Release (K) Key