

**TELETYPEWRITER STATION EQUIPMENT
ARRANGED FOR TELETYPEWRITER
CODE SELECTION
WITH OR WITHOUT AUTOMATIC START**

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CIRCUIT DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The selector circuit operates in conjunction with the mechanism of a teletypewriter to provide a selective calling system on a teletypewriter party line in which one teletype character selects a given station or stations.

1.02 The use of P92.901.02 equipment on a Teletypewriter Automatic Dispatch System (TADS) is described in P65.906. The Control Unit used at the Master Station is described in P65.908.

1.03 Equipment per P92.901.01 is described in Sections 15-17, and was designed for use on circuits associated with a Semi-Automatic Concentrator at a torn tape relay center.

2. WORKING LIMITS

2.01 T, O, M, V, H and S are not suitable as station call letters. FIGURES H is normally used for motor shut off. LETTERS S is normally used for a Broadcast or Group call letter.

2.02 If weather symbols are used on the circuit, FIGURES S must be used as motor shut off, and LETTERS H may be used as the Broadcast call letter. The use of the Bell function is lost in this case.

2.03 A station is selected by one call letter. This may be the assigned call letter or the Broadcast or Group call letter.

2.04 The selector is useful only on single operation circuits of 60 or 75 WPM.

2.05 Special message format must be used on the circuit.

3. FUNCTIONS

- 3.01 Starts teletypewriter motor upon receipt of a line open followed by a line closure.
- 3.02 If the transmitter of the station is loaded with tape, it will automatically start after the receipt of "Figures" followed by the call letter of the station.
- 3.03 The teletypewriter is conditioned to receive traffic by the receipt of "Letters" and the call letter of the station.
- 3.04 The motor will shut off when "Carriage Return" is received, if the station has not been selected.
- 3.05 The motor will shut off if "Figure H" is received.
- 3.06 A Busy Lamp lights when the circuit is in use.
- 3.07 A buzzer is activated when the station is called.
- 3.08 A station may be arranged to respond to one individual and one Broadcast or Group call letter.
- 3.09 The selector allows the station access to the line when the circuit is idle.
- 3.10 The selector is suitable for use on the teletypewriter machine associated with the Automatic Transmitter Start Unit.
- 3.11 A Monitor Key may be furnished that will permit the teletypewriter to print all messages sent on the circuit.

4. CONNECTING CIRCUITS

- 4.01 P92.911.01 Automatic Transmitter Start Unit (Installed at Master Station).

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5. DESCRIPTION OF OPERATION--STATION SEARCHED FOR TRAFFIC BY AUTOMATIC TRANSMITTER START UNIT

5.01 When the circuit is idle, the M and D relays are operated, and the teletypewriter motor is off. The Busy Lamp is dark.

5.02 A two second break signal is transmitted by the Control Unit at the Master Station operating the Line Relay to space which releases the M relay and operates the Busy Lamp. Varistor M helps to make the M relay slow to release.

5.03 When the line closes, the Line Relay operates to mark, releasing the D relay, which was being held from the space contact.

5.04 The release of the D relay operates the Motor Control Relay which starts the motor.

5.05 "Figures" is received from the line causing the machine to shift to upper case, and closes the FIG contacts in the machine.

5.06 The station call letter is next received from the line operating the CALL contacts in the machine.

At 19 Type Stations (See 5.22 for 15 type machines)

5.07 Operation of the CALL contacts will operate the S relay to its first step.

5.08 The S relay is a 2 step type (U-680). The characteristics of this relay are such that it will partially operate closing contacts 5-6T and 5-6B on a low current and fully operate on a higher current.

5.09 Assuming tape is in the transmitter ready to send, contacts K3 are closed.

5.10 When the CALL contacts open, shunt battery is removed from the S relay primary. The S relay will then operate to its second step. The operating path is Battery thru K3 and K2 contacts, the released H relay 5-6T contacts, S relay 5T-6T (operated in 5.07), the S relay Primary and Secondary in series, R14 to ground.

5.11 Operation of the S relay to its second step operates the transmitter START MAG and the transmitter starts sending its tape.

5.12 The end of the tape contains "FIGURES H" which causes the teletypewriter to close FIG H CTS, which operates the H relay. FIG H CTS close only momentarily.

5.13 The H relay locks operated, releases the S relay and grounds the control anode of T TUBE. S relay in releasing opens the START MAGNET stopping the transmitter.

5.14 When the Line Relay operates to mark after the last space signal is received, condenser A starts charging from battery, thru R12, R10 and R11 in parallel, to ground.

5.15 Tube T fires in about 1/2 second when the voltage across condenser A reaches the critical Start Gap voltage. A 120,000 ohm resistance prevents excessive current flow thru the Start Gap. Tube T in firing causes current flow across the Operating Gap which operates relay D and extinguishes the ionization of Tube T.

5.16 Relay D locks operated, and releases the Motor Control Relay stopping the teletype motor, extinguishes the Busy Lamp, and operates relay M.

5.17 The operation of relay M releases the H relay and the circuit is now in the same condition as in 5.01.

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5.18 If in 5.10 there is no tape in the transmitter, the S relay will release when the CALL contacts open.

5.19 The teletypewriter will continue to print all line signals until either "FIGURES H" or Carriage Return is received on the machine. "FIGURES H" will close the FIG H CTS operating the H relay and the action will continue as in 5.14-5.17.

5.20 If Carriage Return is received before FIGURES H, the CAR RET CTS will close in the teletypewriter, operating the M relay which will release the Motor Control Relay and stop the machine. The M relay remains operated from the mark contact of the Line Relay and does not release on teletype signals because of its slow release feature. Operation of the M relay places holding battery on the selector magnets thru 6-7B of the operated M to prevent false selections while the motor stops.

5.21 About one half second from the last space signal received by the Line Relay, Tube T will fire, operating the D relay. Operation of the D relay extinguishes the T Tube and the Busy Lamp and the conditions of 5.01 prevail. If there are any 15 type machines on the circuit, optional strapping will be used which changes the time interval from 1/2 second to 15 seconds.

At 15 Type Station

5.22 Operation of the CALL contacts will operate the S relay to its first step, and operate the BZ relay if the Buzzer Key was previously rotated to SEND. If the Buzzer Key is not on SEND, the S relay will release when the CALL contacts open.

5.23 The S relay is a 2 step (U-680). The characteristics of this relay are such that it will partially operate closing contacts 5-6T and 5-6B on a low current and fully operate on a higher current.

- 5.24 The S relay locks operated in its half step position when the CALL contacts open if the Buzzer Key is on SEND. The operating path is ground, R14, S relay secondary and primary in series, S contacts 5-6T, the released H 5-6T, R16, D and D1 thermistors, released D 5-6B, the Line Relay mark contact, R3 to battery.
- 5.25 The BZ relay locks operated thru 5-6B of the half stepped S relay. The BZ relay operates the buzzer.
- 5.26 When the attendant responds to the buzzer, the Buzzer Key is rotated to the ON position (No effect) and the Control Key is momentarily operated down to the Start position releasing the BZ relay thru contacts 17-18, and operating the S relay to its fully operated position thru contacts 11-13 of the key. The S relay locks operated via its own 3-4B contacts. The buzzer retired when the BZ relay released.
- 5.27 Traffic may now be transmitted from the keyboard using the special message format required with this equipment.
- 5.28 The end of the message contains "FIGURES H" which causes the teletypewriter to close FIG H CTS, which operate the H relay. FIG H CTS close only momentarily.
- 5.29 The H relay locks operated, releases the S relay and grounds the control anode of T TUBE.
- 5.30 After reception of the last space signal by the Line Relay, condenser A starts charging from battery, thru R12, R10 and R11 in parallel, to ground.
- 5.31 Tube T fires in about 1/2 second when the voltage across condenser A reaches the critical Start Gap voltage. A 120,000 ohm resistance prevents excessive current flow thru the Start Gap. Tube T in firing causes current flow across the Operating Gap which operates relay D and extinguishes the ionization of Tube T.

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5.32 Relay D locks operated, and releases the Motor Control Relay stopping the teletype motor, extinguishes the Busy Lamp, and operates relay M.

5.33 The operation of relay M releases the H relay and the circuit is now in the same condition as in 5.01.

5.34 If in 5.26 the attendant fails to respond, the S relay will remain locked in the half step position until the Control Unit starts searching the next station. Operation of the Line Relay to space releases the S relay, and the S relay releases the BZ relay, retiring the buzzer.

5.35 The teletypewriter will continue to print all line signals until either "FIGURES H" or Carriage Return is received on the machine.

5.36 If Carriage Return is received before FIGURES H, the CAR RET CTS will close in the teletypewriter, operating the M relay which will release the Motor Control Relay and stop the machine. The M relay remains operated from the mark contact of the Line Relay and does not release on teletype signals because of its slow release feature. The selector magnets are held operated by 6-7B of the M relay to prevent false selections while the motor stops.

5.37 About 15 seconds from the last space signal received by the Line Relay, Tube T will fire, operating the D relay. Operation of the D relay extinguishes the T Tube and the Busy Lamp and the conditions of 5.01 prevail.

5.38 If FIGURES H is received before Carriage Return, the FIG H contacts close operating the H relay. The H relay locks operated, and the events described in 5.30-5.33 occur, returning the machine to the idle condition.

5.39 15 Type machines may be optionally wired to operate the BZ relay (and thus the Buzzer) when "FIGURES H" is sent on the line if the machine is running and the Buzzer Key is rotated to SEND. The BZ relay remains operated until the H relay releases, an interval of between 1/2 and 1 second. This notifies the attendant that traffic may be sent by using a non-automatic start during the Rest Period.

6. DESCRIPTION OF OPERATION-- MACHINE RECEIVES INCOMING CALL

6.01 When the circuit is idle, the M and D relays are operated, and the machine motor is off. The Busy Lamp is dark.

6.02 When a line open occurs the Line Relay operates to space which releases the M relay and operates the Busy Lamp. Varistor M helps to make the M relay slow to release.

6.03 When the line closes after one second or more, the Line Relay operates to mark, releasing the D relay, which was being held from the space contact.

6.04 The release of the D relay operates the Motor Control Relay which starts the machine motor.

6.05 "LETTERS" is transmitted by the sending machine to the line, causing all machines on the circuit to shift to lower case, and the LTRS contacts to close.

6.06 The Call Letter for the station is received next causing the selected machine to close the CALL contacts.

6.07 The CALL contacts operate the CA relay to its first step (see 5.08) on its secondary winding, and also operate the BZ relay which operates the Buzzer. Varistors CA1 and CA2 serve only as a conducting path at this time.

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6.08 Opening of the CALL contacts by the machine allows the CA relay to fully operate. The operating path is ground, 1-2B of the released S relay, R8, secondary and primary of the CA relay in series aiding, made 5-6T of the CA (from 1st step operation), Varistors M1 and M2 to battery on 3B of the released M relay. Operation of the CA relay opens the operate path of the M relay so that it will not operate on receipt of Carriage Return.

6.09 The teletypewriter prints all incoming signals until "FIGURES H" is received by the machine closing the FIG H CTS, which operate the H relay.

6.10 The H relay locks operated to the released M, allowing T Tube to fire one-half second after the last space signal, which operates the D relay and extinguishes the ionization of T Tube.

6.11 Operation of the D relay operates the M relay, releases the Motor Control Relay and extinguishes the Busy Lamp.

6.12 Operation of the M relay releases the CA and H relays.

6.13 Conditions are now the same as initially (6.01).

6.14 If the call letters received in 6.06 do not include the call letter of this station, the CALL contacts do not close, and on the receipt of Carriage Return, the M relay will operate from the CAR RET CTS, lock up, and release the Motor Control Relay, thus stopping the motor, and will hold the selector magnets operated.

6.15 If there are no 15 type machines on the circuit, and the circuit remains marking for 1/2 second, the T Tube will fire, operating and locking the D relay, which extinguishes the T Tube and Busy Lamp, and the conditions are now the same as initially (6.01).

6.16 If there is a 15 type machine on the circuit, the T Tube timing circuit is strapped to make the operate time about 15 seconds. If 15 seconds pass with the line marking, the T Tube will fire, operating and locking the D relay which extinguishes the T Tube and the Busy Lamp. However, the circuit Control Unit may initiate a new search before 15 seconds, and send a 2 second open on the line. As the M relay was locked to the Mark contact of the Line Relay, it will release on the two second open. To prevent the teletypewriter motor from starting on the open, the release of the M relay closes its contacts 2-3B, sending battery to condenser D, in series with varistors D2-D3 and the secondary winding of the D relay, to ground. The charging current of condenser D is sufficient to operate the D relay, which locks to the space contact of the Line Relay, and prevents the teletypewriter motor from starting. When the Line Relay operates to mark, the D relay releases and the motor starts. Resistor R17 gradually discharges condenser D. Continue in paragraph 5.04.

7. DESCRIPTION OF OPERATION-- MANUAL START

7.01 When the circuit is idle, the M and D relays are operated, and the machine motor is off. The Busy Lamp is dark.

7.02 The CONTROL KEY is operated to the (ON) position, opening the line (key terminals 9-10), and applying battery to the A1 and A2 Thermistors in series with the primary and secondary of the CA relay to ground. The initial current is insufficient to operate CA. However, current flowing in the Thermistors causes them to heat and lower their resistance, which causes more current to flow in the circuit. In about one second, the current is great enough to operate the CA relay.

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7.03 Operation of the CA relay releases the M relay which short circuits Thermistors A1 and A2, effectively removing them from the circuit. The Busy Lamp operates from the space contact of the Line Relay.

7.04 Operation of the Busy Lamp informs the attendant the CONTROL KEY may be released. Release of the CONTROL KEY closes the line and operates the Line Relay to mark, which releases the D relay, which operates the MOTOR CONTROL RELAY starting the teletypewriter motor. The line contacts of the CONTROL KEY are shorted by the released D relay to prevent an accidental line open.

7.05 On a 15 machine, traffic may now be sent. At the conclusion of traffic, "FIGURES H" is sent operating the FIG H CTS, which operates the H relay. Continue in 7.11.

7.06 On a 19 machine with tape in the transmitter, the CONTROL KEY is now operated to the down position (Start) which heats Thermistors S and S1 until the current is sufficient to operate the S relay to the first step (about 1 second). Contacts 5-6T of the S relay close applying battery direct to the primary winding of the S relay causing full operation of the S relay.

7.07 Operation of the S relay releases CA relay, the S and S1 Thermistors and operates the START MAG in the transmitter, starting the transmitter.

7.08 Upon operation of the transmitter, the attendant releases the CONTROL KEY to normal.

7.09 Messages may be transmitted using the standard format until "FIGURES H" is sent on the line which operates the FIG H contacts, operating the H relay, which locks operated.

7.10 The H relay in operating releases the S relay which opens the transmitter START MAG and stops tape sending.

7.11 When the line remains marking for 1/2 second, the T Tube fires, operating the D relay.

7.12 The D relay in operating releases the Motor Control Relay stopping the motor, extinguishes the T Tube and Busy Lamp, and operates the M relay. The operated M releases the H and CA relays. The operated M relay shorts the keyboard to prevent an accidental line open.

7.13 Initial conditions (7.01) now prevail.

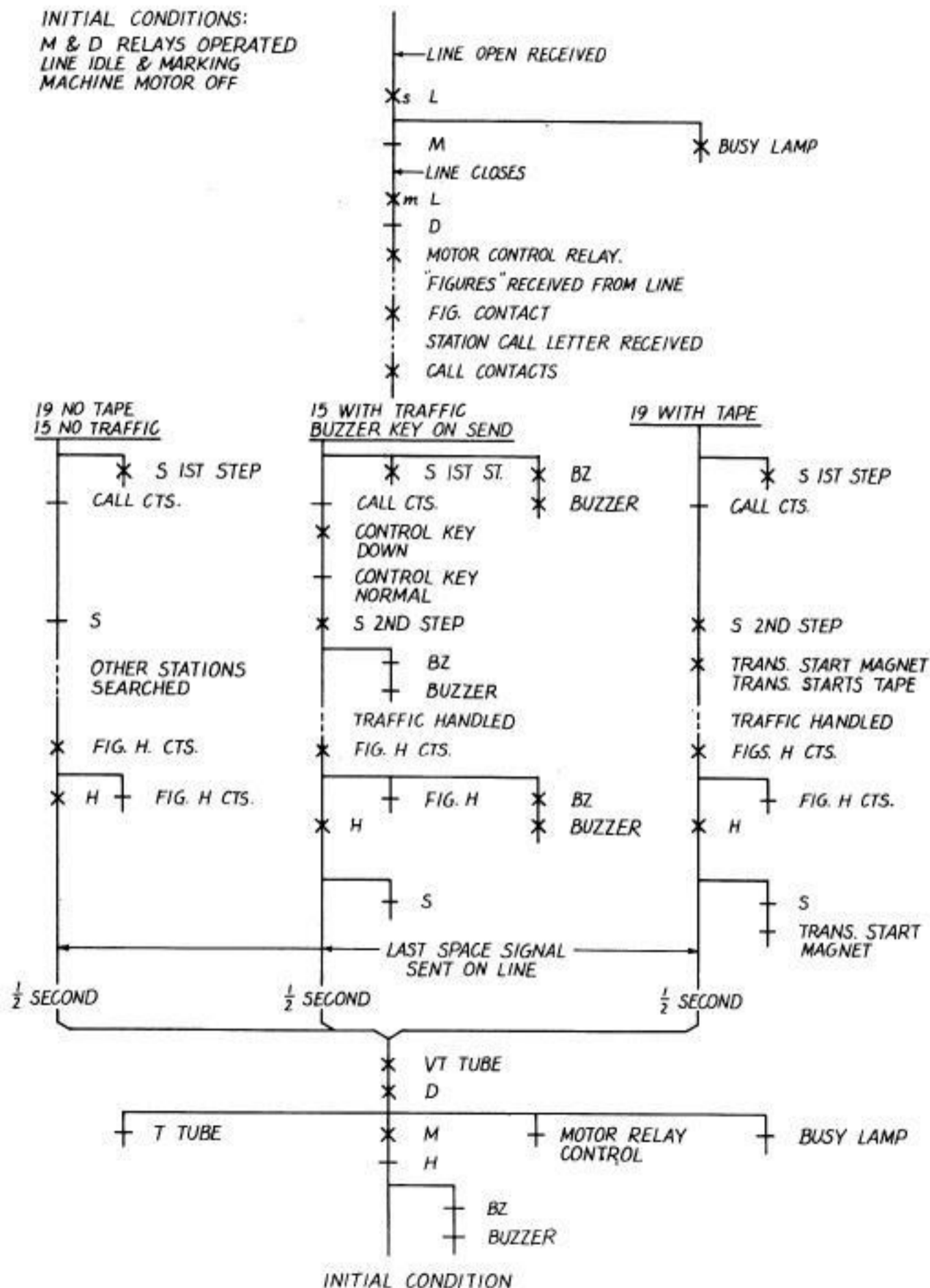
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SEQUENCE CHARTS

8. MACHINE SEARCHED FOR TRAFFIC BY AUTOMATIC TRANSMITTER START UNIT

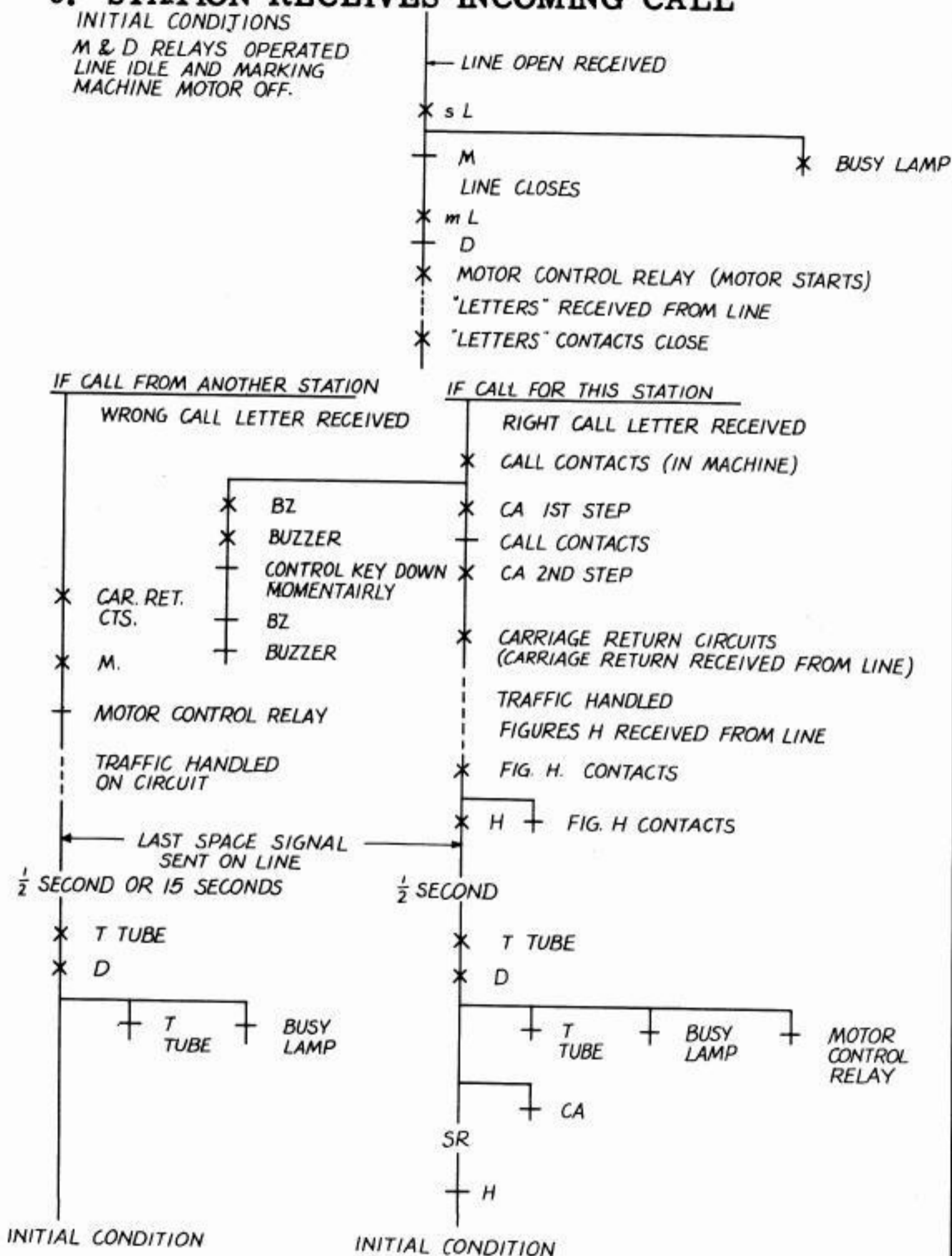
INITIAL CONDITIONS:

M & D RELAYS OPERATED
 LINE IDLE & MARKING
 MACHINE MOTOR OFF



9. STATION RECEIVES INCOMING CALL

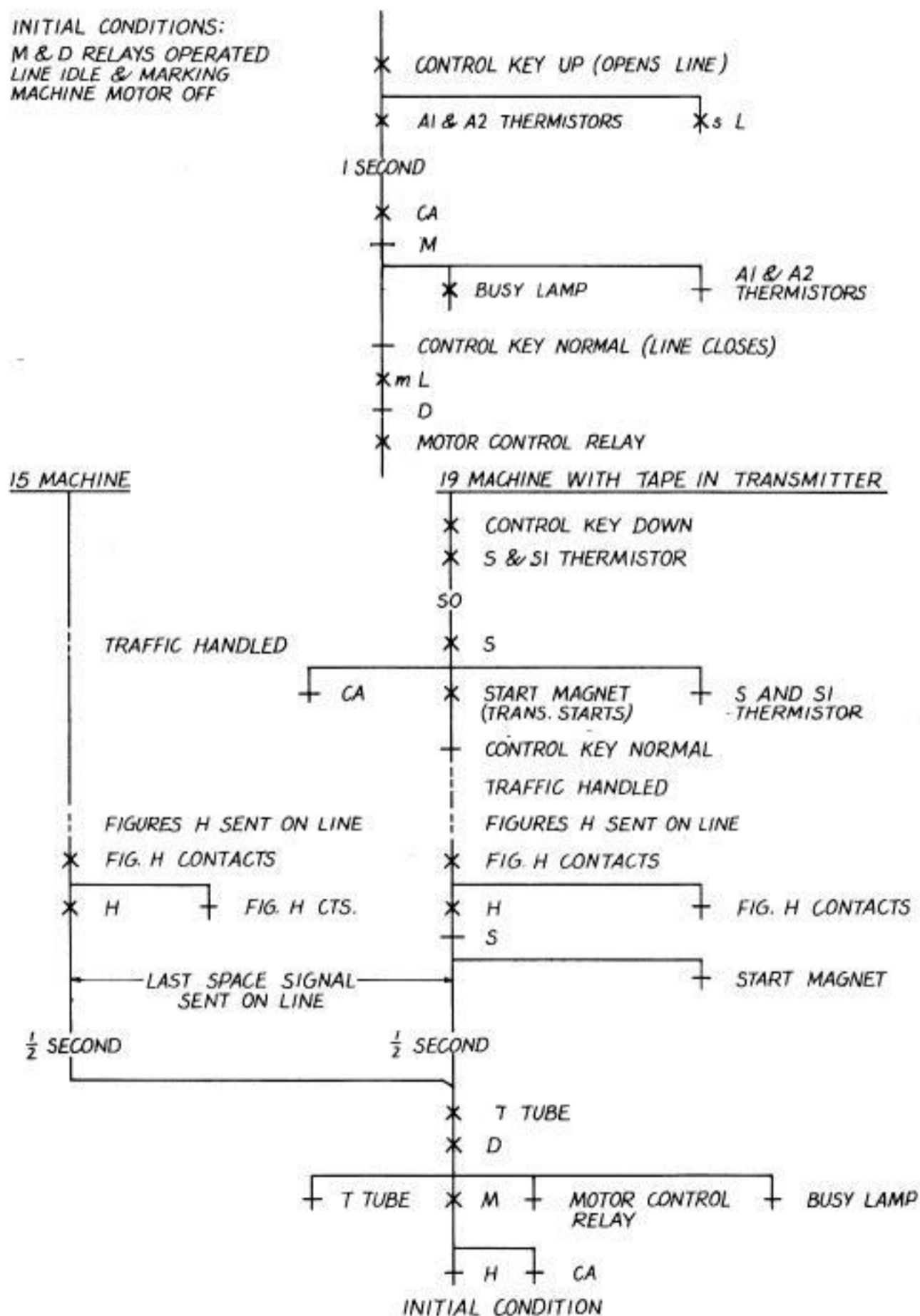
INITIAL CONDITIONS
M & D RELAYS OPERATED
LINE IDLE AND MARKING
MACHINE MOTOR OFF.



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10. STATION STARTED MANUALLY

INITIAL CONDITIONS:
M & D RELAYS OPERATED
LINE IDLE & MARKING
MACHINE MOTOR OFF



11. TIMING CIRCUITS

Cold Cathode Tubes

11.01 The 426A (T Tube) is a three element inert gas filled cold cathode tube that is normally non-conducting. The tube will start to conduct or "fire" when the voltage between the cold cathode and the starter reaches about 75 volts. If the voltage between the cathode and the anode is 75 volts or higher when the tube fires, the tube will conduct heavily across the main gap, that is from cathode to anode. The starter is in effect a trigger, and is not itself designed to carry more than a few milliamperes of current. Resistance must be provided in both the starter lead and the main anode circuit to limit the current to safe values for the tube.

11.02 Figure 1 is a simplified drawing of the one-half second timing circuit. The timing action is described as follows:

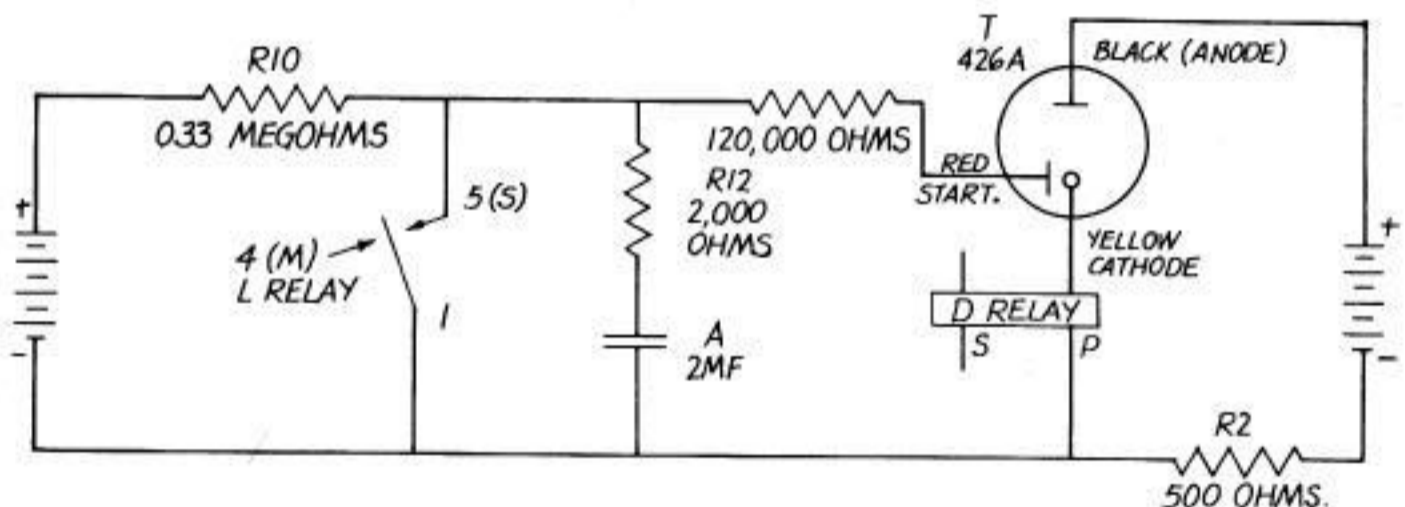


Figure 1

11.03 Timing starts when contacts 1-5 (space) of the L relay open. Current then flows in the R10 and R12 resistors to charge condenser A. Condenser A does not reach full charge immediately but takes a number of seconds to do so because the current flow is limited by the high resistance of R10.

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11.04 The voltage across condenser A is essentially the same voltage appearing between the cathode and starter of the tube.

11.05 About one-half second after condenser A started charging, the voltage reaches about 75 volts and causes the tube to fire. Current flow in the starting gap is limited to less than one milliampere by the 120,000 ohm resistor.

11.06 Tube T in firing, conducts heavily in the main gap causing relay D to operate. Current flow is limited by the resistance of the D relay winding and the R2 resistor. The operation of D ends the timing interval.

11.07 Resistor R12 is provided to reduce sparking when contacts 1-5 (space) of the L relay close, discharging condenser A.

11.08 The amount of time delay provided by the circuit is determined by the capacity of condenser A and the resistance of R10. The values were chosen to provide about one-half second timing in the circuit discussed. Under other operating conditions, resistor R11, 8 megohms, which retimes the circuit to about 15 seconds, is used in place of R10.

11.09 The D relay locks operated thru its own contacts, opening the cathode lead to extinguish the tube T. This action increases the life of the gas tube.

Thermistors

11.10 The A Thermistors used in this equipment are known as "1D Thermistors". They are made of semi-conducting metallic oxides which have a large negative temperature coefficient. A temperature increase of about 20 degrees F. will cause this thermistor to decrease its resistance to half of the original value. Physically, this thermistor takes the form of a tiny

bead of semi-conducting material not much larger than a pin-head. The bead is enclosed in a glass tube to increase its thermal capacity thus slowing down the temperature changes. The glass tube is then installed in a fiber tube. The 1D Thermistor is capable of changing its resistance from 100,000 ohms down to 275 ohms when passing 20 milliamperes of current (maximum).

11.11 The CA relay has two 1D Thermistors in its operating path under some conditions. When the CONTROL KEY is operated UP, the thermistors have a high resistance, and therefore only a small current flows thru the CA relay. However, this current is sufficient to heat the thermistors slowly causing the thermistors to decrease their resistance, and consequently, the current to increase. This process continues until the resistance of the thermistors is low enough to permit operation of the CA relay in about one second after the closing of the key contacts. As the thermistors are no longer needed after the CA relay operates, they are shorted out by its operation.

Varistors

11.12 The 400E Varistors used in this equipment are point contact germanium crystal rectifiers with a maximum current handling capacity of 30 milliamperes, and a maximum reverse direction voltage rating of 140 volts.

11.13 Varistors are used for several different functions in this equipment. In one application, a varistor is connected across the M relay winding, and is connected with the polarity arranged so that current does not flow when the relay is energized. However, when the battery is removed, the energy stored in the magnetic field of the relay induces a voltage in the relay winding that has opposite polarity to the former battery voltage, and this voltage appearing across the varistor will cause it to conduct, and thus establish a current flow thru the relay winding. The effect of this

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current flow thru the relay winding is to hold the relay operated for a longer time, and thus make the relay slow to release. This effect only lasts for a fraction of a second, but is effective in slowing the release of the relay.

11.14 Another application is for isolating two circuits under one application of battery, and to connect them when the battery polarity is reversed. An example is the operation of the CA relay as described in 11.11. Battery appears between winding terminal 7T and ground (CA relay) and would tend to operate the BZ relay thru the Buzzer Key to winding connection 5B of the BZ relay. However, this does not happen as the varistors CA1 and CA2 do not conduct in this direction. However, during other circuit functioning, the CA and BZ relays are both operated by the closing of the CALL and LTRS contacts. The operation of the CA relay is thru the varistors CA1 and CA2 in this case.

12. INSTALLATION

12.01 The teletypewriters used in this service are to be installed in accordance with the other sections of the P Practices which are applicable. The additional equipment required to furnish the automatic transmitter starting and selective calling features of this system are to be installed in accordance with P92.901.02.

12.02 Both after the initial installation and in subsequent tests, the requirements of P30.002, Orientation tests and Distortion Tolerances, must be met.

13. TESTING

13.01 On a new installation, inspect for obvious errors, connect the power and proceed with 13.02. On an established system, the machine must not be re-

moved from the circuit until the Master Station is notified. This is necessary to allow the Master Station to take steps to prevent the loss of a message. The Master Station may send a broadcast call advising all stations, or may have intercept arrangements available. When a station is returned to a circuit, the Master Station must again be notified.

13.02 The machine should have line current supplied from the telegraph office over the regular line facility. The line facility may be terminated at the telegraph office in a spare TLT for the duration of these tests.

13.03 Operate the M and D relays manually. They should remain operated, and the motor should be off.

13.04 Open the line circuit and check that the M relay releases, the Busy Lamp lights and the motor does not start. The CONTROL KEY can not be used to open the line in these tests. Open the line (or short the line) outside the teletypewriter.

13.05 Close the line circuit. The D relay releases, and the motor starts.

13.06 Move the platen to LETTERS position manually, and close CALL contacts manually on the machine. The CA relay should operate to its first step. Release the CALL contacts, the CA relay should fully operate.

13.07 Send CR from the keyboard, the station should not shut off.

13.08 Send FIGURES H from the keyboard. The H relay pulls up. In about one-half second, tube T fires operating the D relay which in turn operates the M relay which in turn extinguishes the Busy Lamp and stops the motor. H relay releases.

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13.09 Repeat 13.04-.05. Operate Buzzer Key to ON position (Arrow Points UP). Send LTRS and own station call letter. The buzzer should operate. Send FIGURES H. Machine shuts off and buzzer retires.

13.10 Repeat 13.04-.05. Send CR from keyboard. M relay operates and motor stops. If ALL machines on the circuit are 19 types, in one-half second the D relay operates and the Busy Lamp extinguishes. If any station on the circuit is a 15 machine, allow approximately 15 seconds for the D relay to operate and the Busy Lamp to extinguish. Timing other than 15 seconds may be specified in the service order.

**FOR 19 MACHINES ONLY
(SEE 13.14 FOR 15 MACHINES)**

13.11 Punch a piece of tape as follows: 10 LTRS, OWN CALL LETTER, LTRS CR, LF, MISC WORDS, "FIGURES H" 10 LTRS.

13.12 Place tape in transmitter. Manually shift platen to FIGURES, repeat 13.04-.05. Close the CALL contacts manually, and hold them closed. The S relay should operate to its first step. Release the CALL contacts, the S relay should fully operate, the transmitter starts, and the tape is sent. At the end of the tape, the machine should shut off and leave the M and D relays operated in the selector.

13.13 Replace the tape in the transmitter so that it is ready to send. Operate the CONTROL KEY up to the ON position and hold it. The Busy Lamp should light after a short delay. Then operate the key down to the START position. In a few seconds, the transmitter should start and send the tape. Release the key to normal. At the conclusion of the tape the machine should stop, leaving the M and D relays operated in the selector, and the Busy Lamp out.

FOR 15 MACHINES ONLY

13.14 Rotate the BUZZER KEY to ON (Arrow Points UP). Place the platen in the letters position. Repeat 13.04-.05 send own station call letter from the keyboard. The CA relay, BZ relay and the buzzer should operate. Operate the CONTROL KEY down to START momentarily. The BZ relay should release and the buzzer stop. Send FIGURES H. The M and D relays operate and the Busy Lamp is extinguished.

13.15 Rotate the BUZZER KEY to the SEND position (Arrow Points right). Repeat 13.04-.05. Send LTRS, and own call letter. The CA relay operates but the buzzer does not sound. Send FIGURES H. The motor should stop, and the buzzer operate momentarily.

13.16 With the BUZZER KEY in the SEND position, Repeat 13.04-.05. Send FIGURES, Operate CALL contacts manually and hold them closed. The S relay operates to the first step, and the BZ relay operates and the buzzer sounds. Release the CALL contacts. No change should occur. Rotate the BUZZER KEY to the ON position and momentarily operate the CONTROL KEY down to the START position. The S relay will fully operate, releasing the buzzer and the BZ relay. Send LTRS, own call letter, and observe that the CA relay does not operate, nor should the buzzer sound. Send CR and observe that the M relay does not operate. Send FIGURES H, the H relay operates momentarily, the M and D relays operate, the motor stops and the Busy Lamp is extinguished.

14. ROUTINE TESTS AND ADJUSTMENTS

14.01 The teletypewriter is routined according to the regular P practices which apply to the machine.

14.02 There are no routine tests on the selector.

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14.03 Adjustment of the relays in the selector is accomplished in accordance with the Circuit Requirements Table in P92.901.02. Adjusting procedure for the relays is found in the following:

Y type relays	B461.010
U type relays	B461.011

14.04 Trouble conditions can best be isolated by making the various tests of Part 13 to locate incorrect functioning.

14.05 A 400E varistor may be tested in the following manner. Disconnect one lead from the circuit under test. If possible, use a long nose pliers to hold the lead wire as heat from the soldering iron can injure the varistor. Connect leads from a KS-14510 volt-ohm-milliammeter to the varistor, with the positive lead to the #1 end, and set the selector to Ohms X10,000. The resistance measured would be at least 500,000 Ohms and may be as high as 1,500,000. The fingers must not touch both leads while marking this measurement. Reverse the connections so that the positive meter lead is connected to the #2 end of the varistor, and turn the selector to Ohms X10. The measured resistance should be between 150 and 250 Ohms. Caution: The Ohms X1 range should not be used as it passes sufficient current thru the varistor to cause damage.

EQUIPMENT PER P92.901.01

15. GENERAL

15.01 The Selector Unit of drawing P92.901.01 does not have the Automatic Transmitter Start feature. Its use therefore, is to provide only the selective calling features of the P92.901.02 Selector Unit. Traffic is handled by waiting for an idle period on the circuit, and then seizing the circuit. Selective calling is accomplished in the same manner as in the .02 circuit.

However, the transmitter is started by operating the switch on the Transmitter--Distributor in the conventional manner after the circuit has been seized.

15.02 As the P92.091.01 equipment is actually a simplified version of P92.901.02, only sufficient additional information is added here to emphasize the differences. A Circuit Description is contained in Sections 16-17 covering the details of operation. Additional information in earlier sections of this Practice should be sufficient to provide any further information, keeping in mind that all references to "Searching for Traffic" and "Automatic Transmitter Starting" are inapplicable.

15.03 An important difference between these two circuits is in the use of the Figures Call Letter for searching, and the Letters Call Letter for selecting in the .02 equipment, while selecting may be done in either case with the .01 equipment, as the .01 equipment does not have Figures and Letters contacts.

15.04 The following testing procedures of Section 13 are applicable:

13.01 thru 13.10, 13.14

CIRCUIT DESCRIPTION

16. MACHINE RECEIVES INCOMING CALL

16.01 When the circuit is idle, the M and D relays are operated, and the teletypewriter motor is off. The Busy Lamp is dark.

16.02 When a line open occurs, the Line Relay operates to space which releases the M relay and operates the Busy Lamp. Varistor M helps to make the M relay slow to release.

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16.03 When the line closes, the Line Relay operates to mark, releasing the D relay, which was being held from the space contact.

16.04 The release of the D relay operates the Motor Control Relay which starts the machine motor. The release of the D relay also removes a short from the keyboard, shorts the line contacts of the CONTROL KEY and transfers the Busy Lamp from the spacing contact of the Line Relay to the marking contact.

16.05 The Call Letter for the station is received next causing the selected machine to close the CALL contacts.

16.06 The CALL contacts operate the CA relay to its first step on its secondary winding, and also operate the BZ relay which operates the Buzzer. Varistors CA1 and CA2 serve only as a conducting path at this time. The Buzzer will operate until the CONTROL KEY is momentarily operated to the down position opening the BZ relay locking path.

16.07 Opening of the CALL contacts by the machine allows the CA relay to fully operate. The operating path is ground, R8, secondary and primary of the CA relay in series aiding, made 5-6T of the CA (from 1st step operation), Varistors M1 and M2 to battery on 3B of the released M relay. Operation of the CA relay opens operate path of M relay so it will not operate on receipt of CR.

16.08 The teletypewriter prints all incoming signals until "FIGURES H" is received by the machine closing the FIG H CTS, which operate the H relay.

16.09 The H relay locks operated to the released M, allowing T Tube to fire in one-half second, which operates the D relay and extinguishes the ionization of T Tube.

16.10 Operation of the D relay operates the M relay, releases the Motor Control Relay and extinguishes the Busy Lamp.

16.11 Operation of the M relay releases the CA and H relays.

16.12 Conditions are now the same as initially (16.01).

16.13 If the call letters received in 16.05 do not include the call letter of this station, the CALL contacts do not close, and on the receipt of Carriage Return, the M relay will operate from the CAR RET CTS, lock up, and releases the Motor Control Relay, thus stopping the motor. 6-7T of the operated M relay short the keyboard to prevent an accidental interruption to the circuit. 7-8T of the released D relay short the CONTROL KEY terminals 9-10 to prevent accidental opening of the line when the circuit is busy.

16.14 15 seconds after the last space signal is received from the line, the T Tube will fire, operate and lock the D relay, extinguish the T Tube and Busy Lamp.

16.15 Conditions are now the same as initially (16.01).

17. STATION TRANSMITS TRAFFIC

17.01 When the circuit is idle, the M and D relays are operated, and the teletypewriter motor is off. The Busy Lamp is dark.

17.02 The CONTROL KEY is operated to the up (ON) position, opening the line (Key terminals 9-10), and applying battery to the A1 and A2 Thermistors in series with the primary and secondary of the CA relay to ground. The initial current is insufficient to operate CA. However, current flowing in the Thermistors causes them to heat and lower their resistance, which causes more current to flow in the circuit. In about one second, the current is great enough to operate the CA relay.

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17.03 Operation of the CA relay releases the M relay which short circuits Thermistors A1 and A2, effectively removing them from the circuit. The Busy Lamp operates from the space contact of the Line Relay.

17.04 Operation of the Busy Lamp informs the attendant the CONTROL KEY may be released. Release of the CONTROL KEY closes the line and operates the Line Relay to mark, which releases the D relay, which operates the Motor Control Relay starting the motor.

17.05 On a 15 machine, traffic may now be sent. At the conclusion of traffic, "FIGURES H" is sent operating the FIG H CTS, which operate the H relay. Continued in 17.07.

17.06 On a 19 machine with tape in the transmitter, the transmitter may be started and the tape sent. Code directing characters are punched in the beginning of the tape, and FIGURES H followed by Letters Characters at the end. When FIGURES H is received by the machine, the FIG H contacts close momentarily operating the H relay which locks operated.

17.07 The H relay in operating closes the operate path for the T Tube. When the Line Relay remains on mark for about 1/2 second, the T Tube fires operating the D relay.

17.08 The D relay in operating releases the Motor Control Relay stopping the machine motor, extinguishes the T Tube and Busy Lamp, and operates the M relay. The operated M releases the H relay.

17.09 Initial conditions (17.01) now prevail.